

**The health of the armies in  
British India, 1850 to 1940**



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## Short abstract

The health of two relatively enclosed populations, the native Indian and European troops which comprised the armies of British India, is studied using printed primary sources supported by unpublished accounts, between c.1850 and c.1940. Military efficiency was essential to the raj. The soldiery had fairly well documented medical attention. Even so, mortality rates especially in the European force were high in the early-nineteenth century, mostly from cholera and dysentery, and fevers such as malaria, but fell rapidly after 1860. Sanitary reforms, introduced from the 1850s seem responsible for reducing diarrhoeal disease incidence, though an effect from selection bias in recruits around that time is considered. The lag in improvement of sepoy health compared to European soldiery over the latter-nineteenth and early-twentieth century is shown to be due to poorer accommodation, less favourable medical facilities and potentially – incorporating McKeown’s hypotheses – nutritional deficiency. The late-nineteenth century rise in typhoid to be the predominate killer of European troops – counterintuitive when diarrhoeas were tempered – is found to be related to transmission of *Salmonella* by flies, and to fall once this was controlled, with a contribution from immunization. Theories of disease and therapy over the long nineteenth century are traced from the Cullenian, via Parisian pathology-based notions to, from mid-century, practical empiricism. Contrary to anachronistic belief, some treatments worked – ipecacuanha for dysentery, supportive measures in pneumonia, and cold douche in heat apoplexy. High rates of venereal disease amongst European rank-and-file did not respond to legalistic restrictions because of failure to corral and cure those affected. Eventual control was established by treatment standardization and moderation of behaviour related to temperance movements. This thesis adds a different dimension to understanding of military population health by focussing less on political and sociological consequences as in previous historiography and more on the practicalities of preventative and therapeutic measures.

## **Long abstract**

### ***Background and aims***

A fit and effective army was central to Britain's imperial control of India. Using the European and native Indian soldiery as its medium, this thesis interrogates influences of the environment and of therapeutic intervention on disease in the nineteenth into the twentieth century. Mortality amongst European troops – though not the sepoy force – of the East India Company in the first half of the nineteenth century was nearly ten percent annually, mostly from diarrhoeal diseases, cholera, malaria and other fevers, and forms the starting point. One hypothesis is that sepoys suffered less because of prior immunity and that factors relating to the European soldier's person, his environment, habits, diet and conduct, predisposed him to certain diseases.

The notion that installation of sanitary infrastructure in the third quarter of the nineteenth century – confirmed from various reports – reduced the European soldiery's mortality from diarrhoeal diseases is tested in the light of other factors operating simultaneously. The effectiveness of restraining measures to control alcoholism and venereal disease is considered. Other propositions are that, for alcohol, hobby-related diversions were ineffective, and, for venereal disease, that lock hospitals and Contagious Diseases Acts had little effect. In the background is Thomas McKeown's hypothesis that better nutrition was responsible for reductions in mortality for European populations over the eighteenth-to-nineteenth centuries.

The present research differs from other health studies of armies in India, for example, those of David Arnold and Philip Curtin. In this work there is a greater emphasis on defining sanitary infrastructural changes, selection bias, unpicking effects of medical interventions,

relating them to disease theories, and comparing native and European armies – rather than interrogating political and sociological questions.

### ***Dates and sources***

The start date of this study, 1850, was chosen as approximating to the time at which detailed annually-published statistics on the health of presidential armies commenced – the actual date varied between presidencies. The end point, 1940, incorporates the twentieth century evolution of events in British India up to but not fully including mobilization in the Second World War. The ninety-year period encompasses major upheavals in India: the 1857 rebellion, subcontinental wars, major famines of the late 1890s, the First World War, and the 1918-20 influenza pandemic. Published and unpublished primary sources have been employed. For the statistical data on disease incidence and mortality, including alcoholism and venereal disease, the most important have been the detailed reports, published annually, of the sanitary (latterly public health) commissioners to the government of all India and before that to the presidencies. The earliest are the Bengal and Bombay reports of 1864 that give some retrospective figures. Earlier information is found in the *Annual Reports of the Army Medical Department*, from 1859, in J.L. Bryden's 1870 *Vital statistics*, and in the 1863-64 *Report of the royal commission to inquire into the sanitary state of the army in India*. Details on nineteenth century infrastructure and building projects, and their financing, are to be found in the returns of engineers and of the sanitary commissioners to the presidencies. Particulars on contemporary theories of disease and treatments have been gleaned from articles and textbooks, many written specifically for doctors in India. The Indian Medical Gazette supplied detail on local opinion and practice. Unpublished letters and journals – from the Royal Army Medical Corps records at the Wellcome Library, and at the British Library – gave supportive material.

## ***Outline of chapters***

Chapter One sets the scene with a *résumé* of the historiography and arguments of previous scholars. Details of how the original source material was gathered, including the use of proformas by military medical officers, how disease classification changed and any effect on diagnosis, are investigated. This study's aims and sources, and hypotheses tested are listed, together with explanation of how this differs from previous scholarship, and ways in which it will contribute to the historiography.

In Chapter Two, on disease incidence and mortality, a comparison of sickness occurrence and mortality rates for the native and European forces of the East India Company and Crown armies is made for ninety years from 1850, with reference to the preceding half century. The analysis is greater in depth than in previous studies. Comparisons are made between native and Europeans forces, with males of recruitable age in the British Isles, with officers, prisoners, and, briefly, with the Crimean War and American Civil War. Diseases encountered in India, initially in armies of the presidencies then for armies of all India, are examined in detail. These include cholera, dysentery, typhoid, hepatitis, malaria, pneumonia and bronchitis, pulmonary tuberculosis, heat apoplexy, scabies and scurvy. Consideration is given to any impact on health of the nutritional status of British recruits, and the relevance of the changing background diseases and mortalities from which this group suffered back home. Factors surrounding mortality rates amongst European troops during and just after the 1850s are examined. Among the new or revitalized determinations are: (a) reasons why case fatality from diarrhoeal diseases especially cholera eventually fell, (b) comment on why typhoid ran rampant during the final quarter of the nineteenth century when other faeco-oral diseases did not, (c) explanation for reduction in typhoid case fatality later in the century, (d) deciphering the hepatitis case fatality fall in the 1880s, (e) understanding the switch in pulmonary

tuberculosis from European to native soldiery, (f) clarifying the progressive improvement in treatment for heat apoplexy, (g) explaining what scabies and scurvy indicate about troop conditions, (h) highlighting the previously unrecognized importance of mortality from respiratory diseases in sepoys, (i) showing where for specific diseases the sepoy had a higher morbidity than his European confrere, (j) how change to martial race recruitment impacted disease prevalence in sepoys, and (k) novel use of case fatality to assess treatment efficacy.

In Chapter Three, evidence is sought for implementation of sanitary improvements in barracks and cantonments. This is then juxtaposed to mortality rates from diarrhoeal diseases. Financial reports, which detail amounts spent, and engineers' reports, that show projects in hand, are used to assess the extent of building construction. Often this is at a presidency level – at which money was predominantly allocated to civilian works. That earmarked for the military is analyzed by type of work supported. Sanitary commissioners' qualitative reports and medical officers' personal accounts add colour to reports of completion of infrastructure works.

Chapter Four looks at, first – how nineteenth century changes in disease theory in India influenced medical thinking there and, secondly, how developments in medical therapeutics, encompassing Indian 'exceptionalism' *contra* western experience, affected case fatality. The latter tests *effectiveness* of medical intervention rather than *prophylaxis*. The contagionist–anticontagionist debate in India was often a war of words between individual practitioners and government advisors who usually held on to traditionalist views. Using textbooks and papers familiar to medical officers in British India, changes in the diagnostic and therapeutic approach are traced longitudinally. Theory-led late eighteenth century adventurism is suffused during the first half of the nineteenth century by an approach based on morbid

anatomy – replaced, from mid-century, by practical empiricism – grounded in observation of what seemed to work. A feature of this thesis is the in-depth critique of sequential treatment stratagems for the main diseases of the army. The popularity of apparently damaging interventions such as bloodletting is explained. Potential benefits of heavy metal medication, unbeknown to the prescribers, are revealed, with reasons why apparently inferior treatments for sepoys were often superior, and how supportive care contributed.

Chapter Five explores soldiers' indulgence in the oft-linked vices of alcohol excess and fornication. The prevalence of venereal disease, a drain on army effectiveness, is traced, paralleled to a critique on the authorities' fumbings at control. Alcoholism proved more difficult to uncover, as it was not recorded in medical returns until, briefly, later in the nineteenth century. Hence, delirium tremens – the potentially fatal severe behavioural effects of alcohol withdrawal – which was recorded, has been used as a proxy. Alcohol consumption and temperance are measured against misdemeanours and ill-health. The historiography of the socio-economic impact of debauchery and intemperance in nineteenth century British India is well document. This chapter adds fuller rendition of timelines, an in-depth evaluation of the medicalized approach, with, uniquely, detail on how lock hospitals functioned and – on treatments given to prostitutes – why these are unlikely to have worked, plus a new opinion on how venereal disease was eventually mastered.

The sixth and final chapter draws the threads of this thesis into a cohesive body, delineates an overriding message for the wider historiography, and outlines directions for future work.

### ***Main findings***

The mortality rates in the East India Company's European Presidency armies in India in the first decade of the nineteenth century were 5.5 percent in Madras, 8.5 percent in Bombay and 9.2 percent in Bengal *annually*. Not only was this a concern for serving troops, it was a major logistical challenge for the Company. These rates increased once cholera became epidemic from the end of the second decade of the century and, although there was pull-back, by 1850, annual mortality across the three presidency European armies was still around 5 percent.

Reported rates for sepoy troops were consistently lower. Once the plight of European soldiery came to the attention of the British public, highlighted by the 1853-56 Crimean War and the 1857 rebellion, and expressed in the *milieu* of developing Christian militarism, a royal commission, which reported in 1863, examined the problem. It recommended sanitary improvements, many of which were delivered over the subsequent two decades, though some measures had been started in the 1850s. The major causes of death for European soldiers in the second and third quarters of the nineteenth century were cholera, dysentery, hepatitis, heat apoplexy and, less so, remittent or enteric fevers. The situation for the sepoy was different. Diseases in the combined 'fevers' category, mostly intermittent (principally malaria) caused most admissions and, although diarrhoeas were prominent, cholera, pneumonia and bronchitis, with malaria, were the principal fatal conditions. Cholera, dysentery and hepatitis declined as causes of death for European troops by end of the nineteenth century. Malaria fell as a cause of death from the three-quarter point of the century but remained more fatal for the sepoy than for the European. Enteric fever/ typhoid surged in European troops towards the end of the nineteenth century before finally being controlled. The pool of young males from Britain and Ireland from which the soldiery was drawn showed some anthropometric signs of poor childhood nutrition in mid-nineteenth century (improving thereafter), which may have impaired the response of new recruits to diseases

first encountered in India. Mortality rates were higher in first year of arrival in the subcontinent and, post-mutiny in the later 1850s, the capability of medical services to cope with increased number of European troops could have been exceeded. Subsequently admission and mortality rates from diarrhoeal diseases declined, from the early 1860s. The extent to which public health sanitary measures in barracks – as opposed to innovations in medical therapies and apparently improving robustness of European recruits (mortality rates were declining in young males around this time back in Britain) will be appraised. The possible health consequences of selection bias in native troops recruited post-rebellion – more were drawn from rural martial races – is considered.

Venereal disease (now known as sexually transmitted disease) blighted European armies in nineteenth century India. For the European army of the East India Company's Madras Presidency, in the 1810s, 26 percent of all hospital admissions were due to venereal infections. There was a slow decrement in the second and third decades, to 12 percent by 1830, but subsequent increase such that, into the 1830s, venereal disease accounted for 19 percent of admissions for Bengal's European army, and into the 1840s, 19 to 36 percent for that of the Madras Presidency. Over 1850-76, annual prevalence of venereal disorders was about 20 percent – ten times higher than in the larger sepoy army. After 1871, when data for all India commenced, the picture was similar. By the century's last decade, European rank-and-file rates had risen to 50 percent annually, though some would have been re-admissions. During the entire nineteenth century, venereal disease consistently failed to respond to legalistic crackdowns in the form of Contagious Diseases and Cantonment Acts, the lock hospital system and available medical treatments. The problem was only overcome in the first decade of the twentieth century, *before* introduction of arsphenamine. The rate fell dramatically to 7 percent in 1908, for newly reasoned explanations that will be presented.

## *Conclusions*

This thesis adds a different dimension to our understanding of military and population health by focussing less on political and sociological consequences, as in previous historiography, and more on practicalities of preventative and therapeutic measures. The cantonment was a relatively isolated enclave, benefitting its inhabitants – more so the European but also the sepoy (certainly from the last two decades of the nineteenth century onwards) – from its sanitary infrastructure and services. The high admission and mortality rate in the European troops during the late 1850s may have been worsened by the triple effect of selection bias of less robust recruits, the known higher first year death rate, and a large immediate post-mutiny influx overwhelming medical capacity. This work suggests that the subsequent fall in incidence of the diarrhoeal diseases was contributed to by better sanitary infrastructure – started before the 1860s reforms – though other factors such as more robust European recruits also might be in play. Coinciding with decline in fluxes, in the final two decades of the century the incidence of and mortality from typhoid surged – speculated reasons include importation of carrier-spreaders from Britain and delayed realization of the importance of flies as transmitters. The sepoy army was disadvantaged compared to the European by delayed infrastructure reform with overcrowded accommodation, poorer medical facilities, and questionable diet, with consequential predisposition to respiratory disease, notably pulmonary tuberculosis – partially affirming McKeown’s proposition – and poorer outcomes for malaria. Its health position in relation to the native civilian population could not be compared since reliable statistics on the latter are not available. Changes in case fatality rates in the soldiery, for several diseases, suggest a positive response to medical intervention, principally a benefit from supportive care and, in typhoid, avoidance of intestinal perforation. Though few drugs were curative – the main exception being cinchona, and perhaps mercury which tempered syphilis – others, previously unrecognized, might have had some genuine

benefit. Revealed here, ipecacuanha seemed effective for amoebic dysentery, silver nitrate and lead acetate enemas could potentially cauterize bleeding bowel in diarrhoeal disorders, and some metal-group compounds may have had an antimicrobial effect. Whereas sanitation measures and other factors truncated intestinal infections, legislation failed to control venereal disease, and neither did lifestyle manipulation moderate alcoholism – standardization of medication and education for the former, and the temperance movement with a change in societal mores, for the latter, proved more compelling explanations. The story of disease in the soldiery of nineteenth-to-twentieth century India thus intercalates public health, status of the soldier’s body, and cultural conformity with therapeutic developments throughout the ninety years of this study.

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## **Dedication**

This thesis is dedicated to my father, Walter Robert Gawkrodger (1919-2011), and to my mother, Elma Jean Gawkrodger *née* Chalmers (1922-1992).

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## List of abbreviations

Army Medical Department	AMD
British Library	BL
Cambridge University Press	CUP
East India Company	EICo
Her (His) Majesty	HM
Her (His) Majesty's Stationary Office	HMSO
Indian Medical Gazette	IMG
Indian Medical Service	IMS
Medical statistical report on the native army of Madras	MSR NA Ma
Non-commissioned officer	NCO
Oxford Dictionary of National Biography	ODNB
Oxford English Dictionary	OED
Oxford University Press	OUP
Registrar general for births, deaths and marriages for England	RG BDME
Report of the public health commissioner to the government of India	RPHCGI
Report of the sanitary commissioner to Bengal	RSCBe
Report of the sanitary commissioner to Bombay	RSCBo
Report of the sanitary commissioner to the government of India	RSCGI
Report of the sanitary commissioner to Madras	RSCMa
Royal Army Medical Corps	RAMC
Subordinate Medical Service	SMS
Superintendent of Government Printing	SGP
The National Archive	TNA
World Health Organization	WHO

## Chapter 1: Introduction

A fit and effective army was central to British control of India. Using this soldiery as its context, this thesis interrogates the influences of the environment and of therapeutic interventions on disease in the nineteenth and into the twentieth century. Its subject – soldiers in the British armies, both indigenous and European – was one of the few populations open to recorded medical scrutiny at the time, and its setting – the tropical and subtropical subcontinent of India – housed the largest force in the imperial military.<sup>1</sup> The armies in India were crucial to the economic and political global dominance of Britain during the nineteenth century.<sup>2</sup> From the small European and sepoy force with which Robert Clive took Calcutta in 1757 and thence Bengal, the armies of the East India Company (EICo) expanded until, at the time of the 1857 mutiny, they numbered over a quarter of a million in strength.<sup>3</sup> Their influence was felt as far afield as Egypt, China, East and South Africa, and Aden, as well as the nearer theatres of Afghanistan, Persia, Malaya and Burma.<sup>4</sup> The security of sea routes to the subcontinent was perhaps their major role outside India. Within India, administration of authority centred on the cantonment – where a civilian population supported a permanent military presence rather than a transitory camp (Figure 1.1)<sup>5</sup> The bodily health of Britain's armies in India was essential to her paramountcy as a global power, so depletion was a

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<sup>1</sup> Throughout this thesis, indigenous troops are referred to as 'native' or sepoys, in accordance with the manner in which they are detailed in source material.

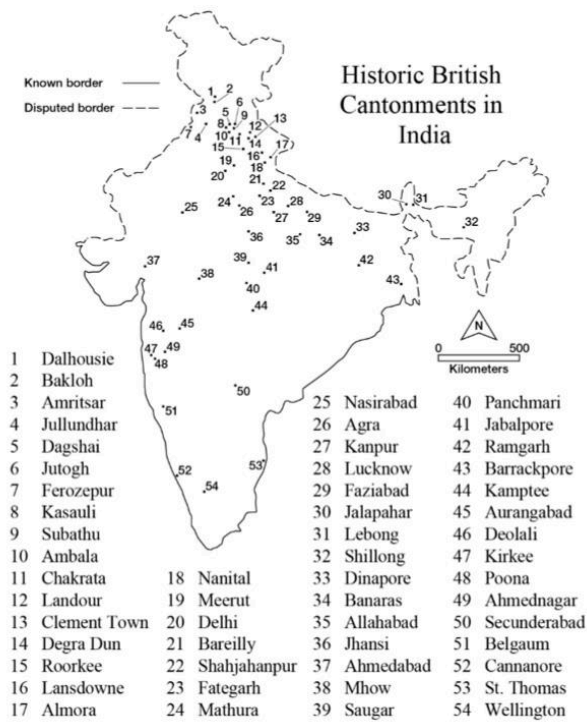
<sup>2</sup> P. Bhattacharya, 'India in the rise of Britain and Europe: a contribution to convergence and great divergence debates,' *Journal of Interdisciplinary Economics* 33 (2021), pp. 24–53.

<sup>3</sup> The numerical growth of the Company's forces is discussed in chapter 2.

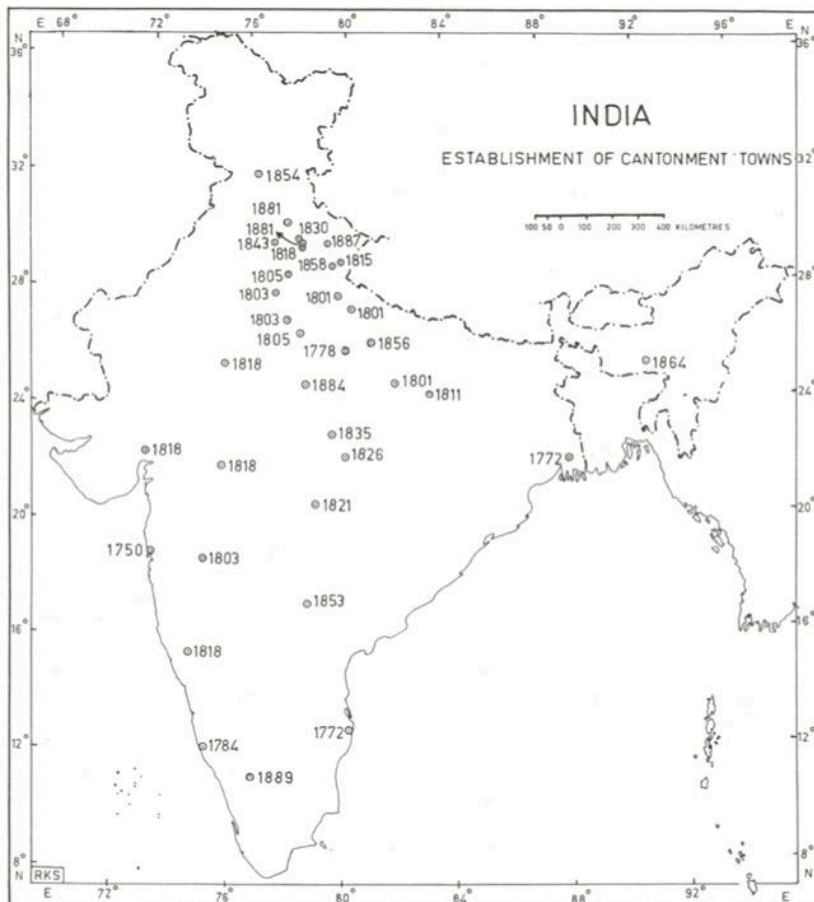
<sup>4</sup> H.V. Bowen, *The business of empire: the East India Company and imperial Britain, 1756-1833* (Cambridge: CUP, 2006), pp. 43-7; Bhattacharya, 'India in the rise', p. 341; The Royal Navy often was of equal or greater importance.

<sup>5</sup> S.H. Halvorsen, J.L. Wescoat Jr, 'Guarding the sons of empire: military-state-society relations in water, sanitation and health programs of mid-19 century India', *Water* 12 (2020), pp. 1-17, doi:10.3390/w12020429 – Figure 1.1(a) from p. 3; K.M. Kulkarni, 'Cantonment towns of India', *Ekistics* 46 (1979), pp. 214-20; The location of the 54 plus cantonments was decided by geo-strategic factors, there being more in the plains due to their greater vulnerability to attack than at higher elevations. Some were in princely states. Services provided in cantonments for the military included transport and communications but also tailoring and European goods, in addition to 'entertainments'. Figure 1.1(b) from p. 217.

**Figure 1.1(a) Cantonment towns in British India: names and locations.**



**Figure 1.1(b) Cantonment towns in British India: dates of establishment.**



concern. Mortality among European troops – though not the sepoy force – of the EICo in the first half of the nineteenth century was around ten percent annually, mostly from diarrhoeal diseases, cholera, malaria and other fevers. Despite this, much of the secondary literature on the army's performance during internal wars, such as that on the Second Anglo-Maratha campaign (1803-05) and the Anglo-Afghan Wars (1839-42, 1878-80), mentions little on troop health.<sup>6</sup>

Using contemporary published records supported by unpublished accounts, this thesis interrogates issues responsible for the health, or otherwise, of these armies, which, for the time, were cared for relatively well compared to civilian populations. The date range, *c.* 1850 to *c.* 1940, is largely defined by the availability of accurate primary sources, though to give background, material is presented, if available, from the eighteenth century. The dates have been chosen to encompass the period of highest mortality – just prior to the 1857 rebellion – up to the start of World War Two – the last period of British influence. Before sketching out the aims of the work, an overview of the historiography will be given, with an outline on hospital organization and medical staffing, as these works frame the analysis in this thesis, and will be engaged with critically.

### ***Historiographic and thematic debate***

Historians have tended to look at the health of armies in India in two ways: either as part of the story of British imperial expansionism, or in the context of the social history of India itself. Arguments on what influenced disease and loss of life have encompassed themes such as financial imperative, immunity, sanitation, nutrition, polity, legal constraint, morality, and, notably in the nineteenth century, topography, though rarely medical intervention. The high

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<sup>6</sup> R.G.S. Cooper, 'Cross-cultural conflict analysis: the 'reality' of British victory in the Second Anglo-Afghan War, 1803-1805' (PhD, University of Cambridge, 1992); A. Burton, ed., *The First Anglo-Afghan Wars: a reader* (Durham: Duke University, 2014),

mortality rate in European recruits to the armies of the EICo has usually been viewed from its impact on military manpower or even from a commercial standpoint, with little emphasis on subaltern aspects, partly due to a lack of primary resource. Douglas Peers in particular has emphasized military fiscalism – ‘While territorial revenues were increasingly dedicated to paying for the military's upkeep, the army was crucial in creating the stability required for efficient [land] revenue collection’.<sup>7</sup> For Philip Curtin the high incidence of some diseases in European soldiers, seen in his colonial settings of Algeria, the West Indies and Madras, was a result of deficient long-term immunity from lack of exposure in childhood.<sup>8</sup> He explains the reduction in ‘relocation cost’, his euphemism for mortality rate, in these troops, sited to the midpoint and final quarter of the nineteenth century, as resulting from improved preventive medicine.<sup>9</sup> Sumit Guha partially agrees, but seems unique in locating better survival more to ‘micro-sanitation’ measures, such as soldiers’ personal hygiene, than to large scale infrastructural projects.<sup>10</sup> Few historians have undertaken a detailed comparative study of the panoply of diseases, comparing native and European soldiers. Curtin examines the main headings, though not in depth, whilst David Arnold focusses on smallpox, plague and cholera. Most scholars concentrate on policy and governmental response, particularly sanitary measures.

Arnold and Daniel Headrick, more so than others, has seen western medicine in India as a ‘colonizing force’, a ‘tool of empire’.<sup>11</sup> Mark Harrison concurs that medicine can be viewed this way in late nineteenth century India but feels that its role has been over-emphasized,

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<sup>7</sup> D.M. Peers, *Between Mars and mammon: colonial armies and the garrison state in early-nineteenth century India* (London: Tauris, 1995), p. 4.

<sup>8</sup> P.D. Curtin, *Death by migration: Europe's encounters with the tropical world in the nineteenth century* (Cambridge: CUP, 2003), p. 6.

<sup>9</sup> Curtin, *Migration*, p. 158.

<sup>10</sup> S. Guha, *Health and population in South Asia* (London: Hurst, 2001), p. 129.

<sup>11</sup> D. Arnold, *Colonizing the body, state medicine and epidemic disease in nineteenth-century India* (Berkeley: University of California, 1993), pp. 292-4; D.R. Headrick, *The tools of empire: technology and European imperialism in the nineteenth century* (New York: OUP, 1981).

partly because successes were limited.<sup>12</sup> The army still had high rates of morbidity. On European civilian health, contemporary pessimism pervaded to the point of denying the possibility of colonization. On the wider scale of Indian civilians, public health benefits were mostly disappointing – outside the main cities being generally restricted to quarantines, provision of dispensaries and vaccination programmes, though there were attempts at other sanitary improvements. Arnold makes the point that the association of medicine with state power led it to be a target – smallpox vaccination and the 1896 plague measures are examples – for nationalist resistance, even if this was ‘vetoing their own advancement’.<sup>13</sup> Experience of backlash from infringement of religious or political niceties also clarifies, as seconded by Harrison, the gradualist approach taken by government in the push for modernization, exemplified by municipal sanitary infrastructure.<sup>14</sup> Radhika Ramasubban argues against this line, insisting that reluctance on the part of the British administration was related to parsimony and indifference to the indigenous population.<sup>15</sup> Anil Kumar agrees that ‘the rulers primarily concentrated on how to provide the best of hygienic sanitary and medical facilities to the military and civil population of their own race’, though the reality was more nuanced.<sup>16</sup> Kumar’s argument that the British administration failed to implement a sanitary policy for India generally overlooks that public health, in India as in Britain and other western countries, frequently was a matter for local government.<sup>17</sup> It was often the Indian rentier classes, dominant in municipal administrations such as Calcutta, who repeatedly had little enthusiasm for such schemes, albeit on financial grounds related to their own taxation.<sup>18</sup>

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<sup>12</sup> M. Harrison, *Public health in British India* (Cambridge: CUP, 1994), pp. 228-30.

<sup>13</sup> Arnold, *Colonizing*, p. 293.

<sup>14</sup> Harrison, *Public health*, p. 230.

<sup>15</sup> R. Ramasubban, *Public health and medical research in India: their origins under the impact of British colonial policy* (Stockholm: SARCDC, 1982), pp. 1-44.

<sup>16</sup> A. Kumar, *Medicine and the raj: British medical policy in India, 1835-1911* (New Delhi: Sage, 1998), p. 216.

<sup>17</sup> Kumar, *British medical*, pp. 141-3.

<sup>18</sup> Harrison, *Public health*, p. 226; Apart from Calcutta, sanitary reform was pioneered in, for example, Ahmedabad and Bombay – M. Ramanna, *Western medicine and public health in colonial Bombay, 1845-1895* (Hyderabad: Orient Longman, 2002), pp. 37, 109.

Hence, sanitary engineering was easier to implement in military cantonments where, provided funding was accessible, the only permission needed was that of the army. Though Kumar despaired about the impact of colonial medicine on the masses of India, Guha saw declines in mortality from plague, cholera and smallpox in the early twentieth century, benefitting a rise in population, as partly resulting from public health measures, additional to, as he reads it, better nutrition following improved harvests consequent upon years of favourable weather – a partial validation of the arguments of Thomas McKeown (1912-88).<sup>19</sup>

Indeed, nutrition requires special mention, central as it is to McKeown's thesis, developed below, on population growth in Europe, and considering its importance to immune function.<sup>20</sup> Nourishment whilst in India coloured the European soldier's health there, but his pre-service status needs scrutiny too. For the sepoy, potential dietary inadequacies would be a drag on his wellbeing. Looking first at the nutritional state of British and Irish recruits, as judged by height, in the fifty years to 1856, estimated heights of young men recruited to the Company's army wavered between 64.14 and 67.64 inches (163-172 cm) without any trend (the Irish tended to be slightly taller).<sup>21</sup> Over the period 1870 to 1914, Roderick Floud and colleagues showed that, despite what they see as unfounded alarm at the time of the Boer War about the habitus of recruits, there was a steady increment in the height of recruits, when allowance is made for changes in height standard.<sup>22</sup> The average height increased from 65.3 inches (166

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<sup>19</sup> Kumar, *British medical*, p. 219; Guha, *Population*, pp. 85-6.

<sup>20</sup> Y. Alwarawrah, K. Kiernan, N.J. MacIver, 'Changes in nutritional status impact immune cell metabolism and function', *Frontiers in Immunology* 16 May 2018, <https://doi.org/10.3389/fimmu.2018.01055> [18 December 2023]

<sup>21</sup> J. Mokyr, C. O Grada, 'Height and health in the United Kingdom 1815-1860: evidence from the East India Company army', *Explorations in Economic History*, 33 (1996), pp. 141-68; Irishmen often comprised near fifty percent of recruits to the Company's European army, with the proportion from urban areas increasing, for Ireland, from 5 percent in 1804 to 44 percent in 1856 (for England, 18 percent to 60 percent over the same period).

<sup>22</sup> R. Floud, K.W. Wachter, A. Gregory, *The physical state of the British working class, 1870-1914: evidence from army recruits*, working paper 1661 (Cambridge: National Bureau of Economic Research, 1985); The authors noted a steady increase in literacy rate from 33 percent in 1864 to 98.5 percent in 1905 – from lagging

cm) in 1879-83 to 66.2 inches (168 cm) in 1908 for a male recruit aged 20, but the latter is still below the mean for British males aged 20-24 in 1985, of 69.3 inches (176 cm).<sup>23</sup> British and Irish recruits then, derived primarily from the unskilled labouring classes, had suboptimal growth as children, either due to infections or to malnourishment, the latter suggested by Emma Griffin's observation of the frequent reportage of hunger in working class autobiographies, both agricultural and industrial, of the early to mid-nineteenth century.<sup>24</sup> The rank and file of the European army was provided with two (later three) meals per day (see Chapter 2) and, though the native force was given an allowance rather than being fed, a better diet was one reason why some sepoys joined up.<sup>25</sup> Arnold finds that the British, having identified caste-related diets as a thorny issue, sidestepped them in the native army until the 1890s or even later (this extended to their First World War hospitals).<sup>26</sup> Though forced to address it in prisons from 1864, a connection between malnourishment and predisposition to disease was often not made, being dismissed, for example, in John Malcolmson's 1835 essay on beri-beri in (mostly) native troops and in gaols: 'the comparative cheapness of all kinds of grain ... are fatal to any supposition of the disease depending on deficient and unhealthy diet'.<sup>27</sup> Similarly, scurvy was a recognized problem in sepoy forces, especially on

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that in the general population to exceeding it. Other authors are more accepting about Sir John Maurice's pessimism concerning the high rejection rate of Boer War volunteers – see: R. Soloway, 'Counting the degenerates: statistics of race deterioration in Edwardian England', *Journal of Contemporary History*, 17 (1982), pp. 137-64.

<sup>23</sup> Equivalent recruitment data are difficult to find for sepoys. David Omissi notes that, prior to World War One, the required height for a Sikh recruit was 69 inches (175 cm), but this fell to 63 inches (160 cm) during wartime conditions – D. Omissi, *The sepoy and the raj; the Indian army 1860-1940* (Basingstoke: Macmillan, 1994), pp. 48-50, 58, 69-70. Omissi reports that many recruits were from farming families whose crop yields were poor – the soldier's income could help develop cultivation or purchase better land. Indeed, in the last quarter of the nineteenth century, and the first of the twentieth, reclaimed land became a reward for service.

<sup>24</sup> E. Griffin, 'Diets, hunger and living standards during the British industrial revolution', *Past and Present*, 239 (2018), pp. 71-111; Griffin notes the high proportion of weekly budget spent on food by working class families; Romola Davenport favours childhood infections as the cause of sustained stunting in the mid-nineteenth century (as well as increased mortality) – 'Urbanization and mortality in Britain, c.1800-50', *Economic History Review*, 73 (2020), pp. 455-85.

<sup>25</sup> Omissi, *Sepoy*, p. 62.

<sup>26</sup> D. Arnold, 'The 'discovery' of malnutrition and diet in colonial India', *Indian Economic and Social History Review*, 31 (1994), pp. 1-26 at pp. 9-10.

<sup>27</sup> J.G. Malcolmson, *A practical essay on history and treatment of beri-beri* (Madras: Vepey Mission, 1835), pp. 11-31, 42; Beri-beri is due to deficiency of thiamine (vitamin B1).

manoeuvres when access to lime juice was limited.<sup>28</sup> In the Company's Bengal native army the sepoy had to purchase and cook his own food, though when on foreign service he was provisioned with flour, dhal (lentils) and rice.<sup>29</sup> Goat's meat, mutton or fish was consumed but rarely due to cost, and never by Brahmins. Mostly, native soldiers ate chapatis, dhal, rice with curry containing kachu (a vegetable), cakes of jowar (millet) and pickles, at a monthly cost of three to five rupees. Aniya Sen recounts that a Bengal sepoy often ate sparingly in order to remit most of his pay, up to three-quarters, to his family for their maintenance.<sup>30</sup> Post-rebellion, Arnold records that the allowance paid to native soldiers to buy their own food was often inadequate.<sup>31</sup> Thus the nutrition of the European soldier, once in India, can be regarded as adequate, though recruitment height data suggest this was often not so in childhood. The diet of the sepoy, from what is known, often has been regarded as suboptimal – though Kaushik Roy records that for a high caste Bengal army sepoy the caloric intake was adequate.<sup>32</sup> These effects are considered in Chapter 2. In the general population of India, malnutrition was a neglected topic until the early 1930s, when John Megaw, director-general of the Indian Medical Service (IMS), concluded, from returns of dispensary doctors, that twenty percent of the population was 'very badly undernourished', their diet, mainly of rice, with small amounts of milk, pulses, vegetables and fats, being deficient in protein and vitamins.<sup>33</sup>

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<sup>28</sup> H.P. Yeld, 'Report on health of troops forming the Vitakri field force, and upon an outbreak of scurvy amongst them', *IMG*, 15 (1880), pp. 10-12.

<sup>29</sup> A. Sen, 'The structure and organisation of Bengal native infantry with special reference to problems of discipline' (PhD, University of London, 1961), pp. 297-9; From 1847 the Bengal government introduced financial compensation if the price of flour exceeded a certain level. In native hospitals one Brahmin and one muslim cook were provided to prepare food for patients unable to do this for themselves (p. 287).

<sup>30</sup> Sen, 'Bengal native army', p. 294; Sen quotes Durgadas Bandopadhyay, *Bidrobe Bangali* (Calcutta, 1924), published in Bengali.

<sup>31</sup> Arnold, *Colonizing*, pp. 92-3.

<sup>32</sup> K. Roy, 'Feeding the Leviathan: supplying the British-Indian army, 1859-1913', *Journal of the Society for Army Historical Research*, 80 (2002), pp. 144-61. One seer was officially defined in 1956 as 1.25 Kg.

<sup>33</sup> J.W.D. Megaw, 'Medicine and public health', in E. Blunt, ed., *Social service in India: an introduction to some social and economic problems of the Indian people* (London: HMSO, 1938), pp. 181-214.

### *Non-Eurocentricity and the McKeown theory*

Warwick Anderson criticized late twentieth century writing on colonial medicine as being trapped in an enclave, too Eurocentric, following a master narrative, and overly obsessed with the importance of germ theory.<sup>34</sup> He called for histories located within the social economies and politics of their settings, and to reflect the ‘influence of colonial practice on metropolitan medicine’.<sup>35</sup> The use of Indian medical systems, ayurveda and unani, in sepoy troops, and any influence on or overlap with western medicine, is pertinent to this, as discussed in Chapter 3.<sup>36</sup> Both Arnold and Curtin write from a western angle, but recent studies from India or by Indians, such as those of Kumar, Guha, Ramanna and Sehrawat, speak from a subcontinental perspective as did, in 1817, Charles Maclean, who used his Indian experience of epidemics to inform the European setting.<sup>37</sup> A major contribution of *this* thesis is to apply in detail non-European data to the debate on the theories of McKeown, whose work on the causes of eighteenth to nineteenth century mortality decline focussed entirely on the western world.

McKeown’s theorems, expounded in the 1960s and 1970s, have extorted debate amongst historians, some of whom have parroted his ideas second-hand or shaped them, e.g. over-valuing his conclusion on nutrition, rather than scrutinizing the source. McKeown sought explanations for the expansion in western populations from the eighteenth century, mostly using English and Welsh data from 1838, the date from which cause of death was recorded

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<sup>34</sup> W. Anderson, ‘Where is the postcolonial history of medicine’, *Bulletin of the History of Medicine*, 72 (1998), pp. 522-30.

<sup>35</sup> This seems to jar with his criticism that historians of tropical medicine ‘have been prepared to treat the colonial context as little more than a palimpsest for European scientific theories’ – Anderson, ‘Postcolonial’, p. 525.

<sup>36</sup> The practice and effectiveness of traditional Indian systems of medicine, ayurvedic and unani, are not studied here *per se*, except where their integration into or comparison with westernized medicine is appropriate. In the eighteenth and early-to-mid nineteenth century they shared similarities with western medicine, as then practiced, since they had common roots.

<sup>37</sup> C. Maclean, *Results of an investigation respecting epidemic and pestilential diseases; including researches in the Levant concerning plague*, 2 vols. (London: Underwood, 1817).

on death certificates.<sup>38</sup> He concluded that population rise was mostly down to a reduction in deaths from infectious diseases, rather than an increase in births; that although there may have been spontaneous reduction in the virulence of some microorganisms, it was insufficient to account for the mortality fall; that ‘medical measures’ post-1838 made ‘only a small contribution’ (he cites those for ‘smallpox, syphilis, tetanus, diphtheria, diarrhoeal diseases and some surgical conditions’); that ‘from the second half of the nineteenth century a substantial reduction of mortality from intestinal infections followed the introduction of hygienic measures – purification of water, efficient sewage disposal and improved food hygiene, particularly in respect of milk’; and that ‘the most acceptable explanation of the large reduction of mortality and growth of population which preceded advances in hygiene is an improvement in nutrition due to greater food supplies’ – inferring consequential improved resistance to disease.<sup>39</sup> He sees improved food supply as a consequence of the agricultural revolution that preceded, and permitted, the industrial one. McKeown acknowledges that public health sanitation in the second half of the nineteenth century reduced exposure to gastrointestinal infections, but states: ‘Such measures had no effect on exposure to airborne infections, the diseases mainly associated with reduction of mortality during the nineteenth century’.<sup>40</sup> This insistence on the preeminence of tuberculosis mortality, linked to overcrowded urban living for the working class, and the counter-Malthusian back-projected causative attribution to nutritional sufficiency for the eighteenth to nineteenth century population rise, are the central issues that have excited controversy.

The relevance of these concepts to armies in British India, particularly the sepoys, will become clear, but here we focus on the European situation. Roger Schofield and David Reher

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<sup>38</sup> T. McKeown, *The modern rise of population* (London: Arnold, 1976), p. 1.

<sup>39</sup> McKeown, *Population*, pp. 152-4.

<sup>40</sup> McKeown, *Population*, p. 159.

see stabilization of ‘crisis mortality’ (the radical year-to-year swings consequent upon epidemics) as critical to mortality reduction (and population growth) in the eighteenth century, noting that mortality rates then plateaued, not to fall again until the later nineteenth century, linked to fewer infant deaths.<sup>41</sup> They dispute whether there was an improvement in nutritional status during this period, pointing out the lack of cause of death data for this era needed to support McKeown’s contention – living standards actually may have worsened, and, whilst agreeing on the importance of tuberculosis, recognize the co-prominence of diarrhoeal diseases.<sup>42</sup> Floud, who equated height with nutritional status, and found that heights rose in Europe as mortality declined, is careful not to put this down empirically to nutrition.<sup>43</sup> He points out that public health measures could contribute to increased height and were implemented simultaneously. Malnourishment, which impairs innate and both humeral and cellular-specific immunity, currently affects not only children in developing countries, predisposing to infections, but also the elderly in western societies, and can take the form of deficiency in micronutrients.<sup>44</sup> For example, supplementation with vitamin A reduces death from measles. Anne Hardy seems to fly in the face of this when she asserts that: ‘The nutritional status of the individual is irrelevant to individual resistance and outcome ...’.<sup>45</sup> Indeed, Hardy is sceptical about income and diet in the second half of the nineteenth century, asserting: ‘rising real income had little impact on improving nutritional standards’, though in an earlier paper she accepts that ‘taking into account the age-specific nature of decreasing phthisis [tuberculosis] mortality ... one may point to rising living standards as a fundamental

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<sup>41</sup> R. Schofield, D. Reher, ‘The decline of mortality in Europe’, in R. Schofield, D. Reher, A. Bideau, eds., *The decline of mortality in Europe* (Oxford: Clarendon, 1991), pp. 1-17.

<sup>42</sup> Schofield, Reher, ‘Mortality’, pp. 5-6, 9; P.H. Lindert, J.G. Williamsone, ‘English workers’ living standards during the industrial revolution: a new look’, *Economic History Review*, 36 (1980), pp 1-25; Nutrition equates to food intake, nutritional status also takes account of disease environment.

<sup>43</sup> R. Floud, ‘Indicators of nutritional status’, in Schofield, *et al.*, *Mortality*, pp. 146-57.

<sup>44</sup> G.T. Keusch, ‘History of nutrition: malnutrition, infection and immunity’, *Journal of Nutrition*, 133 (2003), pp. 336S-40S.

<sup>45</sup> A. Hardy, *The epidemic streets* (Oxford: Clarendon, 1993), pp. 282-3.

cause of decline'.<sup>46</sup> Bernard Harris, whilst questioning the correctness of Hardy's doubts on late nineteenth century nutrition, suggests that, prior to 1800, 'a substantial proportion of the population' had poor diets and that, although this improved between 1820 and 1850, benefits were cancelled out by the negative impact of urbanization, thus accounting for plateauing of the mortality rate at this time.<sup>47</sup> Harris dates the decline in mortality from diarrhoea in infants to the beginning of the twentieth century and, whilst he seems to accept much of the argument on the influence of improved living standards on mortality decline, he feels that McKeown 'interpreted the consequences of this improvement rather too narrowly', by which he means that by focussing on nutrition, the effects of, for example, better housing, were undervalued.<sup>48</sup> Sheila Zurbrigg recently re-emphasized involvement of nutrition in epidemic disease, notably malaria, by developing the early twentieth century work of Major S.R. Christophers. She demonstrated a relationship to famine and synchronism with rainfall.<sup>49</sup>

On the other hand, Sumit Guha concludes it was primarily nutrition that accounted for lessened mortality outside of military populations. He reasons the explanation to be reduced mortality as a proportion of those infected (lower case fatality), due to better person-specific disease resistance to tuberculosis and diarrhoeal microorganisms, rather than a decrease in the incidence of infections – the latter he feels would have applied if public health measures were causative.<sup>50</sup> In this he goes further than McKeown, who felt the last-mentioned did apply to

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<sup>46</sup> A. Hardy, *Health and medicine in Britain since 1860* (Basingstoke: Palgrave, 2001), p. 38; A. Hardy, 'Diagnosis, death, and diet: the case of London, 1750-1909', *Journal of Interdisciplinary History*, 18 (1988), pp. 387-401.

<sup>47</sup> B. Harris, 'Public health, nutrition and decline of mortality: McKeown thesis revisited', *Social History of Medicine*, 17 (2004), pp. 379-407; Harris points out that Szreter and Mooney's described fall in life expectancy in the 1830s is based on data from Glasgow alone – S. Szreter, G. Mooney, 'Urbanization, mortality and the standard of living debate; new estimates of expectation of life at birth in nineteenth-century British cities', *Economic History Review*, 51 (1998), pp. 84-112.

<sup>48</sup> Harris, 'Public health', pp. 404-6.

<sup>49</sup> A. Zurbrigg, 'Hunger and epidemic malaria in Punjab, 1868-1940', *Economic and Political Weekly*, 25 (1992); pp. 2-26.

<sup>50</sup> S. Guha, 'The importance of social intervention in England's mortality decline', *Social History of Medicine*, 7 (1994), pp. 89-113.

gastrointestinal infections. Guha's theory requires demonstration that the incidence of intestinal infections did not fall and that other agencies did not influence the infected person. Evidence for this is not presented – the Friendly Society publications he refers to are actuarial life and sickness duration tables that omit diagnoses. Reports of the *incidence* of disease, rather than resulting mortality, are a rare commodity for civilians in this period – infectious diseases were only statutorily reportable from 1889 in London (1899 for the rest of England and Wales). For Bolton in 1877-78, reported under a local act, scarlet fever accounted for half to three-quarters of all infections, though diarrhoeas, tuberculosis and respiratory disease were excluded.<sup>51</sup> Indeed, Davenport, concerned with the effects of urbanization, found a rise then a decline in the virulence of and mortality from scarlet fever, the main cause of death for children aged one to nine years, between 1830 and 1870, and sees it as a significant contributor to the overall pattern of mortality change in this period.<sup>52</sup>

Re-working McKeown's own data shows that, between 1848-54 and 1901, there was a 22 percent fall in overall mortality rate (21,856 to 16,958, per million), of which proportionally the main contributors were: pulmonary tuberculosis 30 percent, typhoid/ typhus 15 percent, other infections 14 percent, scarlet fever/ diphtheria 11 percent and diarrhoeal diseases 11 percent (deaths from bronchitis, pneumonia and influenza actually *increased* by 9 percent).<sup>53</sup> In view of this it is difficult to understand why McKeown so vehemently singled out tuberculosis as *the* main factor in the decline of overall late nineteenth century mortality.

Simon Szreter's analysis is similar. He concurs that McKeown overemphasized tuberculosis,

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<sup>51</sup> Local government board, *Infectious diseases notification* (London: HMSO, 1882), p. 12; Quarantine was used to limit spread.

<sup>52</sup> Davenport, 'Urbanization', pp. 455-85.

<sup>53</sup> McKeown, *Population*, pp. 54-60; Pulmonary tuberculosis showed a 56 percent fall; In *Population*, McKeown made his comparison between 1848-54 and 1971 using sparse data, though he gives far more detail in his papers, for example, in: T. McKeown, R.G. Record, 'Reasons for the decline of mortality in England and Wales during the nineteenth century', *Population Studies*, 16 (1962), pp. 94-122.

and refutes that evidence suggests a fall in this disease before 1847.<sup>54</sup> Szreter argues, without being specific, that the fall in tuberculosis deaths in the final third of the nineteenth century was ‘a secondary and derivative effect’ of the fall in ‘sanitation diseases’, though he admits that the omission of clean air from sanitary legislation contributed to the increase in other respiratory mortalities.<sup>55</sup> For deaths from bronchitis, pneumonia and influenza he finds it unnecessary to invoke nutritional status, but seemingly does accept this argument for tuberculosis, whilst suggesting that the fall is less than that recorded, due to misclassification.<sup>56</sup> Szreter supports the view as presented above, that the diarrhoeal diseases should be given more prominence than McKeown allows. Szreter’s main gripe is that McKeown places too much emphasis on nutrition (though the latter’s nod to the role of public health in reducing gastrointestinal infections is acknowledged):<sup>57</sup>

... the argument is not that improving nutrition and living standards were entirely unimportant in accounting for the mortality decline, but that the role of a battling public health ideology, politics, and medicine operating of necessity through local government, is more correctly seen as the principal causal agency involved.

The upshot of this is that McKeown was too narrow in implicating a fall in pulmonary tuberculosis, consequent upon improved living standards exemplified through nutrition, as the prime mover in the eighteenth-to-nineteenth century English mortality decline.

Unsurprisingly, the situation is more nuanced. It has to incorporate movement in other disorders, notably diarrhoeal diseases, respiratory infections, and scarlet fever, and alternative mechanisms, specifically public health legislation and altered microorganism virulence. Any

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<sup>54</sup> S. Szreter, ‘The importance of social intervention in Britain’s mortality decline c. 1850-1914: a re-interpretation of the role of public health’, *Social History of Medicine*, 1 (1988), pp. 1-38, at pp. 8, 12-13; Szreter presents his working differently.

<sup>55</sup> Szreter, ‘Social intervention’, pp. 13, 16, 27; The sanitation diseases are gastrointestinal infections.

<sup>56</sup> S. Szreter, Mortality in England in the eighteenth and nineteenth centuries: a reply to Sumit Guha, *Social History of Medicine*, 7 (1994), pp. 269-82; McKeown was more accepting of the role of sanitary measures in his later work, see – T. McKeown, ‘Food, infection and population’, *Journal of Interdisciplinary History*, 14 (1983), pp. 227-47.

<sup>57</sup> Szreter, ‘Social intervention’, pp. 27-30, 36.

role for therapeutics, though, is generally sidelined in the historiography, and little attention has been focussed on trace nutrients. The implications of these sometimes counteracting forces will be analyzed for the military setting of British India in subsequent chapters.

### ***Vice and legislation, morality and misogyny***

Contemporaneous with concerns about infectious disease mortality in British India was the high prevalence of venereal disease and, slightly less problematic, alcoholism, in the European but not the native soldiery throughout the entire nineteenth century, and how the authorities sought to control these and maintain an effective force. On this, scholars of social and women's history, notably Kenneth Ballhatchet, Douglas Peers, Philippa Levine and Erica Wald, have written extensively – though almost exclusively from a western angle, with only brief mention, if any, of the views of the prostitutes or their clients.<sup>58</sup> Some authors focus, using a class-conscious model, on the contradictory dilemma which authorities thought faced them. How were they to control, and limit the negative consequences of, the carnality and drunkenness of the soldier, characteristics deemed natural to his class, whilst simultaneously maintaining the aggressive qualities they desired, seen as an indivisible accoutrement?<sup>59</sup> A system, in all but name, of state-regulated prostitution, the negative effects of which were caught by the lock hospitals – later reinforced by the Contagious Diseases Acts (CDAs) – was devised, Ballhatchet explains, to dissuade soldiers from the worse sins of masturbation and homosexuality.<sup>60</sup> Wald argues that the initial decision to institute lock hospitals was part of the over-riding priority given by the EICo to military fiscalism – an effective army on the

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<sup>58</sup> The term 'prostitute', used in the source material, has been retained to avoid anachronism. Currently people in this employ are referred to as 'sex workers'.

<sup>59</sup> For example, E. Wald, *Vice in the barracks: medicine, the military and the making of colonial India, 1780-1868* (Basingstoke: Palgrave, 2014), p. 190; D.M. Peers, 'Soldiers, surgeons and campaigns to combat sexually transmitted diseases in colonial India, 1805-1860', *Medical History*, 42 (1998), pp. 137-60.

<sup>60</sup> K. Ballhatchet, *Race, sex and class under the raj: imperial attitudes and their critics, 1793-1905* (London: Weidenfeld and Nicolson, 1980), pp. 10, 162.

cheap.<sup>61</sup> Later, post-1830, she sees continuation of lock hospitals, found by then to be mostly ineffective, as part of the conflict between ‘age of reform’ anglicists, and conservative orientalist (who favoured retaining the Indian way of doing things). Peers reads their retention differently – as a desperate strategy of segregation in the face of the inadequacy of available therapies.<sup>62</sup>

Levine sees the state’s pressure to control venereal disease from a racial viewpoint – that of anxiety about sexual relations between people of different ethnicities.<sup>63</sup> She views the semi-official encouragement of transactional prostitution as the British preference to the dangers of the Company’s original proclivity for concubinage, with its emotional ties, though, as will be shown, the cost of wives and children was also a factor.<sup>64</sup> Peers, Levine and Wald all stress that the official line was misogynistic, blaming the prostitute as the originator who passed venereal disease to the soldier, with the infliction of compulsory detention and unpleasant medical interventions on the woman.<sup>65</sup> Peers sees this as part of the iconography of hyper-masculine culture, which additionally demarcated the colonized from the colonizer.<sup>66</sup> But it should not be ignored that soldiers, who, as males, were more likely to have symptoms of the disease, also were detained and themselves subjected to unsavoury procedures.<sup>67</sup>

Transmission in the early nineteenth century was deemed to be female to male. Male-to-male conveyance, men who have sex with men, and homosexuality generally, has received little coverage in the literature on British India.<sup>68</sup> The First World War added the vexed question of

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<sup>61</sup> Wald, *Vice*, pp. 8-9, 84-6, 220.

<sup>62</sup> Peers, ‘Soldiers, surgeons’, p. 160.

<sup>63</sup> P. Levine, *Prostitution, race, and politics* (New York: Routledge, 2003), p. 6

<sup>64</sup> Levine, *Prostitution*, pp. 179, 270.

<sup>65</sup> Peers, ‘Soldiers, surgeons’, p. 146; Levine, *Prostitution*, p. 12, 70-80 – discusses treatments and conditions at lock hospitals; Wald, *Vice*, p. 16.

<sup>66</sup> Peers, ‘Soldiers, surgeons’, p. 146.

<sup>67</sup> Peers speculates that the unpleasantness of mercury treatment resulted in under-reporting – ‘Soldiers, surgeons’, p. 141.

<sup>68</sup> Levine, *Prostitution*, pp. 265, 292-3; Peers, ‘Soldiers, surgeons’, pp. 147, 159.

the use of prophylactics.<sup>69</sup> Though both native and European troops were treated in army hospitals by military doctors, there were differences in methods of healthcare delivery which, it will be shown, had consequences for mortality and morbidity.

### ***Organization and infrastructure of military and civilian hospitals***

Up until 1881, hospitals for both native and European troops of the Company and crown forces in India were organized on a regimental basis, meaning that there could be several hospitals within a station or cantonment shared by different regiments. Regimental *field* hospitals followed the men if on campaign, where they were supported, at a distance, by field general hospitals, with a third tier – the general hospital, often established at a more permanent base.<sup>70</sup> After 1881, a system of ‘station’ hospitals, replacing the regimental ones, was introduced, for European troops only, beginning in the Bengal presidency, followed by Bombay and Madras.<sup>71</sup> The advantages of this system were cost savings, centralization of facilities, development of specialisms – including a nursing establishment and surgical procedures, and the possibility of isolation of infected cases.<sup>72</sup> Reasons cited why regimental hospitals were maintained for native troops were that medical officers would not be familiar with the men, and that centralized kitchen facilities made catering for special diets difficult. In native regimental hospitals, the government provided no bedding, hardly any furniture, and, for food, ill sepoys mostly relied on the cooking of comrades – these deficiencies, combined with the inability to segregate infectious cases, were described in 1910 as likely to

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<sup>69</sup> Levine, *Prostitution*, pp. 147-52.

<sup>70</sup> C.A. Gordon, *Army hygiene* (London: Churchill, 1866), pp. 136-7, 378-82; The number of beds required was worked out as twelve percent of force strength – p. 385. Hospitals for officers were separate from those for rank and file – p. 395.

<sup>71</sup> J.F. Bourke, ‘The Indian hospital corps’, *Journal of the Royal Army Medical Corps*, 75 (1940), pp. 84-93; The station hospital system had replaced regimental hospitals in Britain in 1873. Presidency armies were only abolished by the government of India in 1895; F. Smith, *A short history of the Royal Army Medical Corps* (Aldershot: Gale and Polden, 1929).

<sup>72</sup> S. Sehrawat, *Colonial medical care in north India* (New Delhi: OUP, 2013), pp. 192-202; Sehrawat details delays in implementing station hospitals.

‘prejudice the effectiveness of treatment’.<sup>73</sup> Consideration had been given on numerous occasions, from 1886, to the introduction of station hospitals for native troops, and indeed there was a trial of these in Rawalpindi and Calcutta in 1892, but despite clear advantages, optimism from IMS medical officers, and indications of acceptance by troops, station hospitals for sepoys were not approved until 1918.<sup>74</sup> During the First World War, service of native forces on the Western Front led to rapid improvement in medical management of their casualties, to mirror that of other troops.<sup>75</sup> Arrangements at the Western Front were based on a series of successive triage points – regimental aid post, advanced dressing station, casualty clearing station, and general hospital, each one a further step back from the front line and treating progressively more serious conditions.<sup>76</sup>

Official manuals and reports give descriptions, often idealized, of the recommended structure of hospitals. The 1863 report of commissioners appointed to inquire into the sanitary state of the army in India, describing, presumably, regimental hospitals in European barracks, found considerable variation but suggested as a minimum, 100-130 square foot superficial area, 8 foot wall space and 1,500 cubic foot ventilated space.<sup>77</sup> Hospitals should be raised off the ground, ventilated underneath, and be in detached pavilions containing 20 to 24 beds, arranged in two rows facing each other beneath windows. The common lack of ablution facilities and, often, absence of privies, the 1863 commissioners sought to correct by provision of fixed wash basins, a bath and a water closet for each ward. The native hospitals,

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<sup>73</sup> *Report of the committee appointed to consider the introduction of station hospitals for Indian troops in place of regimental hospitals* (Simla: Government Central Press, 1910) – quoted by Sehwat, *Colonial*, p. 195-8.

<sup>74</sup> The Kitchener Indian Hospital at Brighton was seen by its commander, Sir Bruce Seton, as a trial of the station hospital system for native troops – Sehwat, *Colonial*, p. 196.

<sup>75</sup> Setbacks affecting native forces in the 1915 Mesopotamian campaign exposed deficiencies in medical care of these troops, leading to improvements in organization – Sehwat, *Colonial*, pp. 196-7.

<sup>76</sup> Imperial war museum, *A short guide to medical services during the First World War* <https://www.iwm.org.uk/history/a-short-guide-to-medical-services-during-the-first-world-war> [14 August 2021].

<sup>77</sup> *Report of the commissioners appointed to inquire into the sanitary state of the army in India with précis of evidence* (London: Eyre and Spottiswoode, 1863), pp. 135-9, 166-9.

these commissioners noted, consisted generally of a simply constructed hut with unglazed windows, often with an adjacent court containing privies and a cookhouse but with no bath or washing facilities.<sup>78</sup> They recommended correction of deficiencies, without being specific.

In India the provision of large and well-equipped civilian hospitals, both for Europeans and natives, focussed on municipalities with significant European and middle-class Indian populations, namely Calcutta, Bombay, Madras and, after 1911, New Delhi.<sup>79</sup> Local charitable support for hospitals from the better-off, was encouraged, rather than direct governmental provision.<sup>80</sup> Civilian sanitary infrastructure, which often paralleled military installation (*vide* Chapter 3), was organized in a similar vein. In rural areas, though there was an increasing number of dispensaries, and despite sanitary commissioners having responsibility for overseeing public health, medical and sanitary provision during the nineteenth and through to the first quarter of the twentieth century was much inferior to that in cities with European quarters.<sup>81</sup> This needs to be considered in parallel with India's growth in population. Numbers rose from 158 million in 1800 to 212 million in 1881 – though subsequent growth stagnated, creeping up to 250 million by 1921 – after which, another spurt to 317 million in 1941. From 1881 to 1921, famines, plague and influenza and, in western and central Bengal, malaria, at times wrought a decline in population.<sup>82</sup>

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<sup>78</sup> *Royal Commission 1863*, pp. 155-6.

<sup>79</sup> M. Mann, 'Delhi's belly: on management of water, sewage and excreta in the changing urban environment during the nineteenth century,' *Studies in History*, 23 (2007), pp. 1-31; Kumar, *British medical*, pp. 88-106; Medical missionaries provided hospitals and dispensaries in some outlying areas.

<sup>80</sup> Sehrawat, *Colonial*, pp. 12, 14, 25, 258.

<sup>81</sup> Guha, *Population*, pp. 156-66.

<sup>82</sup> Guha, *Population*, pp. 58, 75-6; M.B. McAlpin, 'Famines, epidemics, and population growth: the case of India', *Journal of Interdisciplinary History*, 14 (1983), pp. 351-66; I. Klein, 'Malaria and mortality in Bengal, 1840-1921', *Indian Economic and Social History Review*, 9 (1972), pp. 132-60; Railway embankments blocking water channels promoted malaria.

***The influence of the later nineteenth century development of isolation hospitals in Britain on medical practice in India***

One of several public health initiatives in Great Britain in the 1860s was, initially in London from 1867, the establishment of the Metropolitan Asylums Board and similar initiatives. Amongst the board's responsibilities was the management of individuals suffering from contagious diseases such as typhoid/typhus, smallpox, diphtheria, and scarlet fever in specific fever isolation hospitals – these were separate from the poor law infirmaries that otherwise would have been the repositories for such cases.<sup>83</sup> Matthew Newsom Kerr argues that the foundation of these hospitals was based more on liberal politics prioritizing population security, and wanting to regulate the behaviour of the infectious sick – taking precedence over the freedom of the individual – rather than any pressing medical reasons (indeed, some smallpox hospitals were found to actually spread the disease).<sup>84</sup> Similar thoughts already seem to exist in India, as evidenced from the pamphlet published by surgeon-major T. Aitchison in 1871.<sup>85</sup> Aitchison recounts that during a cholera epidemic at Meean-Meer [sic] in 1861 and a smallpox outbreak at Umritzir [sic] in 1863, he immediately established isolation facilities. Writing to *The Times* at a point of public concern over the 1870-71 smallpox epidemic in London, he suggested: '... why not apply the simple remedy we at once resort to in India, viz., pitch tents in some high and airy situation, quarantine the encampment, and on the subsidence of the disease, disinfect or burn the camp'.<sup>86</sup> Aitchison implies that the use of localized *cordons sanitaire* was a well-established practice among military surgeons from at least the 1860s, and relatively easy to implement for the army, as

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<sup>83</sup> M.L. Newsom Kerr, *Contagion, isolation and biopolitics in Victorian London* (Cham: Palgrave Macmillan, 2018), pp. 3-6.

<sup>84</sup> Newsom Kerr, *Contagion*, p. 8.

<sup>85</sup> T. Aitchison, *Letters to The Times on small-pox encampments and a word on the contagious diseases acts*, 2<sup>nd</sup> edn (London: T. Richards, 1871).

<sup>86</sup> Aitchison, *Letters*, p. 9.

tents and grounds were readily available.<sup>87</sup> Evidence is presented below that moving camp was standard procedure in the event of an outbreak of cholera among troops from the early 1860s, and it seems this might have applied to other epidemics as well. Later in the century, isolation wards were established in India's major hospitals, for example, the cholera ward at the Eden Hospital of Calcutta Medical College – which was to play a key role in Leonard Rogers' work on intravenous rehydration (see below).<sup>88</sup> Hence it appears unlikely that the development of fever isolation hospitals in Britain from the 1860s had any effect on the management of contagious disease in India, as such procedures were already in place.

### ***The Indian Medical Service, the Army Medical Department and the Royal Army Medical Corps***

The EICo, from its foundation in 1600, employed surgeons to oversee medical matters of its agents and activities. Formal organization into the IMS, serving the 'establishments' of Bengal, Madras and Bombay, was made in 1763-64.<sup>89</sup> The medical officers' primary function, up until 1858, was the health of the Company's soldiers, both native and European, with a secondary responsibility for civilians. Troops of the Crown were cared for by the Army Medical Department (AMD). Details of a medical officer's duties in His Majesty's forces in the early 19<sup>th</sup> century are scarce but the unpublished notes of John Francis Smet (unknown-1840), surgeon to the 8<sup>th</sup> King's Royal Irish Light Dragoons, furnish such an account whilst the regiment was stationed at Meerut and Cawnpore from January 1819 to October 1821.<sup>90</sup> Smet records his activities, complaints seen, treatments administered, and the

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<sup>87</sup> Lord Reay, 'British troops in India', *Hansard*, 17 May 1897, vol. 49, cc.581-612; Reay – Donald James Mackay – was under-secretary of state for India.

<sup>88</sup> S, Chatterjee, R. Ray, D.K. Chakraborty, 'Medical college Bengal – a pioneer over the eras', *Indian Journal of Surgery*, 75 (2013), pp. 385-90.

<sup>89</sup> D.G. Crawford, 'Indian medical Service', *IMG*, 42 (1907), pp. 152-7.

<sup>90</sup> Smet qualified in medicine at Leuven in 1793. He joined the 8<sup>th</sup> King's Royal Irish Light Dragoons as a warrant officer in 1794, serving in the Low Countries, and moved with the regiment in 1794 to South Africa,

state of the troops and barracks. In his report for the second half of 1819, he finds that the regiment contains no soldiers more than 50 years old since, prior to his arrival, those over this age were sent to the invading committee at Calcutta to be retired.<sup>91</sup> He describes one of his public health duties: 'To keep the soldiers free from venereal infection, the public women have been examined once a week'. He regularly inspects the men's eyes for 'ophthalmia' – probably an eye infection or inflammation related to dust. A vaccination programme principally for children is promoted, with checks made ensuring new recruits had been vaccinated. His inspections reveal the barracks to be well ventilated. Smet summarizes the general health of the regiment quarterly or half yearly and describes some of the post mortems he performs. At the end of 1820 the regiment is transferred from Meerut to Cawnpore, with a deterioration in health, which he relates to excessive heat, making performance of his duties 'a very laborious task.' The predominating medical conditions vary over the two-and-a-half-year period of Smet's reports – the biggest impact being when cholera intervenes in late 1819.

During the first quarter of 1819 Smet found 'chronic rheumatism' to be a common complaint, which he treated with calomel, 'pulv antim' (powdered antimony oxide or sulphide), and opium. He describes what sounds like cases of delirium tremens – [conditions that] 'have ended fatally or in a violent manner had been preceded by great excesses in spirituous liquors', for which, 'the practice has consisted in copious bleeding, blisters and depletion'. During the second quarter in addition to further cases of drunkenness, he reports: 'a very great number of cases of intermittent fever have occurred, which have generally given way to

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where he became assistant surgeon. The regiment transferred to India in 1802. In 1808, Smet was promoted to surgeon. He returned to Britain in 1821 due to a recurrent eye infection, retiring in 1824 –

<https://collection.nam.ac.uk/detail.php?acc=1963-09-324-1> [9 March 2024].

<sup>91</sup> Wellcome Collection; RAMC/204: 'Case book, Meerut 1819, Cawnpore 1820-21, of John Francis Smet'.

a mixture of the decoct of cherayta (a kind of gentian),<sup>92</sup> combined with a small portion of purging salts. In some cases, the cinchona has been resorted to, though that medicine is not so much used in intermittents as might be thought it should be; the reason of it being left unused is that it often confines the bowels...’ Gastrointestinal upsets were explained by Smet through meteorological associations.

Cases of *febris continua communis* were treated by shaving the head and applying cold affusion to it, and then attaching leeches, with venesection and blistering. The onset of cholera in his regiment alone at the first quarter of 1820 mystified Smet: ‘it is not in my power to account for the cholera morbus appearing in the barracks and hospital of the 8th light dragoons at a time when no instance of it occurred in the two other European corps at the station.’ The year 1820 also saw cases of continuous fever, drunkenness, chronic rheumatism, and pneumonia, which Smet treated by copious early bleeding, leeches, blisters and antimony in wine. Post mortems of note detected cirrhosis and, in an ante-mortem case of ‘hepatitis’, a hepatic abscess. The mortality rate though in the second part of 1820 had lessened: ‘During this half year, only six men have died in the hospital of the corps ... the corps has escaped the cholera morbus with one exception, which terminated favourably.’ With the move in stations, by the first part of 1821: ‘The regiment has been very sickly at this [to its now new] station of Cawnpore during this quarter, in a degree very far exceeding what it was when stationed here before from 1807 to the end of 1810, but it should be kept in mind that it is since that time that the cholera morbus has commenced to prevail at some season [or] other at almost every military station under this presidency.’ For cholera, venesection was attempted though not always possible, and calomel prescribed, though mortality often

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<sup>92</sup> Decoction – a boiled extract – of *Swertia chirayita*, a Himalayan plant with a bitter taste.

occurred within hours of admission. How well Smet's observations, beliefs and treatments measure up to official records and perceived views become apparent in Chapters 2 and 4.

Fevers, dysentery, and *coup de soleil* were the main causes of death during the North-West frontier campaigns of the mid-1840s, as described in another unpublished journal, that of assistant-surgeon Patrick S. Laing (1821-92), until epidemics of cholera took hold – with high fatality – in 1847.<sup>93</sup> At times Laing reports daily deaths from dysentery or fever, but also he records cases of scurvy and mortality from flogging. Laing was sent back to Britain for recuperation due to fever.

After the rebellion, and unification of the forces of the Company with those of the Crown, from 1864 the IMS was charged with oversight of the native army and, for its civil surgeons, prisoners, dispensaries and native civilian hospitals, with the AMD attending to European soldiery only, as its role was solely military.<sup>94</sup> On amalgamation of the three presidential armies into one all-India force, though with four commands (Bengal, Bombay, Madras and Punjab), in 1895, officers of the IMS were unified into a single corps. Admission as an assistant surgeon to the IMS required a diploma from 1795 – prior to that applicants needed a certificate, having satisfied examiners at the College of Surgeons in London. Diplomas in surgery were issued by Colleges of Surgeons in Edinburgh, Glasgow and Dublin, as well as London, with the University of Glasgow awarding a Master of Surgery degree that was also accepted (other universities at that time only gave degrees in medicine). Appointees were to

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<sup>93</sup> Wellcome Collection; RAMC/1582: 'The journal of Patrick Sinclair Laing'; Laing was assistant-surgeon to the 86<sup>th</sup> regiment, commanded by Sir Charles Napier.

<sup>94</sup> Civil surgeons provided medical services to civil officers, both native and European, and military officers and their families. They undertook post-mortems, oversaw vaccination programmes, inspected dispensaries and factories and, in a few cases, superintended 'lunatic asylums'. Their remit included some care for the native civilian population. Official 'returns' were, according to Crawford, often prepared by a native clerk. The Jail Department had a separate tranche of civil surgeons. Professorships at medical colleges were parallel appointments – Crawford, 'IMS'.

attend lectures in physic and Hindustani. From 1828, possession of *Sketch of the most prevalent diseases of India* by James Annesley (1774-1847), was required. Entrance was by examination after 1855, open to British-born subjects with a diploma in surgery or degree in medicine. Throughout the nineteenth century the Scottish and Irish medical schools, especially Edinburgh, supplied a disproportionately large number of doctors to the IMS, and, even more so, to the AMD, though this imbalance lessened around the turn of the century.<sup>95</sup> Colonel Crawford, in 1907, implied, perhaps optimistically, that enlistment to the IMS was at least as popular as that to the AMD (known as the Royal Army Medical Corps – RAMC, after 1898), though both suffered from recruitment problems in the late nineteenth century due to understaffing and overwork, related to famines and epidemics of plague in India during the 1890s.<sup>96</sup> Harrison argues that the IMS was unattractive to medical recruits, compared to other colonial services, and that this hampered innovation. Sanitary commissioners, important in this thesis as the originators of annual statistical reports, were a branch of the civil IMS – one commissioner for each province, with one to three deputies, plus the commissioner for all India. By 1914, the RAMC had over 500 medical officers, with the IMS numbering 772 in its ranks, at which time 26 percent of recruits were Indians.<sup>97</sup>

From the foundation of the Calcutta Medical College in 1835, native medical graduates of Indian medical schools were employed as assistant civil (or military) surgeons, part of the Subordinate Medical Service (SMS), working in civilian and military hospitals under

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<sup>95</sup> Harrison, *Public health*, pp.19-26, 30-2; From 1863 all IMS recruits spent a year at the Royal Army Medical College at Netley, as did those entering the AMD and Naval Medical Service, for whom entrance was via the same examination. IMS recruits tended to have higher examination scores than did entrants to the other two services.

<sup>96</sup> Crawford, 'IMS', p. 154; Harrison, *Public health*, pp. 6-15; Slowness of promotion was also an issue. The important matter of promotion and rank in military and civil branches of the IMS is detailed by Crawford in a separate article, but will not be dwelt upon here – D.G. Crawford, 'Indian medical Service', *IMG*, 42 (1907), pp. 192-8.

<sup>97</sup> Harrison, *Public health*, pp. 8, 31-2; P. Hehir, *The medical profession in India* (London: Oxford Medical, 1923), p. 37.

direction of IMS surgeons, and undertaking much routine work including a share of surgery.<sup>98</sup> Alongside these were hospital assistants – later designated sub-assistant surgeons – natives who had obtained diplomas after two years college instruction, who, along with apothecaries, also college trained, staffed hospitals and dispensaries, and were responsible for much day-to-day medical provision in the mid-to-late nineteenth century.<sup>99</sup> There was some transference of Indian college-trained native medical graduates to the predominantly British-trained IMS, as Crawford records, writing in 1914: ‘A few members of this service [the SMS] have entered the IMS, either by nomination, before 1860, or by examination’.<sup>100</sup> After 1905, increasing numbers of IMS recruits were native Indians, trained in Indian medical schools. Political unrest, coupled with concerns about conditions and status, made the service unpopular with British graduates, though the sanitary department continued to attract quality applicants due to its better promotion prospects.<sup>101</sup> In professional medical and clerical grades, by the end of the century many positions were filled by native Indians – for example, of the 43 inspectorate staff for Bengal’s sanitary commissioner in 1891, only five were European – the commissioner, two deputies, an engineer and a personal assistant.<sup>102</sup>

Deputy inspector-general Gordon records that each European infantry regiment would have one surgeon and three assistant surgeons – approximately one medical officer per 150 soldiers.<sup>103</sup> These were supported by one apothecary and two assistant apothecaries and, numbering sixty-seven per one hundred sick, a ‘subordinate establishment’ of dressers, ward

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<sup>98</sup> Crawford, ‘IMS’, p. 156; Other medical schools followed.

<sup>99</sup> D.G. Crawford, *A history of the Indian Medical Service, 1600-1913*, Vol. II (London: Thacker, 1914), pp. 100-23; Harrison, *Public health*, pp. 31-2.

<sup>100</sup> Crawford, *IMS*, Vol. II, p. 118.

<sup>101</sup> Harrison, *Public health*, pp. 22-6, 31-3; Postings to Bengal presidency were sought after – it had the most European stations. The secretary of state limited the number of places open to Europeans after 1905 – part of an Indianization process. Potential loss of caste from travel outside India to attend at Netley was a barrier.

<sup>102</sup> BL IOR/P/3885 1891, ‘Sanitary proceedings’, pp. 487-8.

<sup>103</sup> Gordon, *Army hygiene*, pp. 204-5, 258-9; Gordon details that an army in the field of 30,000 men would have 52 staff surgeons and 104 assistant surgeons, arranged over three lines.

servants, cooks, water carriers, sweepers, and various others known collectively as ‘hospital attendants’, who were members of the Hospital Native Corps.<sup>104</sup> Native regimental hospitals seemed proportionally less well staffed, being served by a medical officer, sub-assistant surgeons, and ancillary support personnel.<sup>105</sup> The 1863 sanitary commissioners recommended introduction of female nurses to large European general hospitals, though implementation was slow.<sup>106</sup> For example, the Madras presidency requested funds from the Indian government in 1868 for a ‘lady superintendent and four trained nurses’ to be procured from England, for the Vespery Hospital and elsewhere, to train ‘East Indian women and girl’ probationers.<sup>107</sup> The European and the native armies were thus comparatively discrete units, with their own locations and personnel.

***The returns system operated by army medical officers, the nomenclature of disease, the accuracy of diagnosis and how these may have changed over the period of this study***

Regulations relating to medical reports and returns in the British Army were first published in 1859 – prior to that the process was more *ad hoc*.<sup>108</sup> Returns were made to the office of the director-general of the Army on a weekly, monthly, and annual basis according to various proformas. The nomenclature used for disease classification was established and developed from the 1850s, over a period of twelve years, and was formalized in 1869 by a committee

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<sup>104</sup> Bourke, ‘Indian hospital corps’, p. 89.

<sup>105</sup> *Ibid*, Details on numbers are lacking.

<sup>106</sup> *Royal Commission 1863*, p. 169; P.M. George, J.B. Lourdasamy, ‘Trained army nurses in colonial India: early experience and challenges’, *Medical History* 67 (2023), pp. 347-64.

<sup>107</sup> *Minutes of the proceedings of the sanitary commissioner with the government of India during the year 1868* (Calcutta: Office of SGP, 1869), pp. 3-12; Allowed costs were half those requested. Staffing levels were to be one nurse to twenty beds.

<sup>108</sup> *Regulations for the duties of inspectors-general and deputy inspectors-general of hospitals: for the duties of staff and regimental medical officers, for the organisation of general, regimental, and field hospitals, and for the duties of officers, attendants, and nurses, for sanitary measures, and precautions for preserving the health of the troops, for the duties of sanitary officers attached to armies, and for drawing up sanitary and medical statistics and reports*, (London: Eyre & Spottiswoode, 1859); J. Farr, ‘The health of the British Army and the effects of recent sanitary measure on its mortality and sickness’, *Journal of the Statistical Society of London* 24 (1861), pp. 472-84.

which sat at the Royal College of Physicians of London.<sup>109</sup> The nomenclature's essentially anatomically-based categorizations were 'to be strictly adhered to in all Military and Civilian Medical Returns'.<sup>110</sup> The AMD *Report* for 1862 makes it clear that 'In the British army, a soldier, if unfit for duty by sickness, of however trifling a description, is taken into hospital for treatment'.<sup>111</sup> Hence even quite minor conditions are captured by this system and there is not much scope for variation in threshold or 'decision to treat' between individual regimental medical officers. The proforma prominently features the main disease brackets, but since it ranges to eight pages, it permits the inclusion of lesser and more uncommon conditions should these be recognized – meaning there ought not be 'shoehorning' of diagnoses into a short series of potential categories. The old adage 'common things occur commonly' applied. The usual weekly proforma, Form number 21, was returned every Friday and ran to eight pages (Figure 1.2 shows the first page).<sup>112</sup> This proforma did allow for the situation when cause of admission or death was uncertain, though there were few cases in this category. For example, for 1875, there were 167 admissions of unknown cause out of a total number of 78,208 for the European army of all India, and no deaths in this group – comparable figures for the native army of Bengal in the same year are 60 of 69,014 and 11 of 7,688.<sup>113</sup>

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<sup>109</sup> Joint Committee of the Royal College of Physicians of London, *The nomenclature of diseases* (London: Spottiswoode, 1869); W.R. Cornish, *A code of medical and sanitary regulations for the guidance of medical officers serving in the Madras presidency*, Volume II (Madras: H. Morgan, 1870), pp. 95, 112, 171, 195, 199; The work of William Farr was central to the development of classification of disease – see M.A. Alharbi, G. Isouard, B. Tolchard, 'Historical development of the statistical classification of causes of death and disease', *Cogent Medicine*, 8 (2021), 1893422, pp. 1-10.

<sup>110</sup> Cornish, *Code 1870*, pp.167-72.

<sup>111</sup> AMD, *Statistical, sanitary and medical reports for the year 1862* (London: Harrison, 1864), p. 151; The report states that 'In the French army, only the more severe cases of disease are admitted into hospital' (p. 151).

<sup>112</sup> Cornish, *Code 1870*, pp. 195-202.

<sup>113</sup> *RSCGI 1875*, General summary table.

Figure 1.2: Form 21 used for weekly return by medical officers serving with troops in India, as employed in the Madras presidency in 1870 (the first page of eight).

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FORM No. 21.

For P. M. O. Station. W. O. Form No. 294 A.

(REVISED AS PER NOMENCLATURE OF 1869.)

*Weekly Sick Return.*

TROOPS SERVING ABROAD.

RETURN of Sick of the { Battn. or } of Regt. of for the Week ending Friday.  
 the of { Brigade. } 187 . Station  
 Strength. Strength.

Strength of Non-Commissioned Officers and Men, whose cases of sickness are included in this Return ..... } H. Qrs. at \_\_\_\_\_  
 } Det. at \_\_\_\_\_  
 } Det. at \_\_\_\_\_  
 } Total... \_\_\_\_\_

Strength of Detachments not included in this Return ... } at \_\_\_\_\_  
 } at \_\_\_\_\_  
 } at \_\_\_\_\_

DISEASES.	Remained last Return.	Admitted into Hospital during the Week.	DIED		DIS-CHARGED.		Transferred to other Hospitals.	REMAINING IN HOSPITAL.	
			In Hospital.	Out of Hospital.	To Duty.	Otherwise.*		† Cases.	† Men.
I. ... GENERAL DISEASES.									
1 { Sub-Division A. { Small Pox .....									
Measles .....									
Scarlet Fever.....									
Typhus ,, .....									
Enteric ,, .....									
Simple continued Fever .....									
Febricula .....									
Ague .....									
Remittent Fever .....									
Simple Cholera .....									
Malignant Cholera ...									
Influenza .....									
Erysipelas .....									
Pyæmia .....									
Sub-Division B. { Acute Rheumatism ...									
Chronic ,, .....									
Muscular ,, .....									
Primary Syphilis .....									
Secondary ,, .....									
Cancer .....									
Total carried up...									

\* Cases entered in this column must always be noticed in the Remarks.  
 † Vide Instructions, Medical Regulations, page 119, paragraphs 1, 2, and 3.  
 N.B.—Separate Returns must invariably be furnished for White, and Black or Native Troops.

Returns were collated centrally and then published in the yearly statistical reports of the AMD from 1859 (results for the Indian presidencies first featured in 1860), subsequently in the annual reports of the sanitary commissioners to the presidencies and to the government of all India, and additionally in some other publications such as those of James Bryden.

Cornish's code states:<sup>114</sup>

- (a) Weekly return of sick – A weekly regimental return of sick (Form no. 21) is to be filled up and sent at the end of every week by every surgeon or medical officer in charge to the deputy inspector general of the circle. A duplicate of the weekly return is to be forwarded direct to the inspector general, and a triplicate return to the sanitary commissioner for Madras. To the weekly return may be appended any medical, sanitary, or statistical notes which the medical officer may think it necessary to add respecting the health of the troops. But any unusual amount or kind of sickness or mortality in the regiment, with its causes or predisposing conditions or circumstances, the recommendations made by the medical officer to the commanding officer respecting it, and the results of these recommendations, must always be carefully noted.
- (b) Monthly sanitary report – On all stations, every medical officer holding a separate charge shall transmit it to the principal medical officer of the station together with the last weekly medical return of each month, a report on the health of the troops, and on the sanitary condition of the barracks, quarters, hospitals, and vicinity of the station for the preceding month, and on the rations, drinks, clothing, duties, et cetera of the troops, And the effects of these on their health; the report (see form no. 22 in the appendix) to be sufficiently detailed to enable the administrative medical officer and the inspector general to ascertain that every necessary precaution for protecting the health of the troops has been in use.

Review of results over the 90-year period from 1850, suggests that, apart from the introduction of certain categories such as malaria in 1909, there was no major shift in the main disease categorization for conditions causing admission or mortality, though – as will

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<sup>114</sup> Cornish, *Code 1870*, pp. 195-202.

be explained – refinement of clinical diagnosis did occur to better differentiate the diarrhoeal diseases, and the venereal afflictions. According to several sources, medical officers during the nineteenth century considered dysentery to be in play when there was blood in the stool – anachronistically this can be seen as inaccurate.<sup>115</sup> Hence, confidence on diagnosis varies between categories. Enteric fever (typhoid), for example, may have had a pathognomonic symptomatology once this was recognized – allowing differentiation from typhus, but this cannot be said for malaria (ague) in the pre-blood smear era, as both continuous and remittent fevers can do for this as well as for other disorders. An assessment of the accuracy of approximating continuous or remittent fevers to malaria is given in Chapter 2. It does not appear that the use of a proforma *per se* had an influence on the selection of diagnoses returned for the major conditions dealt with in this thesis, since the most important categories were clearly delineated throughout the period studied.

### ***Christian militarism and popular imperialism in Britain***

Measures to improve the health of the armies in India were linked to the public attitudes back in Britain. In the later eighteenth century, concerns on military health centred on political ambition, e.g. the ability of the Royal Navy to maintain long periods of coastal blockade, as in the Seven Years War, 1756-63, without sailors falling sick,<sup>116</sup> and the economics of sailor or soldier replacement.<sup>117</sup> Over the mid-nineteenth century, the British population became

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<sup>115</sup> For example, M.D. Wainwright, ed., *Brothers in India: the correspondence of Tom, Alfred and Christopher Bassano, 1841-75* (London: University of London, 1979), p. 187.

<sup>116</sup> E.M. Charters, ‘The intention is certainly noble: the Western Squadron, medical trials, and the Sick and Hurt board during the Seven Years War (1756-65)’, in D.B. Haycock, S. Archer, eds., *Health and medicine at sea, 1700-1900* (Suffolk: Boydell, 2009), pp. 19-37; Charters points out that although the navy had more centralized medical facilities and regulation at this time, mortality rates of sailors and soldiers were similar – at 20 per mille annually.

<sup>117</sup> E.M. Charters, *Disease, war and the imperial state: the welfare of British armed forces during the Seven Years’ War* (Chicago: University of Chicago, 2014), pp. 142-71; Mortality rates for European and sepoy troops were similar during 1757, though daily sick rates were slightly lower for the latter (pp. 163, 170); EICo troops had inferior medical care compared to the Crown army (p. 152).

more aware of world events – especially those in the empire – influenced by an enlarging print media and rising literacy. The developing Christian evangelical movement reinforced social awareness tied to these issues. Hence public concern about the poor health of sailors of the Navy’s West Africa Squadron enforcing anti-slavery measures – conditions of ratings were even compared to those of transported enslaved people – led to campaigns for improvements in the 1840s.<sup>118</sup> This can be seen as a turning point in public attitudes, reinforced in the 1850s by the Crimean War and the 1857 Indian rebellion. Influenced by then ascendant religious – often evangelical – sentiment, the public’s perception of its soldiers and sailors became sympathetic, changing from one of disdain to seeing them idealistically as ‘the people’s army’ and ‘our brave men’.<sup>119</sup> Soldiering could now have Christian virtues, and so was born *Christian militarism*, which fed into the temperance societies (Chapter 5) and pastoral care to the military.<sup>120</sup> These public feelings transmuted into *popular imperialism*, which John MacKenzie dates from 1867, whipped up by Benjamin Disraeli in response to the Abyssinian campaign of that year, and continuing through to the Boer Wars.<sup>121</sup> Such sentiments amongst the expanding suffrage influenced the governmental approach to army health in the mid-to-late nineteenth century.

### ***Aims and scope, hypotheses and sources***

In this thesis, the health of these two *relatively* enclosed populations, the native Indian and European (predominantly British and Irish) troops which comprised the armies of India, is

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<sup>118</sup> M. Harrison, ‘An important and truly national subject: the West Africa Service and health of the Royal Navy in the mid-nineteenth century’, in Haycock, Archer, eds., *Medicine at sea*, pp. 108-27.

<sup>119</sup> O. Anderson, ‘The growth of Christian militarism in mid-Victorian Britain’, *English Historical Review*, 86 (1971), pp. 46-73.

<sup>120</sup> Foundation of the Salvation Army, Boys’ Brigade and ‘volunteer movements’ characterize the militarization of British society at this time.

<sup>121</sup> J.M. MacKenzie, ‘Introduction’, in J.M. MacKenzie, ed., *Imperialism and popular culture* (Manchester: Manchester University Press, 1986), pp. 1-16; The movement petered out early in the twentieth century, as criticism of empire mounted and with nationalist agitation, though the concept continued to be promoted into the 1930s (pp. 7-8).

studied. They had quite good, well-documented, medical attention and their efficiency was vital to the raj. Arnold regards the European army in nineteenth century India as a ‘colonial enclave’ – Radhika Ramasubban agrees, describing colonial medicine as ‘enclavist’ – essentially military and not extending much beyond that.<sup>122</sup> This thesis is not an analysis of the health of the civilian population of India, nor of public health or therapeutic measures aimed at them,<sup>123</sup> though the civilian population will be used as a comparator where relevant and when documentation allows. Mortality rates and the diseases which resulted in fatality and morbidity are enumerated longitudinally over the period *c.* 1850 to *c.* 1940. Native troops are contrasted with the European force and other comparators, the hypotheses being that sepoy soldiers suffered less because of prior immunity, and that factors relating to the European soldier’s person, such as his environment, habits, diet and conduct, predisposed him to certain diseases. The hypothesis that installation of sanitary infrastructure in the second half of the nineteenth century, to be confirmed from engineers’, sanitary commissioners’ and financial reports, reduced the prevalence and mortality of certain diseases acquired via the faeco-oral route and possibly by insect vectors, is tested. Acceptance of germ theory in India by medical authorities was delayed in comparison with some other settings, including opinion in Britain. It will be argued that this had little effect on overall mortality in the soldiery. The often toxic treatments prescribed according to the rules of the day are examined in greater detail than in previous historiography, possible effectiveness being measured against twenty-first century knowledge, to ascertain whether the net effect was, as asserted by McKeown (with a few exceptions), a neutral or negative one.<sup>124</sup> No study of armies would be complete without scrutiny of the twin vices of alcoholism and venereal disease – their incidences, the

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<sup>122</sup> Arnold, *Colonizing*, pp. 61, 96; R. Ramasubban, ‘Imperial Health in British India, 1857-1900’, in R. MacLeod, M. Lewis eds., *Disease, medicine and empire: perspectives on western medicine and the experience of European expansion* (London: Routledge, 1988), pp.38-60.

<sup>123</sup> See Harrison, *Public health*, and Guha, *Population*.

<sup>124</sup> McKeown, *Population*, p. 153; McKeown dates the beginning of benefit precisely to when sulphonamides were first widely available in 1935. He acknowledges effectiveness of some interventions.

effectiveness of restraining measures, and reasons why control was finally established. The theorem being that, for alcohol, hobby-related diversions were ineffective, and, for venereal disease, that the lock hospital system and CDAs had no effect.

This research differs from other studies of armies in India in this time frame, for example, those of Arnold and Curtin.<sup>125</sup> There is here greater emphasis on unpicking the health effects of medical interventions themselves, relating them to the disease theories of the time and including the native armies, rather than interrogating political questions and consequences that have tended to be the *métier* of other authors. The start date of this study, 1850, was chosen as approximating to the time at which detailed annually published statistics on the health of presidential armies commenced.<sup>126</sup> The end point, 1940, was selected to incorporate the twentieth century evolution of events in British India up to but not including mobilization in World War Two. The ninety-year study period encompasses several major upheavals in India: the 1857 rebellion, subcontinental wars (for example, the Second Afghan War of 1876-80), famines of the late 1890s, the First World War, and the influenza pandemic of 1918-20.

A wide range of mostly published primary sources, supported by unpublished accounts, have been employed. For statistical data on disease incidence and mortality, including alcoholism and venereal disease, the most important have been the *annual reports* of the sanitary (latterly public health) commissioners of India and before that of the presidencies. These commence with the first annual reports of the commissioners to Bengal and Bombay in 1864, which give some retrospective figures. These were used whenever possible because they represented the centrally gathered official statistic. When these were unavailable, alternative sources were

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<sup>125</sup> Arnold, *Colonizing*; Curtin, *Migration*; Other authors examine soldiers' health as part of a wider study, for example: Kumar, *British medical*; Ramanna, *Western medicine*; Sehwat, *Colonial*.

<sup>126</sup> The actual date varies between presidencies, and depends on source used, as will be discussed.

sought out. Information pre-dating the commencement of sanitary commissioners' reports was located, for example, in the *Annual reports* of the AMD, from 1859, in J.L. Bryden's 1870 *Vital statistics*, in the *Report* of the royal commission to inquire into the sanitary state of the army in India (published 1863-64), and in various other articles and books.

Details on nineteenth century infrastructure and building projects, and their financing, were found mostly in returns of engineers and sanitary commissioners to the presidencies.

Particulars on theories of disease and treatments, from the nineteenth through to the twentieth century, have been gleaned from published articles and medical textbooks, many of which, especially in the first two-thirds of the nineteenth century, were written specifically for doctors in India.

### ***Research methodology and analysis***

Statistics were gathered on an annual basis for the presidency armies of Bengal, Bombay and Madras, from 1850 up to 1878, and then from 1871 for the European army and from 1877 for the native force, for all India, up to 1940. Once a reliable source had been located, the candidate completed a proforma on which details of both armies were recorded for the year in question – namely army strength, with admission and mortality rates for all causes, and for the major specific diseases, that is fevers (intermittent, remittent, continued, enteric – malaria only became a specific category from 1908), cholera, dysentery, diarrhoea, pulmonary tuberculosis, pneumonia, bronchitis, smallpox, influenza, hepatitis, all venereal diseases, syphilis, gonorrhoea, circulatory diseases, wounds and accidents, scabies, rheumatic diseases, delirium tremens (alcoholism 1883-92), scurvy and heat apoplexy. Figures for daily sick and invaliding were also noted. The data were transferred from a paper format into Excel spreadsheets, which subsequently were used for all analyses and for the generation of graphs. Overt statistical analysis was not considered necessary or was not appropriate.

### *Outline of chapters*

In Chapter 2, on disease incidence and mortality, a detailed comparison of overall sickness occurrence and mortality rates for native and European forces of the Company and British armies, is made for the ninety years from 1850, including consideration of the preceding century. The analysis has been performed in greater depth than in any previous study. Comparisons are made between native and Europeans forces, with males of recruitable age in the United Kingdom and Ireland (and the disease milieu from which they came), with officers, prisoners, and – for contrast with armies in the field – briefly with the Crimean War and the American Civil War. Diseases encountered in India, initially in the armies of the presidencies then for the armies of all India, are examined in detail. These include cholera, dysentery, typhoid, hepatitis, malaria, pneumonia and bronchitis, pulmonary tuberculosis, heat apoplexy, scabies and scurvy. Consideration is given to any impact on rates of and mortality from the diseases encountered in India as a result of the nutritional status of recruits from the British Isles, and the relevance of the changing background diseases and mortalities from which this group suffered back home. Factors surrounding the levels of disease amongst the European troops during and just after the 1850s are examined. Among the new or revitalized determinations are: (a) reasons why case fatality from cholera fell after 1910, (b) comment on why typhoid ran rampant during the final quarter of the nineteenth century when other faeco-oral diseases such as dysentery and cholera, did not, (c) explanation for the reduction in case fatality from typhoid in the last quarter of the nineteenth century, (d) deciphering why the hepatitis case fatality rate fell in the late 1880s, (e) how pulmonary tuberculosis switched from being a disease of the European to one of the native soldiery, (f) how case fatality was reduced progressively for heat apoplexy, (g) what disparities in rates of scabies and scurvy indicate about conditions of native troops, (h) the previously unrecognized importance of respiratory diseases as a major cause of death in sepoys, (i) examples where,

despite an overall lower mortality rate, for specific diseases the sepoy had a higher morbidity or mortality rate than his European confrere, (j) a view on whether or not the change to martial race recruitment had any impact on disease prevalence in sepoys, and (k) making novel use of case fatality for assessing treatment efficacy.

In Chapter 3, on implementation of sanitary improvements, evidence is assessed as to the degree to which the desired roll-out of sanitary theory was put into practice, primarily in the barracks and cantonments of India, and contrasted with the overall effect on infectious disease. Evidence is taken from financial reports, detailing amounts spent, and from engineers' reports, showing projects in hand, to assess the types of building constructed. Often this is on a presidency basis, where the money was allocated predominantly to civilian works. That earmarked for the military is analyzed by type of work supported. Qualitative reports, mainly from sanitary commissioners, describe sanitation and conservancy developments. The roles of civilian sanitary projects, quarantine measures, and pilgrimages, are examined. Observed changes in sanitation are compared to prevalence of, and mortality from, infective gastro-intestinal disease.

Chapter 4 will examine two issues. First, how changes during the nineteenth century in theories of disease in India influenced medical thinking there, especially on sanitation. Secondly, how changes in medical therapeutics, taking into account Indian exceptionalism *contra* western experience, affected case fatality for the main diseases. The latter tests *effectiveness* of medicine rather than *prophylaxis*. The contagionist–anti-contagionist debate in India was often a war of words between individuals with up-to-date ideas, and government advisors who stuck to traditionalist standpoints. Using textbooks and scientific papers familiar to medical officers in British India, changes in the philosophy of diagnostic and

therapeutic approaches are traced longitudinally over the long nineteenth century. Theory-led late eighteenth century adventurism is displaced by a more science-based approach. A distinguishing feature of this thesis is the in-depth critique of sequential treatment stratagems for the main fatal diseases of the army: infections – fevers, cholera, dysentery, hepatitis, typhoid, typhus, pneumonia, and tuberculosis – plus heat apoplexy. The popularity, for example, of apparently damaging interventions such as bloodletting is explained. Positive effects of heavy metal medication, unbeknown to the prescribers (and some modern readers), are revealed, along with reasons why apparently inferior treatments dispensed to sepoys could have been better than those given to their European counterparts, and how nursing support contributed.

Chapter 5 explores soldiers' indulgence in the often-linked vices of alcohol excess and fornication. The consequences of what was seen as amoral behaviour are explored. The prevalence of venereal disease, a massive drain on army effectiveness, is traced, paralleled to an appraisal of the authorities' fumbblings at control, with a novel revelation on how rates finally fell. Alcoholism proved more difficult to unravel, as it was not recorded in medical returns until, briefly, later in the nineteenth century. Hence, delirium tremens has been used as an indicative proxy. Alcohol consumption and temperance are weighed against misdemeanours and ill health. The historiography of the socio-economic impact of debauchery and intemperance in nineteenth century British India has been well documented. What this chapter adds is a fuller rendition of timelines, an in-depth evaluation of the medicalized approach to the venereal and to alcoholic excess, with, uniquely, detail on how lock hospitals functioned and – on treatments given to prostitutes – why these are unlikely to have worked, plus a new opinion on how venereal disease was eventually mastered.

The finale, Chapter 6, aims to pull the facets of this thesis into a cohesive body, and delineate its overriding message for the wider historiographic literature.

### ***Conclusions***

At an extreme distillation, this thesis tests factors that cause or cure disease. To do this it uses two relatively encapsulated, defined and well-documented populations, viewed over a ninety-year period that encompasses great change – politically, socially and medically. External determinants include topography, climate, natural elements (e.g. insects), and inhabited physical infrastructure, but also touch on contact with the general population. The internal milieu incorporates immunity, nutrition (diet and water intake), and medical attention. Reduction in disease incidence, as might result from sanitary modifications, is contrasted with diminution in case fatality, potentially from active treatment. The questions posed are different to those considered by McKeown, though the actors in play are similar. McKeown wanted to explain population *increase* – this thesis appraises mortality *decline*. The time periods overlap and, despite disparate scenarios, this study compliments McKeown's by looking to answer some questions he was not able to tackle, such as the detailed outcome of medical intervention.

## Chapter 2: Disease and mortality

India's reputation as a place precarious to the European constitution, and hence settlement, had developed in the 1820s and 1830s, perpetuated by mid-to-later nineteenth century medical men like Julius Jeffreys (1800-77), staff surgeon at Cawnpore, and Joseph Ewart (1831-1906), surgeon to the Bengal Medical Service.<sup>1</sup> Ewart attested to soldiers 'whose constitutions have been shattered by prolonged residence in unhealthy situations'. Jeffreys noted: 'The natives of India look upon us as white bears from the cold unhealthy North, ferociously brave, but of sickly constitutions, disabling us from occupying their country without their aid'.<sup>2</sup> In the last third of the eighteenth century some European observers had not been so pessimistic. James Lind (1716-94), who had been a medical officer in both the West Indies and in India, in his 1768 account, noted that – although India, along with the West Indies, Africa, parts of the Americas and even parts of Europe, were unified as hot climates presenting a foreign disease environment challenging to the health of Europeans – certain areas, for example, away from low lying marshes, might be suitable for British settlement.<sup>3</sup>

Ewart's and Jeffreys' views reflect difficulties faced by the British troops in putting down the 1857 rebellion, and the belief that the mutiny was timed to coincide with the hot season, when cholera and other diseases were most prevalent.<sup>4</sup> The obsession of contemporaries such as Dr James Ranald Martin (1793-1874) with medical topography, which viewed the climate of India as the cause and modifier of much disease, was borne out of the mortalities suffered by the British and Indian armies during the First Burma War (1824-26), and the need, following Lind, to identify relatively healthy

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<sup>1</sup> J. Jeffreys, *The British army in India; its preservation* (London: Longman, 1858), pp. 14-15; J. Ewart, *A digest of the vital statistics of the European and native armies in India* (London: Elder, 1859), p. 10; M. Harrison, *Climates and constitutions: health, race environment and British imperialism in India 1600-1850* (Oxford: OUP, 1999), pp. 111-23.

<sup>2</sup> Jeffreys, *British army*, p. 14; Jeffreys thought a double helmet design the answer to solar overheating (pp. 59-93).

<sup>3</sup> Charters, *Disease*, p. 157; Lind believed that Europeans might adapt to hot climates – J. Lind, *Essay on diseases incidental to Europeans in hot climates* (London: Becket and Hondy, 1768). Experience by the end of the eighteenth century had thrown this into doubt, since leave to return to Britain on health grounds was increasingly offered, but only to officers, not to the rank-and-file, and illness reduced the number of effectives available – sometimes drastically so – debility rates reached 60 or 70 percent during the Seven Years' War (Charters, *Disease*, pp. 168-9).

<sup>4</sup> Harrison, *Climates*, p. 147.

locales – initial optimism for hill stations often was later dashed – for military cantonments and sanatoria.<sup>5</sup> The need for reform of sanitary infrastructure, identified by James Jameson (dates unknown) and others from the 1820s, resulted from observations on the relationship of cholera to both climate (heavy rains, fluctuating temperatures, easterly winds) and location (areas in, for example, Calcutta with poor drainage, rotting vegetation, poor ventilation).<sup>6</sup> Martin's 1837 *Medical topography*, based on experience of Calcutta's second cholera epidemic, conflates cholera with 'filth' – echoing Edwin Chadwick (1800-90) and Thomas Southwood Smith (1788-1861) – and represents movement towards miasmatic theory with, additionally, the elevation of Western over Indian medical viewpoints, seen as a requirement for the imposition of European education.<sup>7</sup> These standpoints built on Chadwickian concepts of disease and public health – for example, Florence Nightingale (1820-1910) saw native bazaars as repositories of disease, believing that, 'Everywhere there are grievous sanitary defects which, wherever they exist, can only lead to sickness and loss of life'.<sup>8</sup> Even as late as the last decade of the nineteenth century, the premise of a disease-inducing topography still existed.<sup>9</sup> Sir Joseph Fayrer (1824-1909), president of the medical board at the India Office, was mindful that, 'In hot climates the blood becomes deteriorated; there is a tendency to liver affections, fever, boils and a variety of ailments'.<sup>10</sup> Much of the remedy to this disadvantaged position, aimed at reducing the vulnerability of the soldiery in the wake of the rebellion, was

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<sup>5</sup> J. Johnson, J.R. Martin, *The influence of tropical climates on European constitutions*, 6th edn (London: Highley, 1841); Harrison, *Climates*, pp. 113, 142.

<sup>6</sup> J. Jameson, *Report on the epidemick cholera morbus as it visited the territories subject to the presidency of Bengal in the years 1817, 1818 and 1819* (Calcutta: Government Gazette Press, 1820), pp. lxxviii, 100; M. Harrison, 'A dreadful scourge: cholera in early nineteenth century India', *Modern Asian Studies*, 54 (2020), pp. 502-53.

<sup>7</sup> J.R. Martin, *Notes on the medical topography of Calcutta* (Calcutta: Huttman, 1837), p. 47; For more on the contributions to this from Chadwick and Southwood Smith, see Christopher Hamlin, 'Predisposing causes and public health in early nineteenth-century medical thought', *Social History of Medicine*, 5 (1992), pp. 43-70 and John Pickstone, 'Dearth, dirt and epidemic fevers, rewriting the history of British 'public health' 1780-1850', in *Epidemics and ideas*, T. Ranger, P. Slack, eds., (Cambridge: CUP, 1992), pp. 125-48.

<sup>8</sup> G. Vallée, L. McDonald, eds., *Florence Nightingale on health in India* (Waterloo: Wilfred Laurier University, 2006), p. 132; Quotes Nightingale's letter to Lord Stanley dated 21 November 1862; J. Gourlay, *Florence Nightingale and the health of the raj* (Aldershot: Ashgate, 2003), p. 102.

<sup>9</sup> Some diseases can be seen as directly related to climate – heat apoplexy is a good example. In others, the connection can be viewed as indirect, as in conditions regarded as 'miasmatic'.

<sup>10</sup> J. Fayrer, *On preservation of health in India* (London: Macmillan, 1894), p. 25; Fayrer notes, p. 9, that 'even the diseases differ from those [the European] has hitherto known'; Fayrer, in an influential position, was an adherent to the miasmatic school, long opposed germ theory and reforms that would have stemmed from its acceptance – see Harrison, *Public health*, pp. 51-9.

directed at improving the health of European troops through what would now be seen as preventative medicine. In this chapter, the ups but mostly downs in incidence and mortality of the main diseases are traced in the armies of India from the nineteenth to the twentieth century, looking for any ameliorating effects of medical science. The views of the sanitary movement, which was instrumental in addressing epidemics in the armies of India, are appraised in Chapter 3.

### ***Methods and sources, definitions and aims***

Apart from the 1857 rebellion and the First World War, the British armies in India from 1850 to 1940 were mostly concerned with the maintenance of internal security, though units were involved in campaigns in Afghanistan, the Middle East and Africa. Consideration will be given to the impact these had on the health of the regiments involved. The EICo kept records on its presidency armies and statistical summaries of some of them have been published. For Her Majesty's (HM's) armies in India, from the late 1850s, detailed returns were made by medical officers, according to a set proforma, which listed disease categories to be reported (detailed in Chapter 1). Centrally these were collated and published either as accounts, as in those of Dr James Lumsdaine Bryden (1833-80), or as annual reports of the Army Medical Department (AMD) or of the sanitary (later public health) commissioners to the Government of India or to the presidencies. Bryden's reports and those of the AMD and sanitary commissioners go into detail on month-to-month changes in disease incidence, relevant for example, to malaria, noting both seasonal and geographic variations. Records show for each disease, rates of admission and of mortality by year, both by absolute number and as a proportion, often expressed per mille (thousand) strength of the regiment or army concerned. Prior to 1900, more detail is given on the rank-and-file, that is non-commissioned officers (NCOs) and privates, than on officers. In the twentieth century, information on officers' health was forthcoming. In the mid-nineteenth century, officers often sought attention from sources

other than their regimental medical officer.<sup>11</sup> The officer corps was considerably smaller than the rank-and-file, numbering less than five percent of the army rollcall.

Admissions give an idea of how common a disease is amongst the population quoted for, bearing in mind that symptoms needed to be of sufficient degree for the medical officer to be consulted – we know from army regulations (Chapter 1) that even minor conditions warranted hospital admission. Mortality is an endpoint of disease severity. Trends are seen when plotted over time. Case fatality, occasionally used by contemporary statisticians but, in this work, employed more widely, is mortality rate as a percentage of admission count. It can give an indication of the success or otherwise of overall medical care. For example, in the case of cholera, the fatality rate did not improve during the nineteenth century, showing that available medical interventions, including nursing, were ineffective.<sup>12</sup> Causes of death for different populations vary over time, depending on changing disease prevalences, and are reliant on factors which this work seeks to elucidate. Comparison of causes of death in different groups at various timepoints will give information about differing types of exposures to contagious diseases, including topographic and geographic variations, and the relative success of measures put in place to minimize illnesses. In addition, group-specific susceptibilities of the cohorts under study, such as a propensity to acquire venereal disease, or environment-related respiratory problems, may become evident. Consideration of invaliding rates shows the wastage of manpower, caused by uncorrectable disease rather than death, over time. The daily sick rate is a running spot count of the proportion of an army incapacitated by disease and unavailable for duties.

In this chapter the aim is to delineate the diseases causing morbidity and mortality in the native and European armies of India in the mid-nineteenth century, and to show how these changed both absolutely and proportionally over the subsequent ninety years. Comparisons will be made by

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<sup>11</sup> Peers, 'Soldiers, surgeons', p. 144.

<sup>12</sup> The fatality rate of cholera increased throughout the nineteenth century, as will be explained.

juxtaposing data from contemporary groups such as officers of the army, English males of recruitable age, the prison population, and other armies. Hypotheses to be considered include that native troops, for some diseases, suffered less than their European counterparts because of prior immunity, and that any longitudinal decline in disease incidence can be related to sanitary aspects of living conditions or location. This chapter sets up the statistical framework of disease incidence and mortality on which questions addressed in subsequent chapters are based, notably on the influences of reform in infrastructure, changes in medical theories, and therapeutic approaches. The general health statistics will be considered first, after which the most important diseases will be presented, but as a prelude, the size of the service will be enumerated.

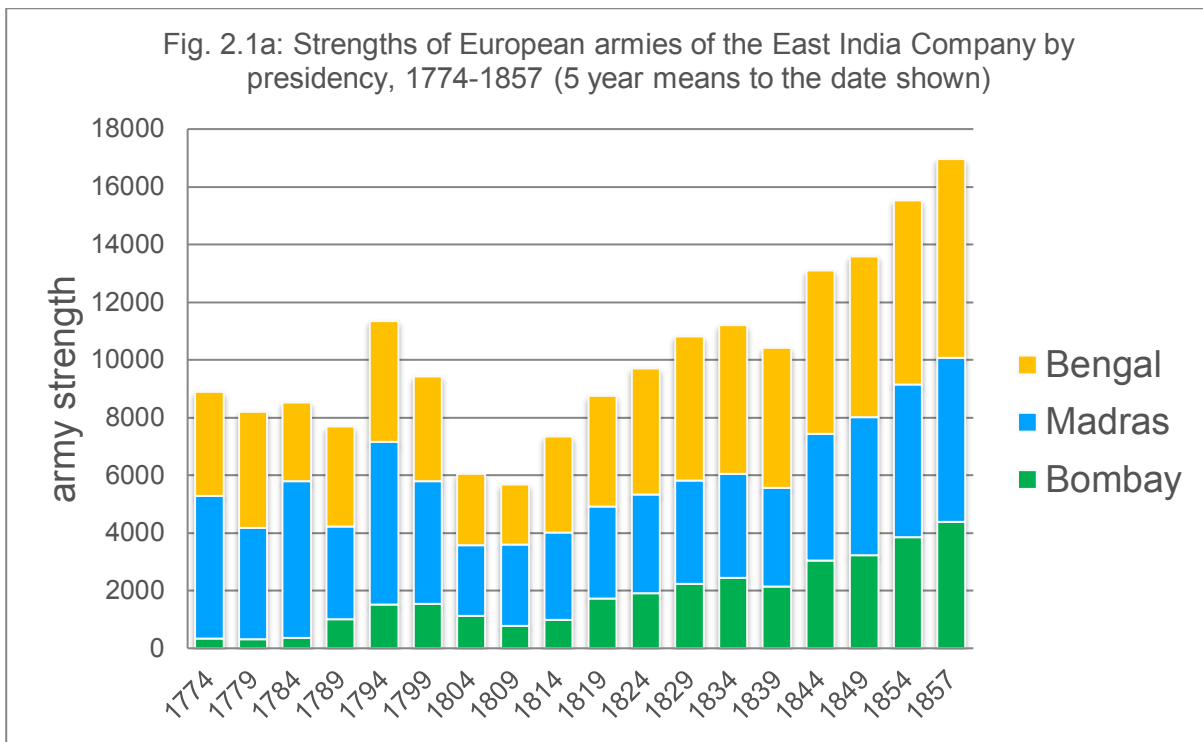
### ***Army strengths in British India***

The history of the British in India starts with the EICo, whose forces prevailed from before 1750 to 1857, after which all troops belonged to HM's army, generally known as the Indian Army.<sup>13</sup> Prior to the 1857-58 revolt, in addition to forces of the EICo, some soldiers were from the Crown army, generally known as the British Army. The Company's European troops in 1774 numbered just under 9,000, but this increased after the first decade of the nineteenth century to almost 17,000 by 1857 (Figure 2.1a).<sup>14</sup> Figures for strengths of different armies are sourced from multiple variously dated reports of the sanitary commissioners to the presidencies of Bengal, Madras and Bombay, and to India, but for Figure 2.1 (a) and (b), they are from *Royal commission 1863* – the full version of the report, not the précis evidence. Other sources state slightly different figures, for example, William Sykes (1790-1872) in 1847 gives a higher number of European troops than do the sanitary commissioners, whereas an 1862 Madras military finance report quotes a higher number of European soldiers than Sykes, but gives a considerably lower tally for the native (i.e. Indian)

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<sup>13</sup> The EICo started trading in 1600, but its interests in India and requirements for an army there, date from the mid eighteenth century.

<sup>14</sup> *Royal commission 1863*, pp. 532-8 – the full version of the report, not the précis evidence.



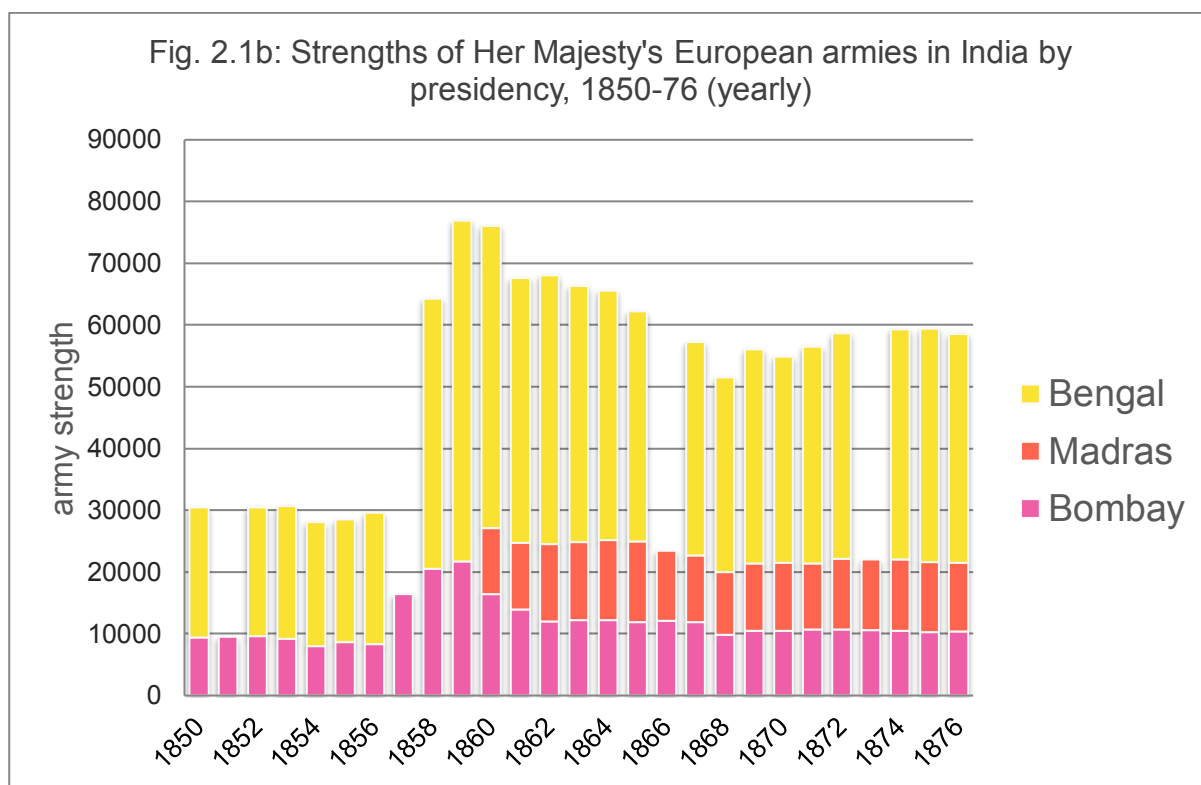
force.<sup>15</sup> All publications purport to count troops of the EICo but the explanation for the discrepancy might be the undeclared inclusion of the British Army soldiery. The sanitary commissioners' reports confirm a gradual increase in the Company's count of European troops in the first half of the nineteenth century, borne out to a lesser extent by an increase of a third between 1825 and 1844 in the Sykes data which, for native troops show a decline in numbers in the fourth decade of the century, with an incline after. The Madras figures confirm an increase in the 1840s and late 1850s. Units of the regular British Army were sent to India from 1754 to supplement EICo forces.<sup>16</sup> This had been adequate for the commercial needs of the Company in the first half of the eighteenth century but the imperial challenge from the French in the second half necessitated bolstering by larger forces of the regular army, which took precedence if conflicts were anticipated. The health of the EICo's European troops was particularly important as the company had difficulties in

<sup>15</sup> W.H. Sykes, 'Vital statistics of the East India Company's armies in India, European and native', *Journal of the Statistical Society of London*, 10 (1847), pp. 100-31; Military Finance Department, *Military budget estimate for 1861-62* (Madras: no publisher given, 1862), p. 19 [BL IOR/L/MIL/17/5/1916]; *Royal commission 1863*, pp. 532-7.

<sup>16</sup> A.N. Gilbert, 'Recruitment and reform in the East India Company army', *Journal of British Studies*, 15 (1975), pp. 89-111.

recruitment, having to compete with the regular army and to contend with scurvy or losses during the six-month incoming sea voyage.<sup>17</sup>

Post-1857, European troops numbers more than doubled (Figure 2.1b).<sup>18</sup> By 1862, there were, in India, in the Queen’s troops, 70,489 European men and NCOs, 3,962 European officers, 108,382 officers and men of the native army, and 11,652 men in the Punjab local force.<sup>19</sup> The worldwide strength of the British Army in 1861 was 227,005, meaning that approximately one third of the entire force was serving in India at any one time, though not all regiments rotated there. The armies in India, in 1857, were arranged into cavalry regiments (typically about 670 men) and infantry battalions (around 1,000 men), supported by companies and troops of horse and foot artillery, with engineers, miners and sappers.<sup>20</sup> The territory of the Indian armies extended to Aden, the Persian Gulf, the Malayan Peninsula, and some locations in the China Sea.



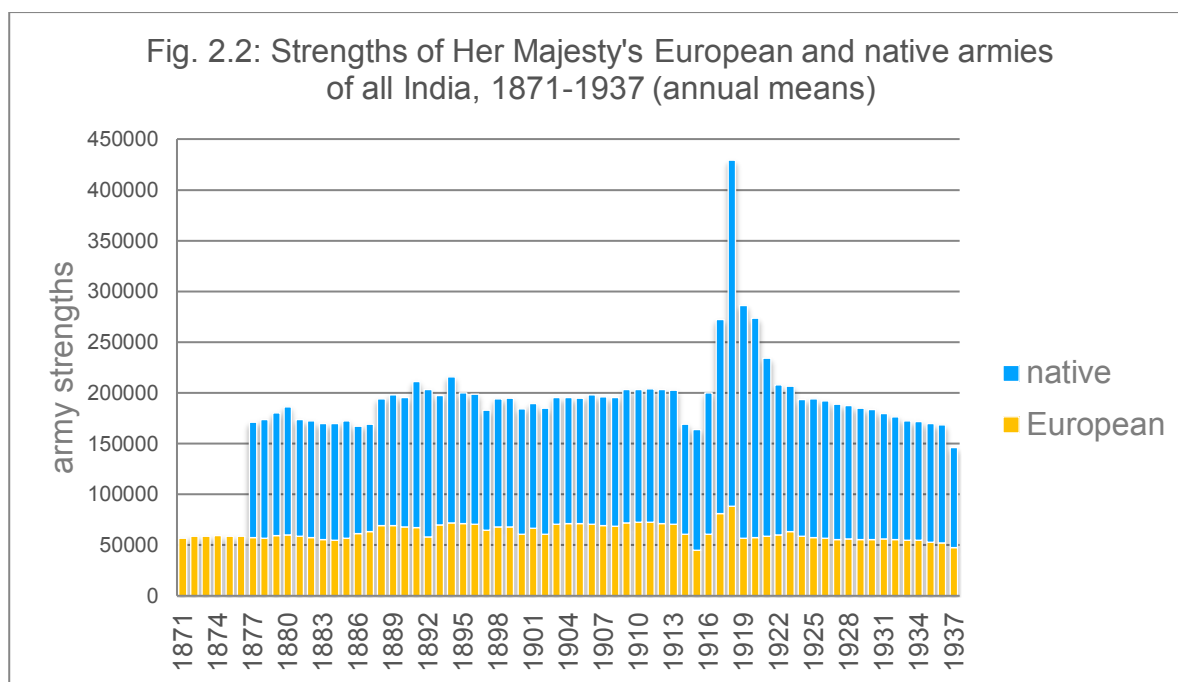
<sup>17</sup> Charters, *Disease*, pp. 151-4, 171; These difficulties encouraged recruitment of sepoys, attracted by promise of ‘land pensions’.

<sup>18</sup> *Royal commission 1863*, pp. 532-8 – the full version of the report, not the précis evidence.

<sup>19</sup> *Royal commission 1863*, pp. 10-15; Not all the soldiery in pre-1857 armies had been incorporated into the Crown Army at this date. The objective of the Punjab local force was security of the north-west frontier. It was outwith control of presidency army authorities and under command of the chief commissioner of the Punjab.

<sup>20</sup> T.A. Heathcote, *The Indian Army* (Newton Abbot: David & Charles, 1974), pp. 51-2, 201.

After doubling following the revolt, troop numbers steadied through the 1870s, increasing slightly (as the Indian army) in the 1880s, peaking dramatically during the later phases of World War One, then declining to 146,289 men by 1937 (Figure 2.2).<sup>21</sup>



***Recruitment of the native armies of the presidencies and all India, and the potential for bias***

On the composition of the native army, in 1869, Mr Garnet Joseph Wolseley (1833-1913) observed that ‘We have in India about 130,000 native soldiers, divided into three armies, the one composed of war-like races of the north-west peninsula, the second recruited almost entirely from different classes in the south, and the third partly from local sources, and partly it is understood, from Oude and the north-west’.<sup>22</sup> Traditionally, the native army of Bengal, from the days off the past Muslim dynasty, had been recruited from high caste Hindus of Bihar, Oudh and Agra.<sup>23</sup> The Madras and Bombay armies were supra-caste and multi-religious – the former recruiting from Madras, Hyderabad and the central provinces, and the latter from Bombay, Sindh, Rajputana and Aden.<sup>24</sup> After the 1857 rebellion, in which the uniformity of the Bengal army was thought to have played a

<sup>21</sup> Sourced from annual reports of sanitary and public health commissioners for all India.  
<sup>22</sup> G.J. Wolseley, ‘Military expenditure in India 1895-96’, *Memorandum on reduction of military expenditure*, 27 March 1877 [BL IOR/L/MIL/7/12783].  
<sup>23</sup> S.H.S. Soderwordi, ‘Punjabisation in the British Indian army 1857-1947 and the advent of military rule in Pakistan’, *Edinburgh Papers in South Asian Studies*, 24 (2010), pp. 1-33.  
<sup>24</sup> *Ibid.*.

part, no single caste or class was allowed to dominate, with greater focus on recruitment from the Punjabi martial races – which from thence contributed over half the entire native army – and from the Gurkhas of Nepal. One upshot of this was that the native soldiery would have had less exposure to endemic diseases of the Gangetic plains and – since predominantly they now came from a poorer and more rural background – possibly had compromised nutrition during childhood.

***Recruitment policy in Britain for the European soldiery of India, and the potential for bias***

Data on the recruitment process including annual rejection rates and reasons for rejection are available in the AMD annual *Reports* from 1860 – details for prior years are not discernable. Some retrospective data are available. The policy for the recruitment of soldiers is stated in the AMD statistical report for 1860, and reads as follows:<sup>25</sup>

For the purpose of raising men to serve in the army, the United Kingdom is divided into districts, each of which is placed in charge of an inspecting field officer, and every district is divided into subdivisions, under the superintendence of subalterns detached from their regiments, and having parties of non-commissioned officers and men specially employed in this service. When a recruit is enlisted by any of the parties, he is examined as to his physical fitness, if at the headquarters of the district by the staff surgeon, or if at an out station, by the army medical officer, when there is one quartered at or near the place of enlistment, and if not, by a private medical practitioner. After being duly attested, if an out station recruit, he has sent to the headquarters of the district, where he is brought before the staff surgeon, previous to being finally approved by the inspecting field officer and sent to his regiment. If the staff surgeon deem him unfit for the service, a board of medical officers is usually ordered to examine him, and to report their opinion for the guidance of the military authorities. If considered fit by the staff surgeon, the recruit is again examined on joining his regiment or depot by the medical officer of the corps, and if objected to by him, is brought before a medical board before final decision.

Hence the process for recruitment was a many gated one, with the potential recruit having to clear at least two hurdles of medical examination before finally being accepted into the army as a private

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<sup>25</sup> AMD, *Statistical, sanitary and medical reports for the year 1860* (London: Harrison, 1862), pp. 33-41.

soldier. Age was to be between 17 and 25 (boys under 17 could join as musicians) for 1861-70 – this changed to 18 to 25 for 1871-1900. The physical measurements required a height minimum: which, according to A.R. Skelley, varied, being 5’8” for 1861-67, 5’5” for 1868, 5’7” for 1869, 5’4.5” for 1870, 5’5.5” for 1871-77, 5’6” for 1878-79, 5’4” for 1880-82, 5’3” for 1883-88, 5’4” for 1889-1899 and 5’3” for 1900.<sup>26</sup> However, the AMD *Report* for 1860 states the minimum height as 5’4” (1.63m).<sup>27</sup> There was no minimum weight until 1884, when it became 115lbs (54 Kg) – the minimum chest measurement was 34” (86 cm) from 1861 to 1900.<sup>28</sup> Of 20,725 recruits accepted for 1860, 56 percent were from England, 32 percent from Ireland, 10 percent from Scotland, 1.5 percent from Wales, and 0.5 percent from colonies.<sup>29</sup> Recruitment by 1865 had shifted to be 64 percent English, 25 percent Irish, 10 percent Scots, and 1 percent other nationalities.<sup>30</sup> In the ten years 1832-41, the rejection rate was 29.8 percent, for 1842-51 it had been 33.5 percent, and in 1860 – when a primary and secondary process operated and hence figures are not directly comparable, it was 25.6 percent.<sup>31</sup> The rejection rate for 1860 was 32 percent in Scotland, 26 percent in Ireland, 24 percent in England and 23 percent in Wales.<sup>32</sup> The 1860 *Report* remarks that the lower rejection rate did not indicate a better grade of applicant, and comments that ‘... the proportion of rejections must vary considerably with reference to the supply and demand’.<sup>33</sup> The main causes of rejection in 1860 were: ‘unsound health’, eye disease, varicose veins, previous injury to the legs, muscular tenuity (underdevelopment), hernia, and malformations of the chest or spine. A half of all recruits were aged 18 to 21 years. Scottish incomers were tallest. The proportion, in 1860, of recruits under 5’5” was 25 percent higher in those from Ireland than in those

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<sup>26</sup> A.R. Skelley, *The Victorian army at home: the recruitment and terms and conditions of the British regular, 1859-1899* (Montreal; McGill-Queen’s University Press, 1977), pp. 237-8.

<sup>27</sup> AMD, *Statistical, sanitary and medical report for the year 1860* (London: Harrison, 1862), pp. 33-41.

<sup>28</sup> Skelley, *Victorian army*, pp. 237-8.

<sup>29</sup> AMD, *Report 1860*, p. 35.

<sup>30</sup> AMD, *Statistical, sanitary and medical reports for the year 1865* (London: Harrison, 1867), pp. 26-8; The proportion of Irish recruits had fallen from almost a third in 1864. By 1896, British regiments worldwide comprised: 79 percent English or Welsh, 13 percent Irish, and 8 percent Scots – Skelley, *Victorian army*, p. 287.

<sup>31</sup> AMD, *Report 1860*, p. 34.

<sup>32</sup> AMD, *Report 1860*, p. 35.

<sup>33</sup> AMD, *Report 1860*, p. 34.

from Scotland, England or Wales, suggesting childhood undernourishment.<sup>34</sup> Most recruits, in 1860, weighed between 110 and 140 lbs (50-63 Kg) – the average was 9 stone (126 lbs; 57 Kg). The proportion able to read and write varied between 53 percent in Ireland and 70 percent in England. One half of recruits had been labourers, servants, or husbandry men (that is an agricultural worker with a smallholding), and one quarter had been ‘mechanics’ – meaning carpenters, smiths or masons (Table 2.1).<sup>35</sup>

**Table 2.1: Recruitment to the British army, 5-yearly sampling 1860 to 1900 showing numbers examined, rejection rate, measurement data and literacy.**

year	number examined	rejection rate %	boys <17 years %	median height	median weight lbs	under 5'4" %	under 110 lbs %	read and write %
1860	27852	25.6	1	5'4"-5'5"	120-130	7.3	8.2	53-70
1865	24891	42.6	1.8	5'5"-5'6"	120-130	0.5	6.5	67
1870	38408	33.7	1.2	5'5"-5'6"	120-130	3.1	4.7	71
1874	30557	27.7	2.2	5'5"-5'6"	120-130	2.6	3.2	72
1882	45423	42.5	2.8	5'5"-5'6"	120-130	7.3	4.3	68
1885	73249	40	2	5'5"-5'6"	120-130	14.2	5.5	82
1890	55367	39.7	3.9	5'4"-5'5"	120-130	14.5	5.1	93
1895	55698	41.1	4.2	5'5"-5'6"	120-130	9.8	4.1	96
1900	84402	28.1	3.6	5'5"-5'6"	120-130	22.1	4.4	97

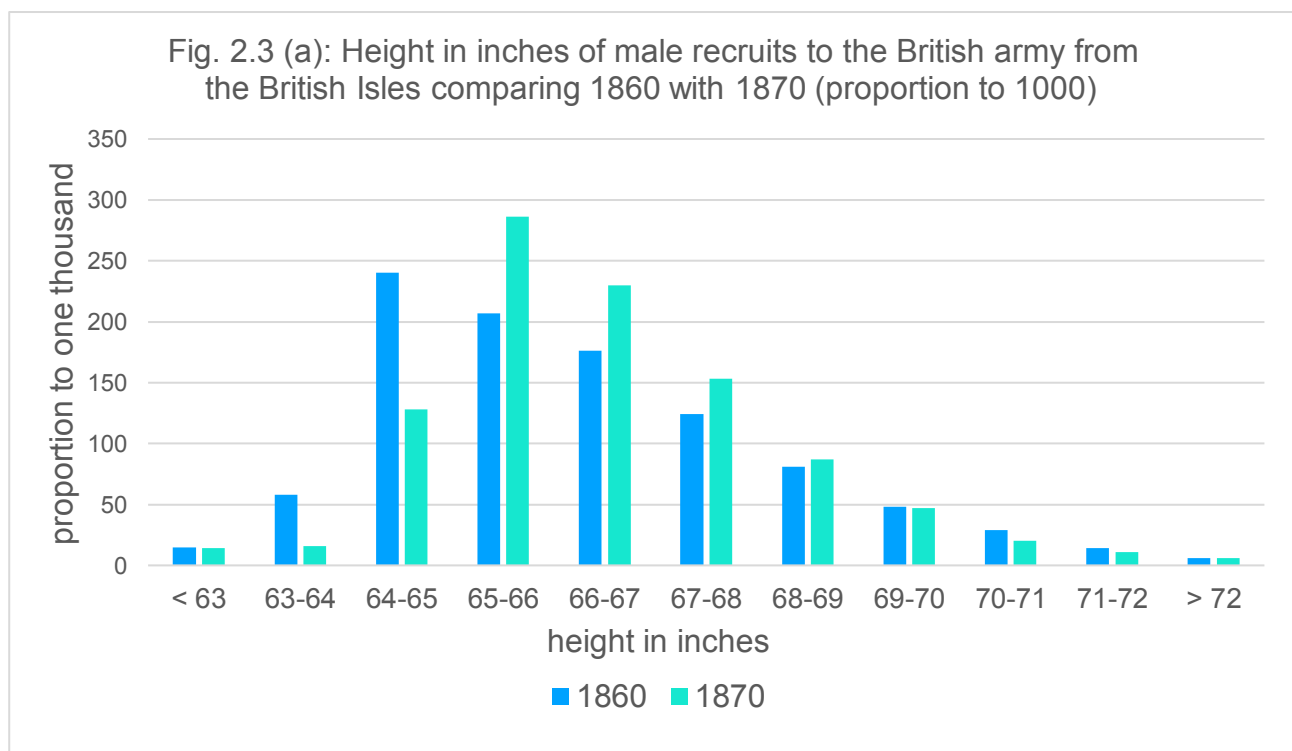
By 1874, the principal reasons for rejecting a recruit were listed, in order of prominence, as muscular tenuity, eye disorder, heart disease, varicose veins, syphilis, chest and spine abnormalities, hernia, lower limb defect and varicocele (enlarged veins within the scrotum). By 1882, the main listed causes of rejection had changed. The most common reason now was being under the required chest measurement, height or weight, followed by defective vision, heart disease, syphilis, varicose veins, and varicocele. By 1890, the industries of applicants had evolved: labourers, servants and

<sup>34</sup> AMD, *Report 1860*, p. 39.

<sup>35</sup> AMD, *Statistical, sanitary and medical report for the years 1860, 1865* (London; Harrison, 1862, 1867); AMD, *Report for the years 1870, 1874, 1882, 1885, 1890, 1895, 1900* (London; Harrison, 1872, 1876, 1892, 1896, 1902; Eyre and Spottiswoode, 1884, 1887), pp. 33-41, 25-34, 38-49, 43-49, 20-26, 25-33, 33-42, 26-34, 37-44.

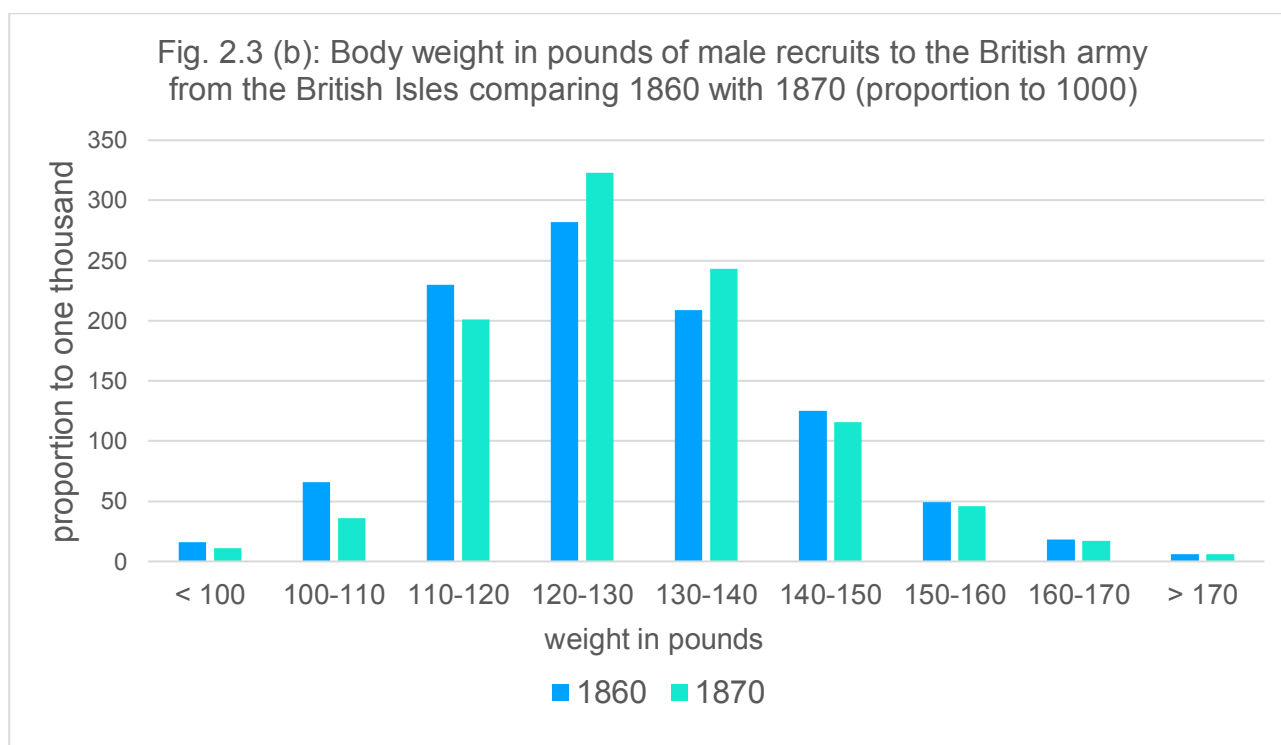
husbandry men now provided 62 percent of applicants, but manufacturing artisans (at 16 percent), replaced mechanics (at 11 percent) as the second group.

Data shown in Table 2.1 are crude but even so give a suggestion that in some years heights were lower than others – 1860 and 1885 to 1900 are examples. A more detailed comparison of the 1860 recruits with those ten years later confirms that the earlier intake undoubtedly was shorter and lighter than their 1870 compatriots – Figure 2.3 (a) and (b).<sup>36</sup> The potential relevance of this will be picked up below. The overall rejection rate is not a reliable marker for the physical condition of recruits as it can be swayed by the requirements of the service. It hovered around 40 percent in the 1880s and 1890s, but had been 25.6 percent in 1860, suggesting standards then were lowered due to exigencies of the service.



To examine the public health milieu from which 1860s recruits emerged, disease and mortality rates for males aged 17 to 25 are reviewed below based on the reports of the Registrar-General for births, deaths and marriages for England (RG BDME). These observations bring into play the contention

<sup>36</sup> AMD, *Report 1860*, p. 39; AMD, *Report 1870*, pp. 44-5.



of Howard Bodenhorn, Timothy Guinnane and Thomas Mroz on the effect of selection bias in sampling, and the effect of economic hardship or employment prospects on an individual's willingness to put himself forward for military service, as discussed below.<sup>37</sup> Bodenhorn and collaborators argue that using heights of military recruits as a proxy for nutritional state and hence changes in economic prosperity over time for the labouring classes generally is misguided as, they argue, only those less robust men unable to find better work prospects elsewhere would be forced to seek entry to the army, inferring that these were less able-bodied and hence not a reflection of working class anthropometry overall. Several authors dispute this and it is not a debate relevant to this thesis,<sup>38</sup> since it seems that Bodenhorn and colleagues do not question the actual validity of the measurements and the implications for the population on which they were made. The conclusion from these data is that by 1870 and beyond, recruits had higher stature, implying better childhood nutrition and less vulnerability to infection, adding another possible reason for the observed

<sup>37</sup> H. Bodenhorn, T.W. Guinnane, T.A. Mroz, 'Sample-selection bias and the industrialization puzzle', *Journal of Economic History*, 77 (2017), pp. 171-207.

<sup>38</sup> J. Komlos, B.A. A'Hearn, 'Clarification of a puzzle: the decline in nutritional status at the onset of modern economic growth in the United States', *Journal of Economic History*, 4 (2019), pp. 1129-53.

reduction in contagious disease rates and mortality.<sup>39</sup> The improvement in literacy by the end of the nineteenth century (*vide supra*) shows a change in the ‘human capital’ of recruits, supplying a further reason why disease rates might fall.

### ***Mortality rates for the armies of the East India Company, the presidencies and of all India***

The earliest statistics on disease in British forces in India relate to mortality rates of EICo European armies, dating from 1770 and extending to 1856 (Figure 2.4).<sup>40</sup> In European troops of the EICo, over two extended periods, 1770-99 and 1800-56, average annual mortality rates were, respectively, 71 rising to 74 per mille for Bengal presidency, 78 lowering to 66 per mille for Bombay, and 38 climbing to 64 per mille for Madras. Epidemics, often of cholera, resulted in considerable year-to-year variation with high mortalities in all presidency armies in the 1810s and 1820s.<sup>41</sup> Generally, mortality rates were lower in the Madras force than in the other two presidency armies, especially in latter decades of the eighteenth century (Figure 2.4).<sup>42</sup> Mortalities approached ten percent annually for the late 1810s and in the 1820s, when cholera was rife. The mortality rates for Bengal and Bombay for 1850-56 were lower than the previous decade. Data relating to native armies are not available for this period. The case book of surgeon John Smet at Meerut and Cawnpore, 1819-21, for the 8<sup>th</sup> King’s Irish Dragoons, does not give mortality rates but paints a picture of fevers, cholera, diarrhoeas, and drunkenness – similar conditions to those reported mid-century – though he makes more mention of rheumatism and does not see venereal disease as much as one might expect

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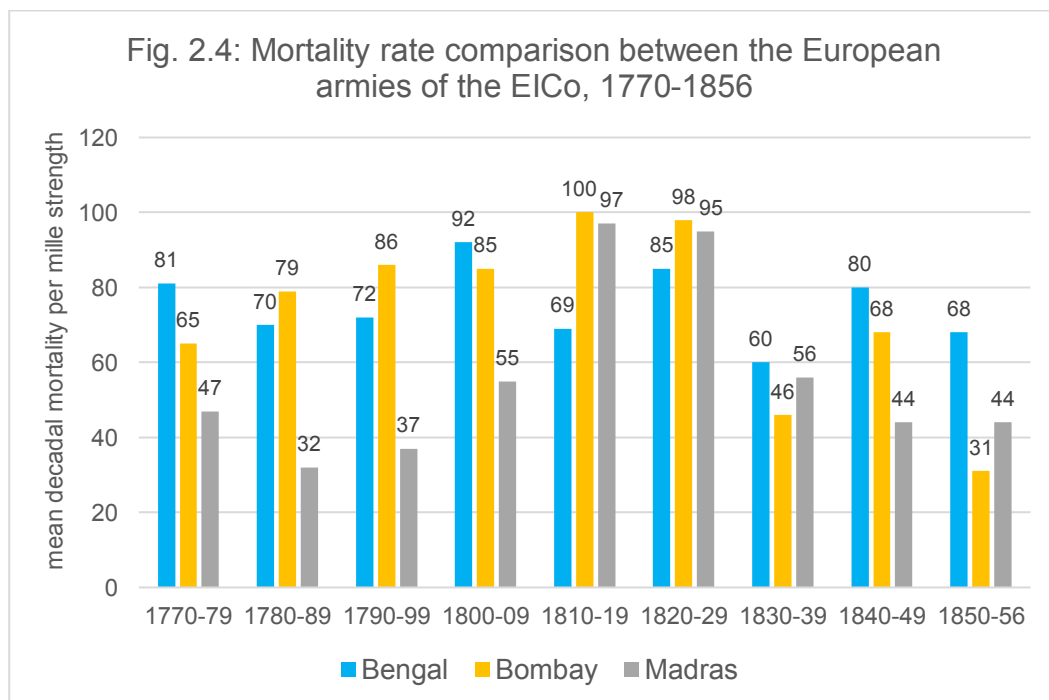
<sup>39</sup> Hatton and Bray, mostly using army recruit figures, confirm this, and show an average increment in height of 1.14 cm for males in Great Britain between 1871-75 and 1911-15; T.J. Hatton, B.E. Bray, ‘Long run trends in the heights of European men, 19<sup>th</sup>-20<sup>th</sup> centuries’, *Economics and Human Biology*, 8 (2010), pp. 405-13.

<sup>40</sup> *Royal commission 1863*, pp. 532-7; Use of the label ‘European’ might seem a misnomer. It is the term usually used in primary sources. Niall Ferguson points out that in the early nineteenth century, the European army of Bengal was composed of 48 percent Irish, 34 percent English and 11 percent Scots: N. Ferguson, *Empire: how Britain made the modern world* (London: Penguin, 2003), p. 39.

<sup>41</sup> Data are not shown here but are discernible from source material; Limited data from a medical officer’s 1757 returns during the Seven Years’ War suggest only slightly higher rates of sickness in British troops, at 13 percent, compared to sepoys, at 8 percent, though other returns showed a bigger discrepancy – Charters, *Disease*, p. 170, quoting BL Asia, Africa and Pacific collection, MSS Eur/Orme India XIII, fol. 98, 103-4.

<sup>42</sup> This reflects impressions formed during the eighteenth century, when parts of the Coromandel coast were effectively used as sanatoria for Europeans to recover their health.

despite (or perhaps because of) his inspections of ‘the public women’.<sup>43</sup> The variability he describes fits with the year-on-year nature of epidemic infectious disease.

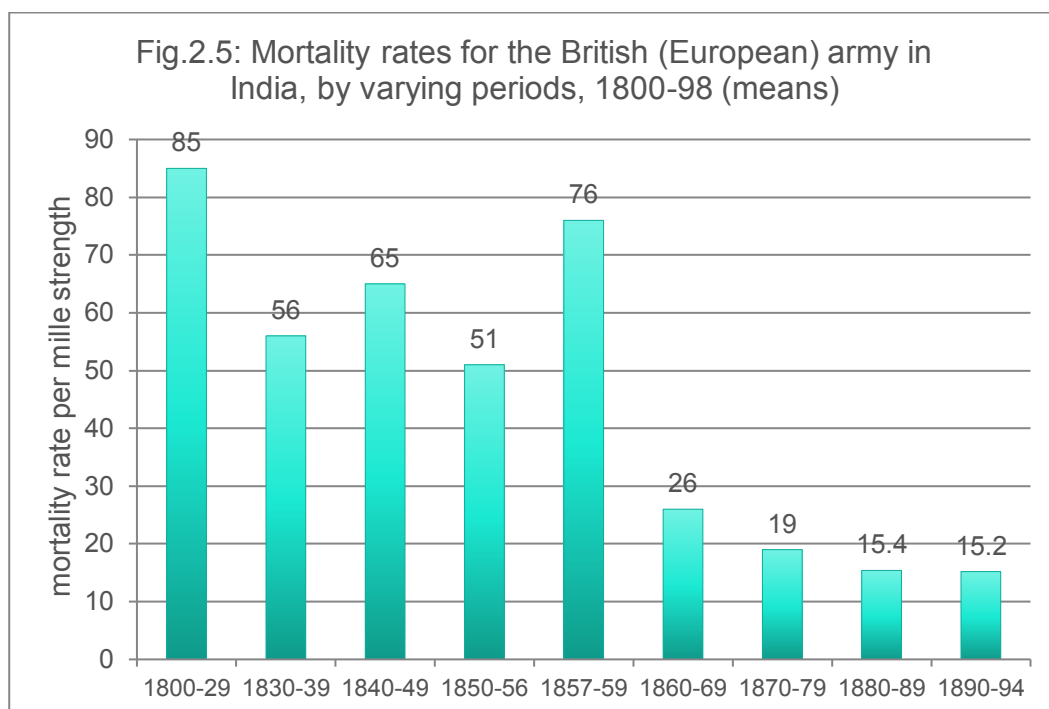


Retrospective information from 1898 for the British Army in India confirms a high mortality rate in the first quarter of the nineteenth century, with a steady decline thereafter, except for an expected blip in 1857-59 (Figure 2.5).<sup>44</sup> According to these figures from the 1900 *Royal commission report*, mortality in European troops in all India halved between 1850-56 and 1860-69 – both these are for all India (only 1856-59 refers to Bengal alone, when there was a surge). Rates for HM’s European troops of the presidencies, available from the 1850s, show slightly lower figures than revealed in the last set for EICo armies, with a downward trend which continued to 1876, when these armies were amalgamated into the Imperial army of all India (i.e. the Indian Army). In contrast to the rank-and file, officers of the EICo’s armies had much lower mortality rates. Over the twenty-year period, 1814-33, the average annual rate of demise for officers of the British Army and of the Company’s

<sup>43</sup> Smet, ‘Case book’ Wellcome, RAMC/204/2.

<sup>44</sup> *Minutes of evidence taken before the Royal commission on the administration of the expenditure of India; with index, analysis and appendices*. Vols. I and III (London: HMSO, 1900), Vol. I, p. 385; Data provided by Sir Edwin Collen. Figures for 1800-29, 1830-39, 1840-49 and 1850-59 are for all of India, figures for 1857-59 are for Bengal, those for 1860 and after are for all of India.

was 34-38 per mille – an officer was twenty times more likely to die from disease than from battle.<sup>45</sup> Rates were highest for officers in Madras, followed by Bombay, then Bengal.



The native armies of the presidencies, in comparison, almost uniformly were reported to have lower mortality rates than their European counterparts. This needs to be viewed with care since deaths on furlough were not always included in returns.<sup>46</sup> The earliest figures for mortality in native troops are those of the EICo over the 20 year period, 1825-44, when the mean rate was 18 per mille, lower than the equivalent European rate of 54 per mille.<sup>47</sup> Mortality for sepoys was greater in Madras than in Bengal or Bombay (rates of 20.9, 17.9 and 12.9 per mille respectively, compared to 38.5, 73.8 and 51 for the European force), with cholera the main cause (at 5.8, 2.2 and 2.8 respectively, compared to 4.3, 11.5 and 5.6 for their European counterparts).<sup>48</sup> The mortality rate of the native

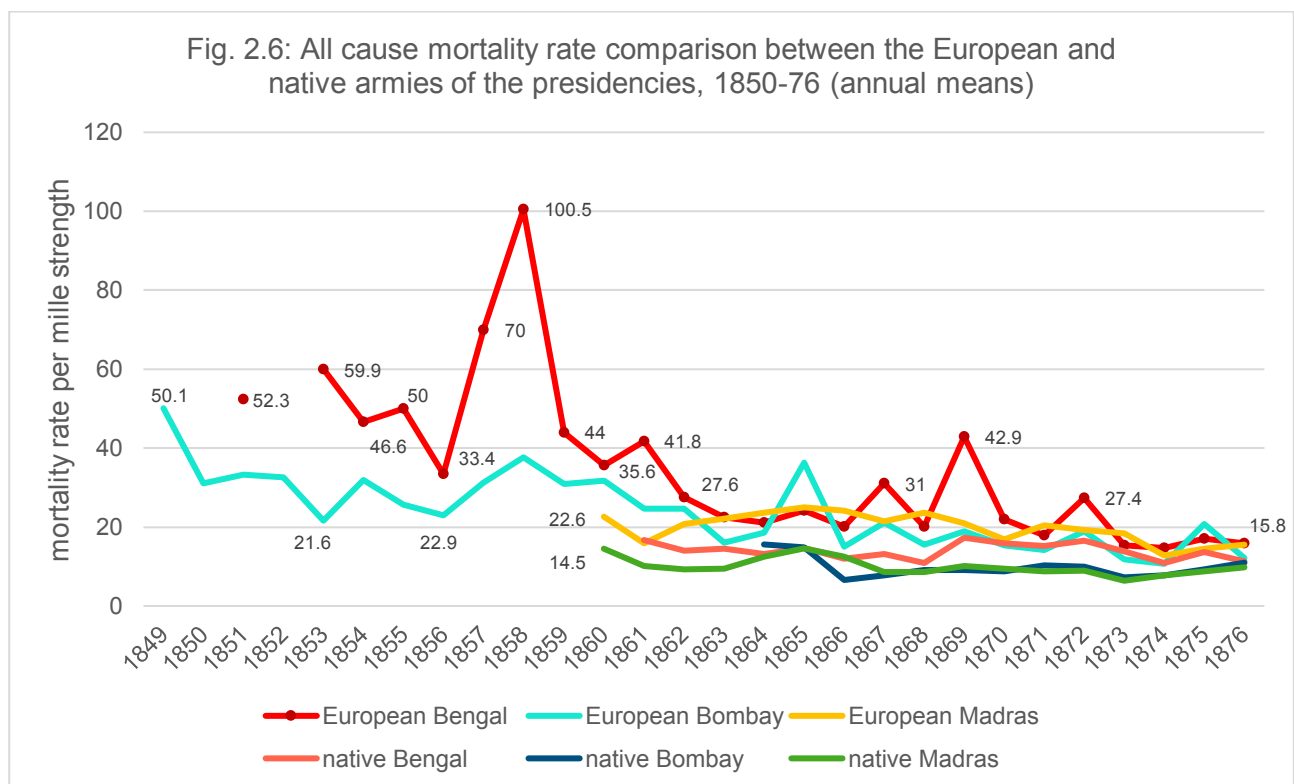
<sup>45</sup> *Royal commission 1863*, pp. 34-40, 178-85 (Tables 10-16); The commissioners offer no explanation for this, as Madras was healthier than Bengal for the rank-and-file.

<sup>46</sup> Where sanitary commissioners' reports show two sets of figures for mortality in native troops, with one set including deaths away from the regiment, the higher figure has usually been used since it is better for purposeful comparison to European troops. The latter were not able to go on furlough and so all deaths in this group would be included in returns, except for those that occurred in soldiers invalided and returned to home, when they may have died on ship or in Britain.

<sup>47</sup> Sykes, 'Vital statistics', pp. 100-31; No explanation was proffered by Sykes for the excess rate in Madras, among sepoys, which was mostly due to cholera, though the location (with regard to water sources) or age of the barracks (concerning sanitary arrangements) might be explanations.

<sup>48</sup> Reasons for the greater sepoy mortality in Madras are unclear. Proximity of barracks to contaminated water supplies or type of accommodation are possible explanations.

army of Madras presidency, annualized over 16 years from 1842 to 1858, was 18 per mille, of which one third was due to cholera.<sup>49</sup> Mortality rates in the presidential armies demonstrate changes in the 1850s which cannot be apparent from combining to give an ‘all India’ statistic, and show differences in disease incidences between regions. Unsurprisingly, since the rebellion occurred principally in the north of India, the overall mortality rate for HM’s European army of Bengal shows a spike for the year 1857 (Figure 2.6), with a lesser peak for Bombay (data are unavailable or sparse for Madras and for the native armies in the decade before 1860-61).<sup>50</sup> The Bengal European

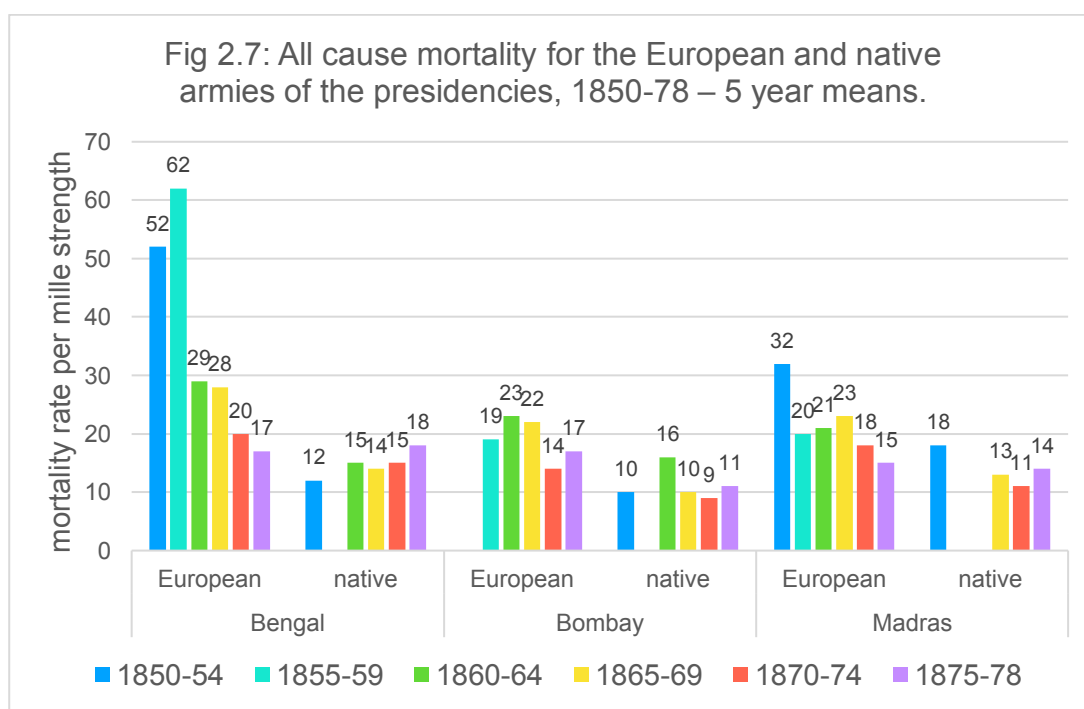


<sup>49</sup> *Royal commission 1863*, pp. 41-2; The figures are those of Inspector-General Macpherson of Madras presidency.

<sup>50</sup> The data on the presidency armies here and elsewhere, for the years shown, have been collated from a variety of sources, namely: Ewart, *Vital statistics*; AMD *Statistical, sanitary and medical reports, 1860 to 1868* (London: HMSO, 1862-1870); *RSCBo, 1869, 1870* (Byculla: Educational Society Press, 1870, 1871); J.L. Bryden, *Reports bringing up statistical history of the European army in India and of the native army and jail population in Bengal to 1876 and cholera history of 1875-76* (Calcutta: SGP, 1878); *RSCMa, 1868-1870* (Madras: Morgan, 1869-1871); J.L. Bryden, *Vital statistics of the Bengal presidency, 1858-69* (Calcutta: SGP, 1870); *RSCBe, 1864-1867* (Calcutta: Cutter/ Military Orphan’s Press, 1865-1868); *RSCBe, 1868-1870* (Calcutta: SGP, 1869-1871); *RSCGI, 1867, 1873-1876* (Calcutta: SGP, 1868, 1874-1877); J.L. Bryden, *Annual returns of the European army of India and of the native army of Bengal and the jail population of the Bengal Presidency for the years 1871 to 1876* (Calcutta: SGP, 1878); *Medical and sanitary report of the native army of Madras for 1872* (Madras: Government Gazette Press, 1874); *MSR NA Ma 1875, 1878* (Madras: Keys at Government Press, 1876, 1880); *MSR NA Ma 1876* (Fort St George: Government Press, 1877); *MSR NA Ma 1878* (Madras: Keys at Government Press, 1880); *MSR NA Bombay 1876-1878* (Byculla: Education Society, 1877-79); *RSCBo 1864, 1865-1870, 1877* (Byculla: Education Society, 1865, 1866-1871, 1878); T.E.P. Martin, *Sketch of the medical history of the native army of Bombay for the years 1870, 1875, 1876* (Byculla: Education Society, 1871; Bombay: Government Central Press, 1876, 1877); *RSCMa, 1866, 1867* (Madras: Gantz Brothers, 1867, 1868); *RSCMa, 1868-1872, 1874, 1875* (Madras: Morgan, 1869-1873, 1875, 1876); *RSCMa, 1876* (Madras: Keys, 1877).

army again demonstrates, as noted for EICo forces, a higher mortality rate through to 1876, the date after which only figures for all India are available for European other ranks. It also shows more spikes from epidemics. Mortality rates are consistently smaller in native armies, though the Bengal troops show, as for the European force, a higher rate than the other two presidencies.

Plotting 5-year means for the presidential armies shows more graphically that mortalities were higher for European troops in Bengal than in Bombay or Madras especially in the 1850s (Figure 2.7).<sup>51</sup> Mortality rates in Bengal though not in the Bombay nor the Madras presidencies, had halved by the mid-1860s, in comparison.



Details of army health provision during the 1857 rebellion are sparse though the unpublished papers of surgeon Francis Innes (1812-85) furnish accounts of the move from Cawnpore on 19<sup>th</sup> September 1857 of the 64<sup>th</sup>, 78<sup>th</sup> and 84<sup>th</sup> regiments, with the 1<sup>st</sup> Madras fusiliers plus Bengal volunteer cavalry and artillery, on to Lucknow, and then of the siege of that city.<sup>52</sup> In the first, undated, account, Innes describes performing multiple amputations under chloroform anaesthesia on European soldiers and

<sup>51</sup> Source data as for Fig. 2.6

<sup>52</sup> Wellcome collection, RAMC/509/1-4, Papers of F.W. Innes; Innes was later to become surgeon-general. The accounts appear to have been written at different times and some of the figures differ slightly.

native followers, extracting ball shot and dressing wounds in the field hospital, sited in a palace garden just over a mile from the city of Lucknow. Several of the medical officers were ill with dysentery or injuries and most of the native support staff had absconded. Food became scarce. Of 138 in the field hospital, 24 had perished by 6<sup>th</sup> October. A relief column arrived from Cawnpore, most of whom were afflicted with ague. This spread to those in the hospital, causing often fatal worsening of their conditions despite intervention with quinine. Intermittent fever and then intractable diarrhoea supervened in the general group.

Innes supplies an additional medical report for the 84<sup>th</sup> regiment on campaign for the year to 31<sup>st</sup> March 1858. The regiment was to march from Rangoon to Calcutta in March 1857 but at barracks at Chinsurah, cholera broke out – Innes blamed the poor condition of the barrack sewers. In June, prior to a detachment being deployed to North-West Provinces during the rebellion, several men got drunk – four fell to heat apoplexy, three of which died. At Benares, on the march, cholera again supervened, Innes believes, due to insubordinate drinking in villages, and further deaths occurred from *coup de soleil*. At conflicts, as described at Orroo, because of being effectively surrounded, there was, for the wounded, no safe shelter to the rear, as was usual in European battles. Innes records that, aside from battle injuries, cholera remained rampant. The force, now of less than 1000 European men led by General Henry Havelock was *en route* to Lucknow but, unable to progress due to being outnumbered, made for Cawnpore. Scurvy was countered by the issuance of lime juice. Innes describes that by now almost all soldiers had some form of diarrhoea with sallow complexions and ‘tongues [that] were white, swollen, and indented like lumps of pipeclay’. On moving out to another battle, twelve out of 200 men fell to heat apoplexy, four dying. During the occupation of temporary accommodation, Innes directed sanitary improvements, notably to drains, and tried to find dry ground for encampment. The force neared Lucknow by 25<sup>th</sup> September 1857 – the sick and wounded were moved to Alumbagh. During the two months occupation of that town by a corps 395 strong, Innes records 90 admissions of which 19 died with 49 recovering and others

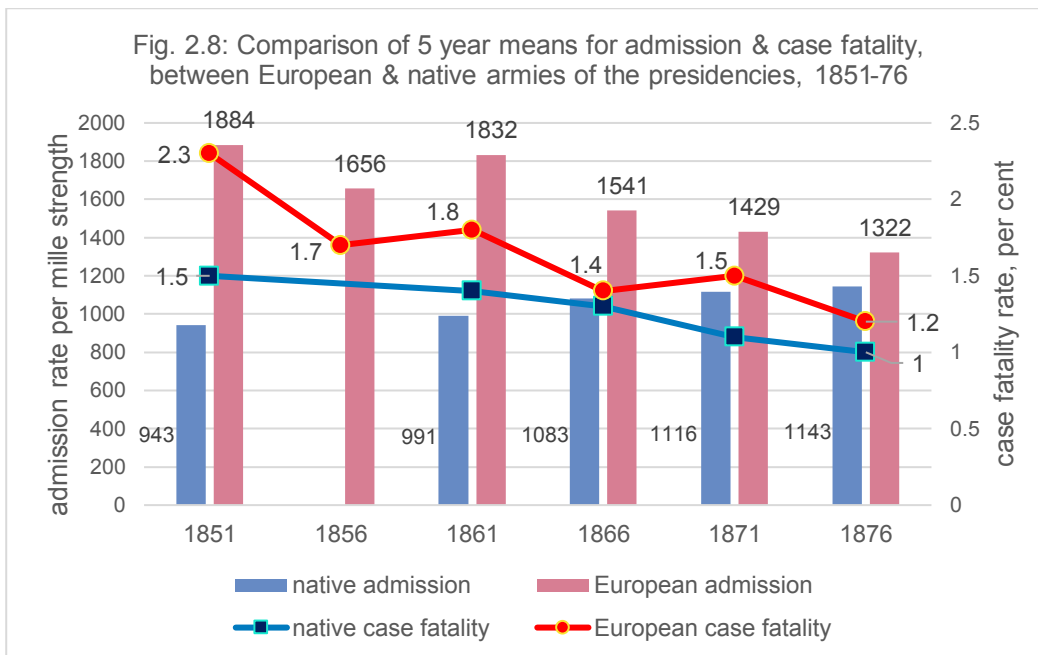
being transferred to Cawnpore: ‘The chief cause of mortality was Haemorrhagic dysentery and Hospital Gangrene. – Intermittent fever was also common but not intractable.’ Two cases of leg amputation both succumbed as did one of the three patients who had an arm amputated: ‘Both in officers and men the most trifling wounds took on gangrenous action, – and some of them proved fatal.’ A relief force boosted the garrison to 3000 men, prior to a successful assault taking Lucknow city in March 1858. During this time, Innes describes 75 admissions to the regimental hospital due to intermittent fever, with two deaths, with 51 admitted generally with ‘a mild type [of dysentery] yielding readily to ipecacuanha and opium.’ Innes, as regimental surgeon, gives overall figures for the 84<sup>th</sup> regiment over the year to 31<sup>st</sup> March 1858, as: killed by enemy – 90, died of wounds – 25, of heat apoplexy – 25, of cholera – 94, of diarrhoea and dysentery – 20, of other diseases – 25; and invalided to Britain due to wounds – 10, or due to disease – 41.<sup>53</sup>

Returning to the official records – these show that admissions peaked in the five years 1857-61 for the European force of Bengal, coinciding with the high mortality as described by Innes, but this subsequently declined in all presidency European armies, with a trend downwards from 1861 in mortality. Native armies showed a tendency towards increased admission rates over the five-yearly steps up to 1876, with little alteration in mortality except for a slight decrement for Bombay in the decade to 1876. If the admission and mortality rates for armies of the three presidencies are amalgamated and averaged, a downward trend in case fatality (deaths per admission) and in admission rate for the European force is evident, though admissions rose slightly up to 1876 for native soldiers (Figure 2.8).<sup>54</sup>

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<sup>53</sup> Wellcome, RAMC/509/1-4, Innes.

<sup>54</sup> It is acknowledged that this gives a statistic of questionable reliability as army sizes are different, but the discernible trend is borne out by other data: Data source, as for Fig. 2.6.

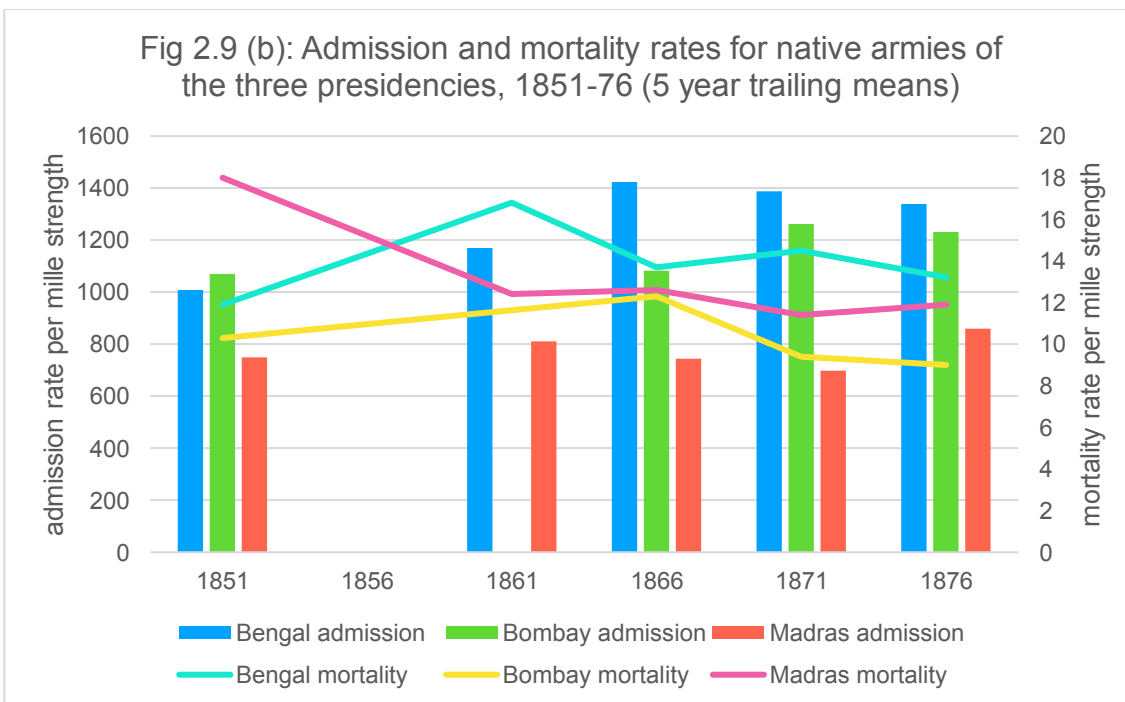
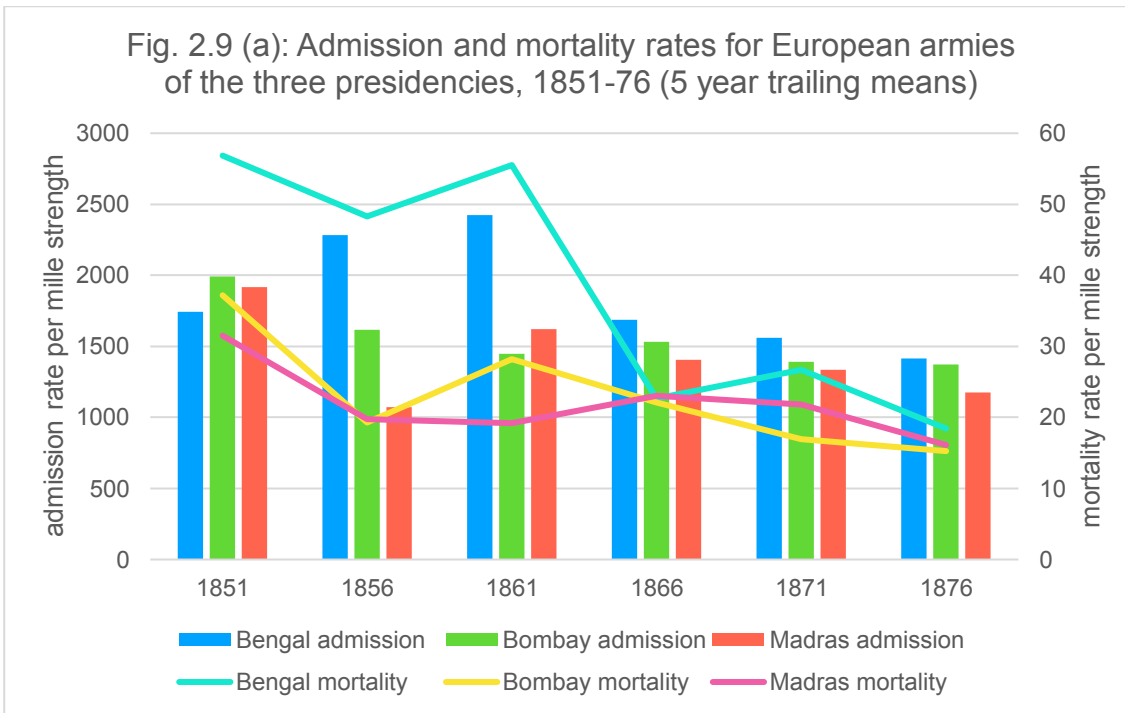


***Comparison of admission and mortality rates in the European and native armies of the presidencies***

Considering the differences in mortality between the European army of Bengal presidency and the smaller forces of Bombay and Madras (Figure 2.7) – variation was less within the comparable native forces though rates were still larger in Bengal – it is useful to consider specific diseases within the presidency troops before detailing changes for all India. The fall in admission and mortality rates occurred after 1861 for the European army of Bengal – there was little change from 1856 for Bombay and Madras (Figure 2.9a).<sup>55</sup> For the native army, the picture is less clear as data are missing for 1856 – both admissions and mortality were higher in Bengal, where admission increases a bit from 1861 to 1866, with a slight reduction in mortality (Figure 2.9b).<sup>56</sup> Admissions but not mortality increased a little from 1861 to 1871 for sepoys in the Bengal and Bombay forces, though small changes only are seen in Madras, which had the lowest overall rate, though its mortality statistic was intermediate between the other two.

<sup>55</sup> Source data as for Fig 2.6

<sup>56</sup> Source data as for Fig 2.6



Looking at specific diseases, mortalities from dysentery and diarrhoea, cholera, fevers and hepatitis were higher in the European army of Bengal over the period 1850-76 (Figure 2.10a).<sup>57</sup> This also, though to a lesser extent, applied for all fevers and pneumonia in the native troops (Figure 2.10b).<sup>58</sup>

<sup>57</sup> Source data as for Fig 2.6

<sup>58</sup> Source data as for Fig 2.6 (also for Figure 2.11).

Fig. 2.10 (a): Rates of mortality for the major causes of death in the European armies of the presidencies, 1850-76

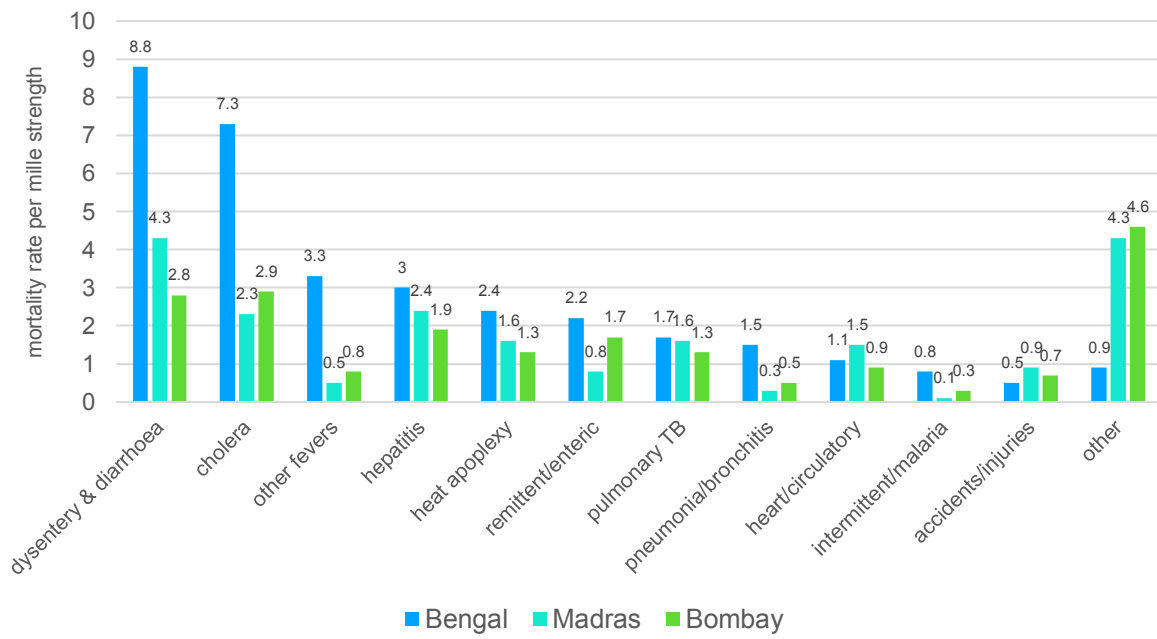
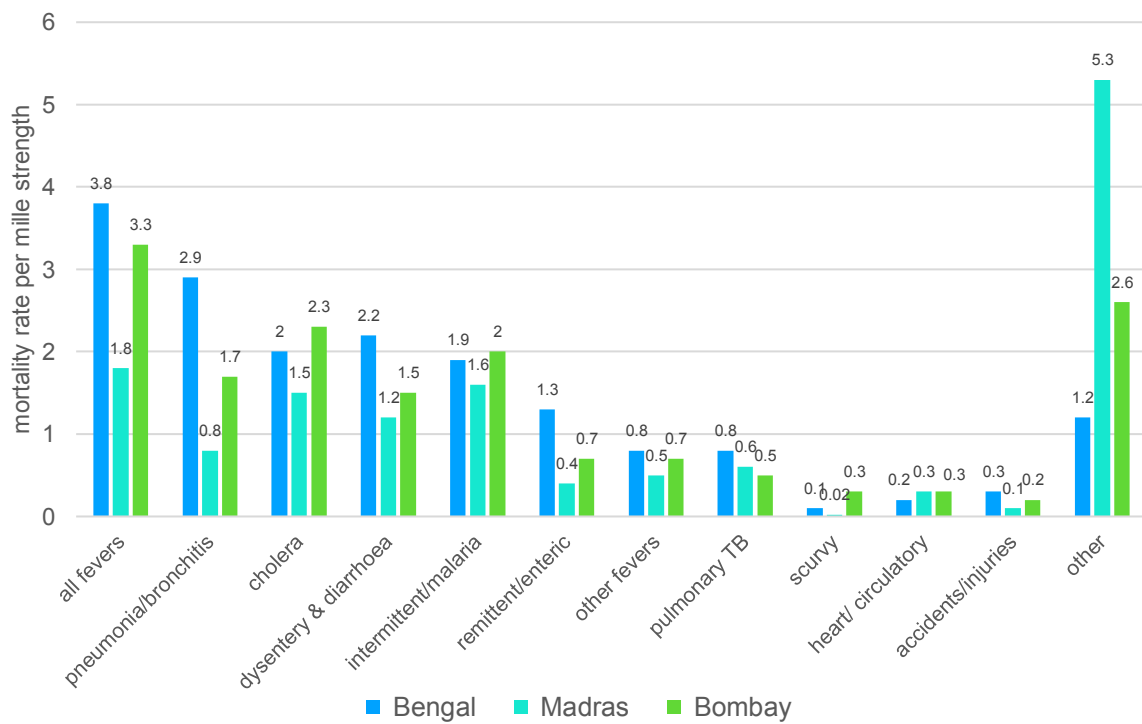
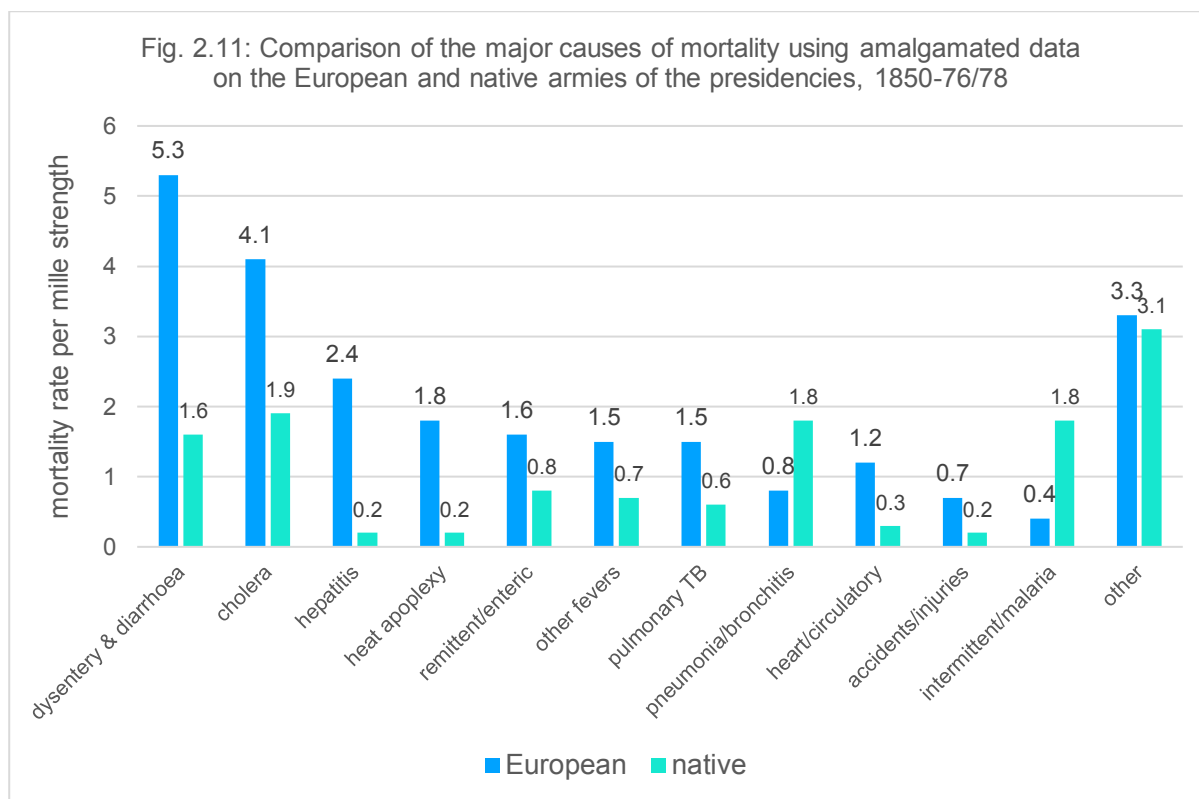


Fig. 2.10 (b): Rates of mortality for the major causes of death in the native armies of the presidencies, 1850-78



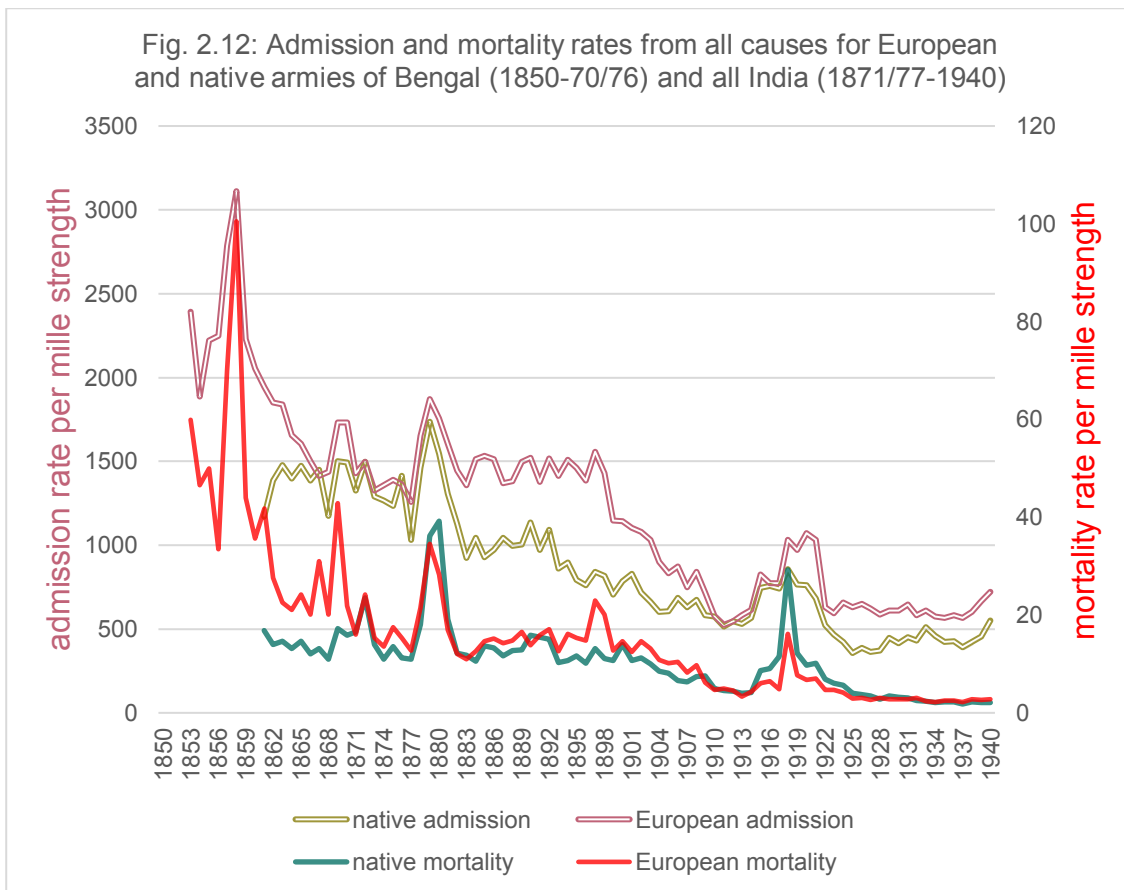
Comparison between the European and native troops of the presidencies over the period 1850-76/78 shows that dysentery and diarrhoea, cholera, hepatitis and heat apoplexy far predominate in the European force, whereas pneumonia and intermittent fevers do so in the native soldiery (Figure 2.11).



### Comparisons between the native and European forces of all India, 1871/77-1940

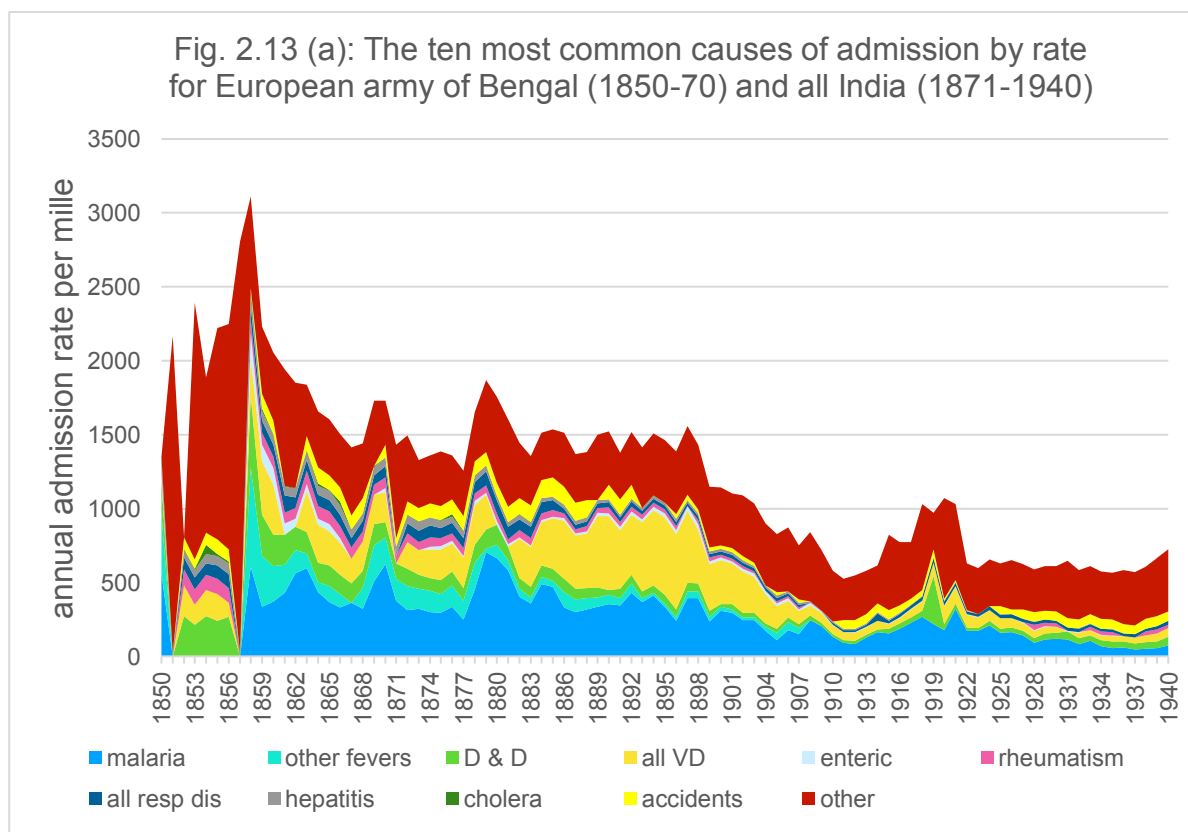
Data on all cause admissions and mortality for both European and native armies show progressive declines over the period 1871/77 to 1940, marked by a series of falls then plateaus, interrupted by peaks due to epidemics (Figure 2.12).<sup>59</sup> The statistics for all India date from 1871 for the European

<sup>59</sup> The data on which Figure 2.12 (and the subsequent figures and tables as indicated) are derived come from a variety of sources, namely: J.L. Bryden, *Annual returns of the European army of the Bengal presidency from 1858 to 1869* (Calcutta: SGP, 1870) [Bengal European, 1850, 1853-56, 1858 – the latter year described by Bryden as ‘an unacclimatized army in its first year of service in India’], AMD *Report* 1861-64 [Bengal European, 1859-61], Ewart, *Vital statistics* [Bengal native, 1853; Bengal European, 1862], AMD *Report*, 1863 [Bengal native, 1861], RSCBe [Bengal native, 1862-70; Bengal European, 1863-69], Bryden, *Annual returns* [native Bengal 1871, 1873; All India European 1871, 1873]; Bryden, *Vital statistics* [Bengal native, 1862]; J.L. Bryden, A. Stephens, *Sickness and mortality in the European army of Bengal presidency from 1870 to 1879 and aggregate of statistics of the ten-year period* (Simla: Government Central Press, 1882); *Reports of the Sanitary Commissioner to the Government of India – RSCGI, 1873-1919* [Bengal native 1872, 1874-76; Bengal European, 1870; all India European, 1872 and 1875-1919, European native, 1877-1919] (Calcutta: SGP, 1871, 1874-1921); *Report of the Public Health Commissioner to the Government of India – RPHCGI, 1920-1940* [all India native and European, 1920-1940] (Calcutta: SGP, 1922, 1923; Simla: Government of India Press, 1924; Calcutta: Central Publication Branch, 1925-1932; New Delhi: Manager of Publications, 1933, 1934; New Delhi: Government of India Press, 1935-1942).



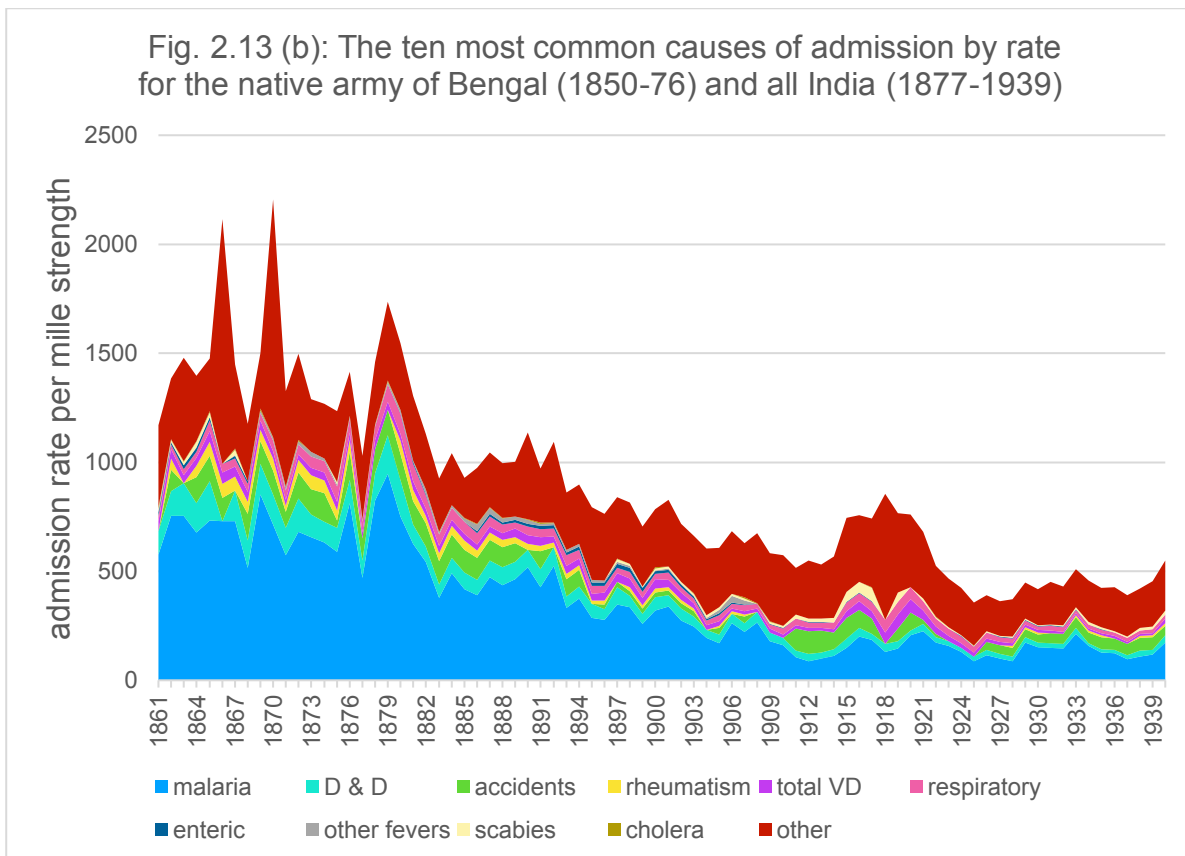
force, and from 1877 for the native army. Figures prior to that are from armies of the Bengal presidency, chosen to be most representative as it was the largest, but with caveats as explained in the previous and subsequent sections. Where, for the native troops, two figures have been given for the army strength (enrolled versus present) or for mortality, the figures that include deaths away from hospital have been taken as these represent the larger number. European admissions always exceed those for native soldiers. From about 1883 to 1897, for the all India European army, admission rates are stable and similar to those for post-mutiny Bengal, but they are around 40 percent higher than in the native troops – in which rates for all India are around 40 percent lower than those for Bengal, seemingly reflecting lower rates of disease when combined with Bombay and Madras. There is a fall off in admission rates from 1897 in the European force (it occurs slightly earlier for sepoys) with the rate more than halving by 1909 whereupon it remains relatively constant for both armies except for the expected major rise during the First World War. The reductions in admissions from 1891 for sepoys and from 1897 for European troops parallel falls in mortality rates, so seem to relate more to preventative effects than to changes in medical practice. The cause

of admission for native and European troops changed over the ninety years from 1850. When the ten most common diseases causing admission are plotted, for the European force, malaria and accidents are a constant over the whole period, other fevers and hepatitis have faded by 1900, and venereal disease was an increasing consideration after 1885 until 1908 – Figure 2.13(a).<sup>60</sup> For the native soldiery, malaria (considered as approximating to ‘intermittent fever’) remained the most prominent single cause of admission during 78 years from 1861, with a contribution from accidents throughout the period, a progressive decline in diarrhoea and dysentery, and a surge in scabies during the First World War – Figures 2.13(b).<sup>61</sup> The mortality rate, at first much higher for Europeans, equalized around the mid-1870s, when native deaths slightly exceeded European, accounted for by dysentery and diarrhoea. Following this, rates of mortality were similar except for the mid-1880s, when the European rate was high due to typhoid.



<sup>60</sup> Source data as for Fig. 2.12.

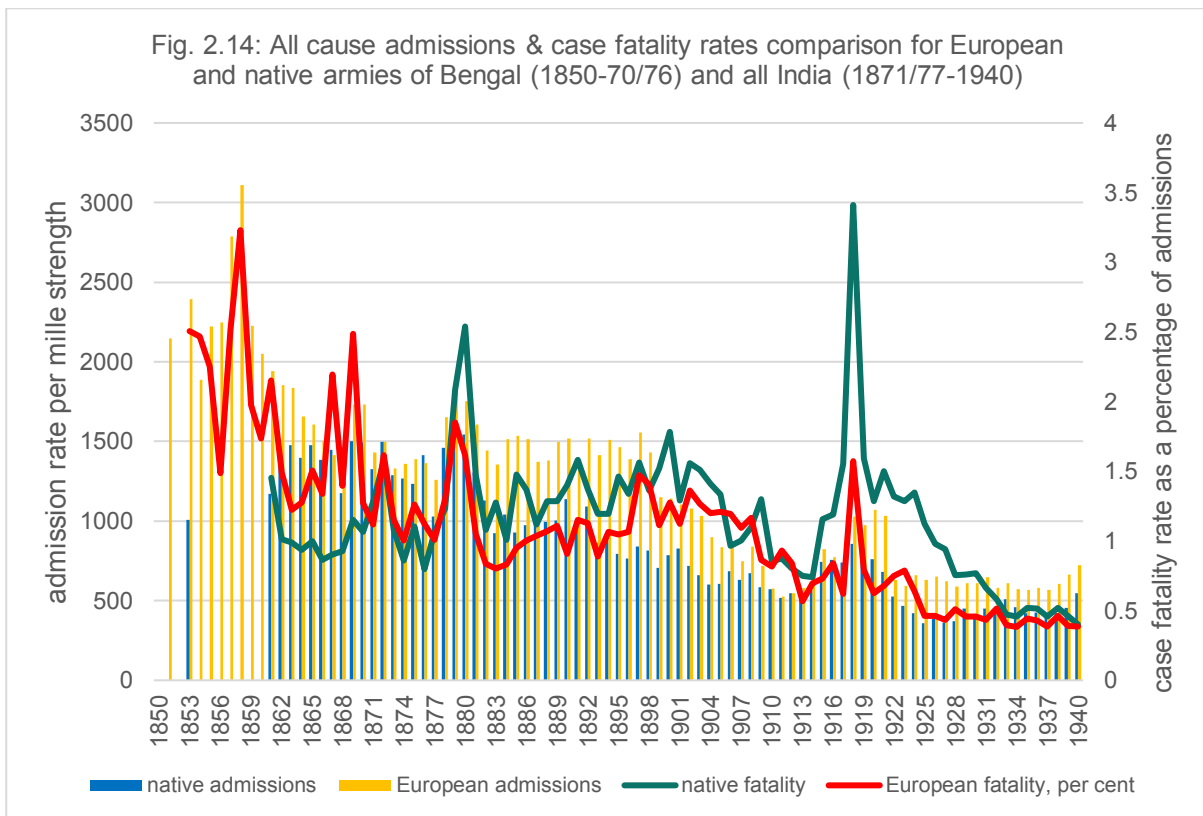
<sup>61</sup> Source data as for Fig. 2.12.



The native mortality rate exceeded that of the European force during and for a few years after the First World War, but then equalized at a low rate in the 1930s up to 1940. Comparison of mortality rates though, only gives part of the picture. When case fatality, that is deaths per admission, is considered, from the mid-1870s onward, especially during the First World War and for the decade after, the overall survival statistic for a native soldier was noticeably less favourable, compared to his European confrere (Figure 2.14).<sup>62</sup>

Comparison of the rank-and-file with their officers is pertinent. Both were exposed to the same topography but they lived in different personal environments. Despite sparsity of health data for officers in the third quarter of the nineteenth century, it can be established that they had a lower mortality rate than did European soldiers, though a higher one than sepoys. This lasted until 1904, after which they had a higher mortality rate than the European rank-and-file up until 1937 – 1914

<sup>62</sup> Details of Indian army activities in the Second World War are given in B.L. Raina, *Official history of the Indian armed forces in the Second World War, 1939-45, Medicine, surgery and pathology* (Calcutta: Indian and Pakistan Combined Inter-Services Historical Section, 1955). Source data as for Fig. 2.12.



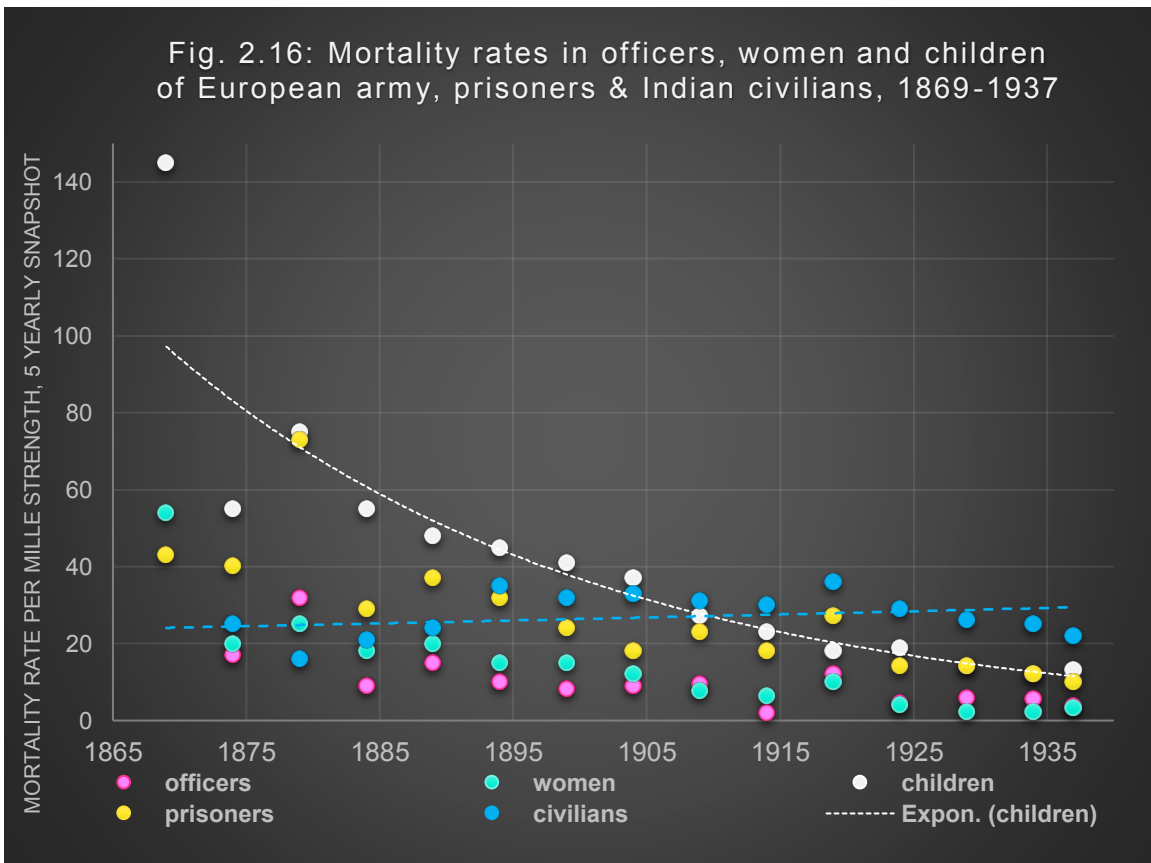
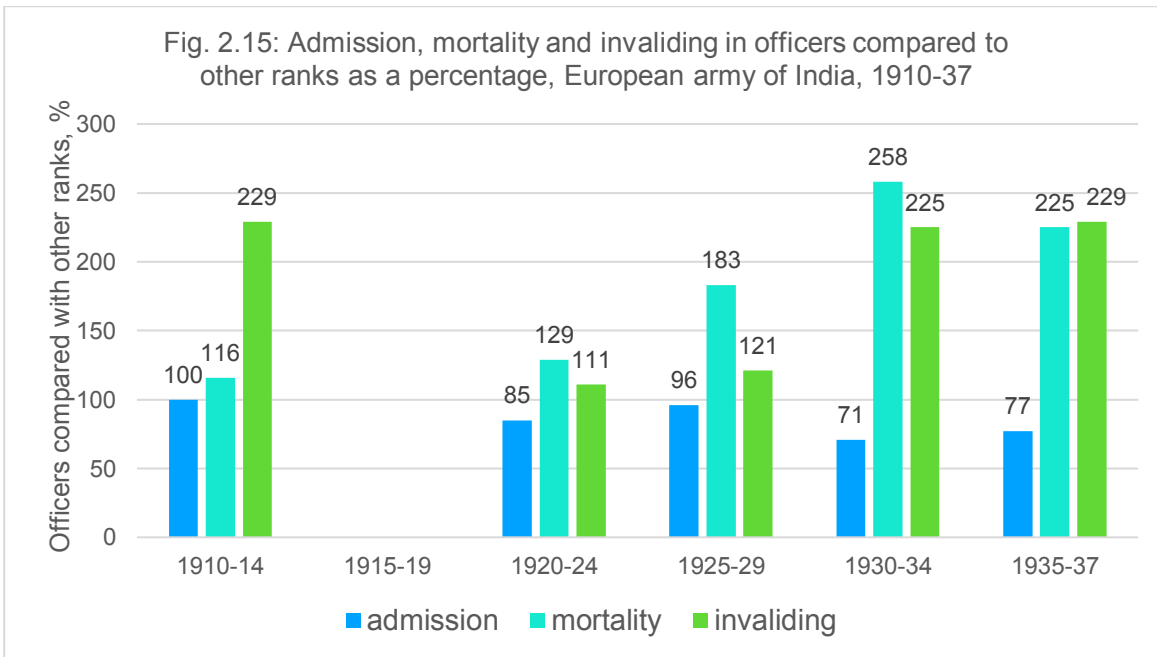
and 1924 excepted.<sup>63</sup> Compared as a proportion to native and European soldiers, the five-year average mortality and invaliding rates for officers in the second to the fourth decades of the twentieth century exceeded both groups, though actual admission levels were lower (Figure 2.15).<sup>64</sup> Officers' rates can be juxtaposed with those of other comparator groups, namely, women and children of the army and prisoners, revealing that, in the 1860s, the mortality rate in children easily eclipsed even that in prisoners but fell exponentially (Figure 2.16).<sup>65</sup> In contradistinction, the mortality rate for civilians, apparently initially low, increased up to and into the first quarter of the twentieth century, where it exceeded all other groups including prisoners.<sup>66</sup> Officers had the lowest mortality rates amongst these groups, other ranks being excluded, in the nineteenth century, and the

<sup>63</sup> Sources are the annual reports of the SCGI, 1869 and every five years to 1934, then 1937 as 1939 does not give the required information. Generally, after 1900, all native deaths were in hospital.

<sup>64</sup> Source data as for Fig. 2.12.

<sup>65</sup> Source data as for Fig. 2.12. The data points shown in Figure 2.16 are snapshots for single years, at five yearly intervals, not period means. Officers include those to both European and native armies. There was very little difference in mortality rate between the two. Most officers were European before 1900. After that increasing number were native Indians.

<sup>66</sup> Harrison, *Public health*, pp. 189-90, 227; An increase in civilian mortality at the end of the nineteenth century seems genuine, related to developments in agriculture which disrupted waterways, coupled with famine and plague.



second lowest in the twentieth after women of the army. The mortality rate for army officers in Britain for 1861-74 was 9.7 per mille, and for 1875, 11.8 (compared to 13.9 and 15.2 at the same time points for officers serving abroad). For the rank-and-file, mortality rates in Britain were 11.1 per mille for 1861-74, and 10.9 for 1875 (18.4 and 13.7 at the same time points for those

overseas).<sup>67</sup> The mortality rate for the total force afloat of 44,360 in the Royal Navy, in 1875, was lower at 8.8 per mille.

The likelihood of dying from a disease depended not only on the region within India to which a man was posted, as illustrated by differences between illness rates in the presidency armies, but also on the topography of the camp, as exemplified by hill stations generally being healthier than those in the plains, and, in addition, on length of service of the soldier. Data from the EICo's European army for 1847-56, also demonstrated by Bryden to hold true for later troops, showed an initially high mortality of 65 per mille in the first year after the arrival in India of unacclimatised soldiers naïve to the infective microorganisms they were about to encounter.<sup>68</sup> Mortality declined to 44 per mille by the fifth year, only to increase again after 10-15 years' service, followed by a slight dip. Any soldier fortunate enough to complete twenty years' service had a mortality rate near that of a new recruit. Whilst having lower rates overall than other ranks, officers also showed mortality rates that rose with age for the period 1840-47, increasing from 25 per mille at age 20, to 36 per mille at 40.<sup>69</sup> EICo European male civil servants in Bengal, at the earlier time period of 1790-1836, had lower rates, varying from 19.9 per mille annually at 20-24, to 16.6 per mille at 31-35, to 35.4 per mille for those aged 40-44.<sup>70</sup> These figures are still in excess of those for men in England at about this time, whose rates rose from 9 per mille at 20, to 14 per mille at age 40. For the years 1857-60, the mortality rate for all officers of the British Army serving outside of the United Kingdom was 30 per mille annually, falling to 16 per mille in 1861.<sup>71</sup>

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<sup>67</sup> RD BDM, *Annual report of the registrar-general of births, deaths and marriages in England, 1875* (London: Eyre and Spottiswoode, 1877), pp. lv-lvi; The total strength of the British Army in 1875 was 184,669 – 38 percent was in England and Wales, 2 percent in Scotland, 13 percent in Ireland and 47 percent 'abroad'. The invaliding rate for the Royal Navy was 4.8 per mille.

<sup>68</sup> *Royal commission 1863*, pp. 15-24, 175-8 (Tables 4-12).

<sup>69</sup> *Royal commission 1863*, p. 37.

<sup>70</sup> H.T. Prinsep. 'Corrected estimate of the risk to life to civil servants of the Bengal presidency', *Journal of the Asiatic Society of Bengal*, VI (1837), pp. 341-6.

<sup>71</sup> The 1857-60 figure included those serving during the rebellion.

Comparisons between world locations of troops can indicate regional susceptibilities, taking Britain as a reference point. Using 1865 as an example, the all-cause mortality rate for European troops in India, at 28 per mille strength, was double that at any other location except for Australasia, though it was similar to that for colonial troops in West Africa and China.<sup>72</sup> Invaliding was comparable to European forces elsewhere, apart from Britain, where the figure may have been inflated due to the return home of soldiers whose illness was acquired abroad. Admission rates for ‘paroxysmal’ fevers, likely to be coterminous with intermittent fevers, were also excessive for India, being twice those of the nearest, namely the West Indies. Rates for diarrhoeal illnesses were similar to those at Cape of Good Hope and the West Indies. At 1865, cholera was only problematic for troops in India.

Causes of admission, a proxy for disease incidence rather than cause of death, can be compared for troops in India, women of the army, and Bengali prisoners for the four or five years around 1880. Fevers accounted for similar numbers for both troops and prisoners but were at half the number in women.<sup>73</sup> Diarrhoea and dysentery were twice as common in prisoners compared to troops, who were more likely to be admitted with injuries. Venereal disease was the second commonest indication for admission in European troops, unlike the other groups. ‘Anaemia and atrophy’ was the most frequent reason for hospitalization of women, in whom spontaneous abortion was also a significant problem.<sup>74</sup> Admission rates for cholera, and diarrhoea and dysentery, were higher in prisoners. Cholera mortality was very high for prisoners in 1863 but, along with admissions, fell to be nearly that of the armies by 1874, and case fatality rates were no higher than those of the soldiery.<sup>75</sup> However, for diarrhoea and dysentery case fatality rates for prisoners were up to five times greater than those for native and European armies, which were identical. This is informative

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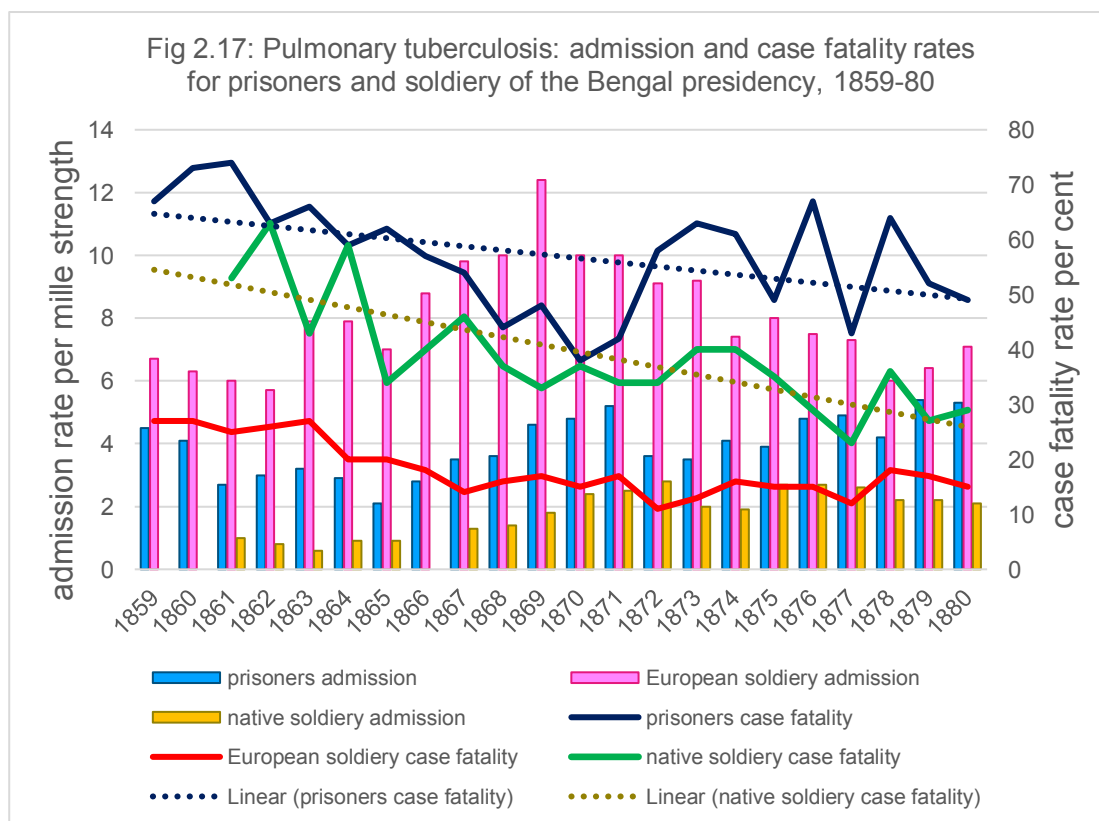
<sup>72</sup> AMD, *Report for the year 1865* (London: Harrison, 1867), pp. 159-60.

<sup>73</sup> Pulmonary tuberculosis has been included under ‘respiratory diseases’.

<sup>74</sup> E.J. Tilt, *Health in India for British women and prevention of disease in tropical climates* (London: Churchill, 1875); Tilt reported the mortality rate for soldiers’ wives in India, for 1860-69, to be on average 43.3 per mille. Tilt’s book is a general discussion on women’s health in India but makes the point that spontaneous abortion and complication of childbirth were notable issues – pp. 59-60, 103.

<sup>75</sup> Case fatality rates for cholera in 1880 were: prisoners, 50 percent; European troops; 69 percent, and native troops, 58 percent.

about the superiority of either the physical and environmental status of the soldiery, the treatment milieu or medical management offered to the military or, less likely, indicative of increased virulence of the microorganisms affecting prisoners. Respiratory disease, principally bronchitis and pneumonia, showed a case fatality several fold higher in prisoners than in the European troops with a worsening trend, and double that of the sepoy army, whose rate was at this time more than twice their European counterparts. Pulmonary tuberculosis in 1861 was about three times more common as a cause of death in the European army than in the native one, but the rate was a third higher in prisoners. By 1880, this mortality rate had reduced in Europeans soldiers, stayed about the same in sepoys, but increased by a third in prisoners. Case fatality for pulmonary tuberculosis in prisoners in 1861 was 74 percent, three times that for European soldiers and twice that for native ones (Figure 2.17).<sup>76</sup> This did reduce in all groups by 1880 but remained proportionally much higher in



<sup>76</sup> Source data as for Fig. 2.12.

prisoners. Again, this is revealing about the physical, environmental and nutritional state of the prisoners and the troops, and the morbid biology of tuberculosis in an era when, from the present-day perspective, effective treatment is not considered to have been available.

### ***Violent casualties from war in the nineteenth century armies of British India***

During the second half of the nineteenth century, deployment of the British armies in India to war, except for the 1857-58 rebellion, was infrequent and casualties from battle or from battlefield living conditions did not figure prominently in returns. It is pertinent to ask what would be the incidence of and mortality from the then prevalent infections under conditions of war, as opposed to near permanent barrack accommodation? This could throw light on the efficacy of existing sanitary arrangements in permanent camps or show up failings in battlefield arrangements. For armies at war, the obvious concern is usually death from armed conflict. However, for most major wars in the nineteenth century, battlefield casualties were less important than those from disease. The armies in British India, despite fighting a series of wars and skirmishes in the subcontinent, Arabia and beyond over the entire nineteenth century, suffered relatively trivial mortalities from battle compared to those from illness acquired in cantonments. Whole armies were rarely engaged – effects fell on the regiments involved. In the Second Anglo-Maratha War of 1803-05, for the EICo's European army, overall mortality rates over the three years, including battlefield casualties, were 85, 134 and 101 per mille.<sup>77</sup> The total casualty counts for the European force over the three years of the Burmese War, 1824-26, were 113, 106 and 130 per mille, and for the First Anglo-Afghan War, 1839-42, and First and Second Anglo-Sikh Wars, 1845-46 and 1848-49, overall annualized mortalities for European troops in the campaigns were 70, 80 and 84 per mille respectively. Even during the 1857-58 rebellion, where the locations of conflicts had differing ecological and operational environments, disease accounted for 94 percent of deaths in the European army: 586 were killed in action out of 9,467 total deaths during this period. The Crimean

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<sup>77</sup> *Royal commission 1863*, pp. 30-1; Randolph Cooper – 'Cross cultural conflict' – gives a full account of the Second Maratha War.

War, 1854-56, and the American Civil War, 1861-65, offer external conflicts documented well enough for comparison.<sup>78</sup> As anticipated, rates of the diarrhoeal infections were high (Table 2.2).<sup>79</sup>

**Table 2.2: Mortality rates for British army of the Crimea (1854-56), The United States Union army (1861-66) and the European and native armies of Bengal (1855-59 and 1860-64 respectively).**

	Crimea		Union army		Bengal, India	
	1854-55	1855-56	1861-66	1863-66	1855-59	1860-64
	British	British	'white'	'coloured'	European	native
diarrhoea	113	7.8	12.6	24.3	4.2	1.5
cholera	99	36	0	0	17	3.2
dysentery	64	8.4	3.1	11	14	1.7
injuries & accidents	26	22	14	5.3	1.2	0.3
remittent/typhoid	6.7	2.5	11.2	12	3.7	1.3
overall	454	106	69	152	57	17

For another contemporary international comparison, the French army of 262,807, in 1865, had an overall mortality rate of 12 per mille strength for troops in France, with an admission rate of 2,090 and daily sick of 54.<sup>80</sup> The French force in Algeria did not fare so well – mortality was 16 per mille, admissions 2,340, and daily sick 56. Battlefield mortality in 1865 for the French army was only 0.3 per mille – it had been 6.8 in the previous year. A further military comparator for location but not for environment, is the Royal Navy. Figures for naval health around the Indian subcontinent are not available, but a comparison for the Mediterranean locus in the first half of the nineteenth century has been made. Major A.M. Tulloch (1803-64) found similar admissions rates for sailors of the Navy (1831-37) compared to army other ranks (1818-37: 1,082 and 981 per mille annualized strength, respectively), but a mortality rate that was nearly double in the army (11.1 versus 20.4),

<sup>78</sup> Reporting of war correspondent William Howard Russell for *The Times* brought suffering of troops to the notice of the British public with a hitherto unrealized immediacy and impact. Data for the American Civil War extend to 1866 as there was a step down from cessation of hostilities.

<sup>79</sup> Only the top five causes of death are shown. AMD, *Medical and surgical history of the British Army which served in Turkey and the Crimea during the war against Russia in the years 1854-55-56*, in two Vols., Part II - History of wounds and injuries (London: Harrison, 1858), p. 251A; The rates for the Crimea were calculated using original data. United States Surgeon-General's Office, *The medical and surgical history of the war of the rebellion 1861-65*, Vol. 1, Medical (Washington: Government Printing, 1870), pp. 1, 15, 21, 26, 28, 31, 636-41, 646-8, 654, 710, 716-18, xxx, xxxvi-xxxviii; The term 'coloured', presently not used, is found in the source text and has been retained since 'African-American' may be inaccurate. Coloured might include non-Europeans such as native (First Peoples) Americans. The data for European troops of the Bengal presidency, sourced as for Fig. 2.6, include the 1857 rebellion.

<sup>80</sup> AMD, *Report 1865*, pp. 170-1.

though invaliding was higher in the Navy (25.7 against 9.5).<sup>81</sup> Soldiers, compared to sailors, had more than twice the mortality rate from fevers (3.7 per mille versus 1.5), lung disease (6.5 against 3.2) and gastro-intestinal disorders (2.5 to 0.9). Sailors had an excess over soldiers of admissions for lung disease (243 per mille, against 144) and syphilis (50 versus 24). These observations highlight the need to consider types of deployment and location, in addition to diet, accommodation and provision of medical support or infrastructure. A further factor is the health of the population from which the army derived its soldiery – in this case, young men of the labouring classes of Britain and Ireland – considered next.

### ***Disease incidence and mortality in males of soldiering age in the United Kingdom, 1850 to 1900***

The contemporary health of men in the U.K. from which were drawn the European soldiery of India is pertinent to this thesis. The annual mortality rate for males aged 15-19, 20-24 and 25-34 years for 1841-45 was 6.8, 9.0 and 9.4 per mille respectively (based on the RG BDME's annual reports on death registrations, for England and Wales) – the demi-decadal trend is shown in Figure 2.18:<sup>82</sup> A fifty percent decline in mortality is seen for the 20-to-24-year age group – the nearest approximation to that making up the pool of recruits – over the twenty-year period, 1851-55 to 1871-75 – it is worth considering whether this better survival trend might have influenced a reduced death rate when this cohort was recruited into military service in India. Cohort life expectancy for a 5-year-old male in 1841 in England and Wales was 49 years.<sup>83</sup> The annual mortality rate for males aged 15 to 24 years for the period 1848-72 (England and Wales) was 7.58 per mille (11.42 for those aged 25 to 44) – the single largest cause of death in both age groups was pulmonary tuberculosis –

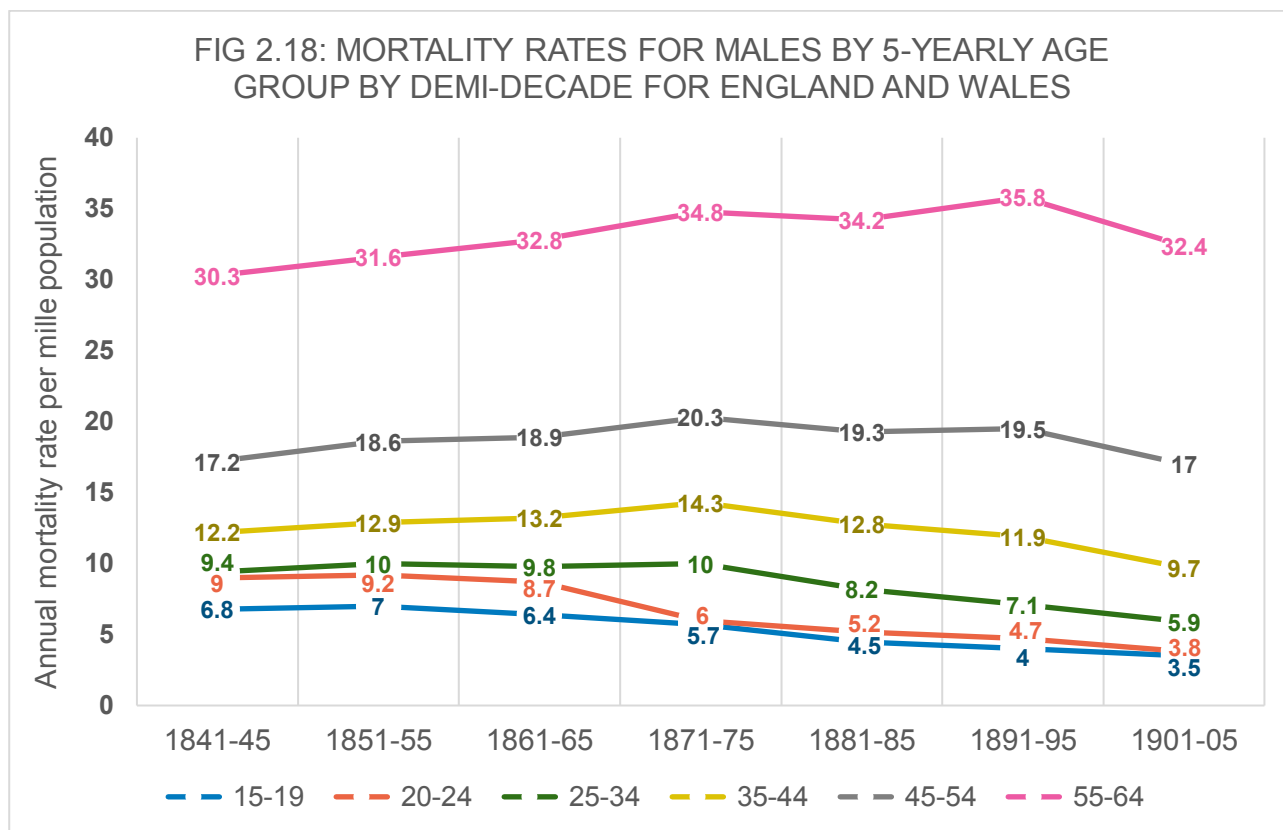
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<sup>81</sup> A.M. Tulloch, 'Comparison of sickness, mortality, and prevailing disease among sailors and soldiers as shewn by navy and military statistical reports', *Journal of the Statistical Society of London*, 4 (1841), pp. 1-16; Tulloch's finding of a high mortality from lung disease in soldiers serving in the Mediterranean is unlike the situation in India.

<sup>82</sup> J. Charlton, 'Trends in all-cause mortality: 1841-1994', in J. Charlton, M. Murphy, eds., *The health of adult Britain 1841-1994*, volume I (London: The Stationary Office, 1997), pp. 19, 23.

<sup>83</sup> Charlton, 'Trends', p. 27.

Table 2.3.<sup>84</sup> The infective diarrhoeas, with the possible exception of typhoid (then grouped with typhus), did not figure in the top ten causes of death for these populations over the period stated.



**Table 2.3: Causes of death for males aged 15-24 and 25-44 for the period 1848-72 (annual, per mille of that population)**

Cause of death	Age group	
	15-24	25-44
All cause	7.58	11.42
Infectious diseases	4.69	5.56
Respiratory tuberculosis	3.06	4.1
Injury or poisoning	0.98	1.19
Other violence	0.89	1.05
Typhoid or typhus	0.84	0.71
Diseases of the respiratory system	0.42	1.17
Diseases of the nervous system	0.41	0.94
Diseases of the circulatory system	0.33	0.84
Diseases of the digestive system	0.32	0.73
Smallpox	0.22	0.19

<sup>84</sup> J. Charlton, M. Murphy, 'Trends in causes of mortality 1841-1994', in Charlton, Murphy, *Health of adult Britain*, Vol. I, p. 35.

Changes in annual rates of causes of death for men aged 15 to 34 years – approximating to the recruitment pool – in England were ascertained from the annual RG BDME reports at around five yearly intervals between 1854 and 1885 – the approximate date range over which the most dramatic alterations in disease incidence was noted in the armies of India.<sup>85</sup> Over the period in question the main cause of death for males aged 15 to 34 was pulmonary tuberculosis, consistently accounting for around 40 percent of the mortality – Figure 2.19(a).<sup>86</sup> The second most important category was zymotic diseases. These had predominated in 1854 London, when they accounted for 37 percent of all deaths, but by 1859 this was 16 percent – the latter figure being for England.<sup>87</sup> Accidental deaths and the typhoid/ typhus group made up the third and fourth major categories for mortalities. Use of the word zymotic changed around 1870, and this may in part account for the observed later reduction in its prominence as a cause of death.<sup>88</sup> Considering cause of death by disorders of organ systems, respiratory diseases – principally pneumonia and bronchitis – predominated at 6.5 percent in 1854, but increased steadily in significance to account for 11 percent of all deaths by 1885 – Figure 2.19(b). Of other infections relevant to India, epidemics of smallpox continued to occur, despite widespread vaccination, as in the early 1860s and 1870s – reflected in low single figure mortalities – Figure 2.19(c).<sup>89</sup> Scarlet fever caused a small number of deaths, even in this age group, up to 1863, but faded after that. Once separated from typhoid, typhus itself, was of minor prominence in 1873 but not thereafter. The significance of this British-based background pathology will be discussed below.

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<sup>85</sup> Data are not available for the United Kingdom as a whole nor for Ireland. Figures are given for England which was used as proxy. In 1854, country-specific data were not given, but those for London are available, and have been used.

<sup>86</sup> RG BDME, *Annual report of the registrar-general of births, deaths, and marriages in England* 1854, 1859, 1863, 1873, 1879, 1885 (London: Eyre and Spottiswoode, 1856; 1861; 1865; 1875; 1881; 1886), 1854 – pp. 120-2; 1859 – pp. xxxiv, xli, 120-4; 1863 – pp. 120-4; 1873 – pp. xviii, 144-9; 1879 – pp. vi, 146-55; 1885 – pp. 105-13.

<sup>87</sup> Zymotic literally refers to diseases then thought to involve fermentation, as in the miasmatic sense. It can be a category difficult to equate to twenty-first century notions of communicable disease. Margaret Pelling discusses the matter at length – *Cholera, fever and English medicine 1825-1865* (Oxford: OUP, 1978), pp. 101-8. William Farr, responsible for the classification and reports, subdivided zymotic into miasmatic, enthetic, dietic and parasitic, and thus included with cholera, various fevers, syphilis, scurvy and worms, and even smallpox, within this grouping.

<sup>88</sup> Pelling, *Cholera*, p. 143.

<sup>89</sup> O. Krylova, D.J. Earn, Patterns of smallpox mortality in London, England, over three centuries', *Plos Biology* 18 (2020), pp. 1-27.

Fig. 2.19 (a): Major categories for cause of death in males 15-34 in England (London 1854) 1854-85

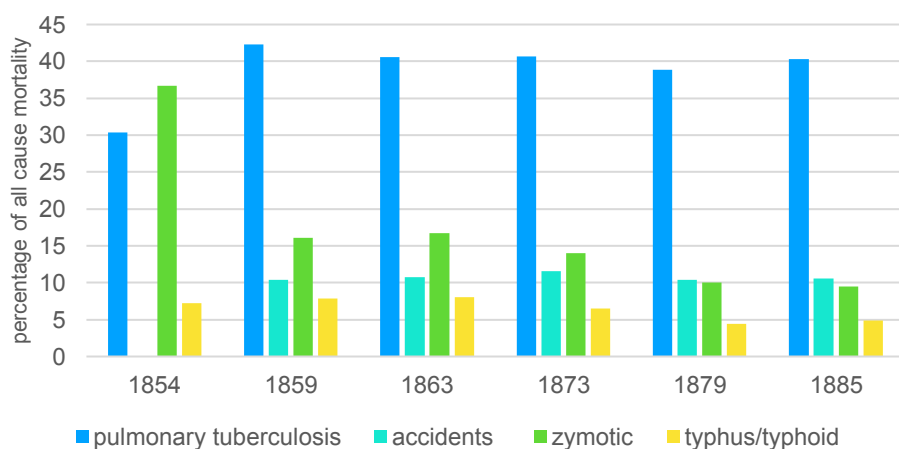


Fig. 2.19 (b): Major mortalities by organ system in males 15-34 in England (London 1854) 1854-85

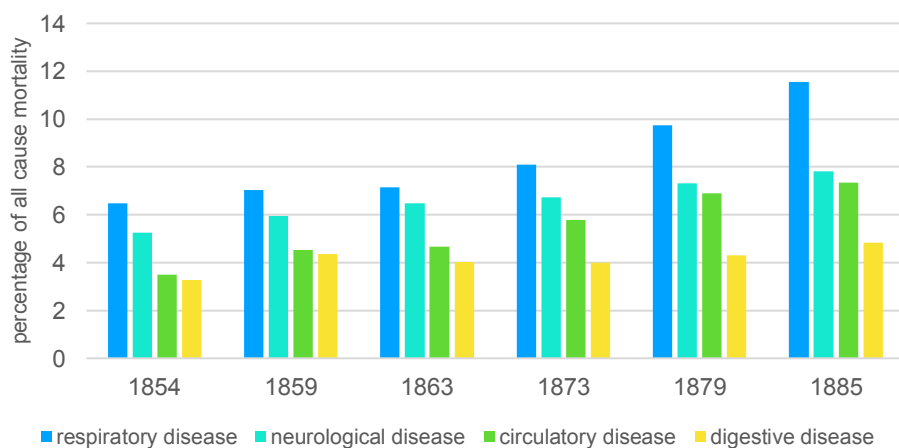
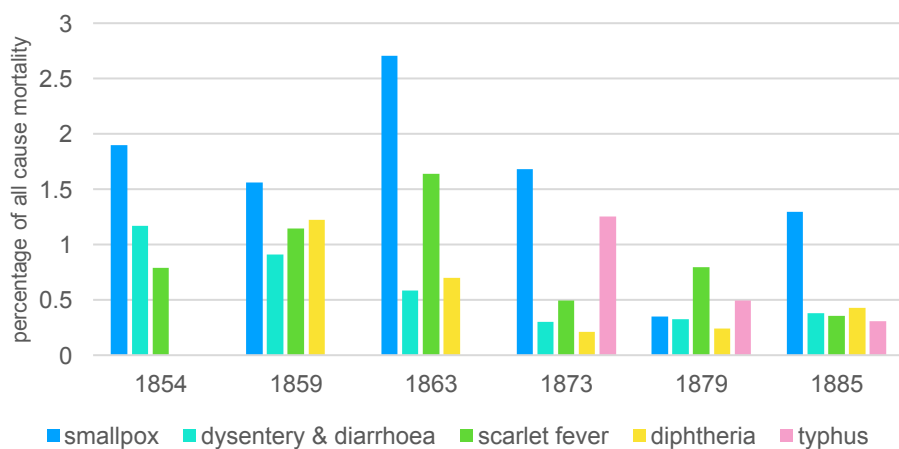


Fig. 2.19 (c): Other infective causes of death in males age 15-34 in England (London 1854) 1854-85



### ***Causes of death in the armies of British India, 1850-1940***

Trends in mortality rates for the European and native soldiery in India over the third quarter of the nineteenth century are best gauged from a comparison of the presidential armies. Rates in the native presidential army were relatively stable over the period – Madras was healthier, then Bombay – Bengal was highest (Figure 2.9). Cholera (less in 1870s), pneumonia/ bronchitis (more in 1870s)<sup>90</sup> and intermittent fever predominated (Figure 2.11). The sanitary commissioner for Madras pertinently noted in 1870, for native soldiers, that ‘The diseases ... therefore are very frequently those depending upon nutrition and bad housing. They are very liable to malarious odours, to diseases of the digestive system, and skin disorders’.<sup>91</sup>

Mortalities were higher in European forces, declining in Bengal from 50 per mille in the 1850s to around 25, the level for Bombay and Madras in the 1860s (Figure 2.9). Dysentery and diarrhoea predominated in Bengal in the 1850s – the 1858 figure of 33.7 was nearly treble that of 1856 (12.6)<sup>92</sup> – but became more prevalent in Madras in the 1860s (Figures 2.20-2.21).<sup>93</sup> Deaths from cholera were most numerous in Bengal, compared to Bombay then Madras over the whole period, though reducing. Fevers predominated in Bengal, over Bombay, being less in the Madras army (Figure 2.22).<sup>94</sup> In the 1850s, hepatitis was more of a problem in the Bengal European troops, but was increasingly seen in the Madras soldiery in the 1860s and 1870s. Pulmonary tuberculosis bucked the trend, initially being most prevalent in the Madras force – in the 1850s – then more seen in the other two presidency armies in the 1860s to 1870s. Heat apoplexy was commoner in the European army of the Bengal presidency, than in that of Madras or Bombay.

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<sup>90</sup> Pneumonia and bronchitis have been combined to make statistical comparisons easier.

<sup>91</sup> *RSCMa*, 1870, p. 57.

<sup>92</sup> Bryden described the 1858 rate as ‘an unacclimatized army in its first year of service in India’ – J.L. Bryden, *Annual return of the European army of Bengal presidency for the years 1858-69* (Calcutta: SPG, 1870).

<sup>93</sup> Source data as for Fig. 2.6.

<sup>94</sup> Source data as for Fig. 2.6.

Fig. 2.20: Major causes of mortality for the European army of Bengal at 5-yearly periods, 1850-76 (annualized means)

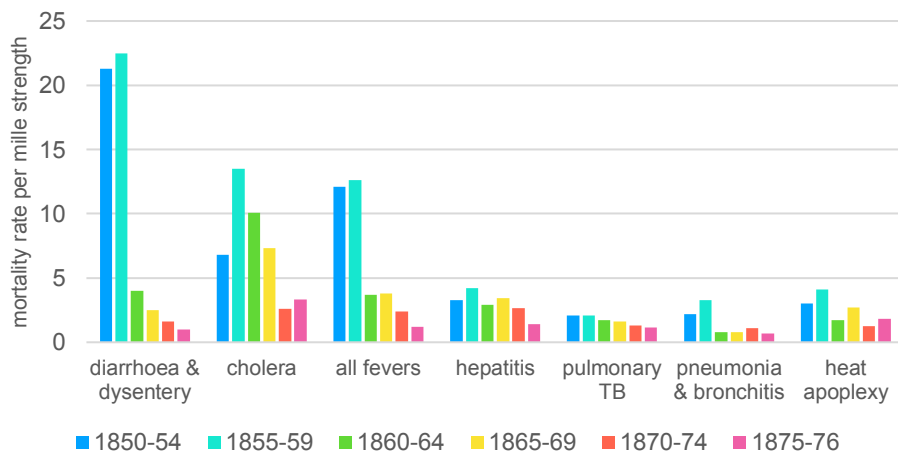


Fig. 2.21: Major causes of mortality for the European army of Madras at 5-yearly periods, 1850-76 (annualized means)

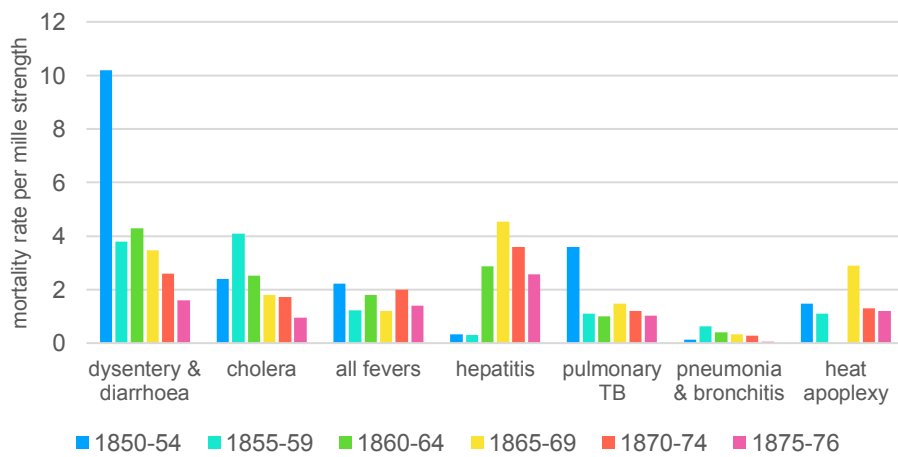
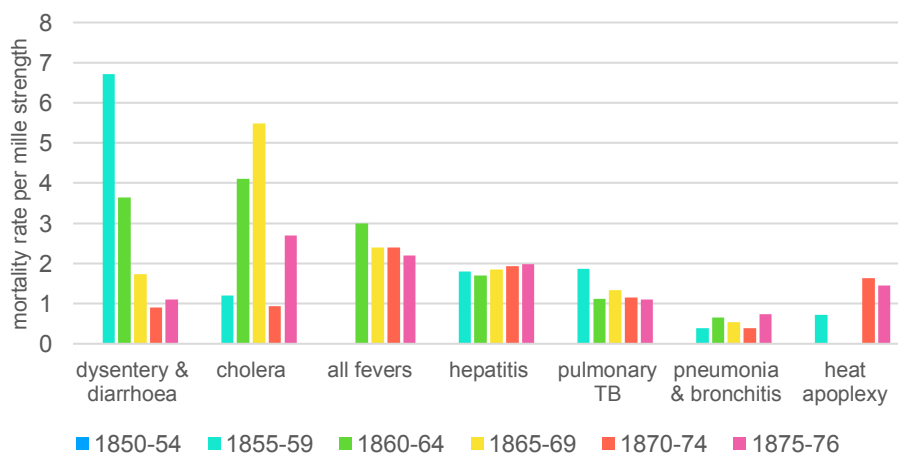
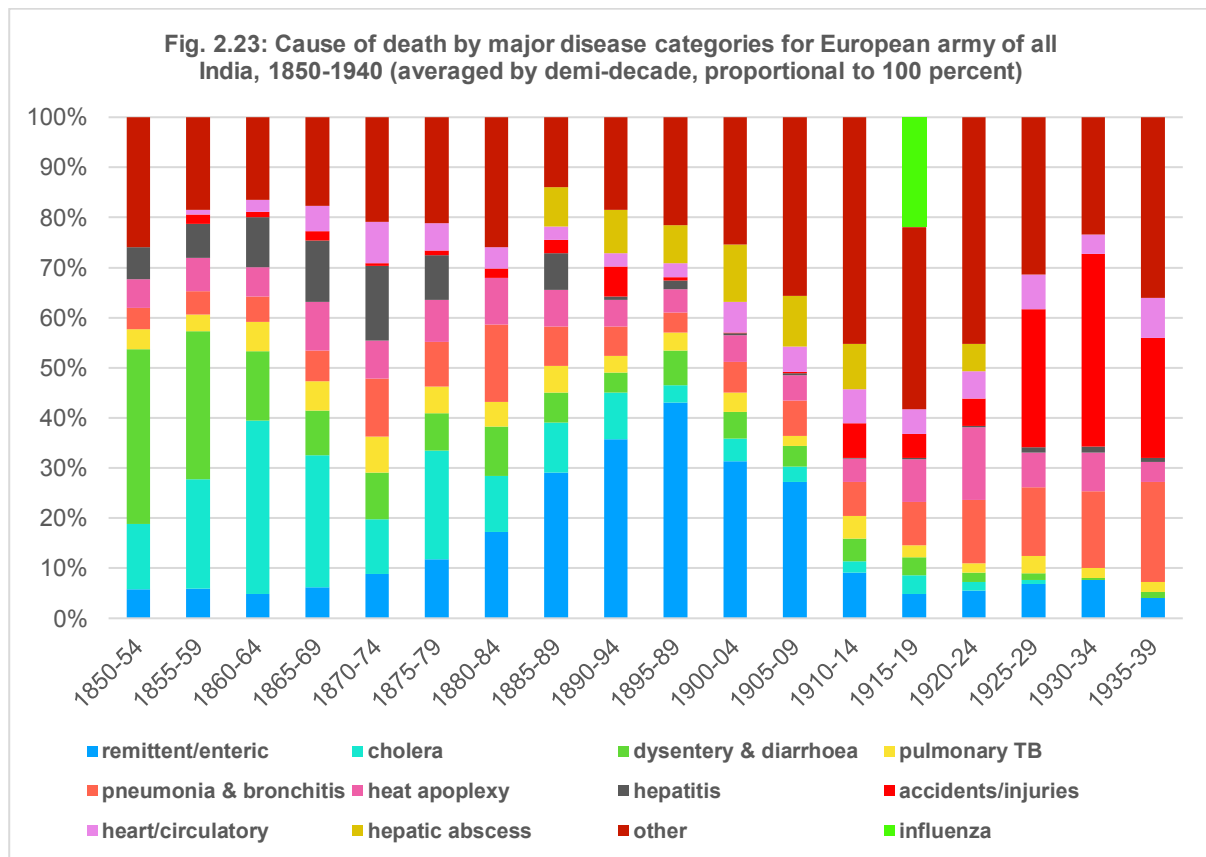


Fig. 2.22: Major causes of mortality for the European army of Bombay at 5-yearly periods, 1850-76 (annualized means)



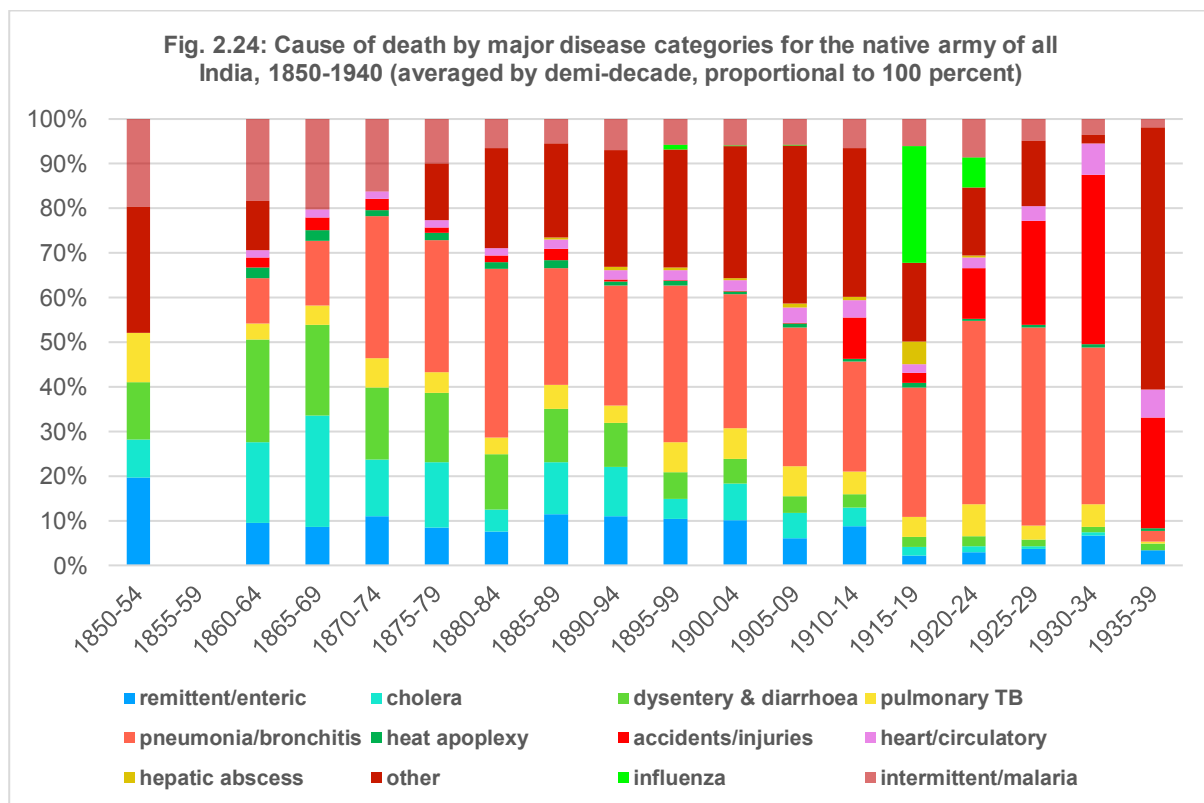
Looking to the fourth quarter of the nineteenth century and into the twentieth, disease trends in mortality can be represented as a proportion of the whole mortality. To provide a full picture over the period of study, Bengal has been used for the first 20 years of the European set (with provisos as explained above) and the first 26 years of the native one (Figures 2.23 and 2.24).<sup>95</sup>



Cholera, dysentery and diarrhoea, and hepatitis had declined as causes of death, for European troops, by the last two decades of the nineteenth century. In the final quarter of the century typhoid became the major cause of demise, along with prominence of hepatic abscess. Both declined in the first decade of the twentieth century. Influenza was notable in the 1915-19 demi-decade. Heat apoplexy was relatively constant throughout the period, in incidence, though reduction in mortality means that it became less common as a cause of death. Contrariwise, some conditions with fatal potential, such as pneumonia and bronchitis, heart and circulatory disorders, and accidents and injuries, became more prominent towards the mid-twentieth century. For the native army, gastro-intestinal and hepatic disorders and heat apoplexy were much less problematic than in their

<sup>95</sup> Source data as for Fig. 2.12; These diagrams must be read with the knowledge that rates decline over this period.

European confreres (Figure 2.24). Intermittent fever (presumed mostly malaria) and pneumonia were more of an issue.



Intermittent fever declined as a cause of death from the three-quarter point of the nineteenth century but remained more fatal for the native soldier than for the European. Pneumonia rose in prominence and was the major cause of death from 1870-74 to 1930-34. With it, pulmonary tuberculosis increased in significance compared to the European soldiery until 1935-39. Influenza was a notable cause of death for the sepoy forces not just in 1915-19 but in the following five years as well, no doubt due to secondary effects. By the end of the third decade of the twentieth century, as in the European case, heart and circulatory disease, and injuries and accidents were the commonest causes of demise in sepoys. By way of comparison for disease incidence in the first decade of the twentieth century, the Saxon and Wurttemberg corps of the Prussian army suffered a similar set of diseases though in a different order of prevalence. Skin disorders, and injuries and accidents, predominated,

followed by digestive, respiratory, musculoskeletal problems, infections, venereal disease and circulatory ailments.<sup>96</sup>

Comparing the causes of death in groups other than native and European rank-and-file could give insight into exposure risks and susceptibilities. Pragmatically, both for availability of data and as a period when medical practice was establishing itself on a more scientific basis, the first half of the 1880 decade was chosen to contrast the different groups. In officers, though overall mortality rates were lower, causes of death generally mirrored those of the European rank-and-file, but at lesser levels and in a slightly differing order. Thus, for 1880-85, the top five causes of demise for officers were, in order: enteric fever, liver disease, dysentery and diarrhoea, heat apoplexy and cholera, whilst those for other ranks for 1889 were: enteric fever, heat apoplexy, cholera, hepatic abscess and dysentery.<sup>97</sup> Unsurprisingly, positively because of their generally better living conditions but negatively because of the then risks of parturition, women of the army, who at 20 per mille had a higher annual mortality rate than officers, had a different profile for cause of death, led by childbirth, then malaria, pulmonary tuberculosis, dysentery and diarrhoea, and cholera. The children of the army, with the highest of all mortality rates, also had different causes of death, dominated by diarrhoea and dysentery, convulsions, ‘dentition’, anaemia and atrophy, and pneumonia and bronchitis.<sup>98</sup> ‘Dentition’ seems unusual as a cause of death category. It was used in the nineteenth century to include what would now be described as sudden infant deaths, as well as deaths from unrecognized convulsions and other causes. Comparison of the mortality rates for the soldiery with that of the Indian civilian population into which they were embedded, would be appropriate –

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<sup>96</sup> *Annual report of the chief medical officer, 1919-20* (London: HMSO, 1920), p. 35; In 1900-02 the annualized incidence of diseases for the Prussian army per mille was as follows: skin disease 240, injuries/accidents 207, digestive ailments 153, respiratory disease 129, musculoskeletal problems 107, infections 40, venereal disease 29 and circulatory disorders 20; Skin diseases have mostly been excluded from analysis of armies in India. They were not listed as a separate group, and trying to add up individual diseases may not have given a suitable comparator for German figures.

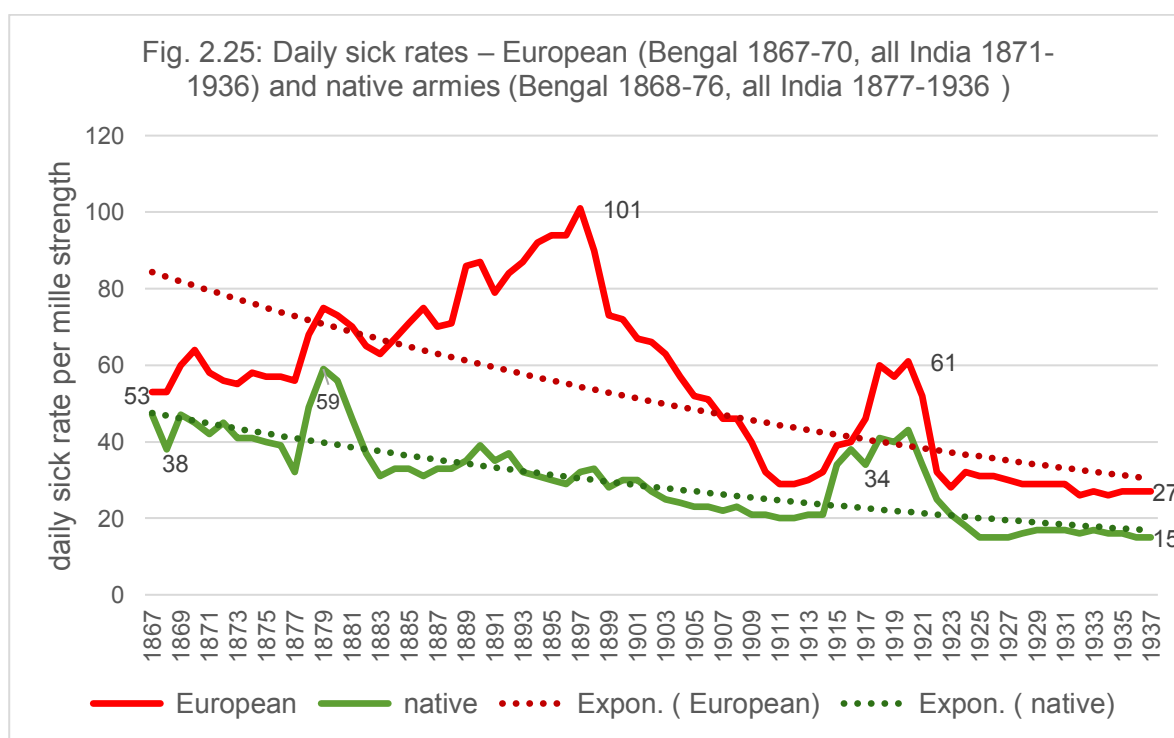
<sup>97</sup> *RSCGI, 1880-1885*; The numbers of officers were small, just 3,000 or so. There were minor differences only between the health statistics of officers of the native and Europeans armies. Because of small numbers, officers of the two armies have been combined. Any deaths away from the regiment have been included.

<sup>98</sup> See – H.L. Gibbons, ‘Teething as a cause of death: an historical review’, *Western Journal of Medicine*, 155 (1991), pp. 658-9; Anaemia and atrophy included pernicious anaemia, other anaemias and some congenital abnormalities.

however, accurate contemporaneous records of causes of death are not available, and neither are those for age-specific mortality. The situation in India's gaols is different, in that prisoners had medical attention and accurate records were kept- *vide supra*.

### **Daily sick, invaliding and life expectancy**

Daily sick rates give an indication of the proportion of men unavailable for active duty due to disease or injury on any one day. These are available from 1867 for troops in India, when they were, averaged over the days of the year, 53 per mille strength for the European army and 47 per mille for the native (Figure 2.25).<sup>99</sup> Rates climbed steadily in the European force to a peak, in



1897, of 101 daily per mille, meaning that ten percent of the army on average was incapacitated and unavailable on any given day that year. Possibly, the later nineteenth century isolation hospital trend in Britain (*vide supra*) could have influenced army medical officers to increase length of stay for infections, thus raising the daily sick rate. In the native army, however, apart from fluctuations in the late 1870s, there was a steady decline to a daily low of 20 per mille just before the First

<sup>99</sup> Details are given in annual reports of the sanitary, later public health, commissioner to the government of India; see source data as for Fig. 2.12

World War, by which time there had also been a steep decline for European soldiery to 29 daily per mille in 1912. The expected elevations during the First World War were followed from 1924 to 1937 by steady slightly downward sloping levels of 32-27 for the European soldier and, at almost half this value, 18-15, for his native counterpart. Rates of daily sickness are not available for officers before 1910, after which they are recorded and are found to be higher than in the other ranks (see below). The consequence, for an individual soldier, of being chronically daily sick and unresponsive to medical management given, was to be invalided.

The act of being invalided differed between native and European forces and, for the latter, changed over the 90-year timeframe in question. In the second half of the nineteenth century for a European soldier who was chronically ill, the first step was to send him to a 'convalescent depot', that is, one of the hill stations such as Murree, Darjeeling, or Landour.<sup>100</sup> Individuals who did not respond to convalescence were 'discharged' back to Britain, and sent by ship, some of them dying *en route* or when they had reached home. For the native soldier who was chronically ill, there was no convalescent depot, invaliding meant discharge from the service. Hill station convalescence was abandoned at the end of the nineteenth century, after which any European soldier invalided was simply returned home. Invaliding rates in the early-to mid-nineteenth century must be viewed circumspectly as they may contain discharges for reasons other than illness.

Invaliding in the European armies of the EICo over the twenty-year period 1825-44 was 29 per mille, compared to 19 per mille for native forces.<sup>101</sup> By the late 1860s, annual invaliding rates in the European army had risen to 47-50 per mille, compared to 16-20 for native troops (Figure 2.26).<sup>102</sup> These rates halved for the European force by the 1890s, with one third of those invalided being discharged back to Britain over the half century. Rates remained in the mid-teens for sepoys. A

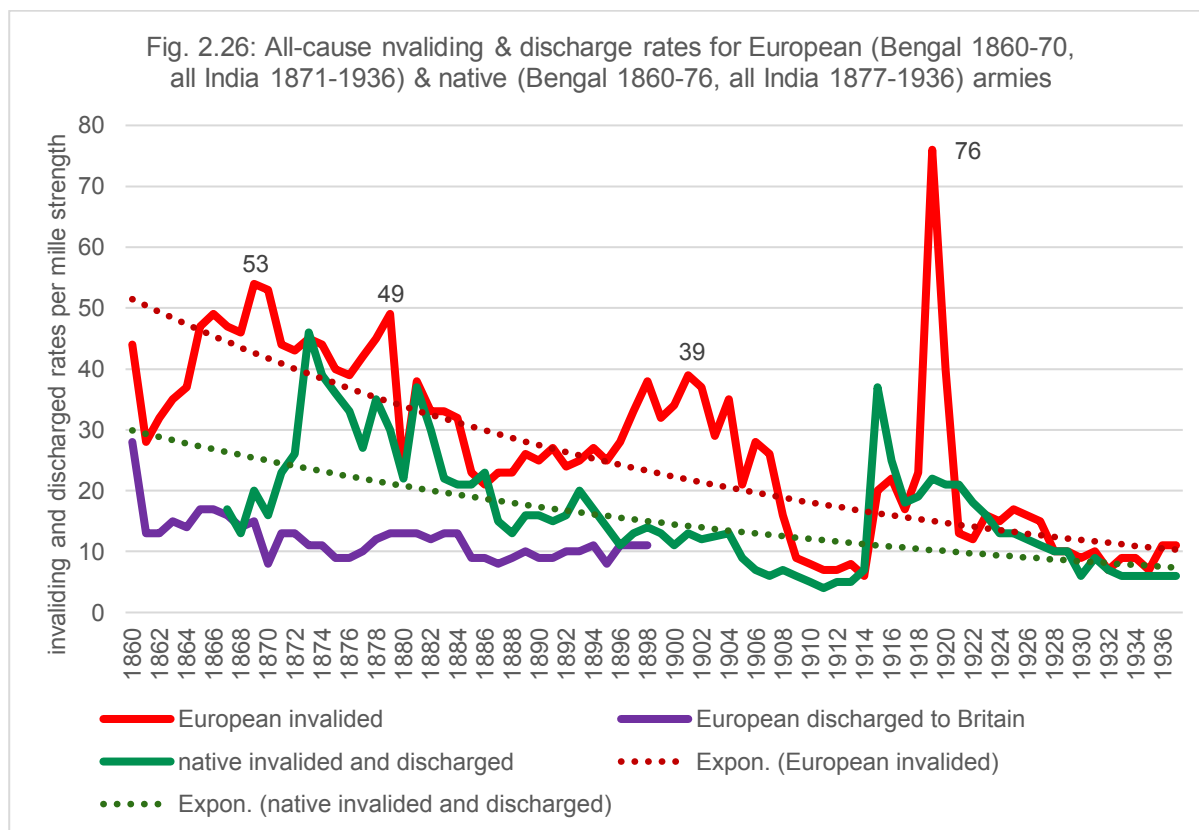
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<sup>100</sup> *RSCGI, 1874*.

<sup>101</sup> Sykes, 'Vital statistics', pp. 100-31.

<sup>102</sup> Source data as for Fig. 2.12.

lower rate of invaliding could potentially be associated with a higher rate of disease if that condition is not of sufficient concern to trigger release from the service. However, it would not have been in the army's interest to keep the chronic sick on its books and there seems no mention of the raising of invaliding threshold in reports.



Invaliding was reduced to single figures before the First World War whereupon it rose, and only dropped back again by the 1930s. The diseases responsible for invaliding in European soldiers in the 1870s were principally, in order: general debility, hepatitis, fevers (probably mostly malaria),<sup>103</sup> pulmonary tuberculosis, neurological and heart disease, and dysentery/diarrhoea.<sup>104</sup> Melancholia and mania, conditions approximating to depression and bipolar disorder, were added as causes in the 1880s, when hepatitis had moved down the list, though debility and heart disease remained the commonest reasons for invaliding. By 1894, venereal disease, principally syphilis, had become the

<sup>103</sup> Invaliding due to fevers was not broken down into fever pattern. It is likely that long-term problematic cases of fever would be due to malaria.

<sup>104</sup> *RSCGI, 1879*, pp. 31-2; Annual reports of sanitary commissioners/ public health commissioners to the government of India have been sampled to scope causes of invaliding, at five yearly intervals from 1869 up to 1938 rather than 1939, as 1938 is the last report to give meaningful information.

predominant cause of invaliding, followed by malaria, debility, heart disease, mental illness and pulmonary tuberculosis. Into the twentieth century, in European troops, venereal disease declined as a cause of invaliding, but other grounds remained similar though varying in proportion, with the addition, once again, of dysentery and, at the quarter century mark and beyond, diseases of the eye and ear, and epilepsy. In the sepoy army the three main reasons for invaliding in 1899 were debility, rheumatism and venereal disease. By 1919 and continuing through to 1938, causes of invaliding in the native force largely mirrored those of the European but with different proportionalities. In both groups, pulmonary tuberculosis was a major cause of invaliding during the twentieth century. By 1924, and extending through to the 1930s, pulmonary tuberculosis had become the preeminent cause of invaliding for the native soldier. It had first appeared as a significant problem twenty years previously for his European confrere, gave way to the predominance of malaria in 1909 through to 1919, but returned as the leading cause, as in the native army, in the 1930s.

Reflections on individual life expectancy flow from consideration of invaliding and mortality rates. Life tables of the EICo for its European troops, based on the ten-year period 1847-56, projected that, by the ten-year mark, an army of 100,000 would have dwindled to 38,542 through the accumulated deaths of 39,570, the invaliding of 6,368 and loss of another 15,520 through discharge by purchase or being time expired, transfer, promotion, desertion or gone missing.<sup>105</sup> After twenty years, only 9,604 would be left. The invaliding rate was noted to steadily increase with length of service. Life expectancy for a rank-and-file soldier at the age of 20 in India was estimated at 17.7 years (to 37.7), compared to 39.5 years in England (to 59.5), a reduction of 21.8 years.<sup>106</sup> At the age of 40, life expectancy was an additional 15.4 years for those in India, 22.3 years for Indian pensioners who had returned to Britain, and 26.1 years for a male in England.

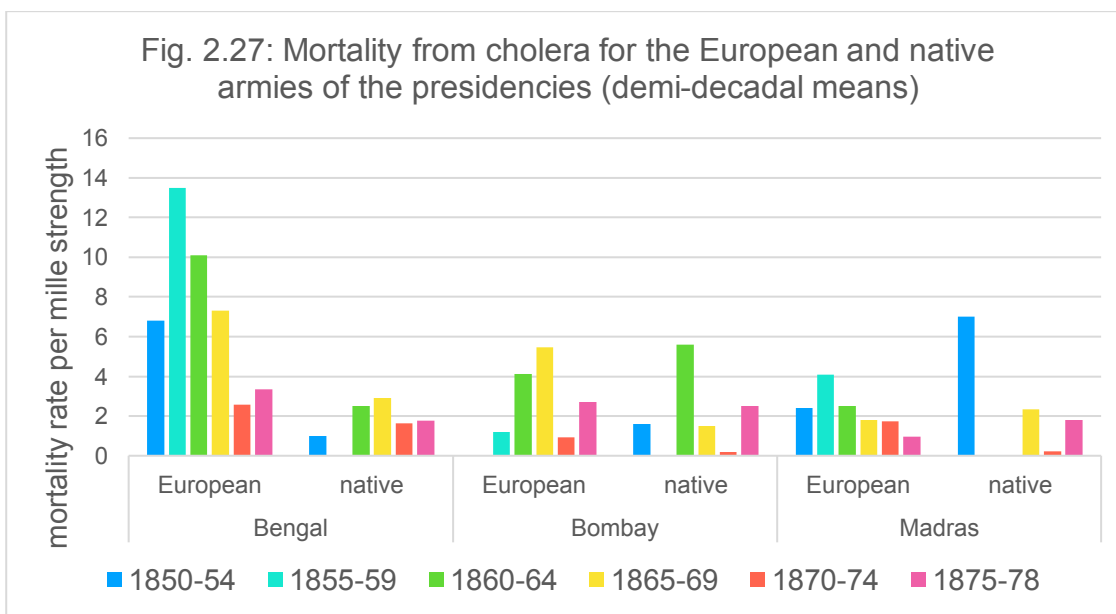
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<sup>105</sup> *Royal commission 1863*, pp. 15-24, 175-8 [Tables 4-12].

<sup>106</sup> *Royal commission 1863*, pp. 20-21, 190-2 [Tables 22 and 25]; Figures are assumed to relate to around the time of publication, that is 1863.

### *The major diseases – Cholera*

Cholera was, for the army, a major and often the preeminent source of mortality throughout India, and elsewhere, during the nineteenth century, occurring in epidemics and tending to affect the European soldier more so than his native equivalent.<sup>107</sup> Data from the third quarter of the century show that the European army of Bengal was more severely affected than the other two European presidency forces, whose strike rate resembled their native counterparts (Figure 2.27).<sup>108</sup> Plotting annual admission against mortality, figures for all India clearly show numerous epidemics and the high mortality rate for both European and native soldiers (Figure 2.28).<sup>109</sup>



The last major epidemic affecting military forces was in 1879, though further smaller recurrences were encountered. Notwithstanding a reduction in the actual incidence of cholera, when the case fatality rate is calculated, an increase is seen to nearly one hundred percent for both European and, to a slightly less extent, for native soldiery by the end of the nineteenth century. Just after 1910, a dramatic fall is evident, coinciding with discovery of how to successfully perform intravenous saline rehydration (Figure 2.29).<sup>110</sup>

<sup>107</sup> For civilians, fevers, which mostly meant malaria, were consistently the main cause of death at this time.

<sup>108</sup> Source data as for Fig. 2.6.

<sup>109</sup> Source data as for Fig. 2.12.

<sup>110</sup> L. Rogers, 'Results of hypertonic and permanganate treatment in 1,000 cases of cholera', *Lancet*, 186 (1915), pp. 219-23; Source data as for Fig. 2.12.

Fig. 2.28: Cholera: admission and mortality rates in European (Bengal 1850-70, all India 1871-1912) and native armies (Bengal 1860-76, all India 1877-1912)

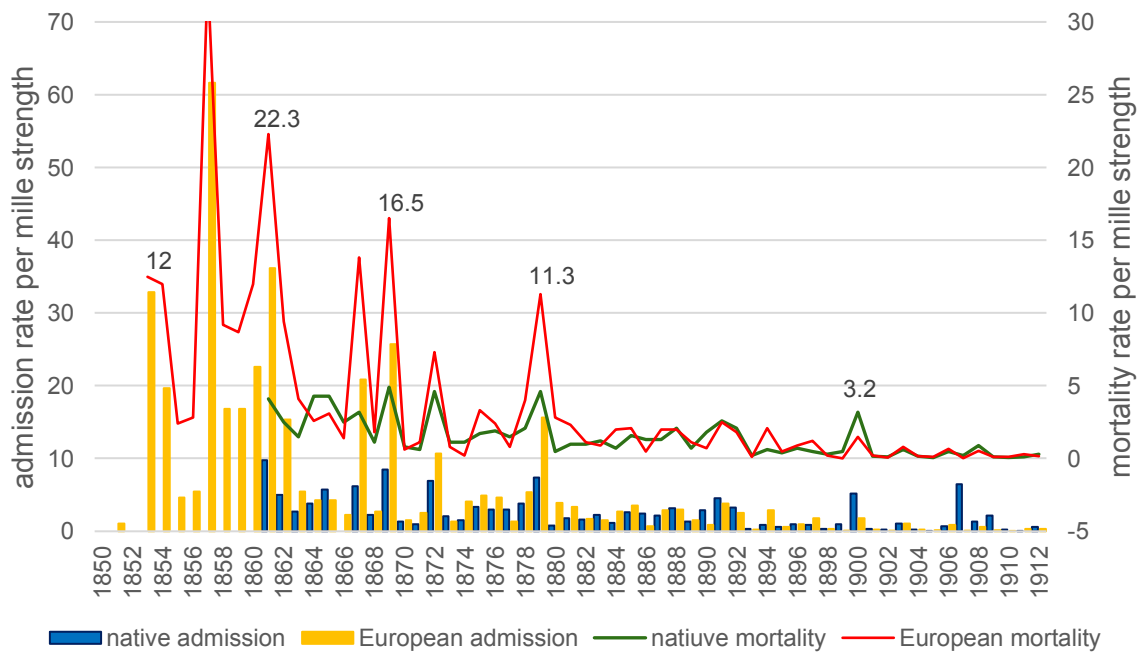
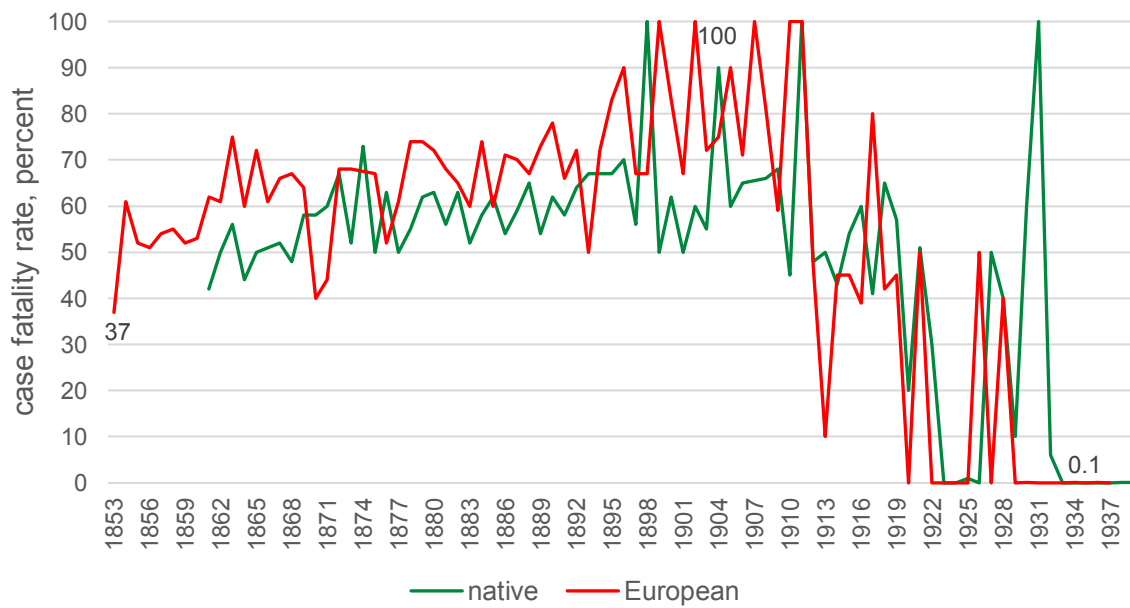


Fig. 2.29: Cholera: case fatality rates in the European (Bengal 1853-70; all India 1971-1937) & native armies (Bengal 1863-76; all India 1877-1937)



The probable reason for the apparent worsening of case fatality is that, as the nineteenth century progressed, diagnosis became more accurate and specific, meaning that previously included cases that were not cholera but presented with similar symptomatology and a better prognosis, were now excluded. In the general civilian population of India, over the ten years period 1928-37, on average 236,143 deaths per year occurred from cholera, an annual rate of 0.7 per mille of population, with,

in 1937, 10,272 of 442,375 villages being ‘infected with’ the *vibrio*.<sup>111</sup> In the same year, five million inoculations against cholera were carried out. Even so, in 1942, an epidemic of cholera in Madras killed 20,868 out of 43,779 afflicted. The military, however, were almost completely unaffected around this time. The sanitary commissioner noted, ‘Cholera did not occur among the personnel of the British army in India in 1937 but one instance causing death’. Cholera, which in the mid nineteenth century threatened western Europe, was perhaps the disease *par excellence* that prodded authorities into action – raising questions enquired on here about disease theory, predispositions, causation, and therapy.

### ***Dysentery and diarrhoea***

Dysentery and diarrhoea were, along with cholera, a major cause of death in the third quarter of the nineteenth century for both the European and, but only slightly less so, for the native army.

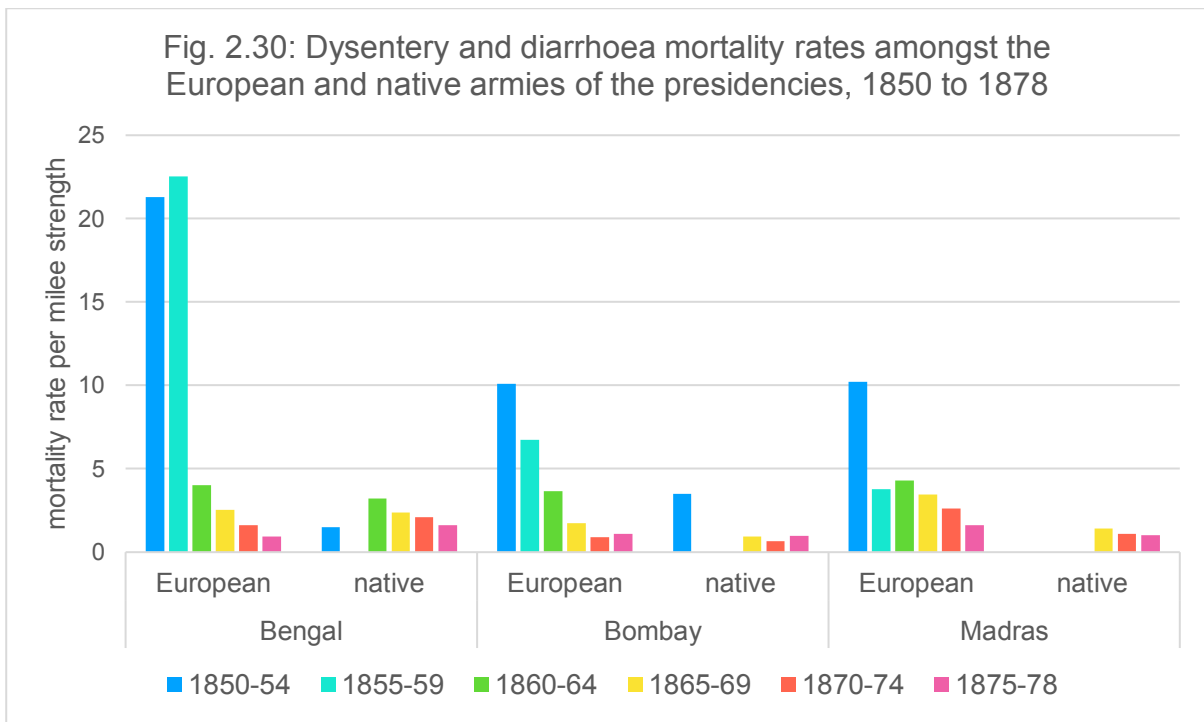
Comparison between the European presidency armies shows that in the 1850s, mortality rates from dysentery and diarrhoea were more than twice as high in Bengal than in Madras or Bombay (Figure 2.30).<sup>112</sup> The 1860-64 rates were similar between the European presidency armies but fell further after 1865 in all three locations. In sepoys, deaths from dysentery and diarrhoea were higher in Bengal than Bombay or Madras until 1870, after which they were similar and for Bengal slightly higher than in the European force.

Diarrhoeal diseases in the mid nineteenth century were seen as a continuum. Differentiation between dysentery, now known to be of either amoebic or bacillary type, and diarrhoea, which can be due to a number of viral or bacterial causes, depended on the severity of the intestinal flux, the presence of blood in the stool (pointing to dysentery, as affirmed by Christopher Bassano (1824-56), assistant surgeon to the 70<sup>th</sup> foot regiment), and the degree of prostration – cholera was its

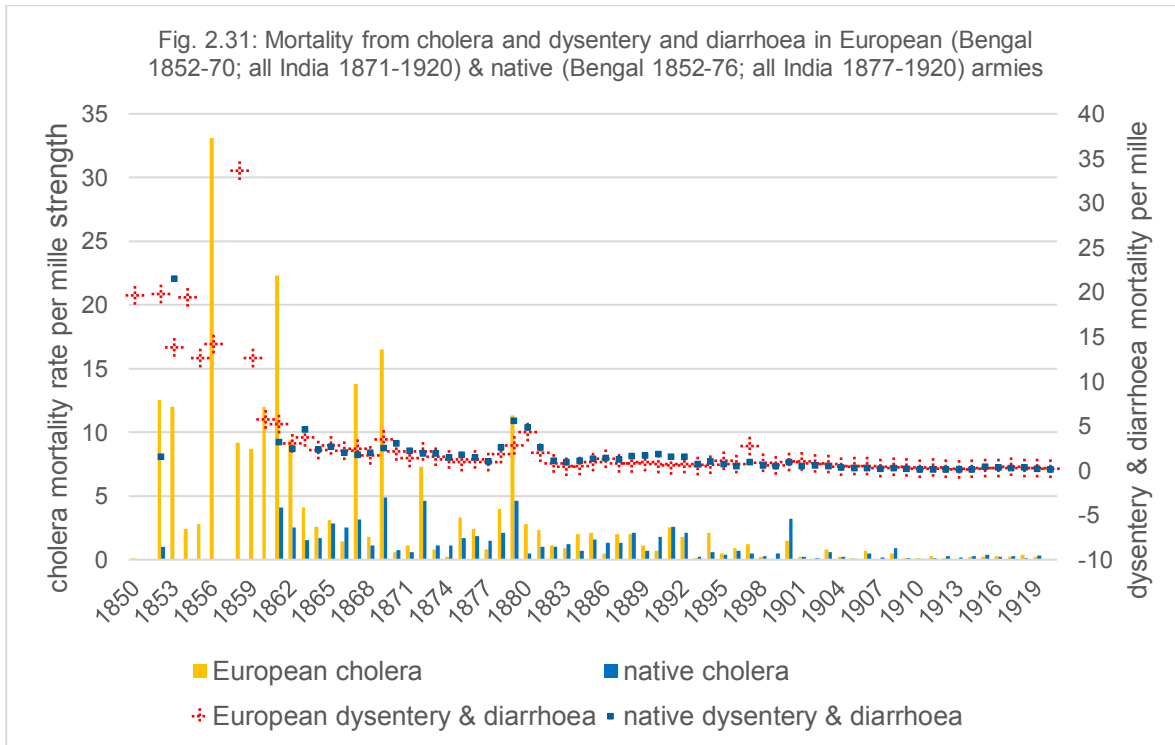
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<sup>111</sup> J.S. Simmons, T.F. Whayne, G.W. Anderson, H.M. Horuck. *Global epidemiology: a geography of disease and sanitation*, Vol. 1 (London: Heineman, 1944), pp. 118-19, 122, 125, 127-8; Quotes *RPHCGI*, 1937.

<sup>112</sup> Source data as for Fig. 2.6.



worst manifestation.<sup>113</sup> Hence, classification was inexact, which meant blurred diagnoses at margins. When cholera and dysentery with diarrhoea are plotted on the same graph, there is some naked eye correlation between the accounts, for example 1879-80 (Figure 2.31).<sup>114</sup>



<sup>113</sup> M.D. Wainwright, ed., *Brothers in India: the correspondence of Tom, Alfred and Christopher Bassano, 1841-75* (London: University of London, 1979), p. 187; Bassano, writing in his diary in 1849 at Fort William, records that death from bloody flux of dysentery could occur ‘in a few hours’.

<sup>114</sup> Source data as for Fig. 2.12.

Mortality from dysentery and diarrhoea fell dramatically after the 1850s, so that, in the 1860s for European troops in Bengal, it was one fifth the rate in the previous decade. Dysentery was more lethal per case than diarrhoea, but the conclusions for the combined group of diarrhoea and dysentery are the same as for dysentery alone (mortality rate trends are shown in the graphs below). For the European army of Bengal, the annual mortality rate per mille in the 1850s, was 14.5 for dysentery, and 3.7 for diarrhoea. Within just a decade, mortality rates had dropped dramatically to 2.6 per mille for dysentery and 0.7 for diarrhoea. Although the overall mortality was lower in the native troops than in the Europeans, after 1860, admission rates for dysentery were almost double for sepoys, and remained so until the First World War, after which Europeans predominated (Figure 2.32).<sup>115</sup> Nonetheless case fatality remained higher for European soldiers until the 1920s (Figure 2.33).<sup>116</sup>

Reasons for the excess of admissions in sepoys will be investigated. Although for the armies, dysentery and diarrhoea had a much-reduced incidence in the 1930s, for Indian civilians they remained a major problem. In 1937, for an Indian population of 272.7 million there were 886,289 cases of amoebic dysentery, 447,889 reports of bacillary dysentery, and 101,940 instances of enteric fever.<sup>117</sup> This thesis will seek explanations for the precipitous decline in dysentery in the European force in the late 1850s.

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<sup>115</sup> Source data as for Fig. 2.12.

<sup>116</sup> Source data as for Fig. 2.12.

<sup>117</sup> Simmons, *et al.*, *Global epidemiology*, pp. 118-19, 122, 125-8.

Fig. 2.32: Dysentery: annual admission and mortality rates for European (Bengal 1850-70; all India 1871-1940) & native troops (Bengal 1860-76; all India 1877-1940)

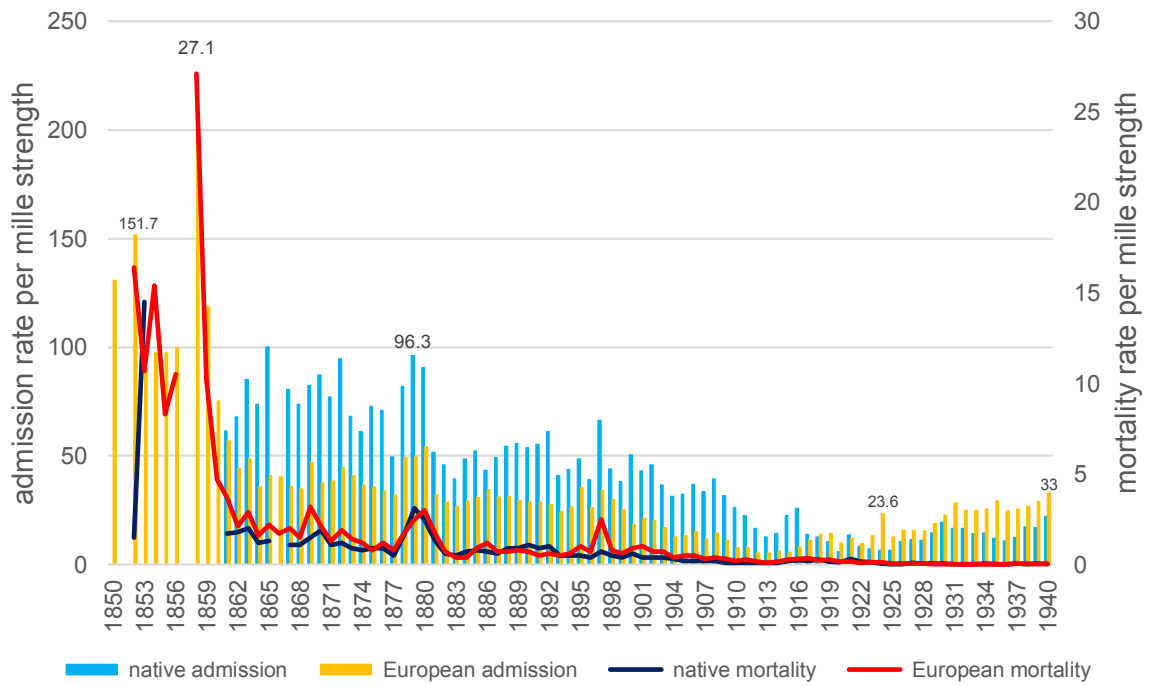
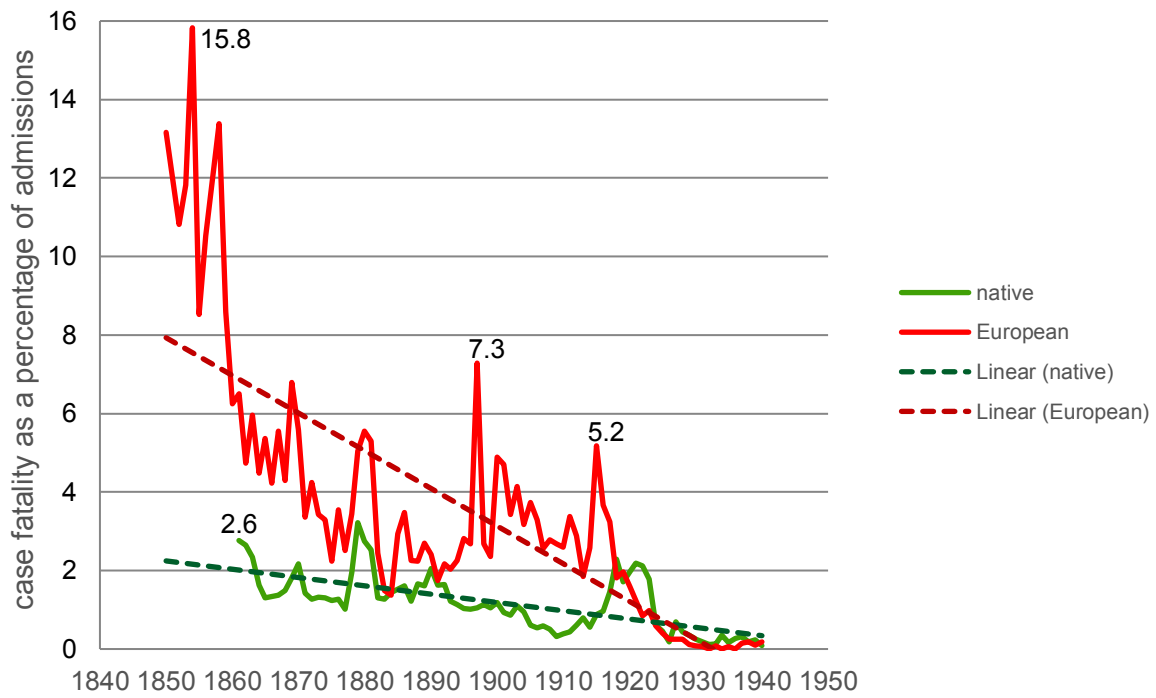


Fig. 2.33: Dysentery: case fatality rate for European (Bengal 1850-70; all India 1871-1940) & native armies (Bengal 1860-76; all India 1877-1940)



### ***Enteric fever and typhoid/ paratyphoid***

Enteric fever, caused by typhoid or paratyphoid, due to variants of the bacterium *Salmonella enterica*, became a specific diagnostic category for reporting by army medical officers in 1870.

Prior to this some cases would have been included under ‘continuous’ or ‘remittent’ fever.<sup>118</sup>

Enteric fever developed into a major clinical problem for European soldiers, though not for the sepoy army, from the late 1870s through to 1910, with peaks in the 1890 decade (Figure 2.34).<sup>119</sup>

This anomalous observation requires explanation. *Salmonella* is spread by the faeco-oral route.

Since other infections with similar modes of transmission, such as cholera and the microorganisms causing dysentery, had declined decades before and not resurfaced, any theory needs to explain why one type of infection proliferated whilst others did not. Despite considerable variance in the frequency of enteric infections between European and native soldiers, there were small differences only in case fatality rate (Figure 2.35).<sup>120</sup>

This showed a progressive and consistent improvement, especially for an infection in the pre-antibiotic era, from a greater than 50 percent fatality in the 1860s to less than 10 percent by the 1930s. Enteric fever/ typhoid diminished rapidly during the late 1900s. Possible reasons, including an ameliorating contribution from immunization at the turn of the century, will be considered.

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<sup>118</sup> Murchison’s *Fevers*, a leading contemporary text, in its 1884 third edition, finds enteric fever as often causing remittent pyrexia, with typhus typically continuous, and ague, still put down to miasma, though a note acknowledges a growing belief in ‘parasitic’ aetiology, showing intermittent or remittent – cases hence may drift between types (C. Murchison, *The continued fevers of Great Britain*, 3<sup>rd</sup> edn (London: Longman, Green, 1884), pp. 36, 286, 494).

Margaret Pelling highlights that William Farr was instrumental in differentiating types of fever, specifically separating typhoid and typhus in 1869 – M. Pelling, *Cholera, fever and English medicine 1825-1865* (Oxford: OUP, 1978), p. 98.

<sup>119</sup> Source data as for Fig. 2.12; An early indication of the surge was noted in 1873-75, as occurring in young recruits considered to be exposed to sudden transition and change of climate, especially for service in the plains – BL IOR/P/525 1873-75, ‘Sanitary proceedings’, pp. 391-8; Causation was considered to involve foul subsoil, occupation of old tenements with overcrowding, open privies, cesspits and sewers, sewer air, and water contaminated with ‘putrescent matter’.

<sup>120</sup> Source data as for Fig. 2.12.

Fig. 2.34: Enteric fever or typhoid (remittent to 1869): annual mortality rates for the European (Bengal 1850-70; all India 1871-1940) & native (Bengal 1860-70; all India 1877-1940) armies

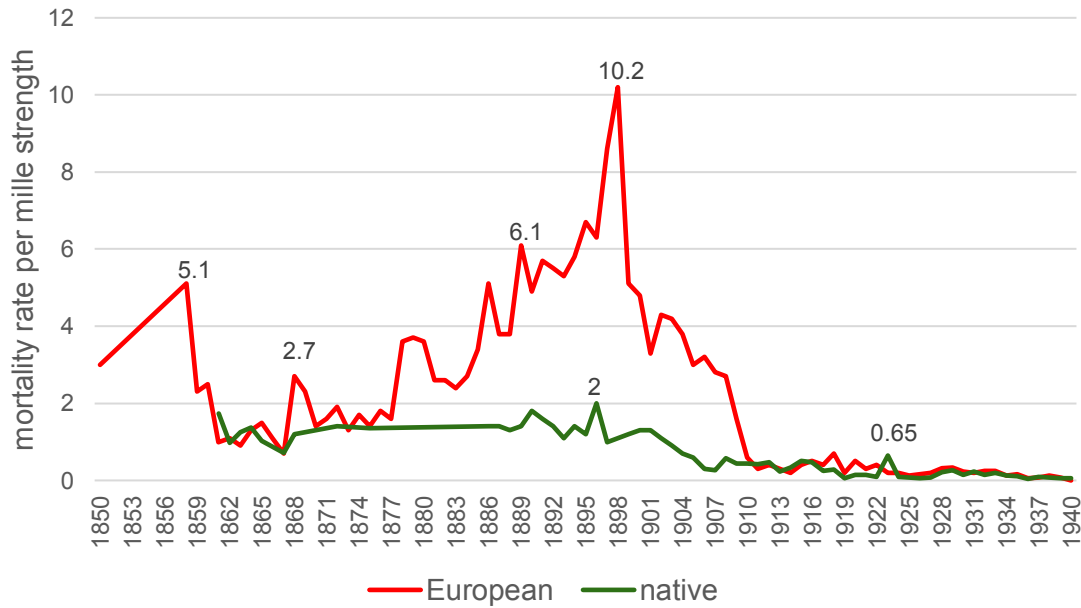
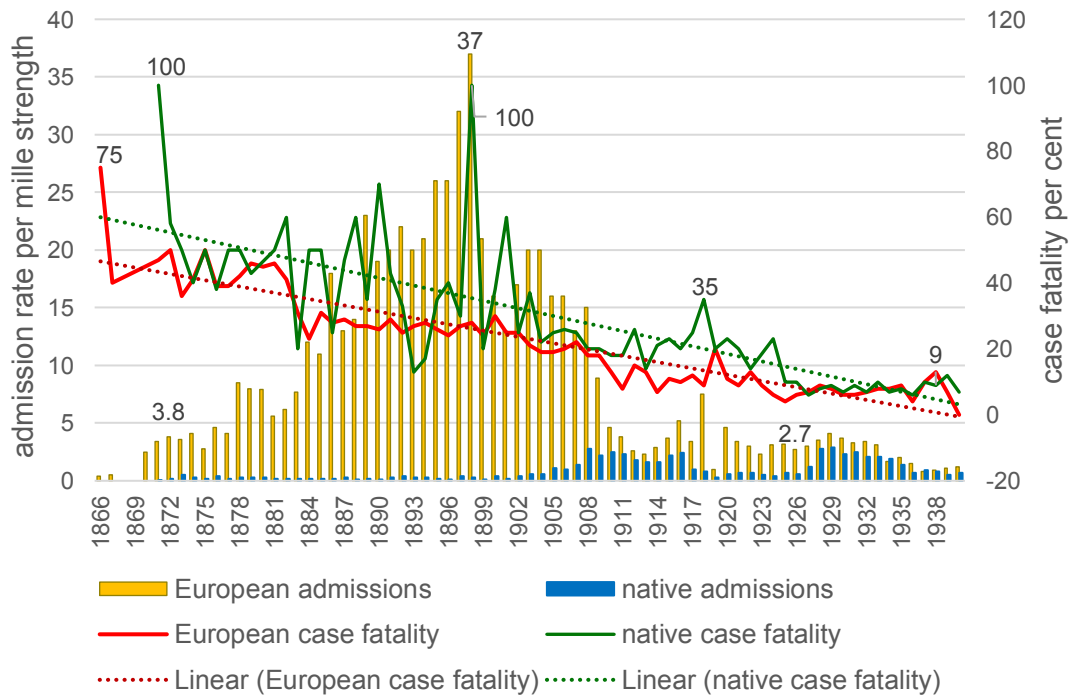
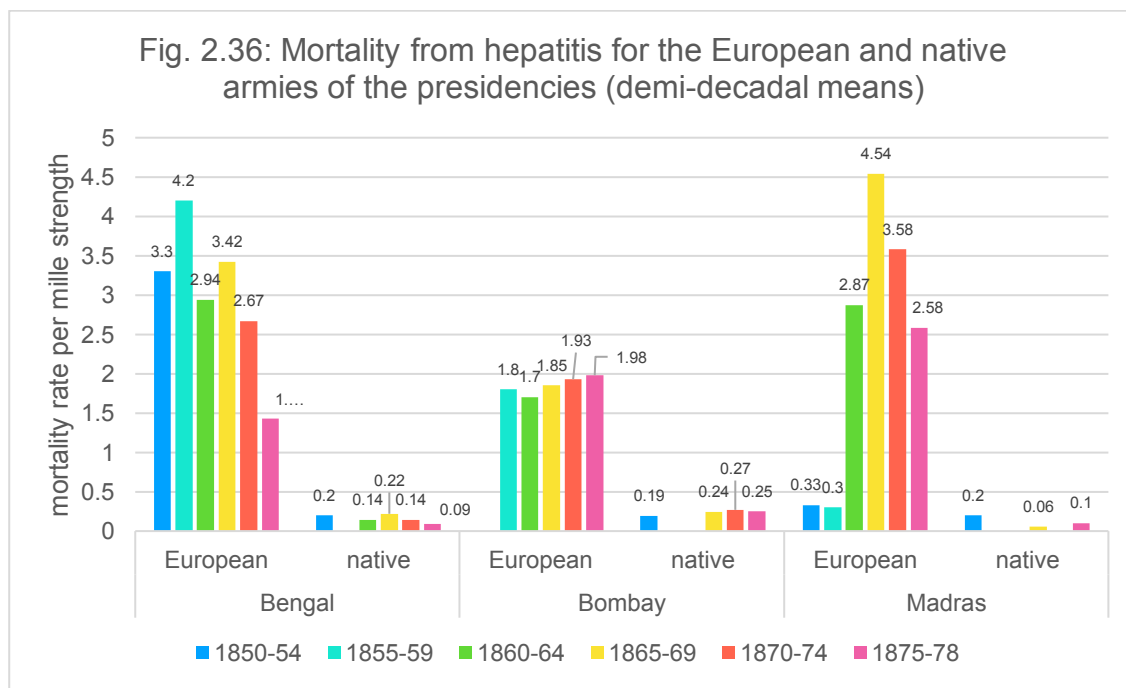


Fig. 2.35: Enteric fever/typhoid (remittent to 1869): admission & case fatality rates for European (Bengal 1850-70; all India 1871-1940) & native (Bengal 1860-76; all India 1877-1940) armies



## Hepatitis

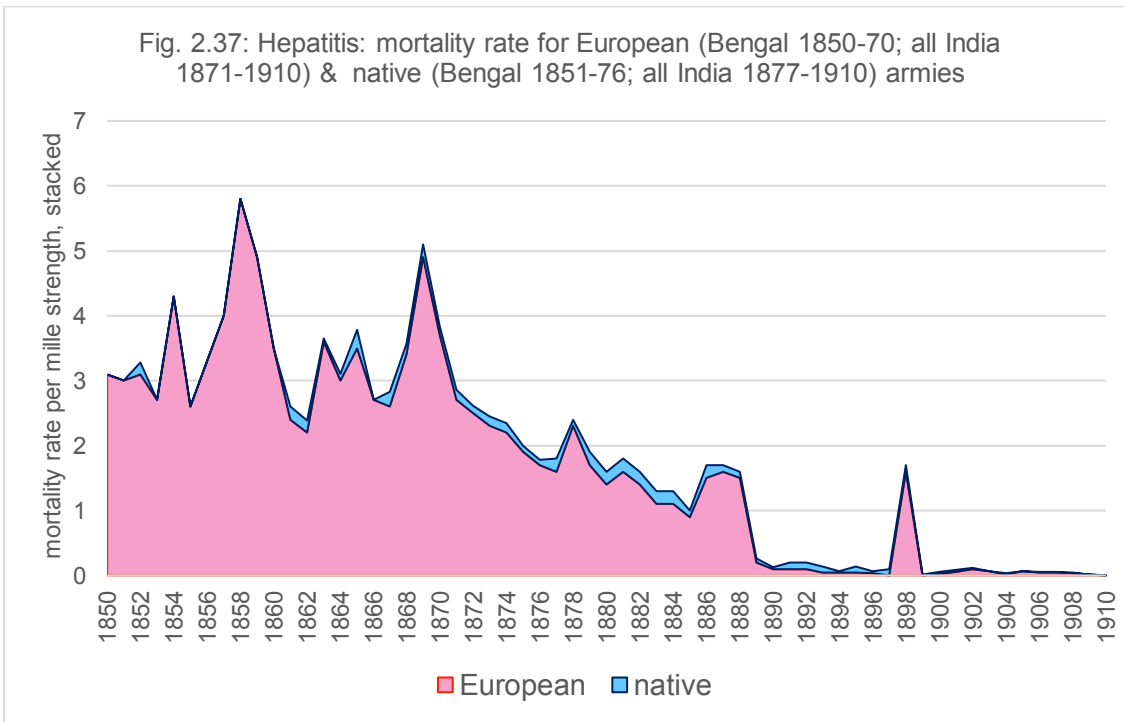
Hepatitis was almost exclusively a condition of the European soldier. It affected those in all three presidency armies in the third quarter of the nineteenth century. Initially it was more prevalent in the Bengal force but by the mid-1860s, mortality rates were higher in Madras (Figure 2.36).<sup>121</sup>



For the European army of all India, mortality stayed quite high in the 1870s, but declined slowly in the 1880s, to taper off fairly abruptly after 1888, apart from a slight return peak in 1898 (Figure 2.37).<sup>122</sup> The high points of the mortality rate in 1858 and 1869 correlate with zeniths of incidence for dysentery, suggesting an association. It is not quite clear what medical officers of the time meant by ‘hepatitis’. The term now refers to an inflammatory condition of the liver, frequently caused by a virus, as in ‘hepatitis B’, and often accompanied by jaundice. Diagnosis today requires liver function tests and blood tests for viral antibodies or antigens, investigations not open to nineteenth century physicians. This thesis will scrutinize how army medical officers made the diagnosis, and whether what they recorded actually was, for example, a viral infection such as hepatitis A, or something else.

<sup>121</sup> Source data as for Fig. 2.6.

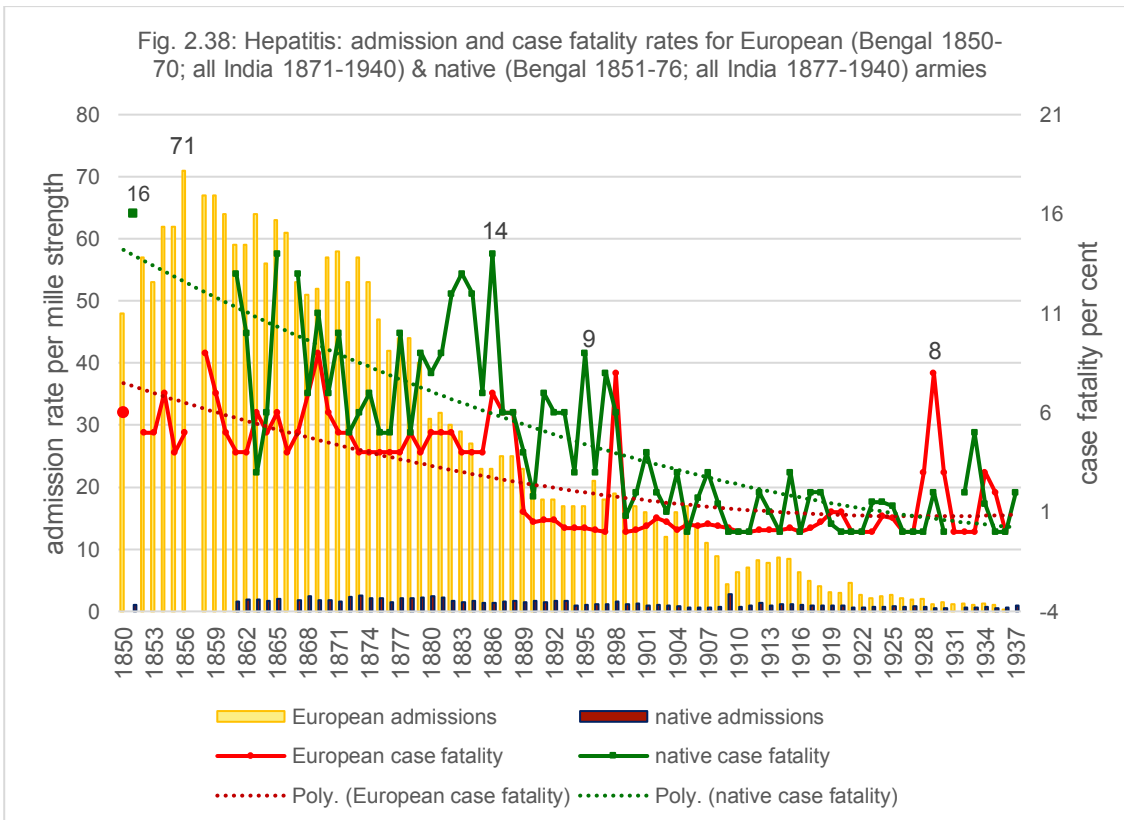
<sup>122</sup> Source data as for Fig. 2.12.



Although mortality in the European soldiery fell, disease frequency did not drop so precipitately.

The reduction in case fatality rate at around 1888 suggests some positive development, as yet

unidentified but to be investigated, in medical management (Figure 2.38).<sup>123</sup> The observation that



<sup>123</sup> Source data as for Fig. 2.12.

native soldiers were very little affected by the disease suggests an infection encountered in childhood, and to which almost all had developed lifelong immunity. Alcoholic hepatitis was not categorized separately from ‘hepatitis’ and so cannot be quantified, though medical officers recognized the effects of alcohol upon the liver, and its consumption was well recorded as often being excessive in European soldiery, including officers, and likewise in civilians (*vide infra*).

### ***Intermittent fever, remittent fever and malaria***

In intermittent fever, elevations in body temperature for a few hours alternate with periods of apyrexia. This pattern of fever can be due to several infections including sepsis, tuberculosis, dengue and kala-azar (systemic leishmaniasis), but the usual cause in India in the nineteenth and twentieth centuries was malaria. The term *mal’aria* (literally ‘bad air’) was first used by the Italian physician Giovanni Lancisi (1654-1720) to denote the danger of locations associated with intermittent and continuous fevers rather than a specific disorder or cause.<sup>124</sup> It was introduced as ‘malaria’ to the scientific literature, conceptualizing the effluvial poison rather than a disease, by the Scottish geologist John MacCulloch in his 1828 monograph.<sup>125</sup> MacCulloch emphasized that swampy locations with undrained soils in Europe, for example the fens of Essex or Lincolnshire, were just as capable at delivering marsh fever or ague – still imprecise terms – as were tropical climates, though often in less severe forms.<sup>126</sup> During the nineteenth century use of the terms ague and malaria gradually narrowed.<sup>127</sup> Charles Gordon (1833-85), deputy inspector general of hospitals in India, in 1872, use still employed ‘malaria’ as the causation of ‘ague’ – by which he meant an intermittent fever with prostration and sometimes splenomegaly that would do for what

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<sup>124</sup> C. Hamlin, *More than hot: a short history of fever* (Baltimore: Johns Hopkins, 2014), p. 213; MacCulloch graduated in medicine from the University of Edinburgh in 1793 but is best known for geological surveys.

<sup>125</sup> L.J. Bruce-Chwatt, ‘John MacCulloch MD FRS (1773-1835)’, *Medical History*, 21 (1977), pp. 156-65; J. MacCulloch, *Malaria, an essay on the production and propagation of this poison, and on the nature and localities by which it is produced* (London: Longman, Rees, Orme, Brown and Green, 1828).

<sup>126</sup> Hamlin, *Fever*, pp. 213-15; Bruce-Chwatt, ‘MacCulloch’, pp. 160-1; MacCulloch, *Malaria*, p. 1.

<sup>127</sup> Hamlin, *Fever*, p. 29.

now see as *Plasmodium malariae*.<sup>128</sup> Only in the final two decades of the century with the identification of the mosquito life cycle through contributions of Charles Laveran (1845-1922) in Algeria and Ronald Ross (1857-1932) in Secunderabad did malaria become a specific disease, reportable by army doctors as a diagnostic category in its own right from 1908. For the purposes of this work, intermittent fever is regarded as nearly equivalent to malaria, though this is an oversimplification as undoubtedly, prior to laboratory diagnosis by blood smear microscopy being made available in the late nineteenth or early twentieth century, the category includes infections other than malaria. The fevers of malaria can be subdivided into quotidian, characterized by bouts of elevated temperature for a few hours every 24 hours and caused by the protozoan *Plasmodium falciparum* or *Plasmodium knowlesi*; tertian, showing a 48-hour periodicity and due to *Plasmodium vivax*, *Plasmodium falciparum* or *Plasmodium ovale*; and quartan, in which the fever shows a 72-hour periodicity, caused by *Plasmodium malariae*. Malaria is most prevalent in Northern India in September to December, following the rainy monsoon months of April to September.<sup>129</sup> William Twining (1790-1835), assistant surgeon to the Calcutta General Hospital, in 1832, linked intermittent fever directly to climate rather than to the then considered modality of miasma:<sup>130</sup>

... it is abundantly evident to every medical man in Bengal, the very first year that he witnesses the results of the change of season and temperature, between 20<sup>th</sup> October and 1<sup>st</sup> December, that intermittents are intimately connected with the diurnal changes of temperature, which take place at commencement of the cold season.

When the frequency of admissions from fever – intermittent, remittent and continuous for European troops of Bengal, intermittent and remittent/ continuous combined for the sepoy soldiery – is plotted by month for 1867-78 (averaged), the anticipated surge in intermittent cases is confirmed for the months August to December, continuous cases being most prevalent in the hot months of April to

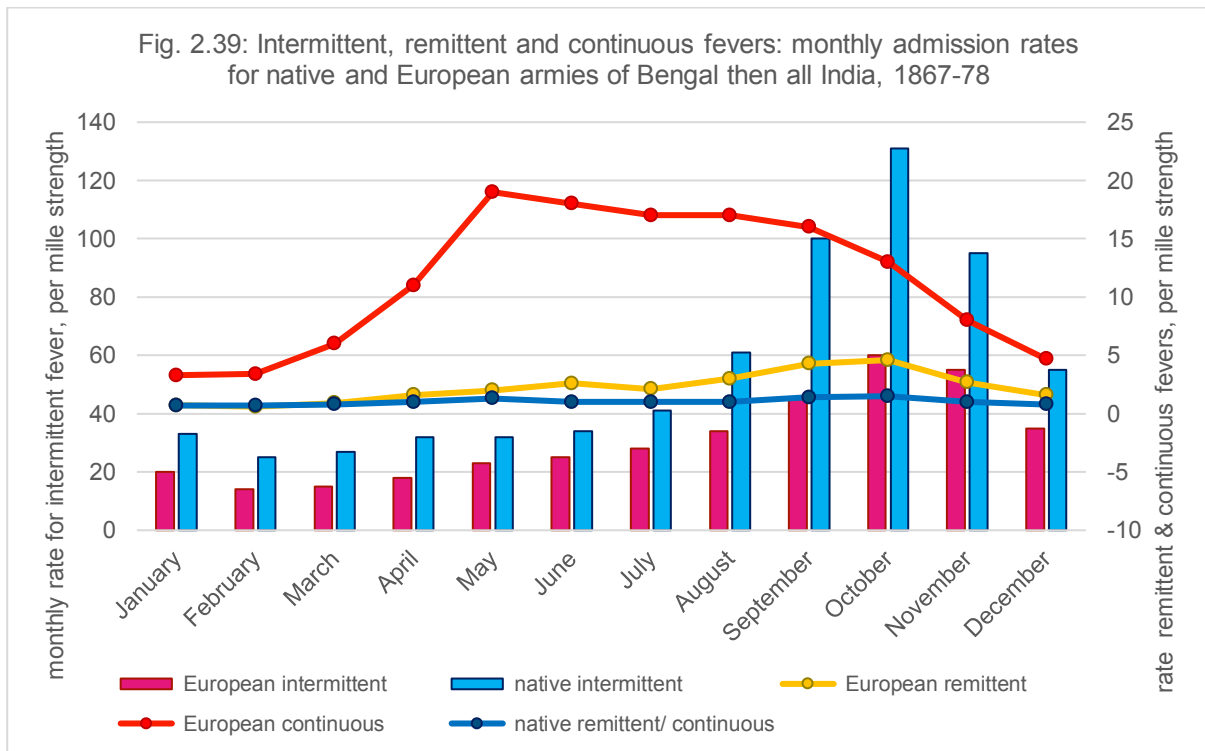
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<sup>128</sup> C.A. Gordon, *Experiences of an army surgeon in India* (London: Bailliere, Tindall, Cox, 1872), pp. 72-7; Earlier writers such as military surgeon Thomas Clark, in 1801, linked this to 'marsh effluvia' – T. Clark, *Observations on the nature and cure of fevers* (Edinburgh: Bell and Bradfute, 1801), pp. 12-13.

<sup>129</sup> J.M. Lauderdale, C. Caminade, A.E. Heath, *et al.* 'Towards seasonal forecasting of malaria in India,' *Malaria Journal*, 13 (2014), pp. 310-30.

<sup>130</sup> W. Twining, *Clinical illustrations of the more important diseases of Bengal* (Calcutta: Baptist Mission Press, 1832), pp. 566-7.

October but only for the European (Figure 2.39).<sup>131</sup> The native army suffered autumn-winter intermittent rates more than double those of the European (mean 92 compared to 40 per mille) and



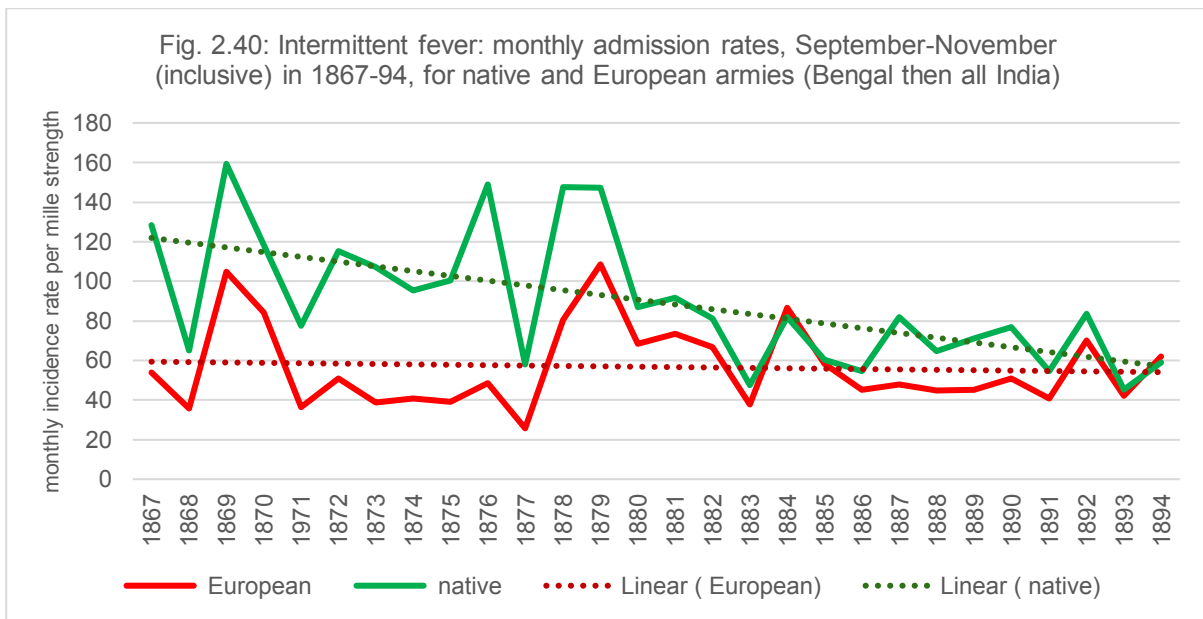
thrice higher than in other months.<sup>132</sup> These findings are compatible with malaria as the cause of most intermittent cases, but of much fewer remittent ones (a small uplift is seen only in European data, September-October). Over the autumn-winter periods 1867 to 1894,<sup>133</sup> the higher native prevalence is maintained, and, despite year-to-year variance, the mean trend is down especially for sepoys for whom rates merge to European levels by the mid 1890s (Figure 2.40).<sup>134</sup>

<sup>131</sup> Source data as for Figs. 2.6 and 2.12; Prior immunity to several infections (including enteric fever) is proposed as a factor for lower rates of continuous fever in sepoys.

<sup>132</sup> Native data 1873-76 (92 vs 30), European 1872-78 (40 vs 18).

<sup>133</sup> 1894 is the last for which figures are available.

<sup>134</sup> Source data as for Fig. 2.12.



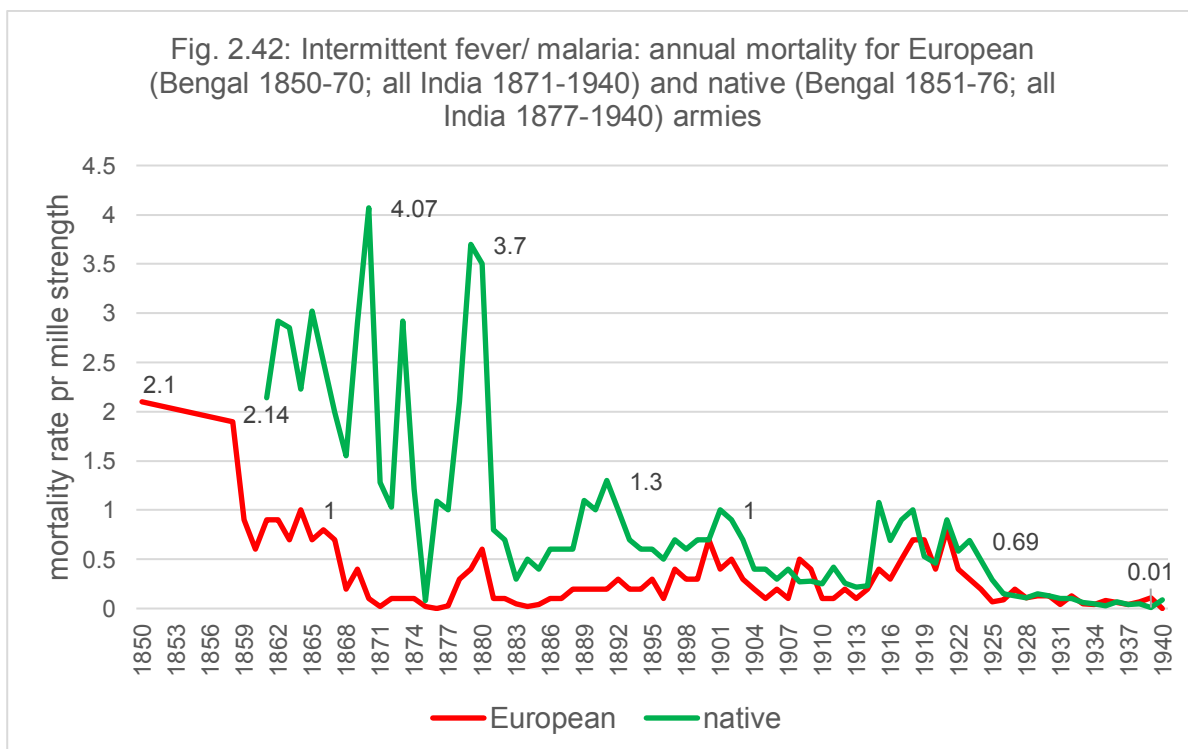
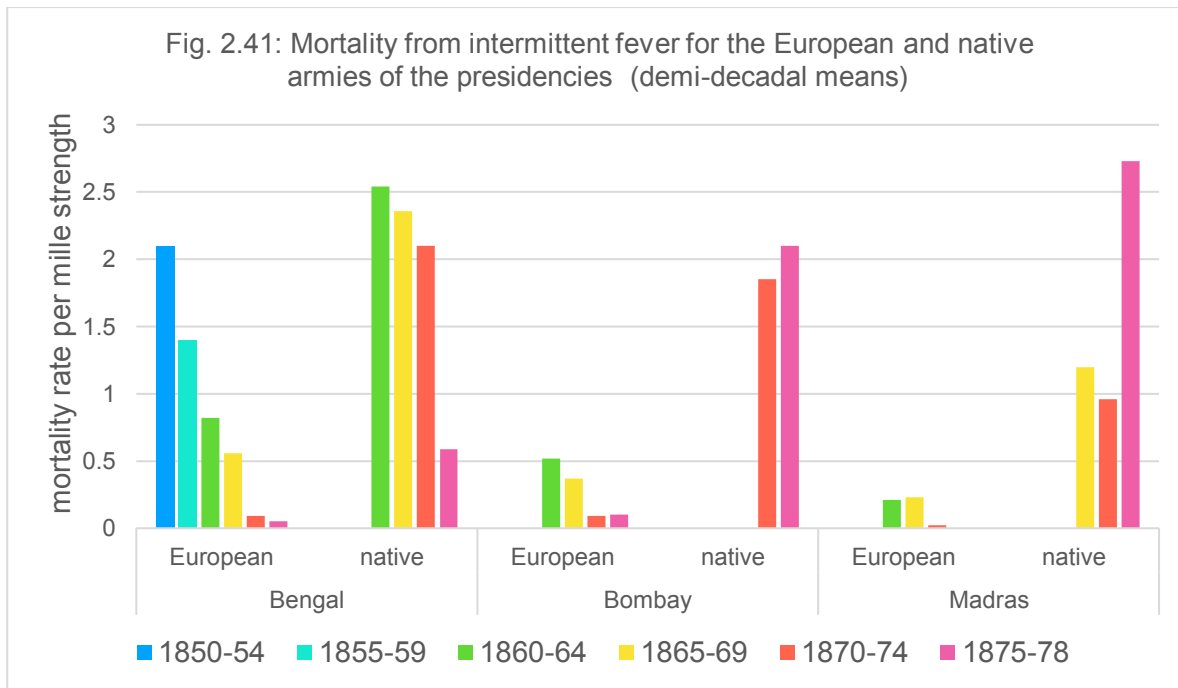
Remittent fever is a pattern of pyrexia in which the temperature remains above the normal of 37 degrees Celsius throughout the day and varies by more than one degree Celsius over a 24-hour period, thus distinguishing itself from continuous fever. Various infections can cause it. A smattering of cases was likely due to malaria (notably *falciparum*), with a fair proportion of the others (though not all) from enteric fever.

Unlike for gastro-intestinal infections, mortality from intermittent fever was, from the earliest available records, higher in the native soldier than in his European counterpart. This was evident for all three presidency sepoy armies (Figure 2.41) and carried on through to the native army of all India, lasting right up until 1926 (Figure 2.42)<sup>135</sup>. Though data are limited, both for the European and more so the native soldier, death from intermittent fever was greater in the Bengal army, with the exception of Madras for sepoys, 1875-78 (Figures 2.41)<sup>136</sup> – probably because the more fatal *falciparum* malaria has a higher prevalence in north-east India – the less serious *vivax* being

<sup>135</sup> Source data as for Figs. 2.6 and 2.12.

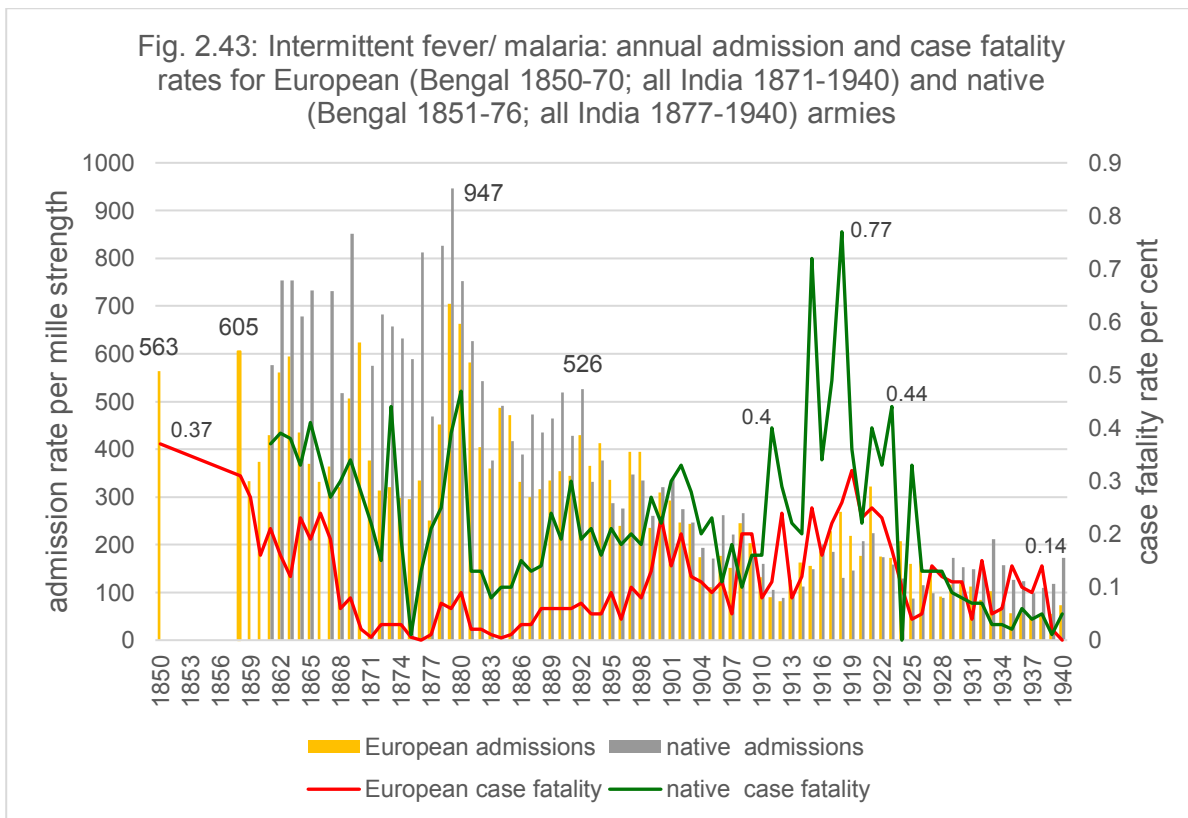
<sup>136</sup> Source data as for Fig. 2.6.

distributed throughout the subcontinent.<sup>137</sup> Rates of admission were also higher for sepoys, who in addition had a greater case fatality rate, quite often more than double that of European soldiers (Figure 2.43)<sup>138</sup>.



<sup>137</sup> A.M. van Eijk, A.S. Mannan, S.A. Sullivan, J.M. Carlton, 'Defining symptoms of malaria in India in an era of asymptomatic infections', *Malaria Journal*, 19 (2020), 237.

<sup>138</sup> Source data as for Fig. 2.12.



Explanations will be sought. Malaria, at times potentiated by malnutrition, was common in the civilian population of India, continuing into the twentieth century. In 1937 there were 12.4 million cases in the Indian population of 272.7 million, an annual occurrence rate of 46 per mille. For the British army the rate was almost identical at 45 per mille in 1937, rising to 73 per mille in the wartime conditions of 1940.<sup>139</sup>

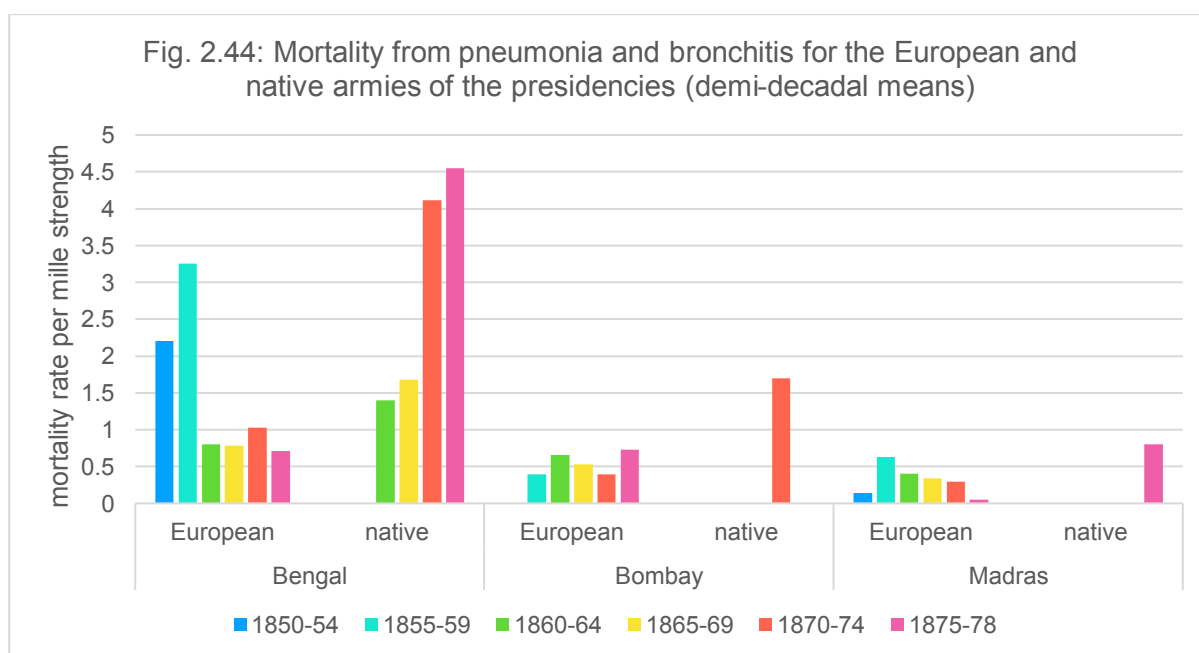
For Indian civilians, though rarely for the military, kala-azar – visceral leishmaniasis caused by *Leishmania donovani* – and, both in epidemics and endemically, plague due to *Yersinia pestis*, were significant diseases that could cause fever, in the later nineteenth and first half of the twentieth centuries. In 1924, there were 530,000 deaths from plague, though this dropped to 28,169 in 1937, occurring mostly in rural areas.<sup>140</sup> Kala-azar resulted in 205,174 recorded civilian cases and 810 deaths in 1937.

<sup>139</sup> Simmons, *et al.*, *Global epidemiology*, pp. 118-19, 122, 125-8.

<sup>140</sup> *Ibid.*

### *Respiratory diseases and pulmonary tuberculosis*

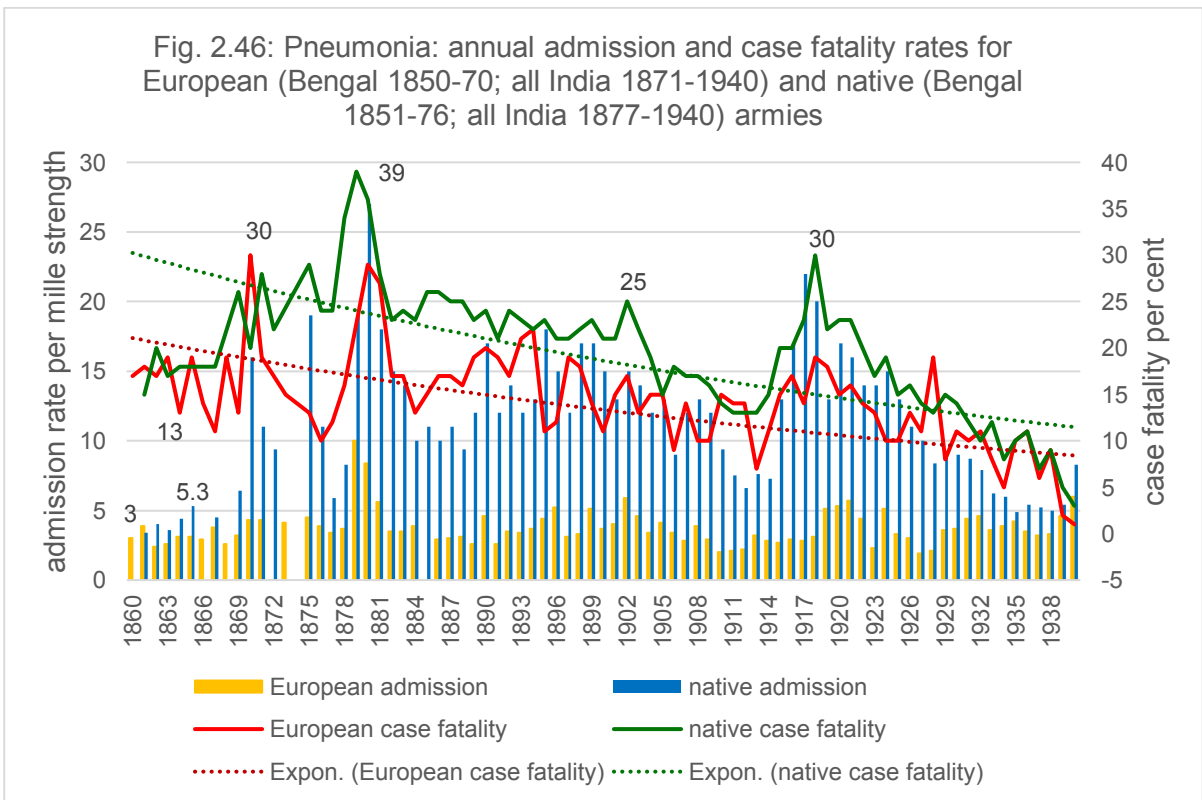
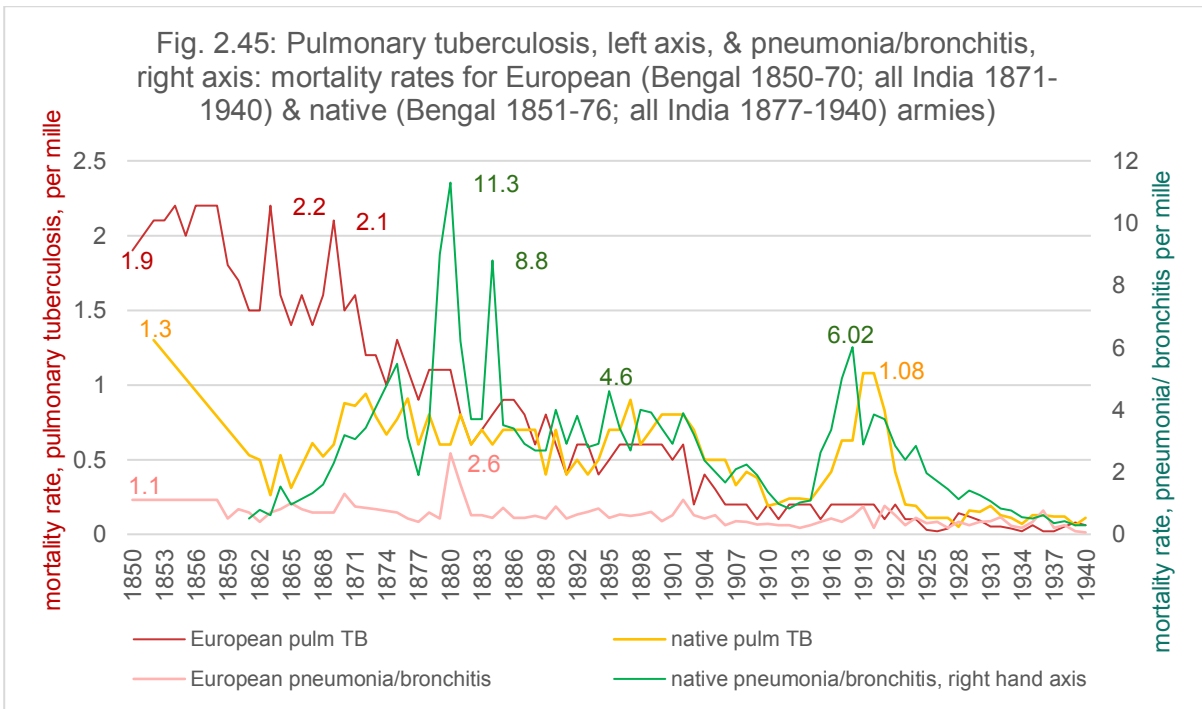
From early data for the armies of Bengal to those for all India in the later nineteenth and first third of the twentieth century, pneumonia and bronchitis, often by several fold, were more commonly a cause of death in the native soldier than in the European (Figure 2.44 and 2.45).<sup>141</sup> Bronchitis included both the more prevalent acute type and the more fatal chronic variety. Admission and mortality rates for pneumonia and bronchitis combined, in the European soldiery, ran at a fairly constant level throughout the second half of the nineteenth century and into the first quarter of the twentieth, whereas there were spikes in admissions and mortality for the native force in the 1870s,



1880s, and during the First World War, that were mirrored to a minor extent for the European (Figures 2.45 and 2.46).<sup>142</sup> The case fatality rate for pneumonia was consistently higher in native compared to European soldiers, but in both there was a downward trend from the later 1870s, for sepoys especially after the First World War. Again, a substantial reduction in fatality was seen

<sup>141</sup> Source data as for Figs. 2.6 and 2.12; As with previous data, records for the native army are those of Bengal to 1876, and then for all India thereafter, whereas figures for European troops are those for Bengal to 1870, and all India from 1871. Bronchitis, including both acute and chronic forms, has been grouped with pneumonia for the purposes of certain analyses. Some records show a category of 'respiratory disease'. It is unclear whether this means respiratory disorders other than bronchitis or pneumonia or whether it includes these. The latter seemed likely in some place and so the category has been excluded from these calculations.

<sup>142</sup> Source data as for Fig. 2.12.



before antibiotics became available, for reason to be explored (Table 2.4).<sup>143</sup> Pulmonary tuberculosis in the second half of the nineteenth century was primarily a disease of the European soldier, but the affiliation switched to favour the native force in the first third of the twentieth

<sup>143</sup> Source data as for Figs. 2.6 and 2.12.

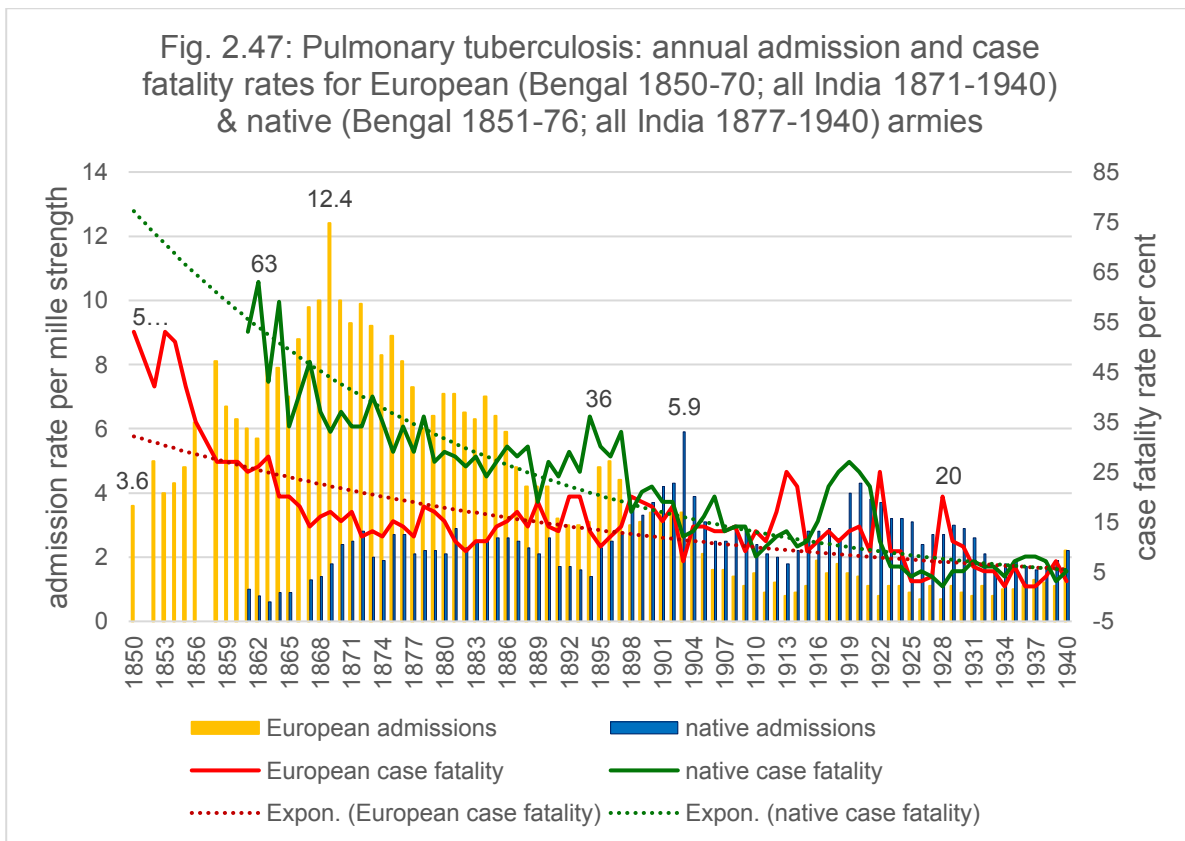
**Table 2.4: Case fatality rates for eight major conditions for the years 1865, 1895, 1925 and 1935 in the European and native armies of India (annual mortality as a percentage of admissions).**

	cholera		dysentery		remittent/ typhoid		hepatitis	
	European	native	European	native	European	native	European	native
1865	72	50	5.4	1.3	75	11	6	14
1895	83	67	2.8	1	26	35	0.2	9
1925	0	0	0.3	0.6	4	10	0.7	1.3
1935	0	0	0.06	0.06	8	8	2	0
	pneumonia		pulmonary TB		intermittent/ malaria		heat apoplexy	
	European	native	European	native	European	native	European	native
1865	19	18	20	34	0.2	0.4	52	50
1895	11	23	10	30	0.1	0.2	29	39
1925	10	15	3	4	0.04	0.3	10	21
1935	10	10	2	4	0.1	0.02	4	7

(Figure 2.47).<sup>144</sup> The annual rate of mortality for the European soldier fell from 2.2 per mille in 1854 to 0.2 per mille in 1903, and did not increase during the First World War. In contrast, for native other ranks, annual mortality increased from 0.26 per mille in 1863 to 4.0 in 1898, falling to 0.19 in 1910 but increasing during the First World War to 1.08, then declining over four years to levels near the European (Figure 2.47).<sup>145</sup> The First World War peak, only seen for sepoys and coinciding in this group with a spike in deaths from pneumonia, may relate to concomitant influenza. Case fatality for native soldiers was 50 percent higher than for their European counterparts in 1918 (30 percent, compared to 19 percent), eventually reaching par at 1932. The trend of case fatality was again downward, in times before specific anti-tuberculous drugs were prescribable.

<sup>144</sup> Source data as for Fig. 2.12.

<sup>145</sup> Source data as for Fig. 2.12.



In the twentieth century, pulmonary tuberculosis was a mounting problem for civilians of India.<sup>146</sup> The recorded mean annual incidences, figures that are considered to be an underestimate, rose from 0.43 per mille in 1929-33, to 0.73 per mille in 1933-38, though the mortality rate altered little over these periods (at 0.015 and 0.016 per mille respectively).<sup>147</sup> It is estimated that 10 to 20 percent of fever deaths and 20 percent of deaths from non-specified respiratory disease were from pulmonary tuberculosis, meaning that a total number of deaths from pulmonary tuberculosis in 1938 was 884,000 for an Indian population of 350 million, a mortality rate of 253 per 100,000 (2.53 per mille), compared to 44.6 per 100,000 for the USA.<sup>148</sup>

**Other diseases**

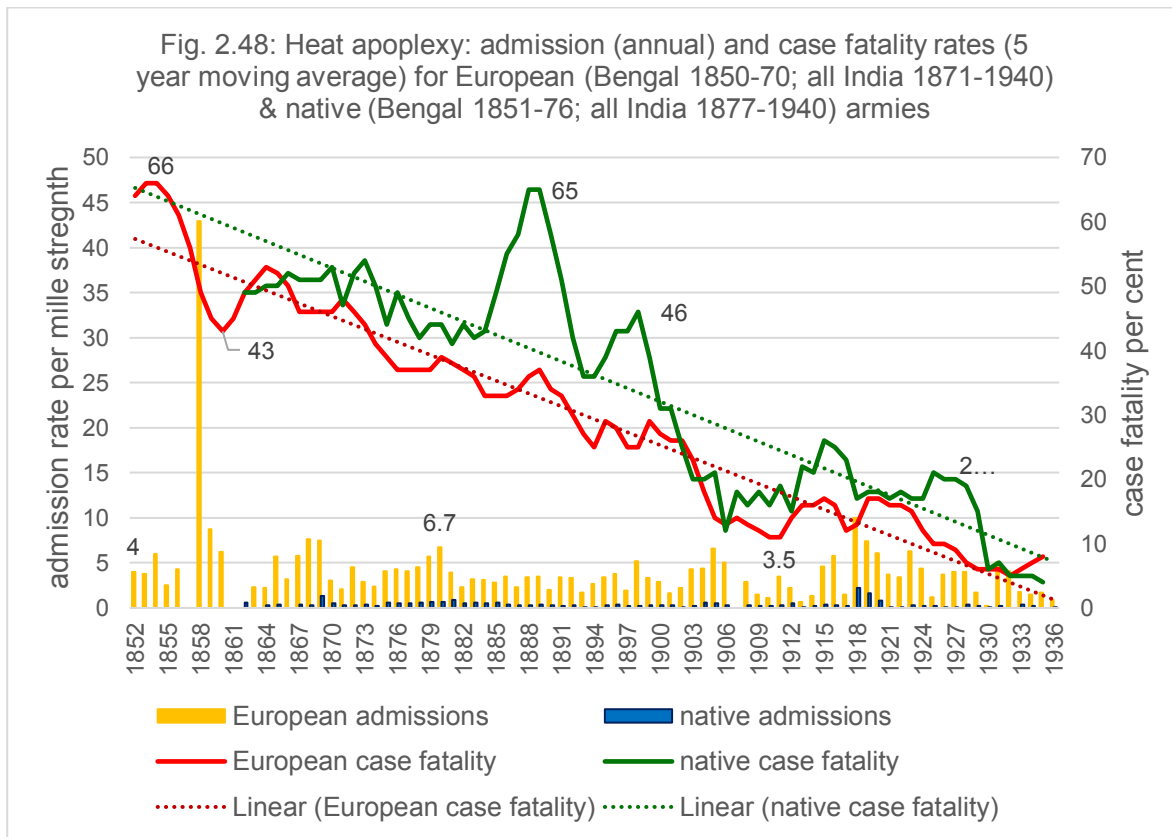
Heat apoplexy, severe over-heating usually the result of strenuous exercise in a hot climate, along with injuries, was one of the few main non-infectious causes of illness and death amongst the

<sup>146</sup> M. Harrison, M. Worboys, 'A disease of civilization', in L. Marks, M. Worboys, eds., *Migrants, minorities and health* (London: Routledge, 1997), pp. 93-124.

<sup>147</sup> *Statistical abstract of British India 1938* (Calcutta: Government of India Press, 1941).

<sup>148</sup> Simmons, et al., *Global epidemiology*, p. 122.

soldiery of the nineteenth century. It was much more common in European troops than in the native force (Figure 2.48).<sup>149</sup> A noticeable spike is evident in frequency for the European rank-and-file,



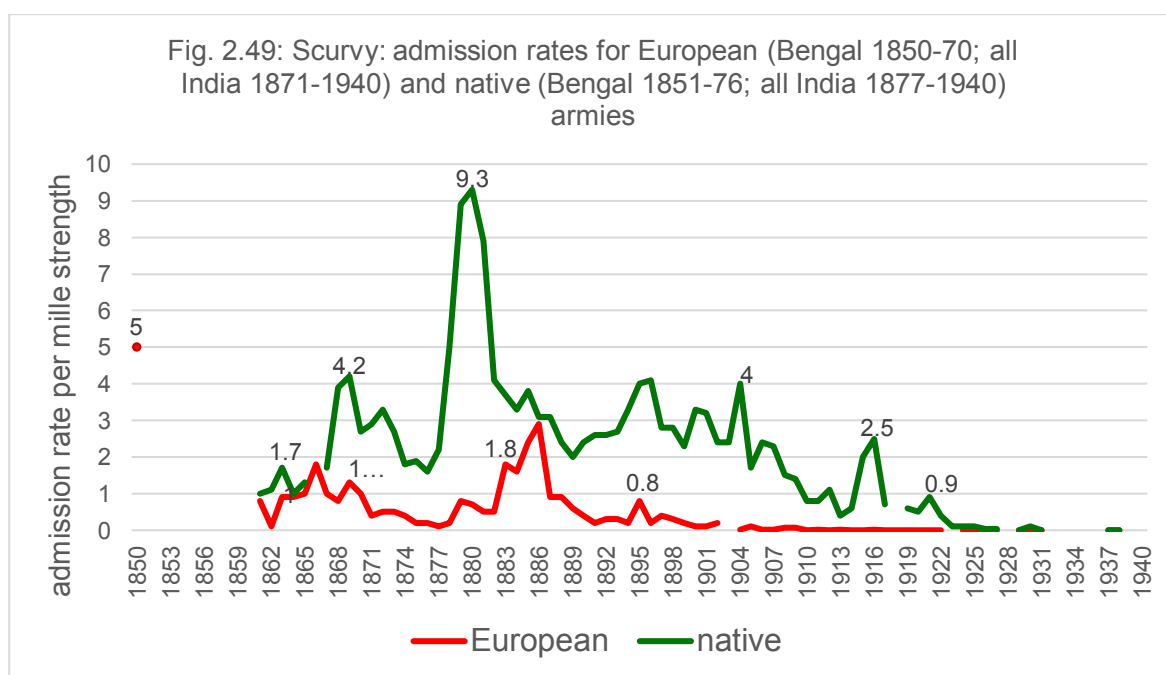
coinciding with the 1857-58 rebellion. Heat apoplexy had a significant case fatality rate, at 66 percent in 1854 for the European soldier. The rate in his native confrere, in whom the condition was much less frequent, was slightly higher. Over the ninety-year period in question there was a steady decline in case fatality rate so that, by 1934, it had been reduced to 5 percent in both European and native forces. Possible reasons will be explored.

Another non-infectious disease of significance was scurvy, due to vitamin C deficiency. This was seen in troops with a diet inadequate in fresh fruit or vegetables. It was especially problematic in armies at war, as in the Crimean campaign and during the American Civil War, when it preferentially affected ‘coloured’ troops.<sup>150</sup> In India, up until the mid-nineteenth century, there was

<sup>149</sup> Source data as for Fig. 2.12.

<sup>150</sup> C. Huang, C.L. Pickavance, D.J. Gawkrödger, ‘Skin disease and military conflicts: lessons from the Crimean War (1854-56)’, *Journal of the Royal College of Physicians of Edinburgh*, 52 (2022), pp. 336-40; Humphreys, *Marrow*, pp. 113, 126.

an opinion that scurvy, which had with famine been responsible for thousands of deaths of troops during the First Burma War (1824-26), was a consequence of impure air or inclement weather.<sup>151</sup> But experience with gaol diets and gaol gardens (also in outpost stations) convinced the EICo of the need for fresh vegetables. In the Indian armies, scurvy was not usually an issue for the European force, but at various times it shows peaks of prevalence in the native army, notably in 1869, 1880, 1895, 1904 and 1915 (Figure 2.49).<sup>152</sup> Hindus, who were the largest group in the native force, are often vegetarians and might be expected to obtain sufficient vitamin C from their diet, though not if it consisted mostly of rice without supplementation by fresh vegetables and fruit.

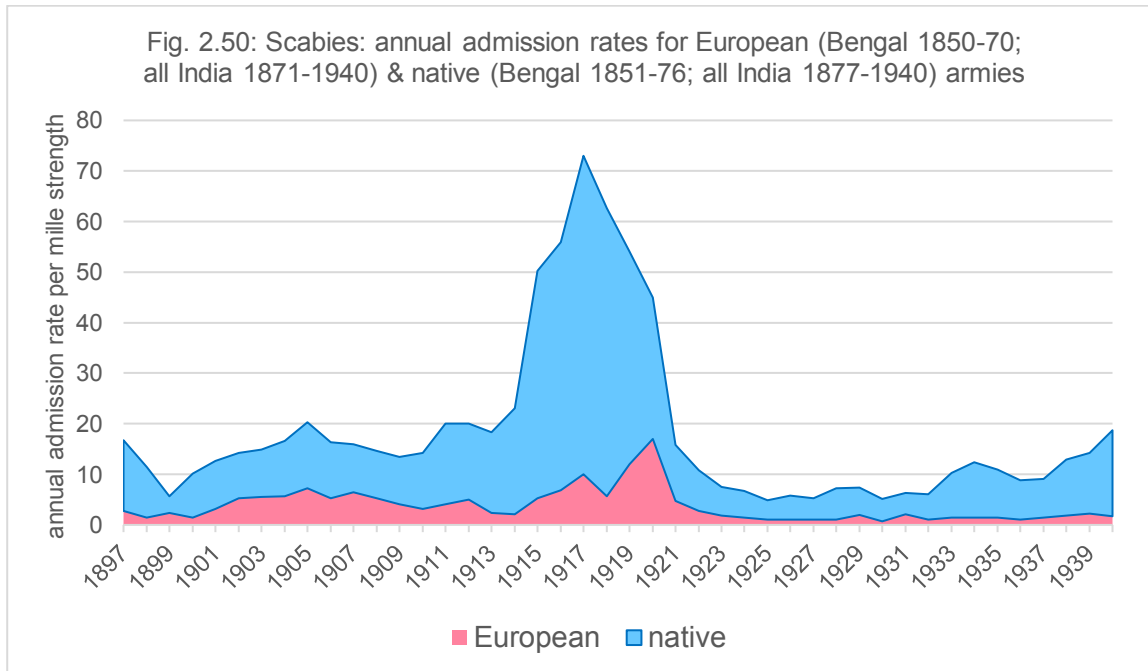


A further disease not caused by a bacterium, virus or protozoan, is scabies, an inflammatory rash due to the burrowing into the superficial layers of the epidermis of the skin by the parasitic mite *Sarcoptes scabiei*. Scabies tends to occur when humans are crammed together in close proximity without facilities for adequate washing and bathing, or regular changing of clothes or bed linen. Unsurprisingly, it manifests at times of war when these measures are minimalized, and so was a major feature in the American Civil War. It also spiked considerably in the native army during the

<sup>151</sup> M. Harrison, 'Scurvy on sea and land: political economy and natural history, c.1780-c.1850', *Journal for Maritime Research*, 15 (2013), pp. 7-25; A consequence of its realization as a deficiency disease was that remote but militarily vital stations, previously abandoned because their weather was thought to predispose to scurvy, could once again be occupied provided correct foodstuffs were supplied (p. 19).

<sup>152</sup> Source data as for Fig. 2.12.

First World War and for two years after, with a peak incidence of 71 per mille in 1917 (Figure 2.50).<sup>153</sup> It had started to incline in 1939 in the earliest stages of the Second World War. European troops only displayed a mild spur in scabies during the First World War, suggesting differences in living conditions.



### Discussion

A population study is at the heart of this thesis. The populace in question is the soldiery in India during the nineteenth and twentieth century and the concepts being tested revolve around influences playing on the health of these troops. The European army in India and, to a lesser extent, the native one, was a defined body of men, confined and controlled up to a certain point, though exposed at its edges to the local civilian environment, and subject to considerable medical supervision. This schema provides a lens through which the wider epidemiology of nineteenth century global health can be viewed. The armies' mass of soldiers, though, was not like a civilian population, the birth-death balance of which, from the eighteenth century, has been intensively debated, but there are similarities. Despite not being subject to birth renewal – the army replenished itself by new recruits – it was subject to decline by death, and fell foul of pestilence, just as much as, sometimes more so

<sup>153</sup> Source data as for Fig. 2.12.

than, the civilian population into which it was embedded, despite efforts at separation by construction of cantonments and attendant regulations. Neither was the soldiery, at least not the European part, subject to the dietary privations that had limited population growth through death from famine and reduced disease resistance prior to the eighteenth century.<sup>154</sup> After this, according to McKeown – though this is debated – the agricultural revolution reduced death rates by providing sufficient food for western Europe, but not necessarily in the wider world.<sup>155</sup> The overall count of soldiers in the armies of India ebbed and flowed as determined by political and military necessity. It rose temporarily post 1857 and again, after a short initial dip when troops were extracted to other theatres, substantially during the First World War. The number needed to replace losses due to death, invaliding and, to only a small extent in the Indian context, battle, was a direct function of the health of the troops. Even in its early days, troops of the EICo were overseen by medical officers, constituted in 1764 into the IMS, which returned records on health.<sup>156</sup> Replacements sent from Europe were expensive, even though the number of European troops was much smaller than the native force.<sup>157</sup> The European and native soldiers were drawn from very different pools. Europeans, many of whom, in the days of the Company, were poor Irish or Scots, entered the army as a last resort, whereas for sepoy in Bengal, who tended to come from a higher stratum of society such as the land-owning castes, joining up provided definite benefits in their communities.<sup>158</sup> Drunkenness, crime, desertion and the necessity for recourse to corporal punishment and other forms of military discipline, were common amongst the European force but not in native troops, who proved easier to manage, especially when whole companies or regiments were derived from

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<sup>154</sup> Famines at the end of the nineteenth century, together with epidemics of plague, reduced the civilian population of India.

<sup>155</sup> McKeown, *Population*, pp. 152-4; The Irish famine of 1845-49 was an exception to the rule on European food availability. There were famines in Bengal in 1783, 1866, 1873, 1892 and 1897.

<sup>156</sup> Crawford, 'IMS', p. 153.

<sup>157</sup> Gilbert, 'Recruitment', p. 92; Instances are recorded where most of the men sent by ship to join the Company's army in India died during the journey; Details of cost are given in the chapter on Sanitation.

<sup>158</sup> Peers, 'Sepoys, soldiers', pp. 211-47; Gilbert describes that 'crimps' press-ganged recruits, locking them up prior to loading them into boats for the voyage. The British Army took over recruitment on behalf of the Company in 1799 (Gilbert, 'Recruitment', pp. 92-5, 111); D. Omissi, A.-M. Misra, N. Owen, 'Co-option and coercion in India 1857-1947', *Contemporary Record*, 6 (2008), pp. 536-52.

one community.<sup>159</sup> This disparity might explain some of the excess propensity of the European soldier to illness in the first part of the nineteenth century. In this discussion it is proposed to test the hypotheses outlined in the introductory chapter, designed to examine the patterns of disease in the European and native armies in nineteenth century India and how they changed over the ninety years to 1940.

The Company's late eighteenth century European army consisted of men from poor backgrounds and reduced nutritional and developmental status, sometimes procured against their will, and subjected to a lengthy sea voyage, which further may have aggravated dietary deficiencies and weakened immune resistance. They were deposited into a land with an unfamiliar climate and subjected to an array of pathogens to which they had had no prior exposure. In return, the rank-and-file of the European troops showed high rates of sickness and death. For example, the average daily sick rate in 1794 was 175 per mille, with deaths for the year, 58 per mille.<sup>160</sup> The mortality rate for the Company's and the British Army's European forces remained of this order through to the 1850s, even increasing after 1817, when cholera spread out from its endemic base in the Ganges delta. Several historians have considered the contribution of nutritional status to disease in troops in India. Curtin believes the diet of the European soldier, fed twice daily until 1845, after which 'tea' was added following evening parade, was adequate in terms of protein and calories, and mostly for other nutrients too, judging from the relatively low incidence of the vitamin deficiency diseases, beri-beri and scurvy, when in barracks.<sup>161</sup> The British soldier's daily ration in 1840 (which they could supplement), given as two meals, breakfast at 8.00am and dinner at 1.00pm, was: 1 lb (0.45 Kg) bread or  $\frac{3}{4}$  lb (0.34 Kg) biscuit, and 1 lb (0.45 Kg) fresh or salt beef or pork, though in tropical climes, on two days of the week the issue of salt pork was reduced to 12 oz (0.34 Kg), and the

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<sup>159</sup> Omissi, *et al.*, 'Co-option', pp. 536-52; Sepoys had the option of leaving after three years, though few did. Very few native soldiers received corporal punishment. Dishonourable discharge was a much more effective threat, according to Peers, 'Sepoys, soldiers', pp. 211-47.

<sup>160</sup> Gilbert, 'Recruitment', p. 92; Quotes TNA War Office 17/1742 and 1743, East India Army returns for 1794-95.

<sup>161</sup> Curtin, *Migration*, pp. 125-9.

following given in lieu – 0.7 oz (141g) cocoa, 1.3 oz (36g) sugar, and ¼ lb (113g) rice or ½ pint (284 mL) of peas (calorific value: 2330 to 2929 kcal).<sup>162</sup> By 1866, Edmund Parkes (1819-76), professor of military hygiene, made an analytical assessment of the army diet, which now comprised, on Indian service: 16 oz bread, 16 oz vegetables (carrots), 12.8 oz meat, 4 oz rice, 2.5 oz sugar, 1 oz salt, and 1.75 oz coffee or black tea (2735 kcal), with breakfast at 8.30am, dinner at 2.30pm, and with the addition of ‘tea’ after evening parade.<sup>163</sup> This diet continued until the First World War.<sup>164</sup> Parkes makes no comment on the sepoy’s provisions but notes, for a Hindu prisoner in a Bengal gaol, a daily ration of 20 oz rice, 4.25 oz ‘dholl’ (dhal, lentils), 6 oz vegetable (cabbage), 0.33 oz oil, 0.33 oz salt and 0.33 oz spices (1228 kcal).

Sepoys did not receive a food ration unless on active duty. Instead, they had a daily allowance (*batta*) with which to purchase and prepare their own food. This meant that, with a rice-based and frequently vegetarian diet, they could be more susceptible to nutritional deficiencies.<sup>165</sup> For fighting sepoy in 1868, provision was based on: 1.75 lb wheat flour or rice, 8 oz fresh vegetables, 4 oz dhal, 2 oz ghee, 0.7 oz salt (average 2440 kcal).<sup>166</sup> Kaushik Roy records that a high caste Bengal army sepoy ‘consumed about 125g of pulse, 10g ghee, 2.5g salt and about one seer of rice daily’ (2626 kcal).<sup>167</sup> On the barracks diet, the surgeon-general of the native Bombay army observed in 1873 that ‘Many sepoy are admitted to hospital with ailments, the result of insufficient food, or of food of bad quality’, and ‘the sepoy is known to underfeed himself to hoard his money’.<sup>168</sup> The

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<sup>162</sup> Tulloch, ‘Comparison of the sickness’, pp. 1-16; Sailors had a more varied diet, including fresh vegetables; E.A. Parkes, professor of military medicine, reduced the protein content and increased the carbohydrate level in the soldier’s diet in the 1860s — see C.A. Gordon, *Army hygiene* (London: Churchill, 1866), pp. 41-2; Calorific values calculated using United States Department of Agriculture (USDA) figures, assuming uncooked rice.

<sup>163</sup> E.A. Parkes, *A manual of military hygiene*, 2nd edn (London: Churchill, 1866), pp. 150-8, 581; For prisoners, Parkes does not say whether rice was cooked or uncooked – the latter has been assumed.

<sup>164</sup> Guha, *Population*, p. 115.

<sup>165</sup> Arnold, *Colonizing*, pp. 42, 92-3; The sepoy’s fixed allowance was not increased when grain prices rose.

<sup>166</sup> *Minutes of the proceedings of the sanitary commissioner with the government of India during the year 1868* (Calcutta: Office of SGP, 1869), p. 549.

<sup>167</sup> K. Roy, ‘Feeding the Leviathan: supplying the British-Indian army, 1859-1913’, *Journal of the Society for Army Historical Research*, 80 (2002), pp. 144-61. One seer was defined in 1956 as 1.25 Kg. Cooked rice presumed (calculation assuming uncooked – 5626 kcal).

<sup>168</sup> Surgeon General, *Sketch of the medical history of the native army of Bombay for the year 1873* (Bombay: Government Central Press, 1874), pp. 3-4.

principal medical officer, even in 1895, noted that the native soldier had to send much of his earnings back to his family so there was ‘little margin out of his pay to spend on pleasure [such as food]’.<sup>169</sup> Unsurprisingly, scurvy was more common in the native army, especially during times of war. The above dietary calorific values, which do not count the contributions from alcohol, are less than the 3300-3800 kcal currently recommended for an active British male soldier.<sup>170</sup>

The army diet can be compared to the blue water diet of the Royal Navy (1825-50) that daily consisted of: salt beef or pork 340g, wheat flour 340g (alternating with dried peas 220g – mixed vegetables for the harbour diet), biscuit 453g, watery tea 3 cups (711g), brown sugar 42g, lemon juice 9g and cocoa powder 28g, said to yield 4112 kcal.<sup>171</sup> Many issuances were increased from 1856, with a rise in calorific value.<sup>172</sup> Vaughan Dutton hypothesizes that an improved naval diet was responsible for a decline in sailor mortality over the second half of the nineteenth century. Though naval ratings were provided with superior diets compared to army ranks, which might explain some differences in disease occurrence, they were not so able to supplement their fare. However, historians have not favoured diet as a cause of the high mortality in European troops in nineteenth century India, apart from when contaminated food may have resulted in disease.<sup>173</sup> Alcohol consumption was another matter, as discussed in Chapter 5.

Investigation of the height and weight data for the British and Irish recruits which were transferred in the tens of thousands to India after the 1857 mutiny shows that there was a higher than usual acceptance rate – dictated by the needs of the service – and that the anthropometric data suggest reduced nutritional status of some of the incomers. A selection bias thus may have been introduced.

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<sup>169</sup> Ballhatchet. *Race, sex*, p. 88; Quotes – Principal medical officer, *Minute, 20-1-1894, India Military Proceedings*, September 1896, p. 1482.

<sup>170</sup> Scientific Advisory Committee on Nutrition, *Statement on military dietary reference values for energy, December 2016*, <https://assets.publishing.service.gov.uk/> [28 January 2023].

<sup>171</sup> V.M. Dutton, *Mortality decline in the Royal Navy, 1850-1899* (DPhil, University of Oxford, 2009), pp. 172-6; Recalculation using USDA figures, for blue water diet, 3620 kcal.

<sup>172</sup> *Ibid.*, p. 184.

<sup>173</sup> Curtin, *Migration*, pp. 108-9, 129, 153; Guha, *Population*, pp. 115-16; Ramanna. *Western medicine*, p. 146.

The influx of a large number of disease-naïve unacclimatized European troops onto the subcontinent thus, it is argued, had a compounding triple effect that promoted the high rates, observed here, in incidence of, and hence mortalities from, diarrhoea and dysentery, cholera, hepatitis, and fevers seen at the end of the 1850s. The already recognized first-year-of-arrival excess in morbidity and deaths from these conditions<sup>174</sup> may well have been exacerbated by a portion of troops harbouring a degree of immune compromise based on poor childhood nutrition.<sup>175</sup> Additionally, the arrival of the men in unprecedented numbers probably overwhelmed the capacity of the existing medical services to deal effectively with them. A further conclusion from the height data is that by 1870 and beyond, recruits had higher stature, implying better childhood nutrition and less vulnerability to infection, adding another possible reason for the observed reduction in contagious disease rates and mortality. The improvement in literacy by the end of the nineteenth century shows a change in the ‘human capital’ of recruits, supplying a further reason why disease rates might fall.

The 1857 rebellion also introduced bias into selection of native troops. Whereas previously the Bengal native army was recruited largely from high caste Brahmins – those for the Bombay and Madras presidencies had always been more broadly-based – after the uprising recruitment from the martial races of the Punjab, notably the Sikhs, and the Gurkhas of Nepal was favoured for the sepoy force, bringing with it a different childhood experience of disease, with reduced exposure to conditions prevalent in the plains.<sup>176</sup> This is a factor to consider when looking to explain the sepoy army’s rise in deaths from intermittent fever noted in the 1870s and increase in mortality from dysentery later in that decade. For example, patterns of exposure to the malaria mosquito may have

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<sup>174</sup> *Royal commission 1863*, pp. 15-24, 175-8 (Tables 4-12).

<sup>175</sup> According to Robert Fogel, diarrhoeas, tuberculosis, respiratory infections and cholera are susceptible to nutrition and nutritional status, but smallpox, malaria and typhoid only minimally so; R.W. Fogel, ‘Nutrition and the decline in mortality since 1700: some preliminary findings’, in S.L. Engerman, R.E. Gallman, eds., *Long term factors in American economic growth* (Chicago: University of Chicago press, 1986), pp. 439-555, at p. 481.

<sup>176</sup> K. Roy, ‘Race and recruitment in the Indian army’, *Modern Asian Studies*, 47 (2013), pp. 1310-47; G. Rand, K.A. Wagner, ‘Recruiting the ‘martial races’: identities and military service in colonial India’, *Patterns of Prejudice*, 46 (2012), pp. 232-94.

been different in the martial races compared to Bengalis. Malarial exposure may have been low in mountainous areas of Nepal, though possibly present in valleys.<sup>177</sup> In the Punjab, irrigation was started with the completion of the Upper Bari Doab canal in 1859, so malarial exposure around that time might have been less than that in the plains of Bengal. However, it was certainly present later, as Sheila Zurbrigg recounts the report of the malariologist major S.R. Christophers on the 1909 malaria epidemic in the Punjab – so the picture is unclear.<sup>178</sup>

Mortality rates in the mid nineteenth century differed between the three presidency armies and between the native and European troops, with the latter usually having the higher count though less so as the decades progressed. Differences in cause of death were apparent: for example, dysentery and diarrhoea, cholera and fevers generally were more common for the European other ranks in Bengal, which had the highest overall mortality rate, than in the Madras or Bombay presidencies. The distinctions were less prominent or reversed in native soldiery, for whom cholera and intermittent fever were more frequent in Bombay than in Bengal or Madras over the period 1850-78. Martin argued that such observations could be explained by medical topography, in which the influence of climate, elevation, and soil type was used, from the late eighteenth century, as a basis to explain disease through the miasmatic theory.<sup>179</sup> Anachronistically, some aspects of medical topography can be accepted. Climate, altitude and drainage can have an effect on, say, the number and type of malaria-bearing mosquitos or on water contamination by the cholera *vibrio*, and so explain how intermittent fever and cholera could be more prevalent in Bengal than in Bombay. The apparent healthiness of the native army over the European, attributed by Martin to climatic adaption

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<sup>177</sup> K.R. Awasthi, J. Jancey, A.C. Clements, R.K. Sah, M.P. Koirala, B. Chalise, J.E. Leavy, 'Traditional beliefs, practices and migration: a risk to malaria transmission in rural Nepal', *International Journal of Environmental Research and Public Health*, 19 (2022), pp. 16872.

<sup>178</sup> S. Zurbrigg, 'Hunger and epidemic malaria in Punjab, 1868-1940', *Economic and Political Weekly*, 25 (1992), pp. 2-26.

<sup>179</sup> Martin, *Medical topography*, pp. 94-5; Partho Datta describes medical topography as 'a record of degenerative influence of environment on human habitations' — P. Datta, 'Ranald Martin's medical topography', in B. Pati, M. Harrison, eds., *The social history of health and medicine in colonial India* (Delhi: Primus, 2011), pp. 15-30; Datta makes no actual assessment of accuracy or otherwise of Martin's views on topography: her comments are of a sociological nature.

and cultural characteristics, cannot be accepted at face value.<sup>180</sup> Arnold, after highlighting the positive effect of immunity acquired from childhood exposure to some microorganisms, noted that later in the century, Gurkhas, removed from their homeland, had similar rates of enteric fever and venereal disease to the European force, and recommends caution in accepting stated numbers.<sup>181</sup> Differences existed in provision of medical infrastructure – native regiments in the 1830s had only one surgeon when the European had three, and native hospitals were smaller and less well equipped than those for the European soldiers, so there was less facility for admission at that time.<sup>182</sup> Christopher Bayly, writing mostly on the late eighteenth century view, notes that Indian natives regarded European medicine with both suspicion and admiration.<sup>183</sup> Assistant surgeon John Murray (1809-98) observed in 1839: ‘Natives generally have an aversion to entering hospital. Those not obliged to attend ... seldom apply for advice, till their diseases are far advanced; they do not like vaccination; here small pox is a common disease’.<sup>184</sup> In addition, because sepoys were more easily discharged from service if suffering from a chronic pre-mortal disease, their subsequent demise would not show on mortality statistics.<sup>185</sup> Interventional therapeutics was more rarely applied to native soldiers but, with the exception of quinine for malaria, this might have been a blessing.<sup>186</sup> Under-reporting of disease in native troops at the half to three-quarter century mark is likely. Even so, in addition to intermittent fever, some conditions shine through as being more prevalent in sepoys, such as pneumonia, bronchitis, scurvy and scabies. The prominence of respiratory diseases

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<sup>180</sup> J.R. Martin, *Influence of tropical climates in producing the acute endemic diseases of Europeans* (London: Churchill, 1861), pp. 217-18.

<sup>181</sup> Arnold, *Colonizing*, p. 91; *RSCGI*, 1895, pp. 59, 62, 67.

<sup>182</sup> Arnold, *Colonizing*, pp. 92-3; For example, in the 1830s at Meerut, the hospital for 400 European soldiers had 36-42 beds, eight staff including one surgeon and assistant surgeon, that for 1,500 native soldiers had 14 beds, four native doctors and a dresser – J. Murray, *On the topography of Meerutt and the physical diseases which prevailed in the 1st brigade of horse artillery at that place* (Calcutta: Huttman, 1839), pp. 9-10.

<sup>183</sup> C. A. Bayly, *Empire and information: intelligence gathering and social communication in India, 1780-1870* (Cambridge: CUP, 1996), p. 268.

<sup>184</sup> Murray, *Meerutt*, p. 52.

<sup>185</sup> Arnold, *Colonizing*, pp. 93-4; Native troops were less likely to be examined for venereal disease.

<sup>186</sup> Discussed in a later chapter.

and scabies suggest compromise of the native soldier's person by physical overcrowding. Scurvy denotes ascorbate deficiency.<sup>187</sup>

The mortality rate for the European armies in the first half of the nineteenth century, ranging between 31 and 100 per mille strength annually, reduced quite rapidly over the 1850s and early 1860s, from 50 in 1855 then 24 in 1865, down to 17.5 in 1875 then 15 in 1885. The declines were noted to the largest extent in the Bengal presidency less so for Bombay and Madras, suggesting that beneficial modulations such as improvements in sanitation (see below and Chapter 3) were most in play in the former, though applicable throughout British India. Overall mortality in the sepoy force change little over 1850-78 for the presidential armies, perhaps implying a lack of the modifications seen for their European equivalents, or the counter-effect of negative influences, such as increased disease susceptibility. Most of the reduction in European deaths is accountable for by a decline in the incidence of and, to a greater extent, death from dysentery and diarrhoea, from fewer cases of hepatitis, and less frequent epidemics of cholera.<sup>188</sup> These diminutions, to a certain extent, parallel improvements in the sanitary state of European barracks from the late-1850s (Chapter 3). Dr John Sutherland (1808-91), one of the sanitary commissioners reporting in 1863, noted 'the present condition of the water-supply is one of the cardinal defects in the sanitary arrangements of India, and that it is unquestionably a predisposing cause of disease, especially during the prevailing seasons of cholera, fever, dysentery, and other zymotic diseases'.<sup>189</sup> Mortalities declined from cholera in both armies and from dysentery in the European, emphasising Curtin's point that the outstanding improvement occurred in water-borne diseases.<sup>190</sup> It seems likely that most cases

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<sup>187</sup> Other causes of respiratory disease will be considered, e.g. smoking and air pollution in huts. Native soldiers were also subject to parasitic intestinal infestations such as hookworm and to the cutaneous infestation, guinea worm – *RSCGI, 1895*, pp. 75-85.

<sup>188</sup> Dysentery was more fatal than diarrhoea. Dysentery seems to have been differentiated from diarrhoea on the basis of whether or not there was blood in the stools — Curtin, *Migration*, p. 147; Murray's *Meerutt*, and Martin's *Influence* do not discuss diagnostic criteria though they go into treatment. Presumably they thought these diagnoses self-evident.

<sup>189</sup> *Royal commission 1863*, p. 94.

<sup>190</sup> Curtin, *Migration*, p. 37; The mortality rate for cholera fell from 13.5 per mille in 1855-59 to 3.4 in 1875-78 for European troops in Bengal; the native rate was 2.5 in 1860-64, 1.8 in 1875-78. Decline in admissions and deaths from hepatitis, for European rank-and-file, as native soldiers were little affected, was a slower process.

diagnosed as hepatitis were observed to follow amoebic dysentery, were characterized by right upper quadrant symptoms or signs, and, anachronistically, appear to represent amoebic hepatitis or abscess.<sup>191</sup> A statistical connection between dysentery and liver disease in the Madras army was recognized by assistant surgeon W.R. Cornish (1828-96) in 1861, and between dysentery and hepatic abscess at Bombay's European General Hospital, by assistant surgeon W.J. Moore (1828-96), in 1862 – giving rise to the sub-term 'hepatic dysentery'.<sup>192</sup>

The fall of diarrhoeal diseases saw a surge in the enteric fevers, specifically typhoid and paratyphoid, which became the single most important cause of death in European soldiers from the 1880s to the 1900s.<sup>193</sup> Sepoys were much less affected, protected – it is proposed – by the prior gaining of immunity.<sup>194</sup> Like cholera and dysentery, *Salmonella* infections are spread by the faeco-oral route, so it is a conundrum why enteric fever increased exponentially in the last quarter of the nineteenth century when the other diseases did not. At Lucknow, where 'pure municipal water' had been introduced the previous year, in 1894 the medical officer stated: 'it is disheartening to find enteric fever amongst the troops almost as rife as ever. Within the regimental lines there is no insanitary influence which should cause the disease'.<sup>195</sup> He found 'no common cause for the disease.' His verdict was that enteric fever, along with venereal disease, was acquired in the native bazaar. Guha opines that the continued presence of *Salmonella* in the confines of barracks could still be explained by faeco-oral transmission.<sup>196</sup> Dr H.E. Armstrong (1848-1937), in 1894, questioned whether the dry earth system for soil disposal was responsible, based on the observation that the 'water closet' system in Newcastle-on-Tyne showed a 0.3 percent prevalence of *Salmonella* retention whilst that for the 'pail-closet' was double.<sup>197</sup> The other contender is a role for the house

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<sup>191</sup> B.H. Kean, 'Amebic hepatitis', *AMA Archives of Internal Medicine*, 96 (1955), pp. 667-73.

<sup>192</sup> W.R. Cornish, 'Remarks on treatment of acute tropical dysentery by large doses of ipecacuanha', *Madras Quarterly Journal of Medical Science*, 2 (1861), pp. 41-52; W.J. Moore, 'The relation of dysentery to abscess of the liver', *Transactions of the Medical and Physical Society of Bombay*, VIII New series (1862), pp. 292-6.

<sup>193</sup> Due to *Salmonella enterica* species. Enteric fevers were much less prevalent in the native army.

<sup>194</sup> Native troops were thought to have acquired immunity from childhood exposure.

<sup>195</sup> *RSCGI*, 1894, p. 31.

<sup>196</sup> Guha, *Population*, pp. 125-6; Arnold in *Colonizing*, pp. 87-90, on enteric fevers, offers no explanation.

<sup>197</sup> AMD, *Report for 1894*, Vol. 36 (London: Harrison, 1896), p. 313.

fly in contaminating food with the typhoid bacillus, proven by the 1900s through a number of studies, and the finding that 1 to 3 percent of people can be chronic carriers and excretors of the bacterium.<sup>198</sup> Measures were put in place to limit predation of flies on food from the 1900s.<sup>199</sup> A steep fall in rates of and deaths from enteric fever followed, though this was also near contemporaneous with introduction of a vaccine.<sup>200</sup> By 1909, a half of European troops in India had been vaccinated against typhoid; by 1913, this was 93 percent, along with most native food handlers and cooks.<sup>201</sup> Both these measures probably contributed to the decline of typhoid.

Heat apoplexy, the inability of the body to control its temperature after exposure to excessive heat, was one of the few numerically significant non-infective disorders to affect soldiers in the nineteenth century, preferentially afflicting European troops. It was often fatal and continued to be among the ten commonest causes of death in every decade from the 1860s to the 1930s. Little change in admission rate for heat apoplexy was seen during this period except for spikes during the 1857 rebellion and First World War. Historiography is minimal on heat apoplexy. Curtin regards it as rare though recognizes the high fatality rate, whereas Arnold, who focusses on infections, does not discuss it.<sup>202</sup> It was well recognized by surgeons in India though. In Bombay, Mr. A. Stewart (dates unknown) noted in the Royal Commissioners' 1863 report, 'cases of death from heat-apoplexy, a very fatal disease in the north-west, and not unlikely to be favoured by imperfect ventilation, [is] far from being uncommon'.<sup>203</sup> Inspector-General Duncan Macpherson (1812-67) found, at Poonamallee, 'the disease is now more amenable to treatment, partly because it is better understood and partly because the soldier has more space allotted to him in barracks'.<sup>204</sup> Heat

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<sup>198</sup> L.O. Howard, *House fly, disease carrier* (New York: Stokes, 1911), pp. 100-37 – *Salmonella enterica typhimurium* was found to persist in excreta in the dry earth system for up to a week; Curtin, *Migration*, p. 153.

<sup>199</sup> Curtin, *Migration*, pp. 114, 153.

<sup>200</sup> W.B. Leishman, 'Progress of anti-typhoid inoculation in the army', *Journal of the Royal Army Medical Corps*, 8 (1907), pp. 463-71.

<sup>201</sup> Curtin, *Migration*, p. 154 – quotes AMD, *Annual reports, 1909*, pp. 75-7; and *1913*, pp. 40-1.

<sup>202</sup> Curtin, *Migration*, pp. 78, 154, 156; Arnold, *Colonizing*, pp. 76-7 – heat apoplexy is listed in tables but not discussed.

<sup>203</sup> *Royal commission on the sanitary state of the army in India. Report of the commissioners*, 2 vols. (London: Eyre and Spottiswoode, 1863), vol. 1, Minutes of evidence, p. 57.

<sup>204</sup> *Ibid.*, pp. 627, 632.

apoplexy was commonest in May or June, especially in hotter locations such as Dinapore, Cawnpore, Muttra and Lucknow.<sup>205</sup> Case fatality for European soldiers in the 1850s approached 50 percent. Heat apoplexy is unique in that, from 1850 to the 1930s, case fatality shows a linear improvement such that mortality in 1932 was 5 percent.

Whereas European troops were laid low predominantly by gastro-intestinal infections in the nineteenth century, their native counterparts suffered preferentially from respiratory diseases, especially from 1870 to 1904, and in 1914 to 1930, with pneumonia the biggest cause of death between 1870 and 1929. The susceptibility of sepoy to respiratory disease has gone under-recognized by previous historiography, though Arnold notes higher death rates from pneumonia during the 1890 and 1918-19 influenza epidemics.<sup>206</sup> Curtin cites an actual health benefit for European troops translocated from Europe to India, and also to the West Indies, during the nineteenth century, for respiratory disease in general, and pulmonary tuberculosis in particular.<sup>207</sup> Rates of pneumonia in the native force were more than double those in the European army from 1870 to 1930. Mortality from pulmonary tuberculosis in European soldiers showed a progressive fall over the second half of the nineteenth century, whilst initially lower rate of deaths in native troops crossed over to then constantly exceed the European level, with a spike during and after the First World War.<sup>208</sup> Native soldiers generally slept out of doors in the early 1860s, but when confined to their huts by rainy weather, they could be subject to poor ventilation.<sup>209</sup> In addition, the 1863 commissioners' report supplies evidence of smoking or eating of opium, ganja or bhang (cannabis) and tobacco by the native forces and population.<sup>210</sup> At Masulipatam, amongst the 12th regiment, Madras native infantry, Dr J.A. Horak (dates unknown) cited opium as a cause 'not only

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<sup>205</sup> *Ibid.*, pp. 380-1.

<sup>206</sup> Arnold, *Colonizing*, p. 93; Susceptibility to respiratory disease is not mentioned by Guha, *Population*, nor by Curtin, *Migration*, both of whom cover other infectious diseases thoroughly.

<sup>207</sup> Curtin, *Migration*, pp. 101-2, 143-5.

<sup>208</sup> Case fatality was usually higher in the sepoy for both pneumonia and bronchitis and for pulmonary tuberculosis.

<sup>209</sup> *Royal commission 1863*, pp. 153-5.

<sup>210</sup> *Royal commission Volume I*, pp. 5, 291; The commanding officer, engineer and medical officer at each station were sent a proforma to be completed. Question 7 under 'diseases' enquired about 'any personal habits among the troops or among the native population which appear to predispose to these diseases'.

of premature decay of vital powers, but of the development of diseases among the natives'.<sup>211</sup> Amongst the native infantry at Berhampore, Dr G.H. Alexander (dates unknown) observed, 'extensive use of bang and opium, ultimately leading to a debilitated state of health ... and overcrowding of huts where there are large families rendering the atmosphere impure, tend to predispose to disease'.<sup>212</sup> It was not just the native troops that took drugs, Europeans did too. Commenting on European troops at Colombo, Ceylon, Dr E.F. Kelaart (1819-60) wrote, 'the number of confirmed drunkards is about 5 per cent. Of confirmed opium eaters the average is 20 per cent'.<sup>213</sup> Answering questions from the commissioners, Dr William Farr (1807-83) commented on Sikh soldiers, 'a great many of them eat opium and bang, which is Indian hemp; but very few of them drink'.<sup>214</sup> Hence, in native soldiery, the high rate of respiratory disease may have been contributed to by overcrowding and smoking, though the latter was also a pastime of European forces.

Intermittent fevers and hence malaria represent another group of diseases or conditions that was both commoner and more fatal in native troops.<sup>215</sup> This applies for virtually the whole period from 1850 to 1938 (Figures 2.28 and 2.29). In the 1860s and 1870s the difference in mortality was several-fold. Joseph Ewart (1831-1906), surgeon to the Bengal Medical Service, in 1859 had multiple explanations.<sup>216</sup> He noted that 'the surgeon of a European regiment has a much better hospital for his sick, and an infinitely better subordinate establishment than his brother officer attached to a Native regiment'. He went on to say that 'the natives ... are notoriously unprotected by proper clothing, &c, from atmospheric vicissitudes', and that they 'do not solicit admission until their disease has made almost irreparable havoc upon their constitutions'. In the second half of the

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<sup>211</sup> *Ibid.*, p. 396.

<sup>212</sup> *Ibid.*, p. 494.

<sup>213</sup> *Ibid.*, p. 926.

<sup>214</sup> *Ibid.*, p. 337.

<sup>215</sup> Prior to the independent classification of malaria from 1908, 'intermittent fevers' contained more than just malaria. It is used as a general indicator with this proviso.

<sup>216</sup> Ewart, *Vital statistics*, pp. 82-5; Arnold credits Ewart with initiating reforms in Indian military hospitals in the 1850s, before the royal commission reported in 1863 – *Colonizing*, p. 71.

nineteenth century, the role of the medical officer in a native hospital was purely one of diagnosis and prescription of drugs.<sup>217</sup> Other aspects such as care and nutrition were left to the native patient's family and comrades. Hence the sepoy's predisposition to malaria appears due to poor nutritional state and exposed accommodation, whilst his higher mortality seems to be a consequence of late presentation and deficient hospital care, perhaps with reduced access to quinine or a disinclination to take it – factors that seem to reverse by the 1890s.

Scurvy and scabies are easily recognizable disorders, generally non-fatal, that are markers for dietetic deficiency and poor social conditions. Scurvy signifies a lack of vitamin C. Scabies – an infestation caused by a mite burrowing into skin and inciting an itchy inflammatory reaction – indicates close inter-personal contact and confinement, a lack of changed bed linen, shared sleeping facilities, and poverty of bathing amenities. Both scurvy and scabies were more common in the sepoy army. The admission rate for scurvy peaked in 1880 at nearly 10 per mille, but also showed a small upturn in the First World War when food supplies were less reliable.<sup>218</sup> Scabies had a 7 percent incidence rate for the native army in 1917, remaining a major problem during the whole of the First World War and for four years after. Scabies has avoided much comment from historians, despite being rampant during major conflicts. The disparity in prevalence of scabies between the native and European armies during the First World War points to radical differences in housing and amenity. Scurvy, on the other hand, once seen as an archetypal disease of 'putrefaction' due to the apparent rotting of the gums, has received plentiful historiographic attention, especially in the Navy.<sup>219</sup> The general suitability in the mid-to-late nineteenth century of the European soldier's diet in India, and the *batta* arrangement that predisposed the sepoy to scurvy and other nutritional

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<sup>217</sup> For a detailed summary of the native army hospital system, see – S. Sehrawat, 'Prejudices clung to by the natives: ethnicity in the Indian army and hospitals for sepoys, 1870-1890', in Pati, Harrison, *Social history*, pp. 151-72.

<sup>218</sup> Such as during the Mesopotamian campaign, see – N. Gardner, 'Sepoys and the siege of Kut-al-Amara, 1915-16', *War in History*, 11 (2004), pp. 307-26.

<sup>219</sup> P. Chakrabarti, *Medicine and empire, 1600-1960* (Basingstoke: Palgrave, 2014), pp. 43-6.

deficiencies, have been noted.<sup>220</sup> Arnold found scurvy particularly prevalent in prisoners – this was ameliorated by introduction of vegetables, peas and wheat flour to the gaol diet in the 1850s.<sup>221</sup>

Prisoners make an appropriate comparator for soldiers in a similar locale, as they are a population under fixed conditions yet subject to medical attention. Other comparative groups include army officers, women and children of the army, and military forces in other locations or times. Prisoners, predictably, had a higher overall mortality rate than every other group except for, right up to 1937, children of the army. Health statistics collected in the nineteenth century on the Indian civilian population are unreliable, as discussed, but prisoners, despite their abject conditions, did have the benefit of medical attention and were well recorded. Prisoners were particularly susceptible to diarrhoea and dysentery, cholera – when it was epidemic, fevers such as typhus, and respiratory diseases in general, especially tuberculosis.<sup>222</sup> Arnold identifies overcrowding, poor sanitation not improved until later in the century, and malnourishment to explain prisoners' disease susceptibilities.<sup>223</sup> Officers of the army lived in conditions almost the opposite of this. They inhabited airy bungalows, had acceptable sanitation, more leave, and good diets – altogether better circumstances than the other ranks.<sup>224</sup> Ewart describes, for the Bengal army probably in 1853-54, comparative all cause mortalities per mille strength of 21.1 for officers, compared to 55.8 for other ranks, and 11.2 for sepoys.<sup>225</sup> The 1863 commissioners' report notes that 'the number of sick officers in India and on leave of absence from ill health is considerable, but it is not returned'.<sup>226</sup> Instead the commissioners relied on historic figures from the EICo for 1814-33, in which the overall mortality rate per mille for officers was 38, compared to 69 for the rank-and-file. Later

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<sup>220</sup> Curtin, *Migration*, pp. 126-9; Guha, *Population*, pp. 115-16.

<sup>221</sup> Arnold, *Colonizing*, pp. 30, 110-11; A.H. Leith, 'A contribution to dietetics', *Transactions of the Medical and Physical Society of Bombay* New Series, 1 (1851-52), pp. 114-27; Dr Leith, a medical officer with the Company's Bombay army, recognized the problem of scurvy among prisoners in the Bombay Island gaol and solved it by altering their diet.

<sup>222</sup> Typhus caused 14 percent of all deaths in prisoners in Bengal gaols over 1859-63, but was subsequently controlled.

<sup>223</sup> Arnold, *Colonizing*, pp. 102-7.

<sup>224</sup> Ewart, *Vital statistics*, p. 153; *Royal commission 1863*, p. 35.

<sup>225</sup> Ewart, *Vital statistics*, pp. 2-3; 1853-54 is the assumed date based on other figures on pp. 41 and 153, though the actual date is not stated.

<sup>226</sup> *Royal commission 1863*, pp. 35-6; 'Not returned' means the information was not returned.

figures, contrary to these views, do not show such a discrepancy. Indeed, once records start to be kept in the 1870s, mortality rates in officers are similar to those for the European or native soldiery, in some years exceeding them, and are consistently greater after 1919. Hence, whilst officers' better accommodation may have protected their health in the first half of the nineteenth century, it did not do so at least after the 1870s, perhaps due to sanitation in the barracks being brought up to standard. Officers slightly higher early twentieth century mortality – compared to other ranks – may be explained by a greater predisposition to typhoid, their eating habits being less well-regulated than enlisted men.<sup>227</sup> Women of the army show higher mortality than officers or the rank-and-file, with a different mortality profile, specifically childbirth, malaria and pulmonary tuberculosis. The highest death rate of all was in children under the age of 15 years, mostly due to an infant mortality rate – a proxy for the quality of public health sanitation – that was greatly in excess of that in Britain, but which came down steadily at an exponential rate. The collection of statistics on Indian civilian mortality began in the 1870s, around the time of the first proper census. Initial estimates of disease incidence were too low, and official counts soon were recorded as exceeding those for native troops and other groups.<sup>228</sup> Up to the end of the nineteenth century there seems to have been a genuine increase in civilian rates of malaria and water-borne disorders, related to disruption of drainage systems by new methods of agriculture and railway construction.<sup>229</sup> Troops were generally isolated from this diseased milieu.

The net effect of the withering loss of soldiers due to death from disease, invaliding, battle casualties, desertion, and other losses such as buying out or transfer, is the need for constant replenishment. In the mid nineteenth century, projected loss was 48 percent at five years, 61 percent at ten years. This diminished from the mid-century on, but the need to increase European troop numbers after the 1857 rebellion, the awakened public realization on soldiers' mortality, and the

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<sup>227</sup> Curtin, *Migration*, pp. 99, 222; Officers could demand repatriation in case of illness, so had a higher invaliding rate.

<sup>228</sup> Curtin, in *Migration*, p. 158, noted the civilian excess, as did Arnold, *Colonizing*, p. 75, who felt the army enjoyed an isolated privileged state.

<sup>229</sup> Harrison, *Public health*, p. 227; Poor nutrition probably contributed as well.

financial implications of the transfer of authority from the EICo to the Crown, acted as an impetus, described by Arnold as a ‘crisis of military health’, to establishing the commission into the sanitary state of the army in India.<sup>230</sup> This commission drew on the Crimean experiences, with input from Nightingale and her sanitary movement collaborators. Many recommendations in the 1863 commissioners’ report, such as more ventilation in barracks, improved disposal of human waste, better recreational facilities, shorter durations of service, and a cleaner water supply, were implemented by the government in India (Chapter 3). Most but not all were aimed at European troops, and it can be seen in retrospect that implemented was partial, due to technical limitations of the day. Pathogen-free water, in particular, was not achieved until the final two decades of the century. Disease incidence and mortality rates fell in the 1860s, though this reduction started in the 1850s, a time when, on the initiative of the administration in India, some sanitary reforms had already been instituted, as recorded by Ewart.<sup>231</sup>

The discussion so far has focussed on armies in India which were, mostly, not on a war footing. Apart from the 1857 rebellion, a few local wars and some overseas conflicts to which regiments were lent, the armies in India during the second half of the nineteenth century were mostly barrack-based, though rotated a certain amount, for example, to hill stations. War brings not only casualties from battle, but a set of living conditions quite unlike life in barracks or on the native lines. The Crimean War, 1854-56, and the American Civil War, 1861-65, briefly have been mentioned as examples of what happened to disease when an army at this time went into the field. A surge resulted in the already lingering diseases, especially of the infective diarrhoeal kind, with a set of additional morale-sapping problems such as nutritional deficiencies and scabies.

Mortality and incidence are not the only statistics that shed light on the health of a defined population. Case fatality – the proportion of deaths per admission – yields an extra dimension. It is

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<sup>230</sup> Arnold, *Colonizing*, p. 67.

<sup>231</sup> Ewart, *Vital statistics*, pp. 1-18.

a proxy for factors of a person-specific nature that kick in once someone has a condition. These include previously acquired immunity, nutritional status, condition from other debilities, supportiveness of the nursing environment and effectiveness of medical intervention, such as drug therapy.<sup>232</sup> The situation for the armies in British India is nuanced. European troops in the second half of the nineteenth century had worse case fatality rates than did their native counterparts for cholera, dysentery and, initially, typhoid, but better rates for pulmonary tuberculosis, malaria and, for the demi-century around 1900, pneumonia. For dysentery and, initially, typhoid, previously acquired immunity may account for the better survival rate of sepoys, though later this did not seem to apply for typhoid, perhaps because of inferior nursing conditions, differences in immunization policy, or, since it was less frequent in native soldiers, because cases that did occur were more severe.<sup>233</sup> Pneumonia was more common in the native soldiery and so was malaria, whilst pulmonary tuberculosis became more prevalent in the twentieth century. The excess case fatality for malaria among sepoys was unlikely to be due to unavailability of quinine, and more probably related to later presentation, reduced nutritional status, and poorer hospital and nursing facilities – the latter also pertaining, with living conditions, for excesses in pneumonia and pulmonary tuberculosis – discussed further in the final chapter.<sup>234</sup> Most case fatality rates had near harmonized by 1935.

### ***Conclusions***

The initially higher rates of illness and death from several diseases in the European troops were substantially turned around during the third quarter of the nineteenth century, with a few exceptions, such that case fatality rates often became worse for the sepoy army. Some of the disease peaks seen in the late 1850s seem to be related to an influx of disease-naïve troops with a suggestion of an impaired childhood nutritional background (and thus of relatively compromised

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<sup>232</sup> Weighting of these factors will vary depending on the situation and disease: for example, a highly effective drug might work even in a debilitated patient nursed in poor conditions.

<sup>233</sup> According to Guha, inoculations against typhoid were introduced to troops in India in 1905, with the TAB vaccine being commenced in 1911 – *Population*, p. 128.

<sup>234</sup> Sehrawat, 'Prejudices', pp. 151-72.

immunity to some disorders) who had the expected first year surge in several conditions, and who arrived in such large numbers that medical care facilities may have been overwhelmed. Recruitment height data suggest that by 1870 and beyond, recruits had had better childhood nutrition and hence might be less vulnerability to infection, adding another possible reason for the observed reduction in contagious disease rates and mortality – background mortality rates for this age groups were also falling in Britain at this stage. Any initial benefit to the native soldier from previously acquired immunity, for example, in diarrhoea and dysentery, later in the century was often counteracted by factors such as inferior accommodation infrastructure, suspect nutritional status, and the poorer quality, organization and support inherent in their hospital accommodation. These deficiencies are difficult to enumerate but appear to have been corrected by the 1930s. A change, at least for the larger Bengal presidency army, from favouring high caste Brahmins to recruitment from the more rural martial races of the Punjab and from the Gurkhas, could possibly have reduced inherent immunity to some plains diseases (inferior childhood nutrition is additionally a possibility), thus affecting the incidence of these in the native force over the second half of the nineteenth century, though firm pointers are lacking. The better health of the native troops over their European confreres in the first three quarters of the nineteenth century appears to have been exaggerated by quirks of statistical collection, such as the possibility of missing deaths that occurred during furlough or through early discharge of sick sepoys. The full extent, for example, by which the practice of discharging seriously ill sepoys before they died whilst on the army payroll, is hard to demonstrate. It is likely that British recruits post-1857 imported the background diseases from which they suffered in the U.K., noticeably pulmonary tuberculosis – which they may well have transferred to the naïve sepoy force – and also, most likely via carriers, typhoid – which they transmitted to their European confreres, and whose spread was promoted by favourable local conditions. The control of typhoid, scourge of European troops in the final quarter of the nineteenth century, occurred in two phases. Around the turn of the century, through control of fly-borne food contamination, and in the late 1900s, with a contribution from immunization – though the degree of

protection provided at this time was modest.<sup>235</sup> Chronological comparison for several disorders from 1850 to 1940 demonstrates improvement in case fatality rates for both armies in India, and hints at successful medical or nursing intervention (Chapter 4). For pneumonia and pulmonary tuberculosis, improvements were seen in the pre-antibiotic era and without the benefit of immunization. This chapter demonstrates the need to take a broad view when looking at disease, especially the benefit of taking social circumstance into account, and supports the probity of questioning the accuracy of published figures.

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<sup>235</sup> The importance of flies as a vector of *Salmonella* generally has been ignored by historians; Of immunized recruits during the Boer War in 1899, 9.7 percent contracted typhoid of which 11.5 percent died, compared to, for the non-immunized, an infection rate of 15.5 percent and a fatality of 14.3 percent – hence immunization protected against contracting typhoid by about a third, with around a quarter protection from dying from it. By the First World War, the typhoid vaccine was much more effective. See – R. Biselli, R. Nisini, F. Lista, *et al.*, ‘A historical review of military medical strategies for fighting infectious diseases: from battlefield to global health’, *Biomedicines*, 10 (2022), 2050. Doi: 10.3390/biomedicines10082050.

### Chapter 3: Sanitary infrastructure

This chapter tests the hypothesis that improvements in sanitation were responsible for the decline in infectious disease amongst the European forces of India after *c.* 1850. Evidence of fulfilment of infrastructure projects including barrack accommodation, washing and toileting facilities, sewage disposal, cookhouses, and provision of clean water, will be examined using financial and other records. The contribution of sanitarians to implementation of these improvements, and whether these were counterproductive to disease control, will be examined. The historiography is briefly summarized. Guha, Arnold and Curtin assert that improved sanitary measures were responsible for reductions in incidence and death among European troops in India over the mid portion of the nineteenth century.<sup>1</sup> Harrison sees upgraded barrack accommodation as the initial instigator, but considers that better water supply and sewerage management took over after the 1870s.<sup>2</sup> The impact of sanitary reform in barracks on McKeown's theories will be critiqued.<sup>3</sup>

Sanitation is described by the World Health Organization, as 'provision of facilities and services for safe management of human excreta from toilet to containment and storage'.<sup>4</sup> The term 'sanitary' is more broadly defined by the Oxford English Dictionary (OED) as 'Of or pertaining to conditions affecting health, especially with reference to cleanliness and precautions against infection and other deleterious influences; pertaining to or concerned with sanitation'.<sup>5</sup> Neither definition mentions provision of clean water, though the latter implies it. Writing in the twenty-first century with over one hundred years of inculcation into the germ theory of infectious disease, it is easy to understand why efficient removal of excreta and provision of clean water are important for prevention of cholera, typhoid or dysentery, transferred as they are via tainted water or the faeco-oral route

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<sup>1</sup> Guha. *Population*, p. 132; Curtin, *Migration*, p. 61; Arnold, *Colonizing*, p. 114.

<sup>2</sup> Harrison, *Public health*, pp. 66, 76.

<sup>3</sup> T. McKeown, *The role of medicine: dream, mirage or nemesis?* (Oxford: Blackwell, 1979).

<sup>4</sup> WHO, 'Sanitation', Health topics, <https://www.who.int/topics/sanitation/en/> [27 July 2019].

<sup>5</sup> OED, 'sanitary (*adj.*)', (Oxford, OUP, 2019), <https://ezproxy-prd.bodleian.ox.ac.uk:10465/view/Entry/170705?redirectedFrom=sanitary> [5 November 2019]

whereby contaminated hands (or flies) convey pathogens to food. Modern definitions of sanitation do not encapsulate the views of mid nineteenth century sanitarians who, through miasmatic theory, understood disease to be spread by bad air arising from decaying organic 'filth' – including rotting vegetation, animal carcasses and human excreta – coupled with dampness or marshiness of the soil and exacerbated by climatic conditions such as the wet weather of the monsoon.<sup>6</sup> The theory divides insanitary factors into the 'exciting' – bad air, organic matter or climatic conditions, and the 'predisposing' – poor housing, inadequate diet or clothing and fatigue.

### ***Quarantine, the EICo, and cholera***

Quarantine – from the Italian *quaranta giorni* (forty days) – was first employed during the 1347-52 epidemic of bubonic plague by the Italian city states, and is a hall mark of contagionist views.<sup>7</sup> It was used by the Royal Navy in the late eighteenth century to control typhus on board ship, borne out of practical experience rather than reasoned theory, and also by civilian boards of health, for example, when cholera broke out in towns adjacent to military cantonments, as in 1832 at South Devon and, in 1848-49 across Britain.<sup>8</sup> Quarantine was pertinent to the major issue of yellow fever, rampant in the Caribbean and Africa, though not in India, as well as plague and some other conditions. In the late eighteenth to early nineteenth century, the Privy Council imposed quarantine against supposed yellow fever in ships and their cargos, usually from the Caribbean and North America (but also from the Mediterranean), sometimes employing 'lazarettos' (quarantine stations).<sup>9</sup> The use or otherwise of quarantine illustrates interplay between contagionists and anti-contagionists. Maritime quarantine continued to be generally imposed for fever onboard ship until the case of HMS Eclair in 1844-45. This, coupled with an accumulating swell of anti-contagionist

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<sup>6</sup> Arnold, *Colonizing*, p.74.

<sup>7</sup> E. Tognotti, 'Lessons from the history of quarantine, from plague to influenza A', *Emerging Infectious Diseases*, 19 (2012), pp. 254-9.

<sup>8</sup> G. Blane, 'On the comparative health of the British Navy, from the year 1779 to the year 1814, with proposals for its farther improvement', in, *Select dissertations on several subjects of medical science* (London: Underwood, 1822), pp. 1-64; D. McLean, *Public health and politics in the age of reform: cholera, the state and the Royal Navy in Victorian Britain* (London: Tauris, 2006), pp. 66-73.

<sup>9</sup> J. Booker, *Maritime quarantine: the British experience, c.1650-1900* (Abingdon: Routledge, 2007), pp. 255-65.

political opinion, forced a slackening of restrictions. After months of anti-slavery duties off the coast of Sierra Leone, multiple cases of fatal fever on board HMS Eclair forced her return to Britain, via Boa Vista on Cape Verde – where she introduced an epidemic.<sup>10</sup> However, strict imposition of quarantine regulations off the southern English coast resulted in considerable loss of life on HMS Eclair, producing such strong professional and public condemnation that quarantine regulations were subsequently relaxed, though still applicable in Britain (not in the West Indies) for yellow fever.<sup>11</sup> This brought conflict with Mediterranean powers, as well as setting off further debate about the infectivity or otherwise of yellow fever and other pestilences. Alexander Bryson (1802-69), for example, who became surgeon inspector-general at the Royal Navy in 1855, was initially a sanitarian, and thus anti-contagionist, but he was to change his mind.<sup>12</sup> Outbreaks of yellow fever in European ports such as Lisbon in 1857, Saint Nazaire in 1861 and Swansea in 1865, traceable to infected ships, convinced Bryson to support contagionism and uphold quarantine.<sup>13</sup> The squabble amongst professional men raged on in the 1850s and 1860s. Outbreaks of cholera on Royal Navy ships in the Black Sea in the 1850s were investigated by the director-general of naval medical services, Sir William Burnett (1779-1861), who concluded that transmission was by air, and that quarantine was inappropriate.<sup>14</sup> An outbreak of yellow fever on Bermuda in 1864 was viewed, by Dr William Campbell MacLean (1811-98), deputy inspector-general of army hospitals and professor of military medicine at the army medical school at Netley, as being due to poor sanitation, whereas colonel William Harmley (1815-93) of the royal engineers on the island was in the contagionist camp.<sup>15</sup>

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<sup>10</sup> J.O. McWilliam, *Report on yellow fever at Boa Vista by Dr. McWilliam* (London: Harrison, 1847); McWilliam in fact concluded that the fever on Boa Vista was the common remittent type of the African coast.

<sup>11</sup> M. Harrison, *Contagion: how commerce has spread disease* (New Haven: Yale, 2008), pp. 80-106.

<sup>12</sup> A. Bryson, *An account of the origin, spread, and decline of the epidemic fevers of Sierra Leone* (London: Henry Renshaw, 1849), pp. 140-1; OED, 'sanitary (adj.)', (Oxford, OUP, 2019), <https://ezproxy-prd.bodleian.ox.ac.uk:10465/view/Entry/170705?redirectedFrom=sanitary> [5 November 2019].

<sup>13</sup> *Statistical report of the health of the Royal Navy for the year 1860* (London: Clowes, 1863), p. iv.

<sup>14</sup> G.T. Bettany, C.E.J. Herrick, 'Burnett, Sir William (1779-1861)', *ODNB*, online (Oxford: OUP, 2012), <https://doi.org/10.1093/ref:odnb/4077> [8 October 2019].

<sup>15</sup> W.C. Maclean, 'On the epidemic of yellow fever in Bermuda in 1864', *Lancet*, 86 (1865), pp. 667-9.

The use of quarantine or *cordons sanitaire* in India during the nineteenth century was accepted as a means of controlling plague though initially not cholera (*vide infra*). Indeed, quarantine was employed in 1802 by the EICo when a detachment of troops returned from Egypt with plague, and for other such outbreaks in the first four decades of that century.<sup>16</sup> The 1817-21 epidemics of cholera initially were viewed by the Company more in terms of a natural disaster, like a famine, and a product of the climate and topography of India, than a public health issue to be addressed, as was plague.<sup>17</sup> Contrary to prevailing views in India, many medical authorities in Britain saw quarantine and isolation as valid for cholera. Dr Reginald Orton (1810-62), who had worked in India prior to the 1830s cholera epidemics, encountered the disease in London during the same decade. Although previously an upholder of climatic theory for cholera, he became a contagionist, claiming proof of person-to-person transmission and, with others including the Royal College of Physicians of London, recommended quarantine.<sup>18</sup> The EICo sought the opinion of Sir Gilbert Blane (1747-1834), a former naval surgeon.<sup>19</sup> He saw firm evidence for the contagion theory of cholera in its spread on the frigate *Topaz* from Ceylon to Reunion and Mauritius. Extension from Reunion was prevented by a *cordon sanitaire* but the disease disseminated on Mauritius where no cordon was used. This led Blane to recommend quarantine as a means to control cholera. However, there were several dissenting voices, some of which objected on an economic basis.<sup>20</sup>

The selective approach taken by the EICo to cholera and like diseases in the first half of the nineteenth century contrasted with coercive public health measures, aimed at prevention, adopted by authorities in Europe for epidemics at the time.<sup>21</sup> Reasons behind the Company's attitude include

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<sup>16</sup> Harrison, *Constitutions*, pp. 192-8; M. Zeheter, *Epidemics, empire and environments: cholera in Madras and Quebec City* (Pittsburgh: University of Pittsburgh, 2015), p. 33.

<sup>17</sup> M. Harrison, 'A dreadful scourge; cholera in early 19th-century India', *Modern Asian Studies*, 54 (2020), pp. 502-53.

<sup>18</sup> R. Orton, 'Observations on the malignant cholera in England', *Lancet*, 19 (1832), pp. 42-5; J. Kennedy, *The history of the contagious cholera* (London: Cochrane, 1831), pp. 241-6; M. Harrison, *Medicine in an age of commerce and empire: Britain and its tropical colonies, 1660-1830* (Oxford: OUP, 2010), pp. 254-86.

<sup>19</sup> Sir Gilbert Blane to the Court of Directors, 16 January 1825, *Observations on cholera communicated by Sir Gilbert Blane to the Court of Directors*, BL, F/4/767, APAC – quoted by Harrison, 'Scourge', p. 42-3.

<sup>20</sup> P. Baldwin, *Contagion and the State in Europe 1830-1930* (Cambridge: CUP, 1999), pp. 123-9.

<sup>21</sup> Harrison, 'Scourge', pp. 1, 48-52.

lack of a centralized infrastructure for collecting and acting on statistical information, absence of rapid communication over long distances – only achieved when the telegraph became operative later in the century – and the Company’s desire to bind itself to the native community through supporting religious rituals.<sup>22</sup> Attitudes in the few urbanized areas such as Calcutta were more in keeping with prevailing European concepts. Control of cholera and other epidemic diseases was of relevance to British armies, due to the proximity of barracks to native civilian habitations, and sometimes the sharing of water supplies. The association of disease with poor sanitation, especially ‘filth’, became accepted dogma with the government of India. It represented a repositioning from a conservative approach towards one based on supposed scientific logic and the hegemony of then held European views over Indian beliefs, as exemplified in Martin’s 1837 *Medical topography*.<sup>23</sup>

The second epidemic of cholera in Britain in 1848-49 ultimately encouraged the government to pass the Public Health Act of 1848. This established a General Board of Health and enabled incorporated boroughs to assume control of drainage, water supply, removal of nuisances and paving.<sup>24</sup> Prior to this, precursor views that would develop into the sanitary movement had already started to take shape in the economic concerns of the Poor Law commissioners who, in 1838, proposed a link between poverty, long-term male sickness that was a burden on the state, and premature death. Drs Thomas Southwood Smith (1788-1861), James Kay-Shuttleworth (1804-77) and Neil Arnott (1788-1874) were tasked with investigating this in some London districts.<sup>25</sup> Edwin Chadwick (1800-90), who had been secretary to the Poor Law commissioners, took the matter further. In 1842 he published his report, *The sanitary condition of the labouring population of Great Britain*. In this he argued that public health in towns could be improved by provision of sewers and drainage, removal

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<sup>22</sup> Harrison, ‘Scourge’, pp. 18, 21, 50.

<sup>23</sup> Martin, *Topography*, pp. 46-7.

<sup>24</sup> Parliament UK, *The 1848 Public Health Act*, <https://www.parliament.uk/about/living-heritage/transformingsociety/towncountry/towns/tyne-and-wear-case-study/about-the-group/public-administration/the-1848-public-health-act/> [28 July 2019].

<sup>25</sup> Poor Law Commission, *Fourth annual report; Sessional papers of the House of Lords, Reports from the commissioners* Vol. XLV (London: Clowes, 1838), pp. 88-96.

of refuse from houses, streets and roads, provision of clean drinking water and appointment of a medical officer.<sup>26</sup> Chadwick was appointed, in 1848, to the General Board of Health, which he chaired, although Dr John Sutherland wrote the cholera report. Sutherland was dismissive of contagion theory and placed the cause of the epidemic firmly on local conditions of overcrowding, poor hygiene, and inadequate ventilation.<sup>27</sup> When at the Poor Law commission, Chadwick had overseen the appointment of Dr William Farr (1807-83) as statistician to the General Register Office in 1839. The two subsequently disagreed on theories of disease. Farr believed that starvation was a great cause of disease and criticized the Poor Law commissioners on this point.<sup>28</sup> Chadwick was a leader on sanitary reform, and an adherent to miasmatic theory.<sup>29</sup> Medical opinion at this time was still divided. A superintendent inspector of the General Board of Health during cholera epidemics, former Royal Navy surgeon Gavin Milroy (1805-86), in 1846 condemned contagionism and railed against quarantine in *Quarantine and the plague*.<sup>30</sup> However, Thomas Stratton (dates unknown), another Royal Navy surgeon, on investigating cholera outbreaks at Chatham, Rochester and Strood dockyards in 1849, noted cholera ‘to some extent communicable by infection’.<sup>31</sup>

### ***Anticontagionism, miasmatic theory and the sanitary movement***

Interest in sanitation as applied to disease and social conditions surged in the 1830s.<sup>32</sup> Quantitative data, presented as fact, became a useful tool for the burgeoning social reform movement. It influenced debate, wider than confines of medical circles, on causation of disease and of epidemic disorders in particular. Advocates of the sanitary movement had identified ‘filth’ as the cause and vehicle of disease, and embraced concepts of cleanliness, which to them went hand-in-hand with

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<sup>26</sup> Poor Law Commission, *Report on an inquiry into the sanitary condition of the labouring population of Great Britain* (London: Clowes, 1842) – Chadwick was the lead author.

<sup>27</sup> *Report of the general board of health on the epidemic cholera of 1848 and 1849* (London: Clowes, 1850).

<sup>28</sup> C. Hamlin, *Public health and social justice in the age of Chadwick* (Cambridge: CUP, 1998), pp. 131, 144-5, 185

<sup>29</sup> Hamlin, *Chadwick*, pp. 4-13, 94.

<sup>30</sup> M. Harrison, ‘Milroy, Gavin (1805-1886)’, *ODNB* online (Oxford, OUP, 2004), <https://ezproxy-prd.bodleian.ox.ac.uk:4563/10.1093/ref:odnb/18797> [8 October 2019]; G. Milroy, *Quarantine and the plague: being a summary of the report on these subjects* (London: Highly, 1846).

<sup>31</sup> T. Stratton, *History of the epidemic of cholera in Chatham, Rochester, and Strood, in 1849* (Edinburgh: Black, 1851), pp. 31-2.

<sup>32</sup> J.M. Eyler, *Victorian social medicine: the ideas and methods of William Farr* (Baltimore: Johns Hopkins, 1979).

moral rectitude and piety.<sup>33</sup> For the main protagonist – the lawyer Edwin Chadwick – Christopher Hamlin argues that public health was simply a matter of sanitary engineering – provision of a clean water supply, sewers and the removal of ‘filth’.<sup>34</sup> Chadwick was supported by the miasmatic adherent Neil Arnott (1788-1876) – he had been a medical officer with the EICo and in the 1840s studied typhus epidemics in Glasgow and Edinburgh.<sup>35</sup> Chadwick and Arnott denied the association of poverty with diseases such as fevers, as was championed by their antagonists, principally William Pulteney Alison (1790-1859), physician to the New Town Dispensary in Edinburgh, and also James Copland (1791-1870) of London’s College of Physicians.<sup>36</sup> The central space in public health had been captured by the sanitary movement, which was confirmedly anticontagionist. Erwin Ackerknecht relates that ‘contagion and the contagium animated [were] rather old theories around 1800’,<sup>37</sup> though concepts of miasma can be found in early eighteenth-century writing.<sup>38</sup> Margaret Pelling and Elspeth Heaman claim that decline of the contagionists has been overemphasized, and it is true that absolute anticontagionism was held by no-one, as all accepted a limited number of diseases – syphilis, smallpox, measles and ‘the itch’ (scabies) – to be contagious.<sup>39</sup> Yet many authorities continued to argue that ‘the big three’ – plague, yellow fever and cholera, plus typhus, the four comprising the main health risks of the time – were explicable by other means, principally miasmatic, and they challenged quarantine, which mostly assumed contagion.<sup>40</sup> Some

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<sup>33</sup> C.E.A. Winslow, *The evolution and significance of the modern public health campaign* (New Haven: Yale, 1923), pp. 12-27; Chadwick’s 1842 *Report* was the movement’s seminal publication.

<sup>34</sup> C. Hamlin, *Public health and social justice in the age of Chadwick* (Cambridge: CUP, 1998), pp. 15, 155, 244.

<sup>35</sup> Hamlin, *Chadwick*, pp. 110-11.

<sup>36</sup> Hamlin, *Chadwick*, pp. 56, 66, 110, 134.

<sup>37</sup> E.H. Ackerknecht, ‘Anticontagionism between 1821 and 1867’, *International Journal of Epidemiology*, 38 (2009), pp. 7-21.

<sup>38</sup> Miasmatic ideas are found in the 1717 report of Giovanni Lancisi *De noxious palladium effluvis*, an epidemiological study of what was most likely malaria and, before that, inferred by the ‘particles of air’ from ‘the various ferments or putrefaction of humours,’ proposed in the 1660s by Sydenham – Z. Klaassen, J. Chen, V. Dixit, *et al.*, ‘Giovanni Maria Lancisi (1654-1720): anatomist and papal physician’, *Clinical Anatomy*, 24 (2011), pp. 802-6; T. Sydenham, *The whole works of that excellent practical physician, Dr. Thomas Sydenham*, 9th edn, tr. J. Pechey (London: Darby, 1729), pp. 1, 58; Sydenham based his views on practical observations rather than the theoretical, and is thus regarded as an ‘empiricist’ – empiricism being defined as ‘A mode of philosophical reasoning which holds that the only reliable source of knowledge is experience’, a product of the Enlightenment thinkers – I. Buchanan, *A dictionary of critical theory*, online (Oxford, OUP, 2010) <https://www.oxfordreference.com/page/crittheory> [9 January 2021].

<sup>39</sup> W.H. Welch, *Public health in theory and practice* (New Haven: Yale, 1925), p.27; Pelling, *Cholera*; E.A. Heaman, ‘The rise and fall of anticontagionism in France’, *Canadian Bulletin of the History of Medicine*, 12 (1995), pp. 3-25.

<sup>40</sup> Ackerknecht, ‘Anticontagionism’, p. 9; The OED defines contagion as ‘communication of disease from body to body by contact direct or mediate’: *OED Online*, (Oxford: OUP, 2020), [www.oed.com/view/Entry/40032](http://www.oed.com/view/Entry/40032) [20 September 2020].

anticontagonists – the contingent ones – accepted that contagious transmission could occur under certain circumstances. The anticipatory concept of microscopic transmissible germs was first formulated as *contagium animatum* in the sixteenth century, mostly by Girolamo Fracastoro (c.1476-1553) in Padua.<sup>41</sup> The theory received support during the seventeenth and eighteenth centuries, and was examined, *vis-à-vis* quarantine laws, in 1819, by a select committee, appointed to consider the validity of the doctrine of contagion in the plague. Appointees concluded: ‘Plague is a disease communicable by contact only, and different in that respect from Epidemic fever’.<sup>42</sup> They noted: ‘It appears from some of the Evidence, that extension and virulence of disease is considerably modified by atmospheric influence’. In this manner they introduced a climatic element, substantially through the evidence of Charles Maclean (c.1766-1825), a leading contagion dissenter along with Thomas Southwood Smith, who propagated the concept that epidemic diseases such as plague, typhus and cholera were derived from ‘a certain condition of the air ... exhalations arising from putrefaction of dead animals and vegetable matter’.<sup>43</sup> One reason why doctors and others at that time had difficulty accepting contagionism was that, as Ackerknecht puts it: ‘Contagion, before germ theory, was visualized as direct passage of some chemical or physical influence from a sick person to a susceptible victim by contact or fomites or, for a relatively short distance, through the atmosphere’.<sup>44</sup> This did not fit the bill for the sporadic nature of epidemics, nor for the lack of direct transmissibility for the three most worrisome killers. The idea of contagion only made sense once the concept of long-range transmission through vectors such as water and food, or by insect or animal carriers, was (later) elaborated. Numerous negative self-inoculation experiments seemed to support anticontagonist views.<sup>45</sup>

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<sup>41</sup> Ackerknecht, ‘Anticontagonism’, pp. 7-21.

<sup>42</sup> *Report from the select committee appointed to consider the validity of the doctrine of contagion in the plague* (London: House of Commons, 1819), p. 3.

<sup>43</sup> *Ibid.*, pp. 3, 14: Maclean practiced in Calcutta for several years in the late eighteenth century; Editorial (T. Southwood Smith), ‘Contagion and the sanitary laws’, *Westminster Review*, 3 (1825), pp. 134-66; M. Brown, ‘From foetid air to filth: the cultural transformation of British epidemiological thought, c.1780-1848’, *Bulletin of the History of Medicine*, 82 (2008), pp. 515-44.

<sup>44</sup> Ackerknecht, ‘Anticontagonism’, p. 8,

<sup>45</sup> *Ibid.*

As William Henry (1774-1836), a physician to Manchester Royal Infirmary, observed, certain recognized contagious diseases were seen to affect an individual only once.<sup>46</sup> Anticontagionists had found the features of epidemic diseases – that they could attack someone repeatedly, had variable symptoms, presented over a wide front, showed seasonality, exhibited little propensity to transmit in hospitals, ceased suddenly and were associated with certain geographic locales – difficult to explain based on their view of contagion.<sup>47</sup> Hence, the anticontagionist argument was essentially a negative one. It was contagionists who had a positive theorem, even if it did not seem to fit exactly at the time. A major weakness of the anticontagionists' argument was that they permitted exceptions for conditions that they *did* recognize as contagious.<sup>48</sup> The contingent contagionists such as James Johnson (1777-1845), Gavin Milroy and Edmund Parkes – all of whom had had experience in India – were an influential centralist voice, aware of the inconstancies and similarities of the polar viewpoints.<sup>49</sup> For example, Parkes, in 1849, accepted that smallpox, scarlet fever and, in some instances, yellow fever, were contagious but he could not do the same for cholera.<sup>50</sup> Parkes' conception of contagion mostly involved the discharge of a poison from skin or lungs into the air, both requiring close physical proximity, though he does mention the possibility of: 'particles thrown out ... with excreta from urinary or intestinal surfaces'.<sup>51</sup> An editorial in the January 1849 edition of the *Monthly Journal of Medical Science* attempted to weigh up evidence from reports on cholera epidemics in Madras, Kurrachee (Karachi) and Edinburgh.<sup>52</sup> The authors accepted that typhus was contagious but, like Parkes, could not do the same for cholera: 'The difficulties in the

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<sup>46</sup> W. Henry, 'Report on the state of our knowledge of the laws of contagion,' *Report of the fourth meeting of the British Association for the Advancement of Science*, 4 (1835), pp. 67-94; Henry's 'laws of contagion', regarded several diseases, some of them epidemic, as contagious, but kept 'marsh miasmas' as the explanation for endemic afflictions. He listed 'siphylis, measles, smallpox, cowpox, hooping cough, scarlatina, and a few others' as 'SPECIFIC CONTAGIONS, or SPECIFIC INFECTIONS [sic]'.  
<sup>47</sup> Southwood Smith, 'Contagion', pp. 160-1.  
<sup>48</sup> C. Maclean, *Evils of quarantine laws and non-existence of pestilential contagion* (London: Underwood, 1824), p. 136.  
<sup>49</sup> Ackerknecht, 'Anticontagionism', p. 9.  
<sup>50</sup> E.A. Parkes, 'An enquiry into the bearing of the earliest cases of cholera, which occurred in London during the present epidemic, on the strict theory of contagion', *British and Foreign Medical Churgical Review*, 4 (1849), pp. 251-76.  
<sup>51</sup> Parkes, 'Enquiry, cholera', pp. 269-70.  
<sup>52</sup> Editorial, 'Reports on Asiatic cholera in regiments of the Madras army from 1828 to 1844, with introductory remarks on its diffusion and prevention, and a summary of general methods of treatment in India', *Monthly Journal of Medical Science*, 3 (1849), pp. 469-85.

way of believing in diffusion of cholera over so wide a territory by means of human effluvia ... have at all times been a great barrier to the belief in its contagious properties *under any circumstances*.<sup>53</sup> Observations, reasoned by contagionists as proving their case, were swept away by their antagonists.<sup>53</sup>

The conversion or reversion of majority opinion to contagion theory was through a slow multi-faceted process and the building of a body of evidence, at the heart of which was the use of statistics. From the 1840s, this substantiation involved the issue of quarantine related to Mediterranean shipping, better evaluation of data from epidemics, and the seminal observations of Dr William Budd (1811-80) in Bristol and Dr John Snow (1813-58) in London.<sup>54</sup> To counteract the importation of plague from Alexandria, ships sailing out of that port to England or France were subject to quarantine, in the 1830s, of twenty days.<sup>55</sup> The reduction to fourteen days for ships on the English route, in 1841, to begin on the day of departure (to recommence if a passenger died suspiciously), presented a commercial quandary for French shipping sailing to Marseilles. The French *Académie Nationale de Médecine*, examining the matter in 1845, concluded that plague had an incubation period of eight days, supporting transmissibility of the disease.<sup>56</sup>

Budd and Snow's work supported the contagionists and germ theory. During the 1849 cholera epidemic, Budd reported seeing microscopic 'organisms' in water from cholera districts, while his colleagues Drs Swayne and Brittan, found the same in 'rice-water' stools of sufferers – they also are said to have found them in the 'atmosphere' from infected locales.<sup>57</sup> However, Snow is the best known protagonist for contagion theory, because of the scientific nature of his proof.<sup>58</sup> He mapped

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<sup>53</sup> Editorial, 'Asiatic cholera', pp. 473-4.

<sup>54</sup> Ackerknecht, 'Anticontagionism', p. 14.

<sup>55</sup> Heaman, 'Anticontagionism', p. 16.

<sup>56</sup> *Ibid.*, pp. 17-18; Heaman quotes R.C. Prus, 'Rapport de la peste et des quarantaines', *Bulletin de l'Académie royale de Médecine*, 11 (1845-46), pp. 545-870.

<sup>57</sup> J.G. Swayne, 'Discovery of living organisms in the rice water evacuations of cholera', *London Journal of Medicine*, X (1849), p. 987.

<sup>58</sup> S.J. Snow, 'Snow, John (1813-1858)', *ODNB* online (Oxford, OUP 2004), <https://doi.org/10.1093/ref.odnb/25979> [8 October 2019].

deaths from cholera in Soho during the third (1854) cholera epidemic in the capital, and discovered that they clustered around a water pump in Broad Street.<sup>59</sup> This early example of epidemiology was sufficient evidence for the local council to disable the pump. Snow's publication helped move medical opinion towards accepting cholera as a water-borne contagion, though it took until the late 1860s for this to be agreed in European circles, still later in India. The 1851 edition, for example, of the *Madras Journal of Medical Science*, a publication by and for members of the Medical Subordinate Department of the Madras presidency – hence reflecting views of practical workers<sup>60</sup> – includes an article by W. Baker (dates unknown) who dismisses Snow's theory, seeing water as no more than a 'predisposing agent', and opining that 'the choleraic virus exists in the atmosphere, and is produced by an altered molecular relation of its ultimate or accidental components, induced by electrical or chemical affinity'.<sup>61</sup> Indeed the concept that cholera was due to 'altered electric condition of the atmosphere' persisted in India into the mid-1860s, with authors going to great length to justify this theory in the face of opposing views, which are described thus: 'It scarcely needs mention that Cholera, according to current opinion, is due to blood-poisoning'.<sup>62</sup> Parkes – a member of the commission on the sanitary state of the army in the Crimea and author of a public health textbook – who had observed cholera in India, from being an early critic of Snow later changed his mind and accept transmission through water contaminated by bowel evacuations of infected subjects.<sup>63</sup> Farr's report on the 1866 cholera outbreak also promoted Snow's views. Previously a critic, Farr like some other anti-contagionists altered his stance and came to accept the transmission theory of cholera – this effectively marked the turning point leading towards general acceptance of germ theory.<sup>64</sup>

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<sup>59</sup> J. Snow, *On the mode of communication of cholera*, 2nd edn (London: Churchill, 1849).

<sup>60</sup> Subordinates were assistant surgeons or apothecaries, often Indian natives, and members of the IMS.

<sup>61</sup> W. Baker, 'Cholera', *Madras Journal of Medical Science*, 1 (1851), pp. 260-8, 326-33.

<sup>62</sup> W. Wilkins, 'Thoughts on the etiology of cholera', *Madras Quarterly Journal of Medical Science*, 10 (1866), pp. 321-38.

<sup>63</sup> Parkes, *Practical hygiene*; B. Bergman, 'Commentary: Edmund Alexander Parkes, John Snow and the miasma controversy', *International Journal of Epidemiology*, 42 (2013), pp. 1562-5.

<sup>64</sup> W. Farr, *Report on the cholera epidemic of 1866 in England* (London: Eyre and Spottiswoode, 1868).

### *Cunningham, Nightingale and the commission*

In India, though, senior medical opinion remained firmly in the sanitarian camp. Sir Joseph Ewart of the Bengal Medical Service in a contemporary report, emphasized that, ‘production of malaria is connected with, or dependent upon, decomposing vegetable matter conjoined with the influence of high temperature and the presence of limited quantities of moisture’.<sup>65</sup> Miasmatic diseases came under Class I, Zymotic Diseases, in the nosology of the day, inferring some form of fermentation.<sup>66</sup> The miasmatic theory made sense at the time. It explained, for example, the periodicity of fevers we know now to be malarial relative to the monsoon. Surgeon-general James MacNabb Cunningham (1829-1905), the first sanitary commissioner and a sceptic about human-to-human passage, and James Bryden, statistical officer to the government of India from 1866, who theorized airborne transmission of cholera, held sway, at least in official circles, in India until about 1870, some time after most European opinion had been convinced otherwise.<sup>67</sup> Bryden believed that cholera only became epidemic under humid environmental conditions related to the onset of the monsoon, when the cholera organism was transmitted from endemic areas by air currents.<sup>68</sup> He saw conditions that permitted this in India as being very different from those in Europe. Bryden’s theory provided a rationale for the government of India to oppose calls for quarantine against Indian shipping in 1866. Eventually, though, the government of India realized Bryden’s opinion was at variance with the

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<sup>65</sup> Ewart, *Vital statistics*, pp. 48-50.

<sup>66</sup> Curtin, *Migration*, pp. 12-13. The disease classification used by the British Army 1859-68, with examples, was as follows:

I: Zymotic

Miasmatic	smallpox, malaria, typhoid, typhus, cholera
Enthetic	venereal diseases
Dietic	scurvy, effects of alcohol
Parasitic	guinea worm

II: Constitutional

Diathetic	lumbago, anaemia, tumours
Tubercular	pulmonary tuberculosis, scrofuloderma

III: Local

Nervous, circulatory, respiratory, digestive, urinary, reproductive, locomotor, skin

IV: Accidents or violent deaths

Accidents, in action, punishments

<sup>67</sup> L. Rogers, ‘The conditions influencing the incidence and spread of cholera in India’, *Proceedings of the Royal Society of Medicine*, 19 (1926), pp. 59-93 at pp. 64-5.

<sup>68</sup> M. Harrison, ‘Bryden, James Lumsdaine (1833-1880)’, *ODNB* online (Oxford: OUP, 2004), <https://doi.org/10.1093/ref.odnb/57376> [6 October 2019]; Bryden’s view was similar to the ‘cholera cloud’ theory, see – P.B. Mukharji, ‘The “cholera cloud” in the nineteenth-century British world: history of an object without an essence’, *Bulletin of the History of Medicine*, 86 (2012), pp. 303-32.

majority views outside of India. On recognizing their position was untenable, they sought advice elsewhere.

Florence Nightingale was another who had a major influence on the sanitary movement. In the British army of the Crimea, 1854-56, cholera and dysentery accounting for 5 and 25 percent of admissions and a quarter and a fifth of all deaths, respectively.<sup>69</sup> Critical reporting of the appalling conditions in this war by William Howard Russell of *The Times* outraged the British public. Nightingale's observations on military hospital organization and her remarkable ability to co-opt government ministers led to reforms.<sup>70</sup> Her collaboration with Sidney Herbert brought about and shaped the constituency of the 1857-58 commission into the sanitary conditions of the army, the organization of military hospitals, and treatment of the sick and wounded.<sup>71</sup> Subsequently her attention turned to armies in India. She influenced appointments to the 1859-63 commission into army health in India, contributed significantly to the report, promulgated its conclusions, and commented on the sanitary state of India in general.<sup>72</sup> Nightingale saw sanitary reform in India as a civilizing mission. In a letter dated 26 September 1864 to Sir John Lawrence, viceroy of India, she said: 'Health is a product of civilization ... you are conquering India anew by civilization, taking possession of the empire for the first time by knowledge instead of by the sword'.<sup>73</sup> Despite being an early proponent of statistics, well into the third quarter of the nineteenth century Nightingale continued to advance the sanitarian cause and, in particular, to rail against quarantine.<sup>74</sup>

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<sup>69</sup> W. Hanbury, T.P. Matthew, 'Medical and surgical history of the British army which served in Turkey and the Crimea during the war against Russia in the years 1854-55-56', Two vols, vol. 1, *Military, medical history of individual corps, 19th Century House of Commons Sessional Papers*, XXXVIII Pt, p.I.1, XXXVIII Pt.II.1 (1857-58), pp. 840-1.

<sup>70</sup> F. Nightingale, *Notes on hospitals*, 3rd edn (London: Longman, 1863).

<sup>71</sup> Vallée, McDonald, *Nightingale*, pp. 11-12.

<sup>72</sup> Vallée, McDonald, *Nightingale*, pp. 4-17; F. Nightingale, *Notes on matters affecting the health, efficiency and hospital administration of the British army founded chiefly on the experience of the later war* (London: Harrison, 1858), pp. 565-7.

<sup>73</sup> F. Nightingale, 'Letter to Sir John Lawrence', Florence Nightingale museum typed copy, Mss 45777 ff49-55, in Vallée, McDonald, *Nightingale*, p. 212.

<sup>74</sup> F. Nightingale, 'Life and death in India, 1873', in Vallée, McDonald, *Nightingale*, p. 722.

Though Nightingale never visited India, she was well informed and her opinion was sought by governors-general Ripon, Dufferin and Lansdowne.<sup>75</sup> She regarded ‘talk about class prejudice’ as ‘an excuse for European laziness’ when it came to sanitary reform of the country.<sup>76</sup> Nightingale was initially willing to attribute unhealthy living conditions in Indian villages to ‘filthy and injurious habits’ but she came to regard the issue as representing government inaction and the tendency of officials to justify inactivity on the basis of cost and apathy of native civilians.<sup>77</sup> However, as Jharna Gourlay points out, Nightingale’s main contribution was not to the health of rural or municipal India, but to debate about sanitary conditions of the armies, even though many of her suggestions were not implemented.<sup>78</sup>

The Bengal sanitary commission, set up to look into provision of nursing in military hospitals in 1864, by the viceroy, Sir John Lawrence (1811-79), was advised by Nightingale, who recommended introduction of female nurses to all large hospitals in India, including those of the army.<sup>79</sup> Hitherto, untrained male coolies provided certain aspects of care, including procedures such as dressings and poultices, supported or replaced in military hospitals by unskilled soldiers who volunteered for the duty.<sup>80</sup> Nurses had already started work in Allahabad General Hospital in 1858 and, at the initiative of Lady Charlotte Canning (1817-61), the Calcutta Hospital Nurses Institution had been set up, and employed 27 women nurses at the city’s General and Medical College Hospitals, in 1864.<sup>81</sup> Eurasian, native Indian (mostly Christian) and European women were being trained as midwives at Madras Lying-in Hospital from 1854 – a measure, Seán Lang explains, that was subsequently rolled out by the other presidencies, in the hope that they would supplant the

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<sup>75</sup> Vallée, McDonald, *Nightingale*, p. 27.

<sup>76</sup> J. Gourlay, *Florence Nightingale and the health of the Raj* (Aldershot: Ashgate, 2003), p. 37.

<sup>77</sup> *Ibid.*, p. 102.

<sup>78</sup> *Ibid.*, pp. 254, 257.

<sup>79</sup> A. Dhar, ‘Florence Nightingale and nursing in colonial India’, *Vidyasagar University Journal of History*, VI (2017-18), pp. 96-104; Vallée, McDonald, *Nightingale*, pp. 939-81.

<sup>80</sup> S. Sanyal, ‘Emergence of nursing as a profession in nineteenth-century Bengal’, *Social Scientist*, 45 (2017), pp. 69-86.

<sup>81</sup> Gourlay, *Nightingale*, p. 66.

activities of traditional birth attendants (*dais*).<sup>82</sup> Difficulties in finding Indian females to train as nurses, Aparajita Dhar suggests, were related to educated upper and middle class Indian women being unavailable through *purdah* – their working class sisters having neither sufficient education nor the means to attain it.<sup>83</sup> Nursing was seen by many, including the vernacular press, as an unsuitable profession, principally, according to Madelaine Healey, due to the menial work, low pay and, even post-independence, ‘inaction of the state’.<sup>84</sup> Lawrence shelved the idea of a general roll-out, and introduction of female nurses to European military hospitals of India was delayed until 1887-88, after which it accelerated, though implementation to native army hospitals had to wait until the 1914-18 conflict.<sup>85</sup> Prejudice of Indian women against training for the profession had lessened by the First World War, through the activities of Lady Dufferin’s National Association for Supplying Medical Aid to Women of India (1885), another scheme operated by Indian philanthropists in Bombay (1891), and Lady Minto’s Indian Nursing Association (1906).<sup>86</sup> The Dufferin Fund aimed to promote education for European and, subsequently, predominantly Indian, women doctors, nurses and midwives, as well as female-led treatment for women (and children) in hospitals, dispensaries and private houses.<sup>87</sup> Maneesha Lal points out that one of the Fund’s enlightened features was a willingness to work within the parameters of *purdah*, and that it served as a conduit for a more humanitarian style of colonial rule, notably by successive vicereines.<sup>88</sup> Sarah Hodges reports that the services of female doctors of the Dufferin Fund were readily taken up

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<sup>82</sup> S. Lang, ‘Drop the demon *dai*: maternal mortality and the state in colonial Madras, 1840-1875’, *Social History of Medicine*, 18 (2005), pp. 357-78.

<sup>83</sup> Gourlay, *Nightingale*, p. 68.

<sup>84</sup> M. Healey, *Indian sisters: a history of nursing and the state, 1907-2007*, (New Delhi: Routledge, 2014), pp. 50, 245; Many locally trained nurses were ‘Eurasians’ of mixed ethnicity, or from the Indian Christian community, some of whom trained in medical missions (Sanyal, ‘Emergence’, p. 79).

<sup>85</sup> Dhar, ‘Nightingale’, p. 101; Sanyal, ‘Emergence’, p. 71.

<sup>86</sup> Dhar, ‘Nightingale’, p. 102; Sanyal, ‘Emergence’, p. 80; Lady Dufferin – Harriot Hamilton-Temple-Blackwood (1843-1936) was vicereine of India 1884-88.

<sup>87</sup> M. Lal, ‘The politics of gender and medicine in colonial India: Countess of Dufferin’s Fund, 1885-1888’, *Bulletin of the History of Medicine*, 68 (1994), pp. 29-66; The Fund was non-sectarian, and avoided employing missionaries. It was though undoubtedly political – aiming to inculcate western values into Indian lives – see S. Lang. ‘Colonial compassion and political calculation’, in P. Bala, ed., *Contesting colonial authority: medicine and indigenous responses in nineteenth- and twentieth-century India* (Lanham: Lexington, 2012), pp. 81-96.

<sup>88</sup> Lal, ‘Dufferin’, pp. 41-2, 59-61.

and improved access to maternity services.<sup>89</sup> From 1914, a separate organization, the Women's Medical Services, also advanced the issue of women's health in India.<sup>90</sup> Around the same time, a cadre of British female social reformers, of whom Eleanor Rathbone (1872-1946), an English MP, and Margaret Cousins (1878-1954) – who established the All India Women's Conference in 1926 – are the best known, also met with success in promoting medical facilities to Indian women.<sup>91</sup> Purdah, Lal argues, may have masked other reasons for ill health in women, such as overcrowding or malnourishment – the practice began to be relaxed from the 1920s.<sup>92</sup>

Nightingale's concerns about India, and those of the British public at large, were brought to a head by the 1857 rebellion. News of supposed atrocities focussed attention on the precarious health and vulnerability of the soldiery in the developing milieu of popular imperialism and Christian militarism (*vide* Chapter 1).<sup>93</sup> The increased need for European troops and the assumption of governmental control post-revolt brought financial accounting to the fore. The cost to replenish European soldiery dying at a rate of 2 to 5 percent or more annually in the 1850s was substantial and recruitment was difficult, with each soldier costing £100 at the time to place.<sup>94</sup> The mortality and constantly sick rates meant that one twelfth of the annual cost of the army was wasted on 'ineffectives'. Hence there were economic as well as humanitarian reasons for a royal commission to examine the situation. Disease and climate were seen as having hampered the ability of the European army to resist the mutiny.<sup>95</sup> After the rebellion, attention honed in on defensibility of cantonments, more use of supposedly healthier hill stations, and a desire to recruit 'martial races' –

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<sup>89</sup> S. Hodges, 'Towards a history of reproduction in modern India', in S. Hodges, ed., *Reproductive health in India* (Hyderabad: Orient Longman, 2006), pp. 6-7.

<sup>90</sup> D. Arnold, 'Official attitudes to population, birth control and reproductive health in India, 1921-1946', in Hodges, *Reproductive*, pp. 36, 40.

<sup>91</sup> B.N. Ramusack, 'Missionaries, maternal imperialists, feminist allies: British women activists in India, 1865-1945', *Women's Studies International Forum*, 13 (1990), pp. 309-21.

<sup>92</sup> M. Lal, 'Purdah as pathology', in Hodges, *Reproductive*, pp. 87-91.

<sup>93</sup> Arnold, *Colonizing*, p. 67; Guha, *Population*, p. 117; Harrison, *Climates*, pp. 147-9.

<sup>94</sup> *Royal commission 1863*, pp. 32-5; R. Hyam, *Empire and sexuality. The British experience* (Manchester: Manchester University, 1990), p. 122.

<sup>95</sup> Harrison, *Constitutions*, pp. 147-8.

principally from the Punjab and northern India – seen as loyal to the British during the uprising.<sup>96</sup> The mutiny engendered in the British a feeling of alienation, made constructive relationships with Indian leaders more difficult, and introduced the idea that Indians were not capable of absorbing western values.<sup>97</sup> The institution of sanitary reform was thus indirectly and in part, a product of the 1857 rebellion.

Edward Stanley (1826-93), Earl of Derby and secretary of state for India, set up the royal commission into the sanitary state of the army in India in 1859. Its broad remit included enquiry into the rates and causes of sickness and mortality of troops in India, the healthiness of existing stations and potential alternatives, construction of troop accommodations, enforcement of health regulations through policing, organization of sanitary and medical services, and the method of collection of statistics on disease and mortality, and their use for comparative purposes.<sup>98</sup> The commissioners took evidence from a wide range of witnesses and produced their report in 1863. They found that the largest proportion of mortality arose ‘from endemic diseases, and notably from fevers, diarrhoea, dysentery, cholera and from diseases of the liver’.<sup>99</sup> The predominant manner in which the commissioners understood infectious disease was through miasmatic theory.<sup>100</sup> This led them to look at the problem by focussing on topography, particularly dampness and drainage of subsoil, the presence of decomposing organic matter, and bad air. The conclusions they arrived at can be seen, anachronistically, as skewed: right in part but often for what we now regard as the ‘wrong’ reasons. The story of disease theory in the latter part of the nineteenth century in India, and how germ theory ultimately played a part in disease control, is told in Chapter 4.

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<sup>96</sup> H. Streets, *Martial races: the military, race and masculinity in British imperial culture, 1857-1914* (Manchester: Manchester University, 2004).

<sup>97</sup> Harrison, *Public health*, pp. 32-4; E.M. Collingham identifies the revolt as the turning point at which British openness to Indian influence, which peaked in the early nineteenth century though with subsequent gradual decline, irrevocably reversed – prestige thenceforth was exhibited through social relations including the emergence of racial concepts and a regimented lifestyle, more centralization of power and, for example, bodily adornment by ceremonial uniforms – *Imperial bodies: the physical experience of the raj, c. 1800-1947* (Cambridge: Polity Press, 2001).

<sup>98</sup> *Royal commission 1863*.

<sup>99</sup> *Ibid.*, pp. 160-1.

<sup>100</sup> *Ibid.*, pp. 56-65.

### *Military sanitary facilities before 1863*

The commissioners reported in 1863 that European barracks in India were generally built on a model plan at or near ground level, but varied in detail as to length and number to be accommodated.<sup>101</sup> Most were single storey huts constructed of burnt brick walls and tiled roofs with floors of stone, brick, tile or cow dung.<sup>102</sup> Doors were on opposite sides of the building, protected by a veranda, with beds positioned alongside walls. The length of the building varied (Figure 3.1).

**Fig. 3.1. Two-storey barracks at Hooghly in 1851 – many were single storey** (photographic print, hand coloured. BL Frederick Fiebig Collection).



The longest lower room was 1,483 feet, at Fort St George, Madras, built to accommodate 400 men, having a width of 18 feet and a height of 15.5 feet. This gave 1,000 cubic feet of air space and 64-69 square feet of ‘superficial’ (i.e. floor) space per occupant. On sepoy accommodation, Dr Mouat told commissioners: ‘... native troops usually hut themselves, being averse to barracks from caste

<sup>101</sup> *Royal commission 1863*, pp. 97-104.

<sup>102</sup> *Engineer’s report for the year 1846-47* (Bombay: Bombay Education Society, 1848), p. 2.

prejudice and loss of privacy ... The huts are constructed of mud, with grass or palm leaf roof ... no drainage except ditches around the huts ... There was one barracks at Dorundah, in which three native regiments were quartered in succession. There was no great objection raised and fair average health was maintained by the men'.<sup>103</sup> Dr Wallich confirmed this: 'The men sleep outside, except during the rains. It would be quite possible to induce them to live in barracks, which would be more healthy'.<sup>104</sup> The temporary or semi-permanent native huts (Figure 3.2), commissioners found, had advantages for ventilation, and in epidemics, where buildings accommodating large numbers became 'absolutely pestilential.' Rank-and-file accommodation contrasts with that of officers, who were quartered in detached bungalows.

**Fig. 3.2: Sepoy lines at Cawnpore cantonment, c.1857** (Illustrated London News).



Verification of the state of barracks in the 1850s is given by the unpublished papers of Sir John Hall (1795-1866), inspector-general of hospitals. Hall visited Deesa (in present day Gujarat), Poorundhur (Purandur, Maharashtra), Kummorhee (not identified) and Hyderabad (Telangana state)

<sup>103</sup> *Royal commission 1863*, pp. 218-19.

<sup>104</sup> *Ibid.*,

in 1853-54.<sup>105</sup> In Deesa, the prevailing diseases of the European soldiery were periodic fevers, with rheumatic, hepatic and venereal disorders, causing an annual mortality of 26 out of a strength of 989 (26 per mille). The state of the hospital including instruments, cooking utensils, bedding, regularity of inspections, cleanliness, diets, record keeping, competence of apothecaries, and confirmation of vaccination (by examining for scars of such), were found satisfactory, though the presence of an offensive cesspit required the digging of a fresh one. At Poorundhur, where fevers and intestinal upsets were the main maladies, findings were similarly positive – apart from inadequate shuttering – and new barracks were planned. Hyderabad had benefitted from completion of new barracks including plumbing, though cisterns had not yet been connected to lavatories, and Hall recommended chloride of lime to better deodorize the privies.

Standard plans were drawn up in London on behalf of the secretary of state for India for barracks and outhouses (Figure 3.3).<sup>106</sup> Lavatories, latrines and urinals were placed in outbuildings a short distance from the European barracks.<sup>107</sup> Some discharged into cesspits cleaned from the outside (Figure 3.4).<sup>108</sup> Newly constructed ones had metal pans without drainage, described by the commissioners as ‘very offensive’, requiring ‘rapid removal of excreta to be buried or otherwise disposed of.’ Some stations had integrated facilities. For example, at the married quarters at Trimulgherry in 1867, deputy inspector-general Edward Balfour (1813-89) noted ‘latrines are two to each block at the ends, one for males and the other for females’.<sup>109</sup> Facilities for washing or bathing were often minimal or even absent. The station at Peshawar had no washing (ablution) facilities for 1,600 European soldiers in 1860.<sup>110</sup>

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<sup>105</sup> Wellcome Collection; RAMC 524/15/5-6: J. Hall, ‘Transcripts of memoranda and summaries of Sir John Hall’s diaries’ (1853-56).

<sup>106</sup> R. Airey, D. Galton, J. Sutherland, T.G. Logan, E. Belfield, P.T. Cautley, J.R. Martin, R. Rawlinson, *Suggestions in regard to sanitary works required for improving Indian stations* (London: Eyre and Spottiswoode, 1864), plates VIII and X.

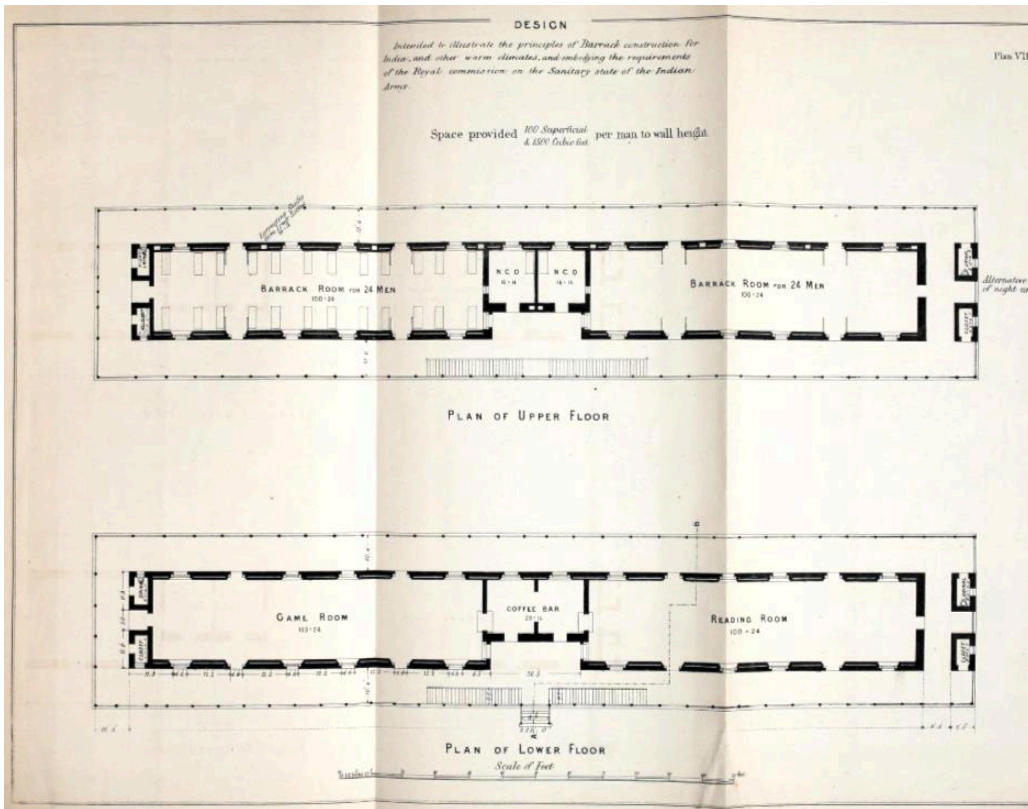
<sup>107</sup> *Ibid.*, pp. 110-11.

<sup>108</sup> *Royal commission volume I*, p. 349.

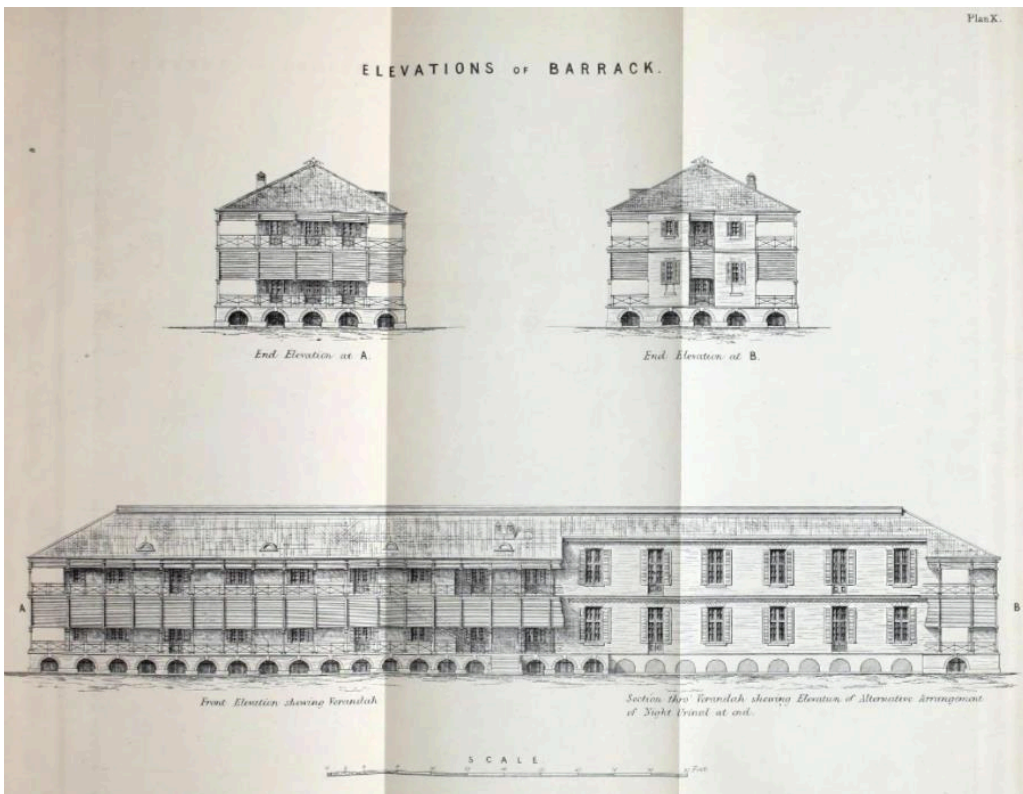
<sup>109</sup> *Proceedings of the Madras government, military department*, 9 January 1867, 13 June 1867 (no place nor publisher given).

<sup>110</sup> *Royal commission 1863*, pp. 108-9.

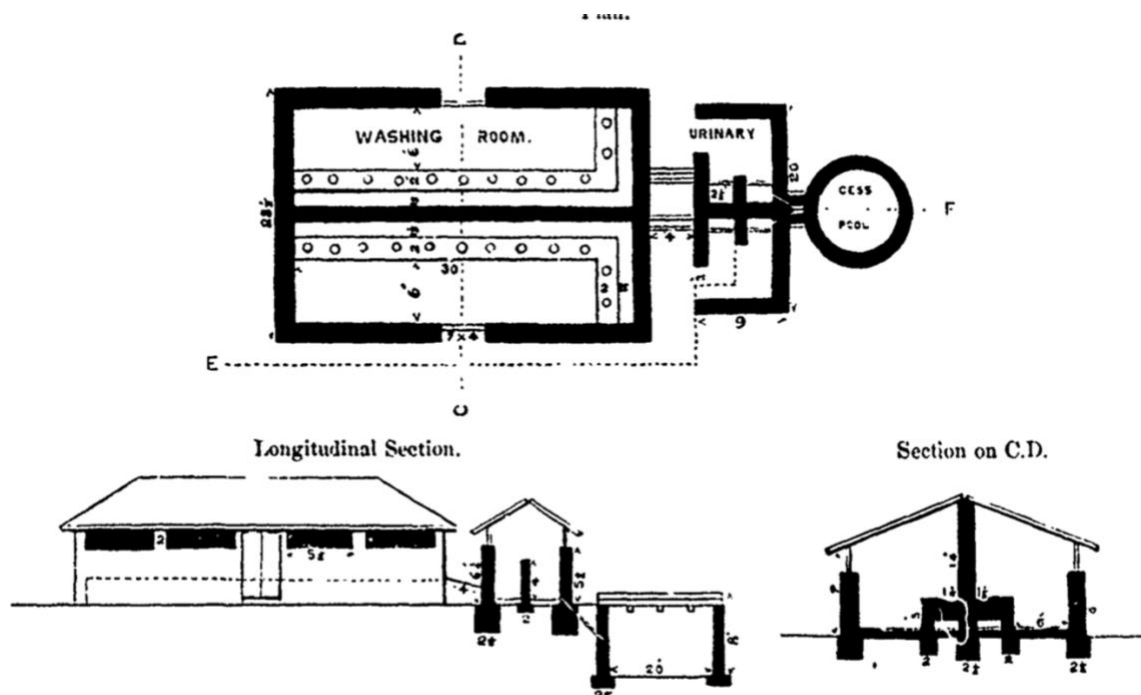
**Fig. 3.3 (a) Design for European barracks.**



**Fig. 3.3 (b) Elevation of European barracks.**



**Fig. 3.4: Plan of the lavatory (washing facilities) and urinary at Aden. Drainage is into a cesspit.**

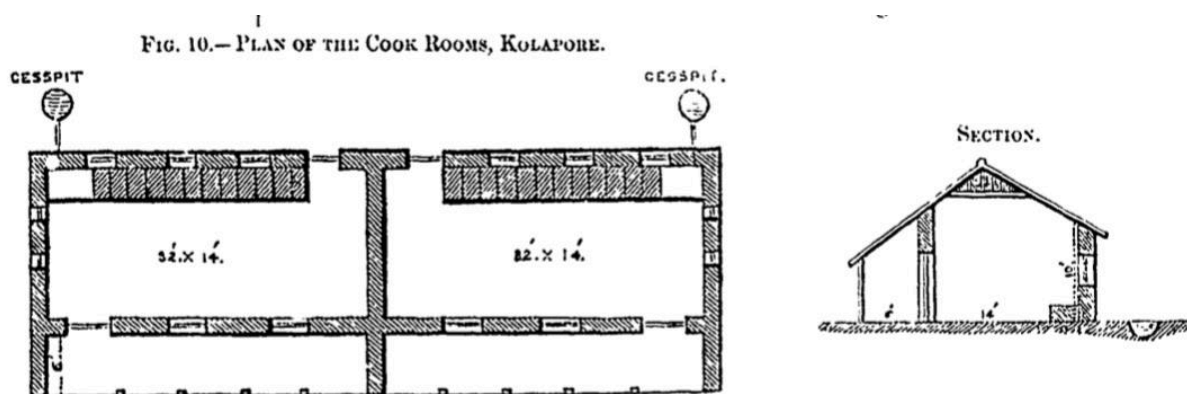


A more typical arrangement, as at Deesa, was of a washroom attached to each barrack, consisting of iron basins draining into a cesspit – water being carried by servants (‘bheesties’). Some larger stations had taps fed from a cistern. According to deputy inspector-general Stewart ‘means of personal ablution at all stations are more or less deficient’. Provision for bathing often consisted of a plunge bath, occasionally smaller baths, though some stations, even the large garrison at Fort William, had no facilities. Balfour, at Trimulgherry, noted ‘the luxury of warm baths for soldiers does not appear practicable, unless government is prepared to sanction a special allowance of wood for the purpose of heating water – it is desirable’.<sup>111</sup> Facilities for native soldiers at Trimulgherry are not recorded. The cookhouse was generally a small, detached shed without chimney, water supply or drainage except a cesspit, and lacking wash basins (Figure 3.5).<sup>112</sup>

<sup>111</sup> *Madras government*, 9 January 1867, 13 June 1867.

<sup>112</sup> *Royal commission 1863*, p. 110; *Royal commission volume I*, p. 434.

**Fig. 3.5: Plan of cook rooms at Kolapore.** No washing facilities are shown. Drainage is into cesspits.



Some soldier's accounts were positive. Staff sergeant Thomas Quinney (1807-?) of the EICo describes, perhaps rather breezily, in 1853, barracks at Ahmednuggur as: 'consisting of a double row of detached one storey buildings, each surrounded by a spacious veranda, so that the soldier can walk around the outside of his barrack room without being exposed to either sun or rain', accommodation he saw as 'decidedly better and more comfortable than the mechanics [factory workers] can procure [in Britain]'.<sup>113</sup> Hence, prior to the 1863 commissioners' report, there were sanitary facilities at some stations for Europeans troops, though these were often rated as deficient.

Water was supplied to military stations generally from tanks in flat or delta districts, from wells in 'up country' locations, and from rivers if this was an accessible source.<sup>114</sup> The near universal method of distribution was for water to be drawn from source by dipping animal skins or other vessel, transported by 'bheestie' water carriers or if necessary on bullocks, to the barracks, where it would be emptied into receptacles including into a barrel or jar for drinking water. The commissioners commented, 'it is obviously unsafe to trust to such a method of supplying troops with one of the prime necessities of life'. The chemist, Dr R.D. Thomas, found the state of water storage tanks, 'quite shocking'. Analysis of water from tanks and wells often showed 'large amounts of organic matter'. For example, at Secunderabad, where bowel disease had been

<sup>113</sup> T. Quinney, *Sketches of a soldier's life in India* (Glasgow: Robertson, 1853), pp. 128, 175; He also records private baths, a library and a vegetable garden, at Bhooj (p. 150).

<sup>114</sup> *Royal commission 1863*, pp. 87-97.

problematic, tank and well water contained up to 119 grains of solid matter per gallon (1.7 gram/litre). Inadequacies of water supply were often commented upon. Colonel Younghusband in 1860 reported that at Ghizree Sanitarium in Scind: ‘want of a good supply of potable water is a serious drawback. It is in fact brought in water casks by the commissariat establishment from cantonments. The only local spring is one in a valley near, received in a shallow tank of 8 feet deep. It is drinkable, but is reported by engineers to be merely surface drainage collected in the declivity – it lasts the whole year’.<sup>115</sup> At Trimulgherry, Balfour observed ‘difficulty in procurement of drinking water and the quality of that water, notably provision of wells for the drawing of the water, the water having been analyzed and found unfit for drinking’.<sup>116</sup> Indubitably, clean water provision was an issue at this time for the soldiery. A scheme of chemical and microscopic analysis for potable water, using Condry’s fluid and silver nitrate solution, was introduced by then surgeon-major James McNabb Cunningham (1829-1905) in the later 1870s, though its success and detection rate is not known.<sup>117</sup>

Various water filter systems were tried in an attempt to reduce the content of organic matter, which was regarded as undesirable and could be measured even before it was possible to culture microbes. A ‘clean’ water supply was a particular problem to an army in the field. Various filtering technologies were developed in the 1870s and 1880s, often using sand, charcoal or iron oxide. Most were hampered by weight and low processing capacity.<sup>118</sup> Macnamara’s filter was standard issue to the British army at this time. At Fort St George in the Madras presidency, in 1878, the inspector reported: ‘water is carefully filtered before use, Macnamara’s filters as well as those of the ordinary three chatty pattern being in use’.<sup>119</sup> However, Macnamara’s filter, consisting of sand and charcoal

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<sup>115</sup> *Papers regarding the extent and nature of the sanitary establishments for European troops in the Bengal, Madras and Bombay presidencies* (Bombay: Military Department, 1860), p. 9.

<sup>116</sup> *Madras government*, 9 January 1867, 13 June 1867.

<sup>117</sup> BL IOR/P/1003 1877, ‘Sanitary proceedings’, pp. 557-9; Condry’s fluid contains alkaline manganates and permanganates and can be used to cleanse water.

<sup>118</sup> Curtin, *Migration*, pp. 119-23.

<sup>119</sup> AMD, *Report for year 1878* (London: Eyre and Spottiswoode, 1880) p. 180; The three chattys are ceramic pots mounted on tripods containing sand and charcoal, as described by Curtin, *Migration*, p. 56.

layers, was actually ineffective. It was later shown not only to allow microorganisms to pass, but to trap them and allow them to proliferate.<sup>120</sup> It was not until the Pasteur-Chamberland and Berkeland filters were introduced in the mid 1880s that effective water filters that prevented passage of microbes were developed, although even these were not a final solution due to their fragility, expense and maintenance requirements. Other systems developed around the turn of the century utilized chemical or heat sterilization, and even ultraviolet irradiation.

Sanitation in terms of the general provision of sewage disposal and organized drainage for India's civilian population in the first half of the nineteenth century did not really exist.<sup>121</sup> Sewerage systems in Indian cities or cantonments in the mid-century were virtually non-existent. Even in the early twentieth century, few larger cities had sewerage disposal plants.<sup>122</sup> In many cases untreated sewage emptied directly into rivers or the sea. Water provision was by bheesties. Shastras, Hindu sacred texts, direct that defaecation be performed in open land or jungle 'at least as far from the house as would be reached by an arrow shot with ordinary force'.<sup>123</sup> Francis Buchanan (1762-1829), writing in 1807, noted 'people's indifference to sanitation, it seems, characterized not only rural but also urban areas'.<sup>124</sup> Disposal of human excrement was left to the sweeper caste, who also swept and removed refuse.<sup>125</sup> Details are lacking about provision of latrines, or washing and bathing facilities for native troops prior to 1863, if indeed there was any. In the second half of the century, after formation of municipalities in the larger cities of Calcutta, Bombay and Madras, attempts were made to manage water, drains and sewers, with varying degrees of success, but rural areas were neglected. In the 1880s, the civilian local government in, for example, the rural North-West

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<sup>120</sup> Curtin, *Migration*, p. 119-20.

<sup>121</sup> H. Jha, *Sanitation in India: a historico-sociological survey* (Delhi: Gyan, 2014), pp. 27-8, 32.

<sup>122</sup> Simmons *et al.*, *Global epidemiology*, pp. 105.

<sup>123</sup> G.N. Jha, 'House building and sanitation in ancient India', *Journal of the Bihar and Orissa Research Society*, 2 (1916), pp. 135-51 [quoted by Jha, *Sanitation*, pp. 88-9].

<sup>124</sup> F. Buchanan, *Reports and diaries* (London: Cadell and Davies, 1807) [quoted by Jha, *Sanitation*, p. 32]; This was not a universal view later in the century as, in 1891, the medical officer to Bengal writes 'Undoubtedly the educated classes see the benefits of sanitary measures, but owing to extreme poverty and cast prejudices the people in rural areas are unable to combine or afford the expense of sanitary improvements, the results of which are in many cases as palatable to them as to Europeans' – BL IOR/P/3885 1891, 'Sanitary proceedings', p. 496.

<sup>125</sup> M.R. Anand, *Untouchable* (London: Penguin, 1940).

Provinces, concerned about high mortality rates such as the 127 per mille annually at Adjuhdia – where subsoil was contaminated with sewage – enquired into schemes of sanitation infrastructure.<sup>126</sup> The *IMG* summarized the problem: ‘Local bodies are unable to afford permanent services of sanitary officers and engineers, and temporary employment of such persons may not be possible or very costly’.<sup>127</sup> They suggested setting up provincial boards, financed by local and central taxation. However, action on this proved limited.

### ***The influence of the royal commission’s report of 1863***

Many of the commissioners’ recommendations were of a practical military nature. They proposed prohibiting of service in India for those under 21, limitation of service to ten years, banning sale of spirits in canteens, modification of clothing and better provision of recreational facilities.<sup>128</sup> Their guidance on sanitation followed miasmatic principles.<sup>129</sup> Focus was on circulation of air in barracks, orientated to receive the prevailing wind, with a limitation on the number of beds to 24 or less per room, arranged in two rows, at least three feet apart, and on purity of the water supply. Air space per man was defined as 1,000 to 1,500 cubic feet, and floor space as 80 to 100 square feet of ‘superficial area’. Attention was given to ‘sufficient ablution and bath accommodation, with a constant water supply’. Iron or earthenware water latrines draining to an outlet were to be ‘introduced instead of the present system’. Commissioners recommended all cesspits be replaced by earthenware vessels, to be removed twice daily, and for urinals to be supplied with a water jet. Similar constraints applied to hospital accommodation, where trained attendants were to be inaugurated, and ‘female nurses be introduced into large general hospitals’. The report specified the sanitary duties of medical officers as described in regulations dated 7 October 1859, including collection of statistics and registration of deaths in large cities. The recommendation was for one third of the army force to be stationed in rotation on hill stations located on high ground,

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<sup>126</sup> Editorial, ‘Sanitation in the Mafisal’, *IMG*, 23 (1888), p. 340.

<sup>127</sup> Editorial, ‘Sanitation in India’, *IMG*, 23 (1888), pp. 275-6.

<sup>128</sup> *Royal commission 1863*, pp. 166-7; Airey, et al., *Sanitary works*, p. 47.

<sup>129</sup> *Royal commission 1863*, pp. 166-71.

supposedly a healthier situation than in the plains, though the locations also had military advantages. Commissioners of sanitation (later called public health) were to be appointed in the presidencies, with wide-ranging powers of inspection.

The government of India largely adopted these recommendations.<sup>130</sup> Definitions of space and number of beds in barracks as set out by commissioners were generally accepted, with minor differences between stations in the plains and hills. Numbers to be accommodated and area space were defined for day rooms and reading rooms, with specific regulations for sergeants and married quarters. Detailed designs were left to the discretion of local officers. Subsidiary accommodation of privies and cook rooms, known as ‘out offices’, were to be located away from main barrack buildings though a ‘night urinal’ could be provided in a veranda, and a bath within sergeant’s quarters ‘for use of the sergeant’s wife’.

### ***Quantifying the implementation of sanitary reforms***

The reports of sanitary commissioners to the governments of India and of the presidencies, are primary sources and give details of inspections of station facilities as well as health reports on garrisoned troops. Public works reports from engineers, both national and presidential, supply particulars of budgets for projected works and accounts of completed assignments. Analysis of monies spent on military new works, mostly building of new barracks, is one way of monitoring commitment of the government of India and its British master to implementation of commissioners' recommendations to improving sanitation in barracks. Details of grants allocated can be found in the annual reports of sanitary commissioners of presidencies and of India, and patchily in public works reports. It was through public works budgets and not those allocated to military finance – which paid for ongoing military services – that funding for military and civil building projects was

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<sup>130</sup> J.J. Frederick, *Remarks by the army sanitary commission on the principle of construction for barracks for single and married men*. Contained in the proceedings of the Governor General of India in Council, of 16th December 1864, circular number 89 of 1864 (London: Eyre and Spottiswoode, 1865).

directed.<sup>131</sup> Extracting comprehensive data proved challenging, but snapshots can illustrate points.

The earliest figures are from 1854-55.<sup>132</sup>

Annual reports of sanitary commissioners, the apparently less frequently issued or preserved reports of public works engineers, and the *Memorandum on measures adopted for sanitary improvement of 1867* give details of projects budgeted for, planned and completed, and provide evidence of implementation.<sup>133</sup> It did not prove possible to obtain a clean set of public works records over the fifty-year period from mid-century. Unlike annual sanitary commissioners' reports which became a contiguous tradition, reports on public works appeared under a variety of guises at both national and presidential levels and seemed to have been issued in sporadic runs, or, less likely, have been preserved by the Bodleian and British Libraries only intermittently. An additional complication in public works reports is that budgets are recorded not only in rupees and lakhs, sometimes using different formats, but also at other places in pounds sterling without a conversion factor. Inflation or devaluation over decades additionally makes comparisons problematic. Major objectives of this chapter are to assess, first, whether the programme of barracks renovation and enhanced sanitary engineering recommended by the royal commission was achieved and, secondly, the extent to which changes in sanitation contributed to a reduction in prevalence of water-borne or faeco-orally transmitted diseases.

### ***All India military building expenditure, 1850-1900***

Finding a baseline figure, for comparative purposes, of annual expenditure on barracks and sanitary works for all India or for the presidencies during the 1850s or earlier proved difficult. Expenditure

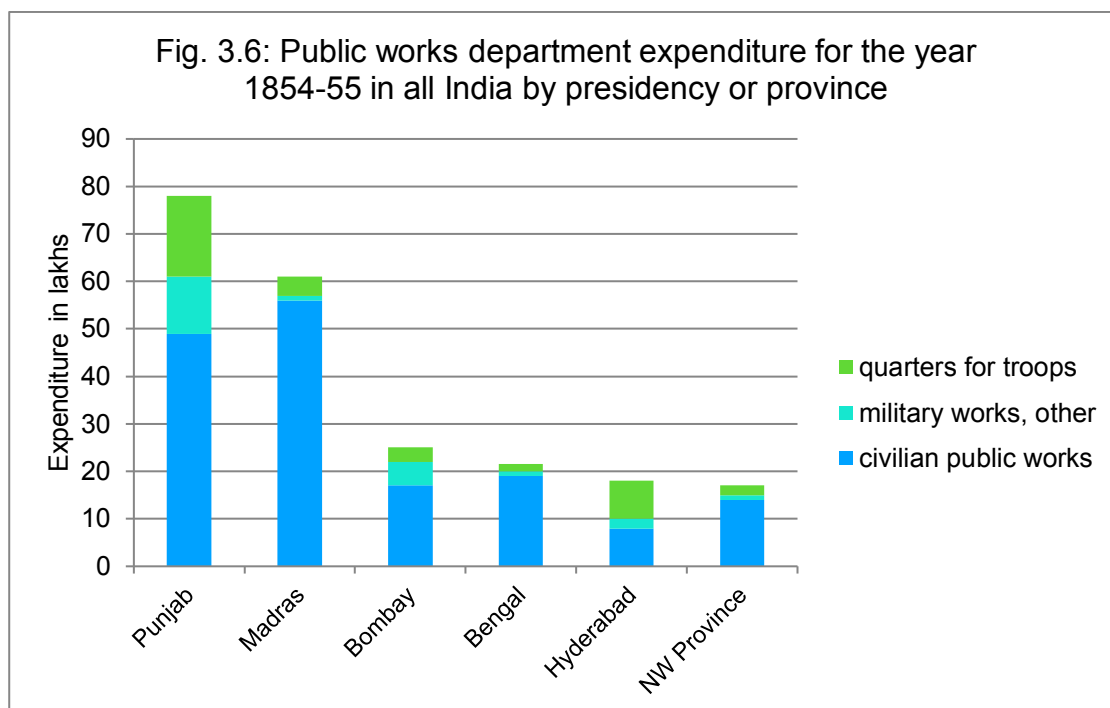
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<sup>131</sup> *Minutes of evidence taken before the royal commission on the administration of the expenditure of India; with index, analysis and appendices*, vol. I (London: HMSO, 1896), p. xxiii.

<sup>132</sup> *Progress report of the public works department for the year 1854-55* (Calcutta: Thomas Jones, 1856), pp. 12, 16-17, 22, 45-47, 50.

<sup>133</sup> *Memorandum on measures adopted for sanitary improvement in India up to the end of 1867* (London: Eyre and Spottiswoode, 1868).

for the three presidencies and for provinces in 1854-55 is shown in Figure 3.6.<sup>134</sup> Total expenditure for military and civilian public works for all British India for the year was 226 lakhs. Accommodation for troops, mostly for the European army, accounted for just over half (53 percent) of the overall (all India) military grant and 15 percent of the total civil and military public works budget. The amount spent on civil hospitals and dispensaries and on water supply was small (Table 3.1).<sup>135</sup> Following the Second Anglo-Sikh war, the EICo annexed the Punjab in 1849.



**Table 3.1: Public works department expenditure for 1854-55 in all India by presidency or province: in rupees, using Indian numbering system (not given, ng).**

Presidency or province	Total military & civilian	Total military works	Quarters for troops	Water supply	Hospitals and dispensaries
Punjab	77,57,128	29,09,116	16,81,475	4,488	700
Madras	60,33,723	4,61,415	3,57,096	ng	1,060
Bombay	24,62,056	7,47,193	2,54,865	16,966	6,309
Bengal	21,04,657	2,37,500	1,36,036	ng	5,214
Hyderabad	17,71,355	9,78,911	7,61,250	ng	ng
North-Western	15,96,520	2,09,201	1,52,953	ng	ng
Sangor & Nerbudda	2,99,916	9,454	9,454	ng	ng
Tenasserum	92,099	79,881	50,577	ng	ng
<b>Grand totals</b>	<b>2,25,97,172</b>	<b>63,93,921</b>	<b>34,03,686</b>	-	<b>(13,283)</b>

<sup>134</sup> *Ibid.*, pp. 12, 16, 17, 22, 45, 47, 50 [One lakh is 100,000 rupees or 1,00,000 in Indian notation].

<sup>135</sup> *Ibid.*

This accounts for the excess of building activity in the Punjab when compared to other provinces at this time. In a letter dated 8 September 1855 to major J.D. MacPherson (dates unknown), military secretary to the Punjab's chief commissioner, Lt-colonel Robert Napier (1810-90), chief engineer to the Punjab, confirmed a building programme.<sup>136</sup>

Twenty-six half company and 40 full company barracks have been in progress during the past year. In addition, 69 buildings for the accommodation, comfort, discipline and recreation of troops including 31 wash houses, 6 staff sergeant bungalows, 5 fives courts, 3 guard rooms, 9 out-offices, 3 stores, 11 full sized hospitals for European officers and one female ward have been commenced. A complete set of lines for a native infantry regiment has been completed at Nowshera, also a set for a wing of a regiment at Kohat. At other stations, 62 buildings have been in progress.

Public works department expenditure reports were set out under the headings of 'state', which included military, naval, judicial, revenue, ecclesiastical, educational and general; and 'internal improvement' that comprised municipal, marine, agricultural, communications and electric telegraph.<sup>137</sup> Further subdivisions were into original works and repairs. Public works expenditure for 1860-61 for all of India, was 308 lakhs, an increase of 36 percent over the 1854-55 figure (Tables 3.2 and 3.3).<sup>138</sup> Eighty-nine lakhs was allocated to the military, of which 73 lakhs was for

**Table 3.2. Public works expenditure for the year 1860-61 for all India, by division.**

<b>Division</b>	<b>Original (new) works</b>	<b>Repairs Rs</b>	<b>Total Rs</b>	<b>Percentage of grand total</b>
Military	73,62,448	15,47,256	89,09,704	29% (23% new)
Communications	27,62,412	38,49,950	66,12,362	21%
Agriculture	19,20,454	24,72,620	43,93,074	14%
Judicial	7,39,522	2,74,295	10,13,817	3%
<b>Subtotal</b>	<b>1,47,36,934</b>	<b>88,03,973</b>	<b>2,35,40,907</b>	<b>76%</b>
Establishment etc.			73,51,006	24%
<b>Grand total</b>			<b>3,08,91,913</b>	<b>100%</b>

<sup>136</sup> *Ibid.*, Calcutta, pp. 57-9.

<sup>137</sup> *Annual report of the progress and expenditure in the public works department for the year of 1860-61* (Calcutta: Cutter, 1862), p. 1.

<sup>138</sup> *Ibid.*, pp. 1,24; *Report of proceedings in the public works department during the official year 1860-61* (Calcutta: Cutter, 1861).

**Table 3.3. Total grants allocated to presidencies and provinces of all India in 1860-61.**

Figures in parentheses are percentages of total allocation, and of military budget.

<b>Presidency or province</b>	<b>Total allocation Rs</b>	<b>Military new works Rs</b>	<b>New quarters for troops Rs</b>	
Madras	58,60,658	6,69,308	5,34,397	(9%, 79%)
North-Western	54,45,643	ng	11,91,233	(22%, -)
Bombay	48,18,105	10,82,294	7,29,996	(15%, 67%)
Punjab	47,22,541	ng	6,24,342	(13%, -)
Bengal	41,80,592	5,61,471	ng	
Oudh	ng	ng	13,97,848	
Hyderabad	ng	ng	5,17,950	
Others	ng	ng	3,83,538	
<b>Grand total</b>	<b>3,09,18,730</b>			

original (new) works (23 percent of overall total), with 66 lakhs to communications, 43 lakhs to agriculture, and 10 lakhs to the judiciary.<sup>139</sup> If the 1854-55 military total encompassed new works and repairs, the 1860-61 figure represents an increase of 39 percent (89 lakhs versus 64 lakhs).<sup>140</sup>

The all India allocation for building work on quarters for troops rose from 34 lakhs in 1854-55 to 54 lakhs for 1860-61, an increase of 58 percent.<sup>141</sup> The amount for the Punjab fell, building having been completed after annexation, but assignment to North-Western Provinces, prominent in the rebellion, and to Oudh, appropriated in 1856, were localities of activity (Figure 3.7). Other publications in the early 1860s, some giving costs in pounds sterling, show similar figures using a conversion factor for the rupee, and provide a list of projects supported (Table 3.4).<sup>142</sup> In Madras presidency, building was recorded at Bellary, St Thomas Mount, Fort St George, Bangalore, Jackatallah, and at the general hospital. In North-Western provinces there was construction at Cawnpore, Goruckpoor, Bareilly, Shahjehanpoor, Jhansi, Lullutpoor, Gwalior, Oorai, Muttra, Jubbulpoor, and Sangor. In Pegu province, work was done on native infantry privies at Tounghoo,

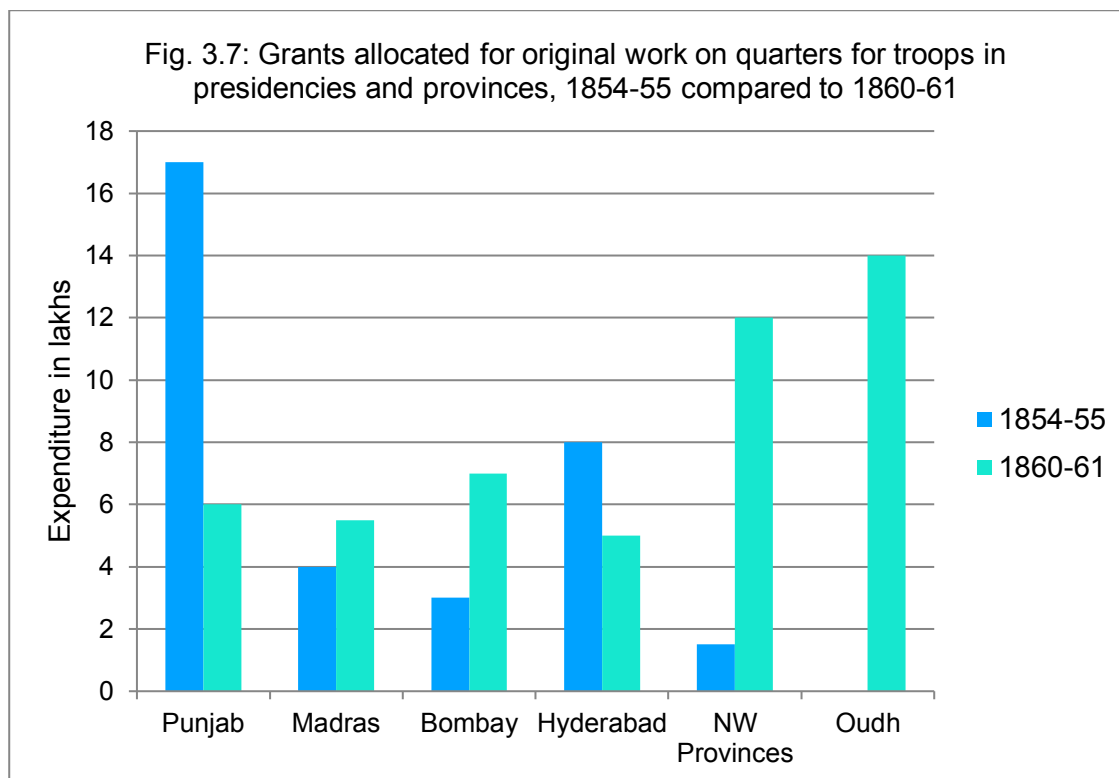
<sup>139</sup> *Ibid.*

<sup>140</sup> *Progress report 1854-55.*

<sup>141</sup> *Public works, 1860-61*, Calcutta, p. 24.

<sup>142</sup> *Report of the public works commissioner during the official year 1860-61* (Calcutta: Cutter, 1861), pp. 1, Appendix A; *Public works 1861-62*, Calcutta, pp. 2, 3; *Report of the government of India in the public works department during 1862-63* (Calcutta: Public Works, 1865), pp. 49, 50, appendix 1; A. Piat Andrew, 'Indian currency problems of the last decade', *Quarterly Journal of Economics*, 15 (1905), pp. 483-516 at p. 515 [In 1860, one rupee was worth about 2/2].

and at a canteen and cookhouses at Thayet May. Successive annual reports repeat names of the same works, since projects were ongoing and taking more than a year to complete. Simple counting will not give a numerical indication of building activity due to double counting.



**Table 3.4. Public works expenditures for all India, 1860-61 to 1862-63 (in pounds sterling).**

Year	Total public works spend	Military new works (%age of total)	New quarters for troops (%age of military spend)
1860-61	£3,917,184	£643,854 (16%)	ng
1861-62	£3,436,100	£445,967 (12%)	£289,915 (65%)
1862-63	£3,624,500	£348,389 (10%)	ng

The government of India, in 1864-65, made an official response to recommendations in the commissioners' report. An estimate of costs was prepared:<sup>143</sup>

... preliminary discussions ... were so far advanced during the year under review, as to make it necessary to prepare for a far more active prosecution of military works than it has hitherto been possible. Colonel [William Arden] Crummelin [1823-87] was therefore desired to prepare approximate estimate of the probable expense ... during the next four years.

<sup>143</sup> *Report of the proceedings of the government of India in the public works department during the year 1864-65* (Calcutta: Public Works, 1866), pp. 1-2; *Annual progress report of public works in India for the year 1864-65* (Calcutta: Cutter, 1865).

Estimates of expenditure on necessary sanitary works were considered under the following headings (in pounds sterling):

• Entirely new sets of barrack buildings for European troops at regular stations, either modification of existing ones or new cantonments.	£3,592,250
• Improve existing buildings for European troops.	1,645,000
• Hill sanatoria.	400,000
• General works in cantonments, water supply, churches, roads, lighting.	280,000
• Fortified posts and places of refuge.	200,000
• Accommodation for native troops.	200,000
• Officers' quarters.	150,000
• Ordnance and commissariat departments.	120,000
• Temporary accommodation for European troops.	50,000
• <b>Total.</b>	<b>£6,637,250</b>

This £6.6m estimate was for Bengal presidency for all work to be completed. The report of proceedings estimated that to include Madras and Bombay presidencies would increase the total required to £10m over a four-year period.<sup>144</sup> This was equivalent to 1,000 lakhs (Rs10,00,00,000) using the 1862 conversion rate of ten rupees to the pound sterling.<sup>145</sup>

Plans for new barracks for European troops were standardized in the mid 1860s, and estimates obtained. For example, in Bombay presidency in 1867-68 the biggest project was at Deolake on the Great Indian Peninsular Railway near Nassick (Nashik), where the scheme, costed at 11 lakhs, was to build 12 barracks (each for 44 men and two non-commissioned officers), 12 latrines, 12 lavatories (here meaning washrooms), 12 cook rooms, 12 detached urinaries, 4 blocks of family quarters (each to accommodate 13 families with detached cook rooms, latrines and urinaries), two blocks of officers' quarters (each to house eight officers with detached cook rooms), and one

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<sup>144</sup> *Government of India, public works, 1864-65*, p. 2; By way of contrast, costs for barrack building and repairs in the UK were modest: for 1857-58, £479,749, a peak at £610,306 for 1860-61, subsequently more than halving annually over the next decade – A.R. Skelley, *The Victorian army at home* (London: Croom Helm, 1977), p. 309.

<sup>145</sup> Piat Andrew, 'Currency', p. 515.

quarter guard with detention room, solitary cell, latrine and urinary.<sup>146</sup> The improved accommodation envisaged one latrine and one urinary and, one lavatory (washroom) between 44 men. Costs for individual buildings varied from Rs1,25,000 to construct a barracks at Balgaum, to Rs14,100 for a canteen at Sattara, to Rs10,000 for a gymnasium at Poona (in 1872).<sup>147</sup>

A significant amount was allocated to developing hill sanitarium. Hill stations, all of which had sanitarium, were established from the 1820s for the military and for European civilians in each presidency, numbering around eighty.<sup>148</sup> The coolness afforded by their 6,000-7,000 feet elevation provided relief from the heat of the plains. After 1858, Shimla, Ootacamund ('Ooty') and Mahabaleshwar served as summer capitals, though this practice ultimately was detrimental politically in that it removed the ruling class from the people it served.<sup>149</sup> On the respective situation of barracks and the civilian town at hill stations, Dale Kennedy notes: 'the social chasm between them was nearly always reinforced by physical distance'.<sup>150</sup> The main convalescent depots were at Landour, Kussowlie, Dugshai, Darjeeling, Senchul, Murree and Nynetal (Figure 3.8).<sup>151</sup> They were believed to benefit malarious fevers due to their elevation though some stations, e.g., Simla, harboured diarrhoeal afflictions. East India military budget estimates give ongoing costs of staffing the sanitarium, though not of construction.<sup>152</sup> Details of costings of individual projects, however, are

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<sup>146</sup> *Administrative report of the public works department, Bombay presidency, for the year 1867-68* (Bombay: Public Works, 1868), pp. 4-6.

<sup>147</sup> *Public works department, budget estimate of the government of Bombay for the year 1872-73* (Bombay: Public Works, 1873).

<sup>148</sup> S. Sharma, A. Saini, B. Shrivastava, G. Kumar, A. Kumar. 'Evolution of Indian hill stations during the British era', *ISVS e-Journal* 9 (2022), pp. 114-29.

<sup>149</sup> D. K. Kennedy, *The magic mountains: hill stations and the British raj* (Berkeley: University of California Press, 1996), pp. 228-9; Kennedy finds that while hill stations may have been intentioned as locations where the British could 'define themselves according to an exclusive set of cultural values and practices' ... 'they attracted a Westernized Indian elite whose adoption of some of the same values and practices subverted British claims of exclusivity'.

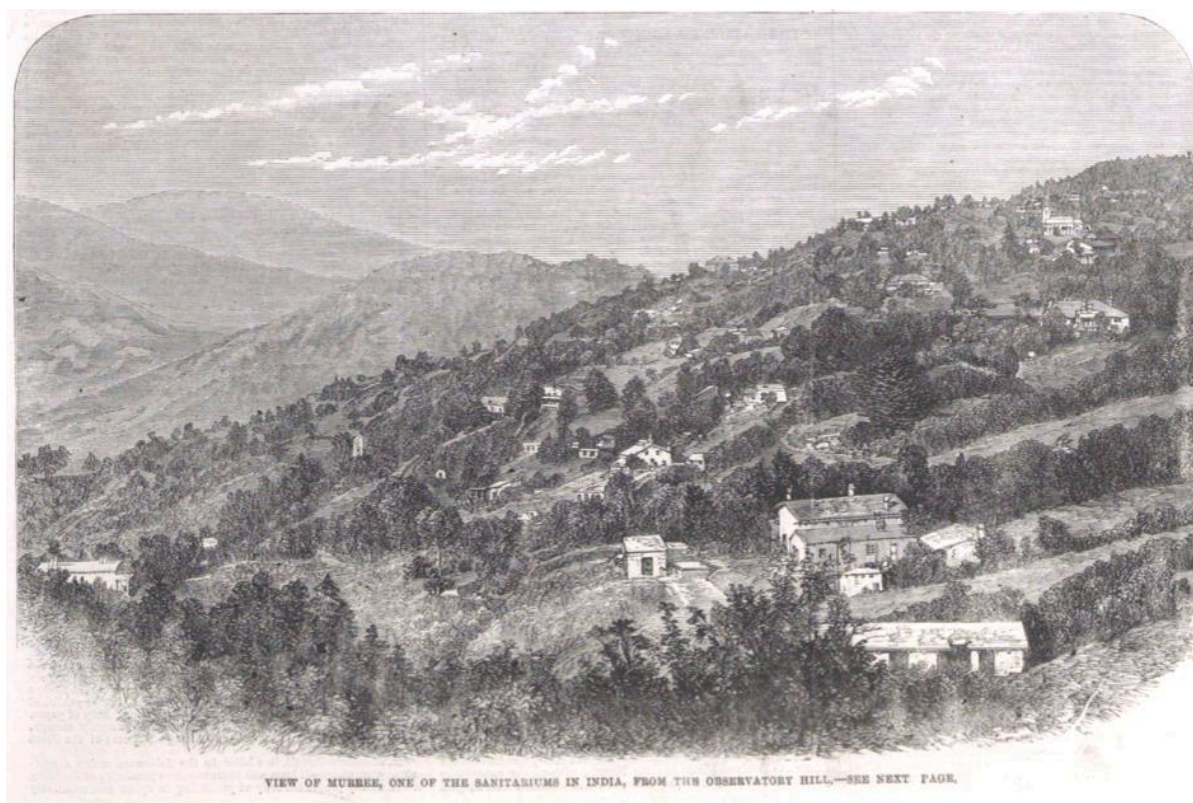
<sup>150</sup> Kennedy, *Magic mountains.*, pp. 113-14, 227-8; Landour, founded in 1827, was the exception, being only a mile away from Mussoorie. Dalhousie and Murree had begun as cantonments but attracted a civilian population. Military hill stations were unpopular with European civilians – those with governmental influence were desirable. European women preferred residence in hill stations because of the social possibilities (pp. 125-6).

<sup>151</sup> Editorial, 'Murree', *The Illustrated London News*, 31 October 1863, pp. 17-18; 'There are barracks for about four hundred British soldiers, which are occupied during the hot season by invalids from the various Royal regiments quartered in the Punjab [sic]'. 'Elevation ... 5,000 ft., or according to another authority, 7,000 ft'. Murree is in the Galyat region of the Punjab, in present day Pakistan.

<sup>152</sup> *East India (military and budget estimates)*, (London: House of Commons, 1867), p. 218.

available and give an indication of expenditure. For example, the budget to build a sanitarium barracks for 100 men at Parisnath Hill (now called Parasnath, in present Jharkhand state, then in Bengal presidency), with bungalows for medical and commanding officers, and road construction and water supply, in 1861, was over Rs64,000 (approximately £8,000 at the then conversion rate).<sup>153</sup> This cost would have been replicated at several locations.

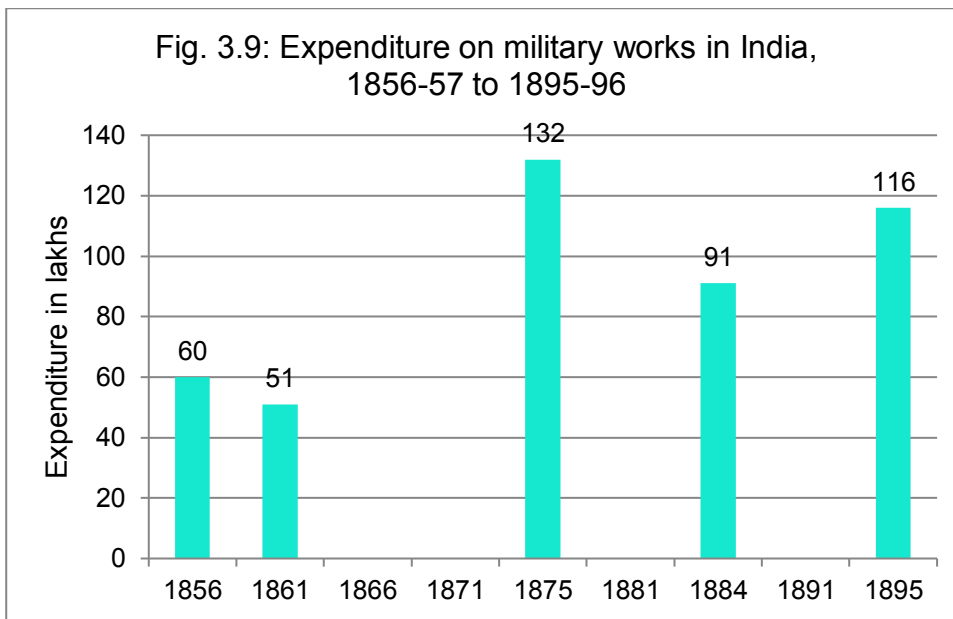
**Fig. 3.8: The hill station sanitarium at Murree, from Observatory Hill (engraving, 19<sup>th</sup> century English school).**



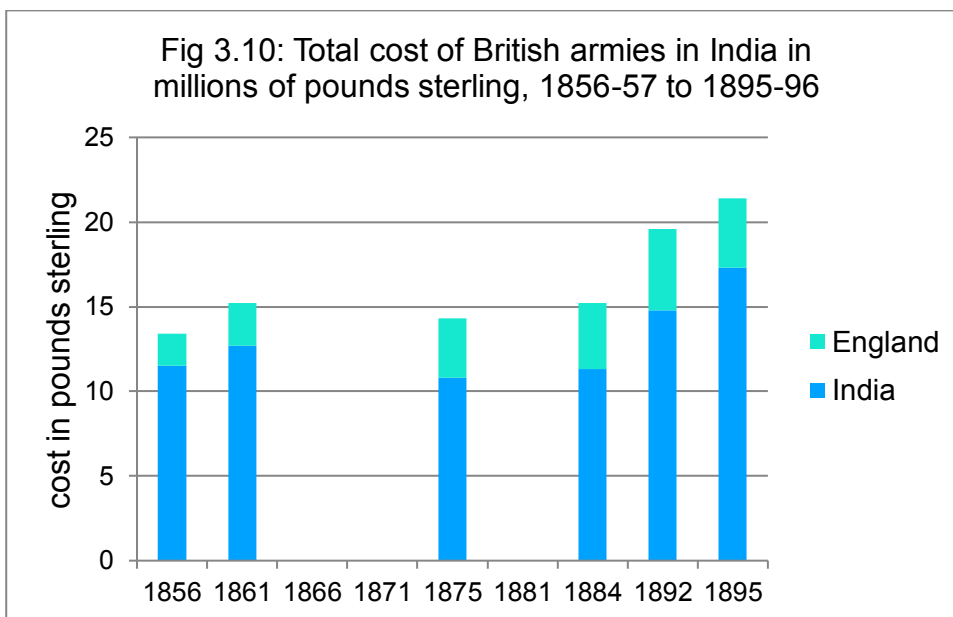
Towards the end of the nineteenth century there was concern about the cost of armies in India, particularly the apportionment between the governments of Great Britain and India. A royal commission on administration of expenditure of the army in India was established. It reported in 1900 and provided numerous data including on military works costs which, although incomplete, show there was a peak of expenditure in 1875-6 (Figure 3.9).<sup>154</sup>

<sup>153</sup> *Papers Relating to a sanitarium [sic] upon Mount Parisnath* (Calcutta: Bengal Military Orphan, 1861), pp. 98c-98d.

<sup>154</sup> *Final report of the royal commission on the administration of the expenditure of India; with index, analysis and appendices*, Vol. IV (London: HMSO, 1900), pp. 78-9, 87; *Note on military expenditure 1861-62 to 1871-72*, pp. 2-3, 12, 14-15, 18-19, 23-4; *Progress report 1854-55*, pp. 12, 16-17, 22, 45-47, 50 [A correction has been applied to data in Figure 3.9].



Over the twenty-one-year period, 1875-6 to 1895-6, the overall cost in India and in England of the British armies in India rose by fifty percent in sterling terms (Figure 3.10).<sup>155</sup>

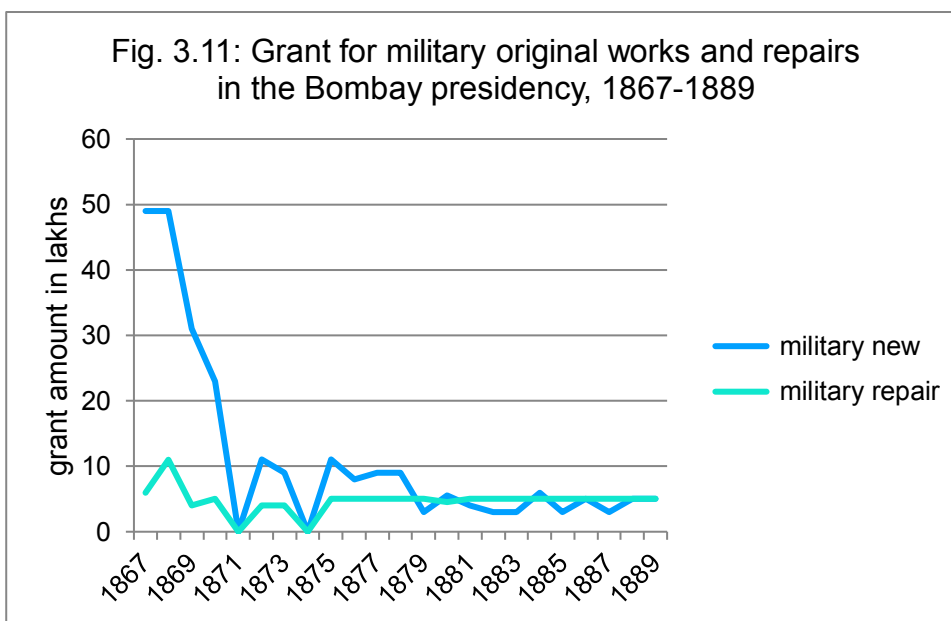


### ***Military building expenditure by presidency, 1857-89***

Details of spending on new military building at a presidency level are given in reports of the chief engineers to the presidencies. The availability of reports is patchy and the way in which the grants and expenditure are expressed, and the level of detail given, vary from year-to-year and between

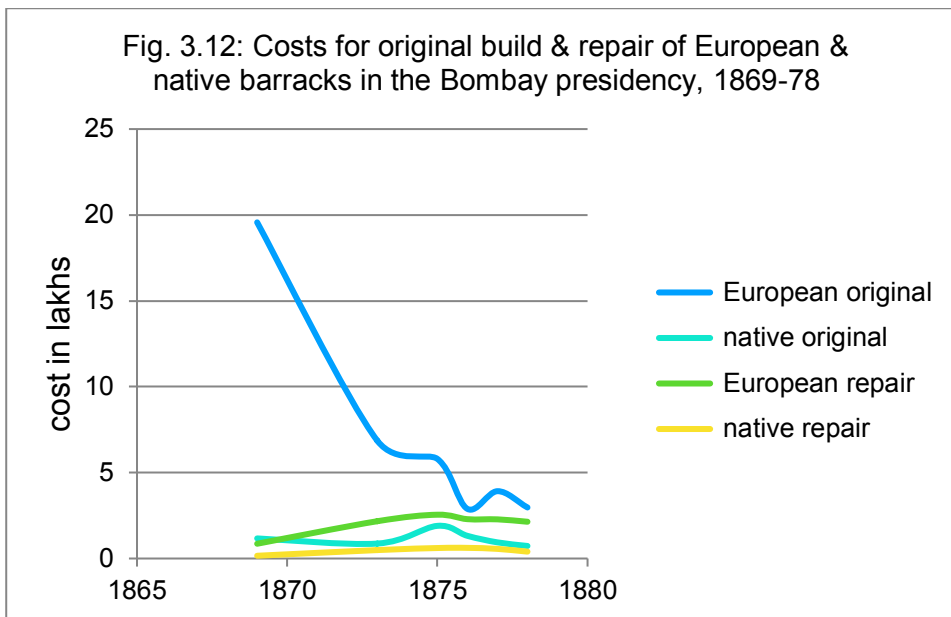
<sup>155</sup> Earl of Northbrook, 'India expenditure - report of the royal commission', *Hansard* 20 July 1900, <https://api.parliament.uk/historic-hansard/lords/1900/jul/20/indian-expenditure-report-of-the-royal> [30 July 2019]; *Royal commission 1900*, vol. IV, pp. 61-2, 78, 80, 92-4 [In 1862, one rupee was worth two shillings (2/-). The value of the rupee fell such that by 1884, one rupee was worth 1/8d, by 1893, 1/3d and by 1896, 1/1.5d].

publications, making it difficult to follow changes over time. Additionally, the government of India made organizational changes that disrupt longitudinal comparison. In the presidencies, the largest proportion of grant was to civilian works, but the percentage and absolute amounts allocated to military original works and repairs varied (Figure 3.11).<sup>156</sup> The highest proportion reserved for military new works was in 1867-68 to 1870-71, when there was allocation of nearly one third of the total. This dropped to 14 percent for 1871-72 to 1879-80, and to 12 percent for 1880-81 to 1884-85, probably due to central government legislation (see below). Figures for grants allocated to new build and repair of European and native barracks are available for 1869-70 to 1878-79 (Figure 3.12). Contributions to the construction of native barracks were small. From a high point in 1869, spends on European barracks seemingly decline steeply over the nine years in question but some of this may be an apparent rather than a true decrease, as will be explained.



The 1860-61 grant for public works in the whole of India was twice that of the Bombay presidency, and roughly a quarter was allocated to military original build. In contrast, for Bengal in 1871-72, of the total public works grant of 109 lakhs, the amount reserved for original military works was 12 lakhs (11 percent of total grant) from which 3.4 lakhs (28 percent of the military works grant) was

<sup>156</sup> *Public works Bombay 1867-68*; subsequent years, 1868-69 to 1884-85, are from the annual reports of the same department; 1871-72 and 1874-75 are not available, neither are figures for the 1850s; *Administrative report of military works of the public works department Bombay presidency for the year 1885-86* (Bombay: Government Central, 1886); subsequent years 1886-87 to 1899-1900, are from the same publication, 1899-1900 was its last year of publication.



designated to troop accommodation.<sup>157</sup> The chief engineer's reports for Bengal do not give allocations to new military building (apart from 1871-72), hence comparison cannot be made with the Bombay figures. However, overall military works spending did fall over the four years after 1871-72.<sup>158</sup> Bengal public works reports indicate that work was completed on 33 imperial military buildings in 1871-72, five in 1872-73, two in 1873-74, and zero in 1873-74 and 1876-77. The work in 1871-72 may represent the tail end of the barrack building project or a reduction in that supervised by the presidency engineer. Irrigation projects were a major capital outlay. Major works were completed at Lahore where, in the later 1870s to 1881, drains were constructed that discharged into the Ravi river (cost 13 lakhs).<sup>159</sup> Provision of good quality irrigated land in the 'canal colonies' of the Punjab for retired sepoys in the 1880s was an important aspect of their terms of service.<sup>160</sup>

<sup>157</sup> *Annual report of works under the chief engineer of Bengal for the year 1871-72* (place: publisher, date - not given), pp. 19, appendices E and F.

<sup>158</sup> *Annual progress reports of works Bengal* (Place: publisher, date of publication – not given); 1871-72, pp. 1, 11, appendix E, F; 1872-73, p. 6, Appendix B; 1873-74, p. 6, Appendix B; 1876-77, p. 5, Appendix A; The 1874-75 'other' grant is high due to a large spend on roads.

<sup>159</sup> F.R. Hogg, *Indian notes* (London: Churchill, 1880), pp. 76-7, 88; Editorial, 'Report on the sanitary administration of the Punjab for the year 1868', *Medical Times and Gazette* 1 (1870), pp. 451-2; Dr A.C. De Renzy, the first sanitary commissioner to the Punjab, appointed in 1868, and a contagionist who frequently clashed with J.M. Cuninghame the government sanitary commissioner, identified stagnant water in wells as a source of cholera and recommended water projects to correct this in the Punjab. De Renzy's full recommendations for water projects were viewed as too costly for the government. His disagreements with Cuninghame resulted in his demotion to a position in remote Assam. See BL IOR/P/1003 1877, April, A.C.C. De Renzy to Government of Punjab (letter, pp. 91-2) – De Renzy states that the cause of an outbreak of cholera should be sought in the cantonment itself and not in the local native villages.

<sup>160</sup> Omissi, Misra, Owen, 'Co-option', p. 541.

In the Madras presidency, figures for public works expenditures for 1856-57 to 1883-84, like those for Bombay and Bengal, often do not give the allocation for troop accommodation as a separate category.<sup>161</sup> In the year 1856-57, civil projects, mainly roads, communications, irrigation and canals, made up 52 lakhs out of the total civil and military grant of 67 lakhs for that year, leaving only 8.3 lakhs for military works (12 percent of the civil and military grant), of which 6.0 lakhs (72 percent of the military grant) was directed to house soldiers.<sup>162</sup> The total budgets for troop accommodation for Madras in 1857-58, 1858-59 and 1859-60 remained low at 4.4 lakhs, 2.1 lakhs and 7.2 lakhs respectively.<sup>163</sup> These figures are lower than those for Bengal, for Bombay and for some provinces at a similar time point. Information is lacking on the spending on barracks in the Madras presidency for the critical decade of the 1860s. In the 1870s, expenditure on military original works remained modest, never rising above 3.9 lakhs (in 1875-76) and even declining in the early 1880s – it was 1.9 lakhs in 1883-84.<sup>164</sup> The reason for this and the other apparent decreases described above may be the Indian government resolution of 1871.

The 1871-72 Bengal chief engineer's report identified problems with the barracks building project. The government of India, in a resolution dated 15 November 1871, removed military works from the control of local government and placed them under the inspector-general of military works with central government. The main reasons given were : '...[the] failures that had taken place in construction of new barracks, and [the] inconvenience found to arise in the working of the grant for military works allotted between several local administrations, which it was thought would be removed if the whole was placed under the control of one central authority'.<sup>165</sup> Grants for military

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<sup>161</sup> Most reports are small pamphlets. Several years are missing, hence the incomplete data set.

<sup>162</sup> *Selection from the records of the Madras government, number XXXVIII, papers relating to the budget of public works for 1856-57* (Madras: Pharaoh, 1857), pp. 281-2; 'establishment', i.e. administration, makes up the difference in numbers.

<sup>163</sup> *Selection from the records of the Madras government, number LIV, papers relating to the budget of public works* (Madras: Chetty, 1858), p. 165; *Budget of public works in the Madras presidency for the official years 1858-59 [and] 1859-60 submitted to the government of India* (Madras: Smith, 1858, 1859), 1858-59, pp. 3-7; 1859-60, pp. iii-v.

<sup>164</sup> *Administrative report of public works in Madras presidency for the year 1871-72* (Madras: Morgan, 1872). The same publication was accessed for each year between 1871-72 and 1883-84. None of these slim volumes shows the amount directed to building of accommodation for troops.

<sup>165</sup> *Annual progress report Bengal 1871-72*, p. 1.

building thus were removed from regional governments and placed centrally after 1871. This explains why military building grants in the presidency reports declined through the rest of the decade and later, though not in the accounts for the whole of India.

### ***Recurrent expenditure on military services, 1857-1900***

Military finance publications give the details of recurrent spending on military services, as opposed to capital outlays for new build and repair work. Details are available for the financial years 1861-62 to 1892-93. Grants were organized under twenty headings.<sup>166</sup> The barrack establishment grant includes ‘care and conservancy’, and also sundry supplies, but it does not include new building nor repairs.<sup>167</sup> The medical establishment grant encompasses administrative officers to the AMD and IMS, AMD army officers and army hospital native corps attached to station hospitals. It also incorporates medical store depots, supply of medical and surgical stores, of hospital comforts and equipment, diets for hospitalized sick and, after 1888-89, nursing services.<sup>168</sup> Executive and subordinate ‘establishment’ costs, that is administration, are included. Figures for the 31-year period from 1861-62 show a doubling of the barrack establishment grant between 1861-62 and 1864-65, indicating a focus on improving circumstance of barracks, together with an initial surge in medical services, most likely in response to the commissioners’ report (Figure 3.13).<sup>169</sup> A near fifty percent fall to 1873-74 followed, with a levelling off thereafter. Over the thirty-one-year period, 1861-62 to 1892-93, for the running costs of barracks, there was a slight increase but little change in

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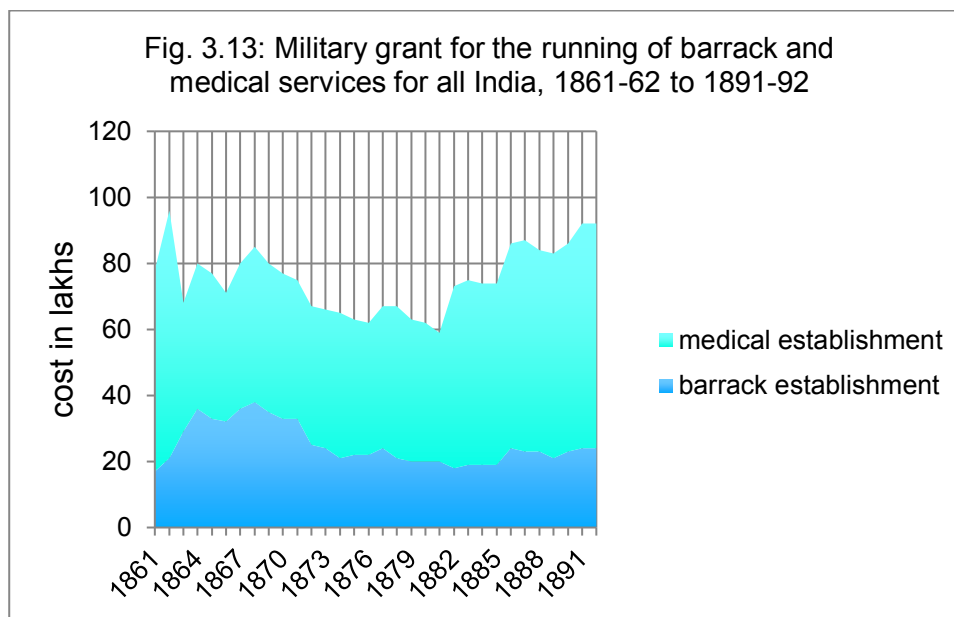
<sup>166</sup> *Military expenditure in India, royal commission on Indian expenditure 1895-96* (Place: publisher, date – not given) [BL IOR/L/MIL/7/12797].

<sup>167</sup> *Note on military expenditure for the army in India from 1872-73 to 1883-84* (Calcutta: SGP, 1885), p. 11 [BL IOR/L/MIL/17/5/1892].

<sup>168</sup> *Military expenditure 1872-73 to 1883-84*, pp. 12, 51.

<sup>169</sup> *Note on military expenditure for the army in India in the years 1861-62 to 1871-72* (Calcutta: SGP, 1873), pp. 2-3, 15, 18-19, 23-4 [BL IOR/L/MIL/17/5/1890]; *Military expenditure 1872-73 to 1883-84*, pp. 11-12; *Detailed account of army charges for 1884-85 and 1893-94* (Calcutta: SGP, 1894) [BL IOR/L/MIL/17/5/1896]; *Brief review of the military expenditure for the army in India from 1884-85 to 1892-93* (Calcutta: SGP, 1893), pp. 12, 22, 71-4 [BL IOR/L/MIL/17/5/1895]. The expression of amount in rupees in the 1884-85 to 1892-93 documents seems to have changed from the 1872 document, as it no longer uses the Indian numbering system based on lakhs. It is inconceivable that there was a ten-fold step change downwards in the budget on and after 1884-85. A ten-fold correction has been applied for figures from 1884-85 onwards.

real terms, allowing for inflation, as the value of the rupee relative to sterling fell by 23 percent between 1882 and 1892.<sup>170</sup>



The medical budget between 1872 and 1892 showed a fifty percent uplift, with a doubling of the amount spent on medicine and supplies. The cost of nursing services was first given as a separate statement in 1888-89, when it was Rs3,225. It rose rapidly to Rs8,706 in 1891-92 and to Rs11,003 in 1892-93 through it was still small compared to other costs.<sup>171</sup> The nursing service was finally established in 1888-89 at the instigation of the commander-in-chief, Lord (Frederick) Roberts (1832-1914), ‘to provide trained nursing of British soldiers and officers’.<sup>172</sup> The Army Hospital Corps had been formed in 1881. There were several enquiries and other attempts, over the final quarter of the nineteenth century, to limit military expenditure in India, seen as excessive.<sup>173</sup>

Documents listing the number of barrack establishments give an indication of new building even in absence of a financial record. The number of barrack establishments in all India between 1864-65 and 1868-69 increased by ten percent, with a 50 percent uplift in Bombay, according to figures

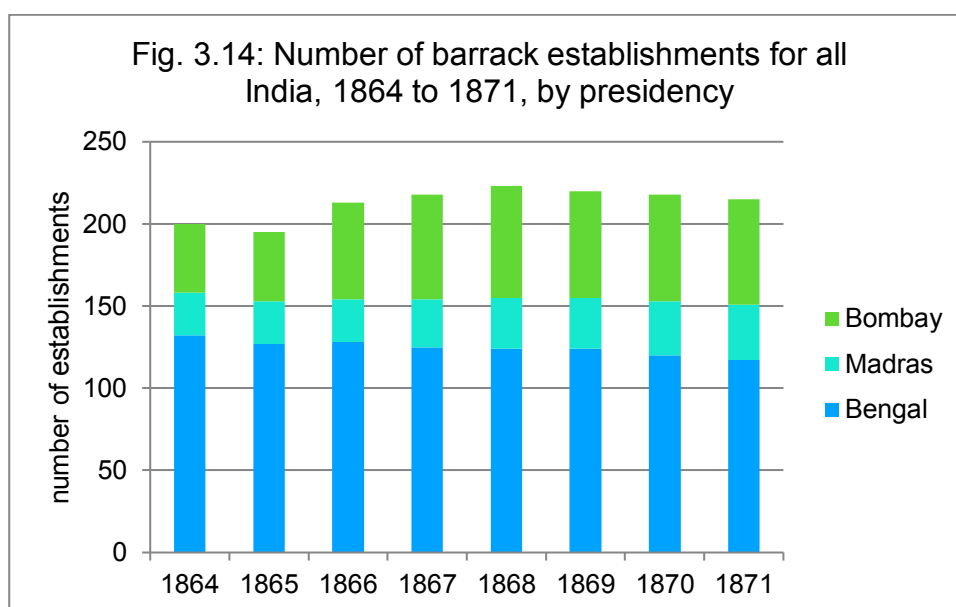
<sup>170</sup> Piat Andrew, ‘Currency’, p. 515.

<sup>171</sup> *Military expenditure 1884-85 to 1892-93*, p. 73.

<sup>172</sup> *Ibid.*, pp. 72-3.

<sup>173</sup> G.J. Wolseley, ‘Military expenditure in India 1895-96’, *Memorandum on reduction of military expenditure*, 27 March 1877 [BL IOR/L/MIL/7/12783].

given in the army military budget reports (Figure 3.14).<sup>174</sup> In Madras the increase was slight and in Bengal, numbers hardly changed, meaning that barrack renewal here was mostly on existing stations unlike in Bombay presidency where new locations were added. Over the same period a 25 percent increase in medical establishments, an all-encompassing term that included not only hospitals and dispensaries of various types but also medical stores and depots, was observed, with a near doubling in Bengal. Medical establishments, proportionally more so of the hospital type, showed a two and a half-fold increment between 1864-66 (109) and 1867-69 (286) for the European army, falling to 227 in 1869-70. The number of native medical establishments (that included dispensaries) went down a little from 949 in 1864-66 to 812 in 1869-70.



These data indicate a substantial spate of barrack building and improvements, along with other military works, in the 1860s and 1870s, in Bengal and Bombay presidencies, and in Madras – though there the records are less complete – for European troops, with albeit quite a lot less for sepoys. In the final quarter century, spending on building tailed off whilst budgets for repairs remained relatively constant; however, maintenance costs increased.

<sup>174</sup> *Analysis of the Indian military budgets together with the effective and established strength of the Indian armies and establishments from 1863-64 to 1873-74* (London: Eyre and Spottiswoode, 1875), pp. 136-7, 151-4 [BL IOR/L/MIL/17/5/1915].

### *The state of sanitation from the 1867 Memorandum and from inspectors' reports*

The *Memorandum on measures adopted* gives qualitative detail on sanitary reforms in European cantonments, especially in Bengal and Bombay presidencies.<sup>175</sup> It confirms that certain improvements had already been initiated before the sanitary commissioners reported in 1863-64, including giving greater superficial space per soldier. Barracks had been built at Umballa in 1843 by Sir Charles Napier (1782-1853), and at Sealkote (1850-52), Rangoon (1852-54), Fort William (1853, occupied 1859) and elsewhere.<sup>176</sup> The commissioners required privies and urinals that discharged into drains to be abolished and replaced by dry earth conservancy – the removal and burial of excreta.<sup>177</sup> Dr Hathaway's system of dry conservancy had been introduced into Punjabi gaols in 1852, and was extended to all cantonments in Bengal in 1863.<sup>178</sup> The supply of water was problematic. Despite a willingness to use deep wells rather than tank storage, 'use of water skins does not seem likely to be soon superseded'. The employment of female nurses, sited in Calcutta hospitals since 1863 and deemed a success, the commissioners thought should be extended to government hospitals and 'all regimental hospitals', but as noted this plan was shelved on account of recruitment difficulty and cost.<sup>179</sup> For the Bombay presidency, the *Memorandum* reports simply that 'much progress was made' in adapting existing European barracks, planning new ones, and in converting latrines to the dry earth system.<sup>180</sup> For native troops, latrines had been introduced in some places, for example, at Vepery, and there found suitable.<sup>181</sup> The intention was for a general rollout to all native stations in Bengal, though in Madras presidency, problems were anticipated due to the large number of relatives that co-habited with the soldier. The *Memorandum* reveals judicious

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<sup>175</sup> *Memorandum on measures adopted 1867*; Details for Madras presidency mention building of new barracks, for example, at Neilgherry Hills, Secunderabad and Trimulgherry (pp. 70, 82-3). Some particulars are given on civilian municipal sanitation (e.g. Calcutta, pp. 49, 88).

<sup>176</sup> *Ibid.*, pp. 24-5, 65; Sewers were not then favoured due to problems anticipated in drainage. The budget for military works in India, 1864-65, was £2 million, £1.5 million of this for Bengal – of the total, £1.8 million was for original works (p. 45).

<sup>177</sup> Dry earth conservancy is described in: *First annual report of the sanitary commissioner for Madras* (Madras: Gantz, 1865) pp. xxv, xxxiv.

<sup>178</sup> *Memorandum on measures adopted 1867*, p. 39.

<sup>179</sup> *Ibid.*, pp. 38-9, 65.

<sup>180</sup> *Ibid.*, pp. 96-7, 99.

<sup>181</sup> *Ibid.*, pp. 67-8, 82, 85; Vepery is in present day Chennai.

planning for cholera epidemics, namely prior selection of ‘encamping grounds’, distanced from local civilian towns, for troops to be moved to, if cholera struck.

The sanitary commissioners’ and engineers’ reports give more detail than the *Memorandum* on the general state of sanitation and implementation of commission recommendations. For example, the water supply at Fort William was described by the chief engineer for Bengal as ‘not entirely satisfactory’ in 1871, and consideration was given to obtaining water from the waterworks of Calcutta.<sup>182</sup> This did not happen because the justices of the Calcutta municipality demanded too high a price for the supply.<sup>183</sup> By 1878, agreement had been reached as, ‘The water supply (which is noted as good and ample) is directly derived from the municipal main. There is, however, no direct connection by pipes between it and the General Hospital, water is carried in casks from the nearest tap’.<sup>184</sup>

Inspectors’ reports give an indication of how a sanitary appraisal was made and what was found. The station at Trimulgherry in Madras presidency was inspected by Edward Balfour, on 20 January 1868.<sup>185</sup> Dr Balfour was satisfied with the healthiness of the location, ‘being open, and elevated, with good natural drainage’, but the barracks were: ‘too compactly arranged, and a few out offices ... might be removed, so as to admit a freer circulation of air.’ Concerning floor space, Balfour found that, ‘Each man will have a space of ninety superficial feet.’ The present accommodation consisted of: ‘...eight blocks occupied by the 21st Fusiliers, and on the completion ... ten will then be occupied by this regiment, and ... upper stories might be added to these buildings.’ Family quarters were present: ‘each family has a separate latrine and cookhouse.’ Balfour was concerned about the siting of barracks of the 2nd European infantry regiment, which, ‘appears to have been

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<sup>182</sup> *Annual report of works under the chief engineer of Bengal for the year 1871-72* (place: publisher, date – not given), p. 5.

<sup>183</sup> *Report chief engineer Bengal 1871-72*, p. 5.

<sup>184</sup> AMD, *Report 1878*, p. 170 – Gives details of the state of sanitary facilities and of improvements made at barracks and hospitals.

<sup>185</sup> E. Balfour, *Proceedings of Madras government military department* (Madras: publisher unknown, 1868), pp. 2-7.

entirely overlooked on sanitary grounds alone', unsatisfactorily placed 'within a mile and a half of the Secunderabad bazaar which is densely populated.' Means of amusement are recorded as the soldiers' institute, gardening, skittle alleys, fives court, cricket and gymnastics. Balfour wanted to preserve the location: 'measures should be adopted to prevent encroachment of villages, encampments of natives, extension of bazaars, removal of a wet cultivation and shallow tanks' and was aware of miasmatic dangers in the vicinity, recommending: 'removal of the Commissariat Kharkana [compound] to the southward of the European lines, away from the influence of prevailing winds during the unhealthy months, which now blow over it, and carry the poisoned atmosphere direct into the lines of the 108th Regiment.' With regards to removal of excreta, 'conservancy regulations ... and supervision exercised by commanding officers over their respective lines, is good, and improvements are daily being made.'<sup>186</sup> Balfour suggested additional hospital facilities: 'having seen this hospital much overcrowded with patients ... crowding the sick cannot be but attended with prejudicial results', and noted the inmates: 'Young men sent out from the Depot physically unfit for service in this country, volunteers who have already been too long in India, and men with shattered constitutions consequent upon the degrading vice of drunkenness. It is a cause of much regret that intoxicating drinks are obtained with such facility'. He had concerns about the drinking water: 'a well is being sunk for use of the 18th Hussars, the water drawn from that in the barracks square having been analyzed and pronounced unfit for drinking purposes'.<sup>187</sup>

At Fort William in 1878, the inspector observed that more latrines were being added.<sup>188</sup> At Benares, barracks and hospital were, 'all of the old pattern ... Latrines on the new standard plan are very necessary, and detached lavatories for the married quarters', and at Cawnpore, barracks for the infantry were, 'on the new standard plan; those for Royal Artillery of old construction, but good, and have proved healthy. Pucka drains around barracks are a sanitary necessity'.<sup>189</sup> At Fort Gwalior,

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<sup>186</sup> *Ibid.*

<sup>187</sup> *Ibid.*

<sup>188</sup> AMD, *Report 1878*, p. 170.

<sup>189</sup> *Ibid.*, p. 171.

in 1878, the inspector describes the latrine procedure: ‘dry earth system carried out, and night soil removed to a distance of half a mile from the fortress, where it is buried in pits’, whilst at Chowbattia, there was an issue with the water supply: ‘The principal medical officer also suggests that if Chowbattia is retained as a military station, provision of a steam-force pump to raise water from the spring to the highest level of the cantonment would be advisable, both as a sanitary and an economic measure, in substitution of its transport in water skins’.<sup>190</sup> In Agra, concerns centred on native attendants: ‘there are no quarters for medical subordinates, and native attendants on the sick live in the neighbouring bazaar, in constant communication with the inhabitants, amongst whom smallpox is endemic and cholera outbreaks frequent’. In Delhi, water quality varied: ‘Very good drinking water is to be found in the fort, but the majority of wells are brackish and the mains supply for drinking purposes is now derived from the canal’.<sup>191</sup> At St Thomas Mount in 1878, there were problems with the introduction of piped water: ‘lavatories [wash rooms] attached to the new barracks are fitted with force pumps and reservoirs, and pipes with taps for distribution. Owing to mechanical defects this elaborate system has not worked satisfactorily, basins and other utensils have been filled by hand’.<sup>192</sup> A prevailing feature in these reports is inadequacy of water supply.

### ***Municipal sanitation***

The civil populations of India lived cheek by jowl with military cantonments, as noted to the consternation of army medical officers, especially regarding the proximity of the native bazaar. Unsurprisingly more attention was paid to implementation of sanitary improvements to control epidemic diseases in areas of municipal population than in rural regions. City dwelling Europeans and native Indians of, for example, merchant and land-owning classes, both demanded action and had the means politically and economically, to enforce it. The main example of this was Calcutta. Schemes to improve drainage in the city were mooted in the first decade of the nineteenth century when Richard, Marquess Wellesley, was governor-general of Bengal (1797-1805), but shelved on

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<sup>190</sup> *Ibid.*, p. 172.

<sup>191</sup> *Ibid.*, p. 173.

<sup>192</sup> *Ibid.*, p. 180.

his recall to London.<sup>193</sup> Efforts in 1807 floundered through lack of funds. However, a lottery committee established in 1817, composed of professional Europeans, met with more success.<sup>194</sup> The committee's remit was to extend drainage and roads, though conservancy remained a matter for city magistrates. The cholera outbreak of 1817 provided an impetus – the presence of an epidemic risked Calcutta being labelled an 'oriental city' like Cairo, with an implied tendency to outbreaks of plague, and taints of corruption and maladministration.<sup>195</sup> Clearing areas of north Calcutta and replacing them with well-ventilated houses and wide streets was proposed, though when a plan was approved in 1818, it was for a lesser scheme.<sup>196</sup> There were concerns about drainage and the disease potential of stagnant water. A report on the cholera outbreak by Dr James Jameson, secretary to the Bengal Medical Board, saw the high prevalence in poor parts of the city as due to inadequate ventilation and dampness.<sup>197</sup> In the early nineteenth century British residents stored rainwater in 'Pegue' jars for subsequent use, whilst others including better off Indians had access to water storage tanks.<sup>198</sup>

Calcutta still had a high death rate from cholera in the 1860s despite the £400,000 spent on a proper water and drainage scheme. Water was collected from the river Hooghly at Pultaghat, transported in open canals to the city, passed through a filtration system at Ballygatchea, and then piped along the city's main streets to housing.<sup>199</sup> Despite this, Calcutta's public health arrangements when inspected in 1869 by Dr David Boyes Smith (1833-89), commissioner for Bengal, were described as 'sanitary mal-administration'.<sup>200</sup> Smith expressed concerns about disposal of night soil, which was

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<sup>193</sup> C.A. Bayly, 'Richard, Marquess Wellesley formerly Wesley (1760-1842)', *ODNB online* (Oxford, OUP, 2004) <https://doi.org/10.1093/ref:odnb/29008> [8 October 2019].

<sup>194</sup> Harrison, *Climates*, p. 156.

<sup>195</sup> Harrison, 'Scourge', pp. 33-4; P. Datta, *Planning the city: urbanization and reform in Calcutta c.1800-c.1940* (New Delhi: Tulika, 2012), p. 59.

<sup>196</sup> Datta, *Planning*, p. 59.

<sup>197</sup> J. Jameson, *Report on the epidemick cholera morbus, as it visited the territories subject to the presidency of Bengal, in the years 1817, 1818 and 1819* (Calcutta: Government Gazette, 1820), pp. lxxvii, 87, 100, 106.

<sup>198</sup> Martin, *Topography*, p. 28; P. Chakrabarti, 'Purifying the river: pollution and purity of water in colonial Calcutta', *Studies in History (New Delhi)*, 31 (2015), pp.178-205.

<sup>199</sup> Chakrabarti, 'Purifying', pp. 188-9.

<sup>200</sup> D.B. Smith, *Report on the drainage and conservancy of Calcutta* (Calcutta: Bengal Secretariat, 1869), pp. 1, 113.

discharged into the Hooghly. He made a connection between this and the high rate of cholera, and suggested a water carriage system for sewerage, which he admitted would be ‘prohibitively expensive for the municipality’, or a dry conservancy method, despite the already high cost of drainage.<sup>201</sup> Smith enumerated other sanitary problems in 1869 Calcutta, as ‘obstructed drainage, numberless uncared-for cesspools, [and] wilful river pollution’, and suggests small scale dry earth systems for managing excrement.<sup>202</sup> However, dry earth was in short supply, and carriage was both costly and ‘cumbrous’. The alternative, a water carriage system, polluted water courses (as experienced with the Thames), was dependent on collateral conditions, and was prohibitively expensive.<sup>203</sup> By 1872, Calcutta’s first health officer, Dr C. Fabre Tonnerre (c.1818-84), felt that sufficient had been done for the city’s European southern portion and recommended, ‘extension of sanitary labors [sic] of the Justices to the northern division which requires urgent improvements, most especially in villages which abound it’.<sup>204</sup> The municipal engineer and the Indian-dominated special committee on native villages – ‘bustis’ referred to in documents, indicate slum housing – demanded in 1875, better roads, ventilation, filling of stagnant pools, drainage, conservancy and provision of public latrines for the bustis, but faced resistance from landlords due to expense and from villagers who did not want to be displaced.<sup>205</sup> Septic tanks for anaerobic treatment of sewage were finally established in Calcutta at the end of the nineteenth century.<sup>206</sup> Clean water supply as a sanitation measure was gradually rolled out to the civilian population, for example, in the Bombay presidency area, to 15 cities and towns between 1874 and 1886, including Poona, Karachi and Hyderabad.<sup>207</sup> Elsewhere for many locations, the government organized the new supply or renewal of water tanks, wells, drains, and latrines, and funded larger projects such as bridges and roads, hospitals and dispensaries, and canals.<sup>208</sup> From 1880 to 1889, in Bengal, annual expenditure on

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<sup>201</sup> *Ibid.*, pp. 113-14, 120.

<sup>202</sup> *Ibid.*, p. 117.

<sup>203</sup> *Ibid.*, pp. 117, 120-2.

<sup>204</sup> *Administrative report of the Calcutta municipality, 1872*, Appendix 7, pp. 5-7 (quoted by Datta, *Planning*, p. 148).

<sup>205</sup> *Ibid.*, pp. 63-5 (quoted by Datta, *Planning*, pp. 150-1).

<sup>206</sup> Chakrabarti, ‘Purifying’, pp. 202-3.

<sup>207</sup> BL IOR/P/3885 1891, ‘Sanitary proceedings’, p. 483.

<sup>208</sup> *Ibid.*, pp. 440-1, 486. 489-95, 504-6.

sanitation projects rose by more than a half, from Rs11,07,560 to Rs17,20,740 – the biggest spending, consuming two-thirds to three-quarters of capital, was on conservancy including latrines, and roadbuilding.<sup>209</sup> Between 1877 and 1890, outlay on sanitation projects in the Punjab nearly doubled, from Rs6,87,123 to Rs12,82,856.<sup>210</sup> These figures provide evidence of commitment to improving sanitation in the mofussil, though the demand was large.

Legal means were also available to control spread of disease. Cantonment acts were articles by which authorities could regulate areas around military camps and, in theory at least, aim to preserve the soldiery from sanitary hazards. The 1864 act, though primarily aimed at controlling spread of venereal disease, also was concerned with matters of sanitation and its remit extended beyond confines of the cantonment itself.<sup>211</sup> Specifically, the act drew together and linked threats perceived from venereal disease, intemperance and filth. Further acts followed in 1868 and 1889. The success of this legislation is discussed in Chapter 5.

Provision of general hospitals for civilians, to cope with outbreaks of disease, was focussed on the major centres. For example, by 1887, Calcutta had six hospitals serving its native and European populations, with the Campbell Hospital admitting the most in-patients, and the Mayo Institution treating a majority of outpatients (Table 3.5).<sup>212</sup> Of note is that the lock hospital was still functioning and that most of its clients were out-patients (*vide* Chapter 5). The mortality rate was highest in the Campbell Hospital, though this might have been because it dealt with the most difficult cases. *Sanitary proceedings* indicates that in 1887 there were 1508 medical institutions serving the civilian population of India, catering for 248,439 in patients and 10,622,189 outpatients.<sup>213</sup>

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<sup>209</sup> *Ibid.*, p. 491.

<sup>210</sup> *Ibid.*, p. 507.

<sup>211</sup> Wald, *Vice*, pp. 159, 184-5.

<sup>212</sup> BL IOR/P/3429 1889, 'Sanitary proceedings', p. 955.

<sup>213</sup> *Ibid.*, p. 954; Most institutions were dispensaries.

**Table 3.5. Patients seen in public hospitals in Calcutta, 1887.**

Hospital	In-patients	Outpatients	Mortality per mille
Campbell Hospital	6,432	-	210
Medical College	5,953	48,518	105
General Hospital	2,966	-	41
Municipal Police	2,738	-	8
Mayo Institution	2,736	179,249	86
Voluntary Lock	458	2214	49
Total	21,283	229,981	112

***Quarantine in India, internal and maritime – plague, pilgrims and trade***

Quarantine was used internally in India in the first half of the nineteenth century as a well-recognized means of controlling plague. An outbreak of what was thought to be plague in 1836 spread throughout Gujarat to Rajasthan, with up to fifty percent mortality.<sup>214</sup> The Company authorities responded by restricted movement of those thought to have the disease. A *cordon sanitaire* was established around the city of Pali, and quarantine stations set up on roads that led out to neighbouring territories. Later in the century, quarantine was employed to manage further outbreaks of plague. Quarantine proved a matter of conflict between the government of India and some European powers regarding maritime trade.

The passage from the subcontinent to Europe, especially after 1869 when the Suez Canal opened, was contentious if disease broke out on board ship. The Bombay Act 6 of 1867 allowed the government to establish a *cordon sanitaire* on shore or in the harbour to secure people suspected of being infected.<sup>215</sup> The Pilgrim and Native Passenger Ships Act of 1870 required ships to show a

<sup>214</sup> Harrison, *Climates*, pp. 192-5.

<sup>215</sup> Ramanna, *Western medicine*, pp. 152-3.

clean bill of health and not to be overcrowded before they left India. The 1876 Native Passenger Ships Act introduced inspection of pilgrims travelling to the haj, prior to boarding. Outbreaks of cholera around Mediterranean ports or in Europe were often blamed on ships from India, inflaming political tensions. The opinion of the government of India on the issue was influenced by, though not always in agreement with those of J.McN. Cuningham, its sanitary commissioner from 1868 to 1884, and J.L. Bryden, its statistical officer from 1866 to 1880.<sup>216</sup> Initially, Cuningham took the view that cholera was transmitted by human interaction, through the stools of an infected person, though he believed the germ could only survive in insanitary conditions. He supported local *cordon sanitaire* in the path of returning pilgrims but saw general quarantine as impractical.<sup>217</sup>

Cuningham's view in the early-to-mid 1860s was similar to many medical officers in India at that time, incorporating elements of both miasmatic and contagionist theories. Cholera epidemics were seen as a product of pilgrim movement, foul water, poor nutrition, inadequate hygiene, and accumulated filth.<sup>218</sup> By the late 1860s, probably influenced by Bryden, who believed that cholera spread in monsoon air currents, Cuningham along with other officials became sceptical about inter-human transmission, though he was still prepared to hear opposing views. By the 1870s Cuningham's stance was against quarantine, as on the occasion in 1876 when the quartermaster general in the Punjab wanted to establish a sanitary cordon along the river Indus at Attock – though in this instance the government sided with the military authority, agreeing the request. Cuningham often clashed with Annesley C.C. De Renzy (1824-1914), sanitary commissioner to the Punjab, a confirmed contagionist, though they did agree that quarantine was frequently ineffective.<sup>219</sup> Many military officers, especially in the Punjab, sided with De Renzy, and used quarantine to control outbreaks of cholera. During the 1869 cholera epidemic twelve instances of use of *cordon sanitaire* are recorded, three in military cantonments (e.g., Meean Meer), three in gaols (e.g., Amritsar) and

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<sup>216</sup> M. Harrison, 'Cuningham, James McNabb (1829-1905)', *ODNB* online (Oxford, OUP, 2004) <https://doi.org/10.1093/ref:odnb/32664> [23 October 2019].

<sup>217</sup> M. Harrison, 'The great shift: cholera theory and sanitary policy in British India, 1867-1879', in B. Pati, M. Harrison, eds. *Society, medicine and politics in colonial India* (London: Routledge, 2018), pp. 37-60.

<sup>218</sup> *Ibid.*, pp. 41-8.

<sup>219</sup> Harrison, 'Cuningham'; Harrison, 'Shift', pp. 47-8.

six in civilian towns or cities (e.g., Peshawar).<sup>220</sup> The effectiveness was debated – though need for ‘a pure water supply’ was agreed.

Maritime quarantine developed into an issue for the government of India when the Egyptian and Ottoman authorities became concerned about cholera with the opening of the Suez canal. The government initially acquiesced by passing the Native Passenger Ships Act in 1870. With the anticipated arrival of cholera in the middle east in 1871, the Egyptian and Ottoman boards of health demanded quarantine on ships from infected ports, disrupting trade. The government of India then responded in a negative manner, though the Bombay presidency was more willing to comply.<sup>221</sup> Quarantine measures were in place at Aden and other ports during the 1870s but the Indian government remained intransigent, following Cuningham’s advice, until 1878, when it was forced by the British government to draw up quarantine rules, drafted by Cuningham against his own prejudices, for all Indian ports, finally bringing India into line with regulations pertaining in Britain. Eventually the government of India realized that Cuningham’s anticontagionist views were out of step with contemporary opinion and he was sidelined. In the early twentieth century, when typhoid was prevalent, precautionary quarantine was employed for new troops arriving in India from Britain. New arrivals were sent to a separate part of an army camp with its own latrines and cooking facilities for 28 days, or longer if anyone went down with typhoid.<sup>222</sup>

Internally, government attempts at sanitary control of Hindu pilgrimages often resulted in bad feeling. The most notorious cholera episode was at the Hurdwar (Haridwar) pilgrimage and festival (*kumbh mela*) of 1867, attended by three million Hindus. Cholera broke out at the festival and spread along lines of passage with pilgrims as they returned to their villages. Possibly a quarter of a million pilgrims contracted cholera of whom a half perished.<sup>223</sup> The pilgrim rite included total

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<sup>220</sup> *RSCGI 1969*, pp. 12, 19, 34-6, 42-3, 207, 218, 235-6.

<sup>221</sup> Harrison, ‘Shift’, pp. 49-54.

<sup>222</sup> *Report of the AMD 1904*; 46: pp. 248-51.

<sup>223</sup> D. Arnold, ‘Cholera and colonialism in British India’, *Past and Present*, 113 (1986), pp. 118-51.

immersion in a tank of water. Investigation by Dr John Murray, inspector-general of hospitals in North-Western Provinces, strongly suggested a contagious agent. Murray recommended regulation of water supply and restriction on population movement at festivals.<sup>224</sup> However, opposition in the Indian press, and government concern about being heavy-handed, prevented adoption of a *cordon sanitaire* approach to festivals. A more aggressive line was taken by the military, though, when it came to protecting cantonments from native civilian populations – sanitary cordons imposed at Attock on the Indus are an example.<sup>225</sup> The military response to a local outbreak of cholera was to remove troops to a cholera-free area.<sup>226</sup> The 1863 commissioners' report shows that military stations enacted isolation of one or more soldiers thought to have an epidemic disease, for example, at Delhi and Sealkote.<sup>227</sup> The Military Cantonments Acts of 1864 regulated land use and drainage, and placed sanitary matters in cantonments under the direct charge of military medical officers. These powers were extended in 1877 to allow government inspection of villages within five miles of a cantonment when there was concern about contaminated water supplies.<sup>228</sup> Cantonments were seen as 'medical and sanitary enclaves', but this was more hope than reality due to the relative proximity of the native town.<sup>229</sup>

### ***Critique of method***

The use of financial records to demonstrate the extent to which sanitary improvements were implemented can be criticized on a number of counts. There is a lack of a public works data set extending across the whole period in question, that is from 1850 to the end of the century. What reports exist are for runs of a few years here and there, or for a run of years that does not include the 1850s or the early 1860s – times essential to assessment of whether or not there was an increase in spending. Reports issued were in different forms and did not uniformly indicate the proportions of

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<sup>224</sup> Harrison. *Public health*, pp. 106-8.

<sup>225</sup> Harrison, 'Shift', p. 48.

<sup>226</sup> Harrison. *Public health*, p. 108.

<sup>227</sup> *Royal commission Volume I*, Appendix, pp. 114, 177.

<sup>228</sup> Harrison. *Public health*, pp. 76-8.

<sup>229</sup> Arnold, *Colonizing*, pp. 96-7, 114.

military original works budgets allocated to building accommodation or sanitary schemes for troops. Ascertaining amounts spent on latrine or ablution facilities, or on improvement in water supply, is difficult from public works reports. Observational accounts of inspectors add colour to quantitative statements. An additional criticism concerns the currencies used in reports. Some quote in pounds sterling whilst most use rupees. Even then there can be confusion. The Indian numbering convention was mostly used, but in the 1880 decade some reports employed a western style numbering system which seems out by a factor of ten compared to previously quoted amounts. Nonetheless, financial records confirm execution of sanitary infrastructure projects, though often at a lesser level than originally intended.

### ***Discussion***

Can changes in admissions due to cholera and dysentery, the main diseases targetted by the sanitary commissioners, be ascribed to the sanitary building programme? The main reduction in incidence of both these diarrhoeal diseases in the European army occurred in the late 1850s, before introduction of commissioners' sanitary measures. This confirms comment at the time, supported by financial evidence shown here, that infrastructural improvements had already begun in the late 1850s, and were yielding results.<sup>230</sup> Continuing but less prominent falls were seen in the late 1860s and 1870s for cholera, though less so for dysentery. These can be considered a response to the commission's sanitary reforms, implemented, as revealed here, from the 1860s. Declines in the sepoy army were slower, from a lower base, but compatible as a response to lesser and later sanitary interventions. Some contemporary medical officers were scathing about the benefits of early reforms. Dr W.J. Moore, later surgeon-general in Bombay, claimed that the reduced mortality between 1844 and 1865 was explained by increased transfer of the sick to Britain.<sup>231</sup> Other potential factors related to the nature of European recruits and their demands on the service have been discussed in Chapter 2.

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<sup>230</sup> A.H. Leith, *Report on the general sanitary condition of the Bombay army* (Bombay: Education Society, 1864); Arnold, *Colonizing*, p. 71; Ewart, *Vital statistics*, pp. 19, 22, 36-7.

<sup>231</sup> W.J. Moore, 'Results of sanitation in India', *IMG*, 2 (1867), pp. 173-6.

Sanitary improvements were made over a wide front. New barracks were airier, had superior ablution and latrine facilities, and were better situated compared to previous ones. What has become clear from analyzing inspectors' reports is frequent concern about supply of clean water right up to the end of the 1870s – even when improved, the final stage was often in casks. Descriptions also reveal a lack of hand washing facilities in cookhouses. Historians have placed varying emphasis on which facets of 'sanitation' contributed to disease reduction. Guha sees success in disease control as having been achieved through 'environmental sanitation' by which he means the wide scope of protecting the water supply, removing excreta and refuse, checking overcrowding and providing ventilation.<sup>232</sup> He also identifies personal knowledge and hygiene as relevant. Curtin has similar views, espousing 'multipurpose public health measures' to include altitude, clean water, clean air and sewage disposal.<sup>233</sup> He locates the initiating effect of these measures rather earlier than some to 'midcentury' and suggests the move to hill stations after 1863 reduced mortality from 'malaria'. Arnold, in contrast, sees 'sanitary segregation' as the principal reason for reduction in mortality, especially after 1890, by transforming barracks into 'sanitary enclaves'.<sup>234</sup> Harrison argues that initially better living conditions in barracks made a difference, but that, after the 1870s, improvements in sewage disposal and in water supply took over.<sup>235</sup> Arnold's assertion that cantonments were sanitary enclaves might seem overconfident for the third quarter of the nineteenth century, as an intimate relationship of army camps with their neighbouring native towns was clear to the extent of sometimes sharing water supply. Recently Sarah Halvorson and James Westcoat have confirmed that 'military enclaves were never fully separated from urban water and sanitation systems'.<sup>236</sup> However, sanitary facilities within cantonments far exceeded those outside. Internal quarantine, used patchily, was not identified as a major influence on rates of disease. Jonathan Chapman, in a study of urban mortality in Britain, estimates that the accumulative effect of

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<sup>232</sup> Guha, *Population*, pp. 18, 123, 136.

<sup>233</sup> Curtin, *Migration*, p. 61.

<sup>234</sup> Arnold, *Colonizing*, p. 114.

<sup>235</sup> Harrison, *Public health*, pp. 66, 76.

<sup>236</sup> S.J. Halvorson, J.L. Westcoat. 'Guarding the sons of empire: military-state-society relations in water, sanitation and health programs of mid 19<sup>th</sup>-century India', *Water*, 12 (2020), p. 429; doi:10.3390/w12020429.

investment in urban infrastructure, meaning street paving, public parks, as well as sewer systems and clean water, was responsible for 56 percent of the mortality decline in British cities between 1861 and 1900.<sup>237</sup> Chapman was looking at overall urban mortality to which a reduction in child and maternal fatalities would contribute, and in a western urban population – these are not directly comparable to death rates for soldiery in India. Nonetheless, Chapman unequivocally demonstrated that improved sanitation had a beneficial influence. Points raised by the present work both contrast with and support views of previous historians. Good evidence for better ventilation and reduced overcrowding has been found and this can be chronologically linked with a reduction in pulmonary tuberculosis in European troops (Chapter 2).<sup>238</sup> Reductions in cholera and dysentery, from the late 1850s through to the 1870s, fit best with improved removal of excreta (using dry earth conservancy or, to a lesser extent, water-based system), together with more spacing in barracks, though other factors relating to the background health and nutritional status of the recruits and the demands on army medical services need considering as well (*vide* Chapter 2). Some contribution might have come from re-encampment to new grounds and by improving the supply of drinking water, though enthusiasm for the latter is tempered by knowledge that purity remained suspect until the final decades of the century.

Benefit from rotation to hill stations, generally located above 5,000 feet (1,524 meters), and regarded as healthier locations than the plains, is noted by some historians.<sup>239</sup> Hill stations were viewed by British officials in the immediate post-rebellion period – Kennedy observes – ‘as the only sites where they could establish a lasting presence without imperilling their physical and moral integrity’ – that is, locations free from what was regarded as the degeneracy that surrounded cantonments in the plains.<sup>240</sup> They were favoured as mostly being less prone to cholera, dysentery,

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<sup>237</sup> J. Chapman, ‘The contribution of infrastructure investment to Britain’s urban mortality decline, 1861-1900’, *Economic History Review*, 72 (2019), pp. 23-59.

<sup>238</sup> Curtin, *Migration*, pp. 40-2.

<sup>239</sup> Curtin, *Migration*, p. 160; Arnold, *Colonizing*, p. 79; Harrison, *Public health*, p. 61.

<sup>240</sup> Kennedy, *Magic mountains*, pp. 35-6.

ague and hepatitis – mid-century mortality rates were a half of those in the plains.<sup>241</sup> Parkes, in 1864, wrote: ‘If properly selected, the vast class of malarious diseases disappear; liver diseases are less common, and bowel complaints, in some stations at any rate, are neither so frequent nor so violent’.<sup>242</sup> It was not always so. At some hill stations such as Wellington in the Madras presidency, bowel complaints were a problem, enteric fever became endemic at Ootacamund in the late 1860s, as did ‘hill diarrhoea’ at Simla – related to insufficiencies in water supply and sanitation.<sup>243</sup> A mid-1850s account by Dr Alexander Grant (1817-1900) of the convalescent depot at Murree, opened in 1851, shows that, for 1852, 161 officers and soldiers were admitted, of whom six died.<sup>244</sup> The commonest reason for transfer to Murree was fevers, accounting for 49 (mainly the malarial type – intermittent quotidian), followed by chronic hepatitis (32), dysentery/ diarrhoea (24), and rheumatism (16). Ague fevers especially seemed to remit, as did the more acute diarrhoeas, but Grant found that chronic cases of hepatitis, dysentery or rheumatism, or of consumption (pulmonary tuberculosis) did not do so well and should not be sent. Invaliding to Britain was necessary in a fifth of his cases, notably for liver complaints.

The royal commission recommended a third of troops be stationed at any one time in the hills, though this was not achieved. By 1870, a sixth of European troops were at hill stations; by the mid-1890s, a quarter.<sup>245</sup> Different species of mosquito can survive at differing elevations. *Anopheles culicifacies*, one of the main malaria-carrying species of mosquito in the Indian subcontinent, is most numerous in the plains, but in foothills and forests, particularly of the north-east, *Anopheles*

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<sup>241</sup> *Ibid.*, pp. 25-8; Hill sanatoria typically were not used for soldiers with epilepsy, rheumatism, bronchitis or syphilis, as it was thought the high altitude and cool temperatures might aggravate these conditions.

<sup>242</sup> E.A. Parkes, *A manual of practical hygiene*, 7th edn, ed. F.S.B. de Chaumont (London: Churchill, 1887), p. 664 [1st edition 1864].

<sup>243</sup> Davidson, ‘Medico-topographical and statistical report of the convalescent depot at Wellington, India, for the year 1870’, in *AMD Report for the year 1870*, Vol XXII (London: Harrison, 1872), pp. 474-85 [Davidson’s first name is not given].

<sup>244</sup> A. Grant, *The convalescent depots: Murree, its topographical and medical history* (Place: publisher, unknown – mid 1850s); Hill diarrhoea was not a problem in Murree at this time.

<sup>245</sup> Arnold, *Colonizing*, p. 79.

*minimus* and *Anopheles dirus* are prominent plasmodium-bearing vectors.<sup>246</sup> Increased time spent by European troops at hill stations might account for some reduction in contagious disease incidence, especially fevers representing malaria, but probably only to a small degree. Much of the decline had occurred before troop relocations were implemented. Curtin comments that introduction in 1870 of the shorter service regimen of twelve years, of which part could be spent in reserves, replacing the twelve-years often rolled over by another twelve, reduced mortality.<sup>247</sup> It may have done so, but the greatest fall in infectious disease incidence was seen before 1870.

Historians question whether McKeown's findings can translate to the setting of European troops exposed to nineteenth century tropical locations.<sup>248</sup> Although best known for asserting primacy of nutrition to account for growth in western populations during the industrial revolution and for decrying the effectiveness of most pre-twentieth century medicines, McKeown also concerned himself with sanitation and saw a deterioration in some aspects of this in nineteenth century England,<sup>249</sup> as opposed to improvements noted for armies in India. For the European army in nineteenth century India, nutrition was easily adequate and cannot account for a reduction in contagious disease, though for the sepoy, diet was often suboptimal, and likely did contribute to increased disease susceptibility and mortality, as discussed elsewhere.<sup>250</sup> However, as McKeown states, food handling and personal hygiene in regard to eating are points in play (see Chapter 4).

The primary emphasis of sanitary reforms was on wellbeing of the European army. The health of the native army in mid-century was held to be acceptable and a target to be matched for the European force. In the mid-century native troops were mainly accommodated in wooden or semi-permanent huts. Over the second half of the century, records indicate that, to a limited extent, more

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<sup>246</sup> S.K. Subbarao, N. Nanda, M. Rahi, K. Raghavendra, 'Biology and bionomics of malaria vectors in India', *Malaria Journal*, 18 (2019), <https://doi.org/10.1186/s12936-019-3011-8> [26 April 2024].

<sup>247</sup> Curtin, *Migration*, pp. 48, 81.

<sup>248</sup> Guha, *Population*, pp. 13, 18, 110-11, 134; Curtin, *Migration*, pp. 40-1.

<sup>249</sup> McKeown, *Population*, pp. 125-7.

<sup>250</sup> Guha, *Population*, p. 115; Curtin, *Migration*, pp. 41-2.

permanent accommodation was created for them.<sup>251</sup> Whether this resulted in the observed increases in respiratory diseases, notably pulmonary tuberculosis, through overcrowding and confining ventilation, is considered elsewhere. Omissi claims, referencing a 1931 *Defence of India* memorandum, that it was not until the 1930s that most native soldiers were housed in ‘comfortable and airy’ barracks.<sup>252</sup>

### **Conclusions**

To conclude, examination of the budgetary records of the government of India and of the presidencies has confirmed that a programme of barrack building and improvement in latrine and ablution facilities and to a lesser extent in water supply, for European armies was put into action in the fifteen or so years following publication of the 1863 commission report. However, there is evidence that such sanitary reforms had been started in the 1850s, pre-dating this publication. For cholera, which showed the greatest downturn in the late 1850s, sanitary reforms that preceded the 1863 commission report seem to have been key, along with factors enumerated in Chapter 2. A similar finding was made for dysentery. Other potential contributors to the falling rates of the diarrhoeal diseases, as mentioned previously, might include contributions from an improvement in the robustness of recruits, and an easing of the stress on medical resources caused by the post-rebellion troops surge. Subsequent but lesser reductions observed in the rates of the diarrhoeal diseases after the mid-1860s can be associated with the sanitary infrastructure installed in that decade. A higher rate of incidence of dysentery among native troops – compared to their European colleagues – could be a sequela of their poorer sanitary facilities – the change to martial race recruitment can also be considered as a possibility. The royal commissioners based most of their

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<sup>251</sup> *Report of the public works commissioner during the official year 1860-61*, pp. 1, appendix A; *Report of proceedings in the public works department during the official year 1861-62*, pp. 2-3; *Report of the government of India in the public works department during 1862-63*, pp. 49-50, appendix 1; *Progress report 1854-55*, pp. 57-9; *Report of the proceedings of the government of India in the public works department during the year 1864-65*, pp. 1-2; *Annual progress report India 1864-65*; *Analysis of the Indian military budgets together with the effective and established strength of the Indian armies and establishments from 1863-64 to 1873-74*, pp. 151-2; Balfour, *Proceedings of the Madras government military department*, 1868, pp. 2-7.

<sup>252</sup> Omissi, *Sepoy*, p. 63.

guidance on the miasmatic doctrine of infectious disease, rather than contagionism. Nonetheless, certain of their suggestions can be seen as pertinent, though for ‘wrong’ reasons. Some historians have argued that the commission’s advocacy of troop relocation and the short service scheme were responsible for a degree of decline in disease incidence. Yet, the contribution of these measures must have been small since – by the time they were introduced in the 1870s, the greatest impact on disease reduction already had occurred. They might be responsible for later smaller furtherances, as may improve personal hygiene. Poor nutritional state is not a supportable explanation for contagious disease prevalences in the European army, but it could be a predisposing factor for the native soldiery. Quarantine measures were not widely implemented within India, but had a role controlling plague, and in local outbreaks of cholera when a *cordon sanitaire* was placed around a cantonment, or when an army encampment in a cholera area was moved to a fresh location.<sup>253</sup> An improved water supply, though, is likely to be a minor contributor to disease reduction in the 1860s and 1870s. Significant improvements in this were delayed until the final quarter of the century. Better barrack accommodation, with improved ablution and latrine facilities, is the rational explanation for the diminished *incidence* of infectious disease, especially diarrhoeas, in European troops particularly, in the third quarter of the nineteenth century. The exception is typhoid. Overall mortality fell as a consequence of reduced disease incidence, but it is also a function of improved case fatality rates, as discussed in the next chapter.

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<sup>253</sup> In 1877, a committee examining land quarantine found that this would be difficult to implement in India. Local measures, notably attention to the water supply, were preferred with the decampment of troops without delay to alternative locations that should be well away from lines of communication, especially that of pilgrims – BL IOR/P/1003 1877, ‘Sanitary proceedings’, pp. 971-5, 983-9.

## Chapter 4: Theories and therapies

At the beginning of the nineteenth century, the life of the rank-and-file soldier in British India was continually endangered by disease, but by 1900, this threat had lessened considerably. Reduced exposure, as a result of an improved sanitary infrastructure, discussed in chapter 3, is one side of the coin. The other is the influence of the practice of medicine itself. In the hundred years leading up to 1800, theories of disease had been through several revisions, though understanding of the mechanisms of bodily dysfunction had advanced but little. In the century that followed, however, improved comprehension of pathologies was to make a definite impact on health. Medical developments associated with The Enlightenment had been mainly in the fields of anatomy and, to a lesser extent, physiology, but not in nosology.<sup>1</sup> Throughout the course of the nineteenth century, especially after 1850, medical thinking on infections was to accelerate to such an extent that, by 1900, germ theory was widely accepted. In the early 1900s it was necessary to propose the existence of sub-microscopic viruses, even though they could not yet be visualized.<sup>2</sup> The theoretical conception of disease is important because it influences preventative public health measures and drives treatments, both of which, if successful, reduce the two separate but related parameters, illness-related morbidity and mortality. For the British Empire in the nineteenth century, death from infectious disease was a major concern for the army in India, which, for most of the century, had a strength of more than one hundred and fifty thousand men.<sup>3</sup> The mortality rate for the army's European troops, in the first half of the century, was between five and ten percent per year, which was not only a human tragedy but a financial penalty as well, since each new recruit cost one hundred pounds to be placed into India.<sup>4</sup> Dysentery and fevers, and in some years cholera, accounted for more than half of all deaths in both European and native forces at this time.

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<sup>1</sup> R. Porter, *The greatest benefit to mankind* (London: HarperCollins, 1997), pp. 242-54; Medical advancements lagged behind those in chemistry and physics, in scientific discoveries that flowed from interest in quantitative analysis stimulated by 'The Enlightenment'.

<sup>2</sup> The electron microscope was developed in the 1930s.

<sup>3</sup> *Royal Commission 1863*, pp. 10-15.

<sup>4</sup> Sykes, 'Vital statistics', pp. 32-5.

This chapter examines the ways in which theories of disease, mostly but not exclusively on what we now know as infectious diseases, changed over the course of the long nineteenth century, how this influenced the treatments that were meted out, and whether or not actual therapeutic intervention had any beneficial effect – aside from the contribution of hypotheses to sanitary schemes employed as a public health strategy – mostly in the military. These are areas poorly detailed in the historiography, and perhaps ill-understood by some historians, who tend to focus on public health measures. It will be argued that, in distinction to the apparent views of some past historians, there was often a rational basis to treatments employed by nineteenth-century medical officers – such as a better understanding of pathology in addition to empiricist observation – and, perhaps more controversially, that some of the treatments, especially the supportive (notably nursing) measures, were actually more effective than hitherto has been recognized.

For the first half of the nineteenth century, and on the rise of the practice of medicine in the tropics, the focus historiographically has often been on miasmatic theory and the exceptional presentation of disease (e.g. dysentery or hepatitis). Disease theory before the final quarter of the nineteenth century mostly has been passed over by historians such as Curtin, who prefers to focus on using contemporary publications to support developments in sanitary engineering in the tropics, and pays only brief attention to the efficacy of quinine as a treatment.<sup>5</sup> Arnold records the strong emphasis laid on topography by educators at the Army Medical School at Netley, singling out medical officers who served in India such as Martin, Parkes, Charles Curtis (dates unknown), George Ballingall (1786-1855), James Johnson, James Annesley, and William Twining.<sup>6</sup> Detailing of therapies – bleeding, purging and mercurials included – is not accompanied by views on their effectiveness, though Arnold holds what he sees as the ineffectiveness of medications for malaria and cholera to account for the ‘heroic’ treatments of ‘punitive ferocity’ (referring to the degree of

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<sup>5</sup> Curtin, *Migration*, pp. 104-9, 137.

<sup>6</sup> Arnold, *Colonizing*, pp. 23-43.

bleeding) that were delivered, rather than there being any rationale to them.<sup>7</sup> The use of arsenicals in fevers or ague is rarely mentioned.<sup>8</sup> Bynum remarks, perhaps rather too negatively, on late eighteenth to early nineteenth century treatments for fever: ‘none of our doctors could offer much objective help’, and might under-call when he claims ‘the principal kinds of therapy outlined by Cullen had been available to the Hippocratics’.<sup>9</sup>

William Cullen (1710-90), occupying the chair of physic at the University of Edinburgh, was instrumental in devising a nosology of disease – his *Synopsis nosologiae methodicae* (1769).<sup>10</sup> His *First lines of the practice of physic* (1777-84), a symptoms-based approach to medicine, emphasized the primacy of the nervous system, but was eclipsed by the French morbid anatomists, notably Marie-François Xavier Bichat (1771-1802), in the early nineteenth century.<sup>11</sup> Fever was recognized by its associated features, such as chills and shivering, the signs of heat in the skin, or sweating. Clinical thermometers were only developed and brought into practical use from the end of the third quarter of the nineteenth century, following the work of Carl Wunderlich (1815-77), William Aitken (1825-92), and Clifford Allbutt (1836-1925).<sup>12</sup> Cullen’s *Synopsis*, which contains themes often referenced by early-to-mid nineteenth century medical authors in British India, identifies four classes of malady: fevers, wasting disorders, neuroses, and local diseases, though these were further subdivided into orders and genera.<sup>13</sup> Medical diagnosis in the second half of the eighteenth century, exemplified by the approach of Cullen’s predecessor John Rutherford (1695-

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<sup>7</sup> Arnold, *Colonizing*, pp. 38-9, 41.

<sup>8</sup> Ramana, *Western*, pp. 27, 147; Arsenic and antimony had been used for centuries, calomel (mercuric chloride) since the sixteenth century.

<sup>9</sup> W.F. Bynum, ‘Cullen and the study of fevers in Britain, 1760-1820’, *Medical History*, Supplement, 1 (1981), pp. 135-47.

<sup>10</sup> W.F. Bynum, Cullen, William (1710-90), *ODNB* online (Oxford, OUP, 2004) <https://ezproxy-prd.bodleian.ox.ac.uk:2095/10.1093/ref:odnb/6874> [17 September 2020].

<sup>11</sup> Marie-François Xavier Bichat was the leading anatomist and exponent of a system of medicine based on the pathology of disease. See – M.M. Shoja, R.S. Tubbs, M. Loukas, *et al.*, ‘Marie-François Xavier Bichat and his contributions to the foundations of pathological anatomy and modern medicine’, *Annals of Anatomy*, 190 (2008), pp. 413-20.

<sup>12</sup> Carl Wunderlich (1815-77), professor of medicine at Leipzig from 1850, developed a clinical thermometer. See – I. Blumenthal, ‘Development of the clinical thermometer’, *Proceedings of the Royal College of Physicians of Edinburgh*, 28 (1998), pp. 67-72.

<sup>13</sup> Bynum, ‘Cullen, fevers’, pp. 135-47.

1779) in Edinburgh, was based on the clinical history, and included only minimal physical examination. It relied upon the physician's five senses, namely: the quality of the pulse; smell – for example, for gangrene; tasting the urine; noting regularity of breathing; and observing the skin and eye conjunctiva.<sup>14</sup> Cullen's one-time pupil, John Brown (c.1735-88), takes this a stage further (or back) in reductive minimization by theorizing disease as a continuum, between the *sthenic* (from the Greek, σθένος, meaning strength), characterized by excitatory stimulation that could ultimately lead to the other end of the spectrum, the debilitatory, *asthenic* – themes also referenced by later writers.<sup>15</sup> Health in Brunonianism was an equilibrium, a balance between sthenic and asthenic. Brunonianism appealed because of its simplicity, especially when applied to large numbers as in the army or navy, and its lack of ambiguity.<sup>16</sup> Depletion was achieved by bleeding, low diet, cathartics such as calomel (in high dose, low was seen as stimulatory) or jalap, emetics such as ipecacuanha or tartar (antimonial compounds), and counterirritants, for example, blistering.<sup>17</sup> Stimulants included cinchona, alcohol, iron, camphor, opium, ether and a full diet.<sup>18</sup>

Cullen's system regarded fever as a single specific, though variable, systemic entity, rather than the patho-physiological symptom of a range of conditions. He saw fevers from the standpoint of the phenomena associated with them, such as qualities of the pulse, sweating, headache, and the periodicity of variations in temperature, for example, intermittent versus continuous.<sup>19</sup> This view of

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<sup>14</sup> D'A. Power, revised by J. Loudon, Rutherford, John (1695-1779), *ODNB* online (Oxford, OUP, 2004) <https://ezproxy-prd.bodleian.ox.ac.uk:2095/10.1093/ref:odnb/24363> [17 September 2020].

<sup>15</sup> C. Lawrence, Brown, John (bap. 1735-1788), *ODNB* online (Oxford, OUP, 2004) <https://ezproxy-prd.bodleian.ox.ac.uk:2095/10.1093/ref:odnb/3623> [18 September 2020]. Brunonian theories expounded in Brown's [Ioannis Brunon] *Elementa medicinae*, 2nd edn (Venetiis: Iacobs Stori, 1793) were influential in early nineteenth century German and Italian medical circles.

<sup>16</sup> Harrison, *Commerce and empire*, pp. 173-5.

<sup>17</sup> J.H. Warner, *The therapeutic perspective: medical practice and identity in America, 1820-1885* (Cambridge: Harvard University, 1986), pp. 91-3, 98.

<sup>18</sup> In fact, it was Thomas Sydenham (1624-89), who popularized use of laudanum and cinchona, available from the seventeenth century. Sydenham, a successor to Thomas Willis (1621-75), was less driven by theorems and more by results, devised a new and sequential therapeutic approach that consisted of: first bleeding, secondly use of an emetic, then an 'incider' (orally administered – believed to cut up viscous blockages and purge, to induce 'separation'), with finally a diaphoretic to induce sweating – A. Cunningham, 'Sydenham versus Newton: the Edinburgh fever dispute of the 1690s', in W.F. Bynum, V. Nutton, eds., *Theories of fever from antiquity to The Enlightenment*, (Granada: Dynamis, 1982), pp. 71-98; S.L. Sigal, 'Fever theory in the seventeenth century: building towards a comprehensive physiology', *Yale Journal of Biology and Medicine*, 51 (1978), pp. 571-82.

<sup>19</sup> Porter, *Benefit*, pp. 261-2.

fever, in transmuted forms, continued to influence thinking, in varying degrees, with a core of devotees, throughout the first half or more of the nineteenth century. In common with his belief that the nervous system played a central role in disease symptomatology, Cullen saw fever as having three stages: first, debility with atonic relaxation of the arteries; secondly, irritation or ‘chill’; and lastly a hot phase, the result of arterial spasm which might be relieved through venesection.<sup>20</sup> Many of the symptoms – sweating, vomiting, diarrhoea – were regarded as attempts by the body to rid itself of poisonous matter and correct a humoral imbalance. In Cullen’s view, fever resulted from a variety of causes, the internal and the external, the predisposing and the exciting, which included: miasma, contagion, heat or cold, dirt and putrefaction.<sup>21</sup> Fevers such as smallpox, with well-defined features, were separated off as identifiable contagions. Other pyrexias were regarded more as a continuum that could transmutate, as described by Cullen’s contemporary, John Clark (1744-1805).<sup>22</sup>

Around the turn of the eighteenth into the nineteenth century Bichat’s *Anatomie générale* represented a pivot point in medicine, away from Cullen’s symptom-based approach towards one founded on pathology of disease.<sup>23</sup> This was judged from post-mortem macroscopic examination of the body and organs, which could be interpreted in light of pre-mortem clinical findings, leading to a better understanding of the meaning of physical signs. Through leadership of René Laennec (1781-1826), Gaspard Bayle (1774-1816), Pierre Louis (1787-1872) and others, Paris became a pre-eminent centre for medical learning.<sup>24</sup> Medical colleges in the British Isles in the early nineteenth century, principally those in Edinburgh, Glasgow, Dublin and London, which provided the majority of surgeons to the IMS and the AMD, took account of techniques of the French School, though not

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<sup>20</sup> W.F. Bynum, *Science and the practice of medicine in the nineteenth century* (Cambridge: CUP, 1994), pp. 20-4.

<sup>21</sup> Bynum, ‘Cullen, fevers’, pp. 135-47.

<sup>22</sup> J. Clark, *Observations on fevers* (London: Cadell, 1780), pp. 6-10: Clark was physician to Newcastle Dispensary.

<sup>23</sup> X. Bichat, *Anatomie générale: appliquée à la physiologie et à la médecine* (Paris: Brosson, Gabon et Cie, 1801).

<sup>24</sup> D.B. Weiner, M.J. Sauter, ‘The city of Paris and the rise of clinical medicine’, *Osiris*, 18 (2003), pp. 23-42: Vienna was the other concurrently prominent European centre for medical education, though at this time subservient to Paris.

to exclusion of Cullen's symptom-based system.<sup>25</sup> Diet, drink and clothing are held out, with the Indian climate and topography, as predisposing to fevers. In the late seventeenth century through to the eighteenth, dialogue between European medical officers in India and local hakims and vaidyas was on an equal footing due to the closeness of the origins of respective professional traditions, notably on humoral concepts of the body and illness.<sup>26</sup> Publication of several pharmacopoeias in the late eighteenth and early nineteenth centuries by British surgeons attests to the continuing acceptance that western medicine could learn from the Indian experience, and is well documented, though cinchona (and opium) apart, not commonly in specific indications nor for effectiveness.<sup>27</sup> Initial receptiveness to Ayurvedic or Unani pharmacopoeias was characterized by the inclusion and acceptance of several Indian botanicals, for example, by Sir Whitelaw Ainslie (1767-1837), surgeon to the EICo notably in Madras, in his 1813 *Materia medica of Hindoostan*,<sup>28</sup> and by W.B. O'Shaughnessy (1808-89) of Calcutta Medical College, in his 1841 *Bengal pharmacopoeia*.<sup>29</sup> By 1840, the army medical services obtained some medicaments such as asafoetida (a gum resin), arrowroot and camphor, from Indian sources in place of 'originals' from South America or Europe.<sup>30</sup> The wedge of divergence though had been introduced by the morbid anatomical experience of the EICo surgeons at the turn into the nineteenth century – contemporaneously mirrored by Parisian anatomists – which seemed to paint European medicine as scientific compared to the apparent stasis of native medicine. Shared synergies such as the centrality of equilibrium – which chimed with Brunonianism – and belief in the influence of environment on health – echoed

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<sup>25</sup> Porter, *Benefit*, p. 336.

<sup>26</sup> M. Harrison, 'Medicine and orientalism', in B. Pati, M. Harrison, eds., *Health, medicine and empire: new perspectives on colonial India* (London: Sangam, 2001), pp. 37-81; Charters, *Disease*, p. 149.

<sup>27</sup> Harrison, 'Orientalism', p. 42; Chakrabarti, *Medicine and empire*, pp. 30-6; Harrison, *Public health*, pp. 40-1; Projit Mukharji records this process in detail but gives no specific examples of drugs used, though Amar Farooqui writes on opium in the same publication – P.B. Mukharji, 'Pharmacology, indigenous knowledge, nationalism', in Pati, Harrison, *Social history*, pp. 195-212; A. Farooqui, 'Opium as a household remedy in nineteenth century India', *Ibid*, pp. 229-37.

<sup>28</sup> Bayly, *Information*, p. 273; W. Ainslie, *Materia medica of Hindoostan and artisan's and agriculturist's nomenclature* (Madras: Government Press, 1813); Ainslie cited use of croton as a purgative, and of some barks (though not cinchona) for intermittent fevers.

<sup>29</sup> W.B. O'Shaughnessy, *Bengal dispensatory and pharmacopoeia* (Calcutta: Bishop's College Press, 1841).

<sup>30</sup> Bayly, *Information*, p. 157; Charters confirms that EICo apothecaries obtained supplies locally from the last quarter of the eighteenth century – *Disease*, p. 149.

in miasmatic theory – subsequently were seen as reinforcing rather than expanding knowledge.<sup>31</sup> Collaboration gave way, after governor-general Lord Bentinck’s acceptance of a committee report in 1835 (on ‘improving native medical institutions’), to the favouring of western style medicine.<sup>32</sup> Assistant surgeon R.J. Irvine (dates unknown), in 1841, was critical of native Indian medical practices after making a systematic evaluation: ‘From this selection, a tolerably clear impression of the vile, depressed state of native medicine may be ascertained’.<sup>33</sup> As plague and ague faded in Europe – remaining endemic in India with cholera rampant – initial theories of ‘human climatic adaption’ gave way to considering native Indians as inherently different in disease predisposition from Europeans – so-called ‘biological fixity’.<sup>34</sup> Interest in oriental medicine revived in the late nineteenth century with the ‘Central indigenous drugs committee’ which reported in 1896 and, although Anil Kumar states it was unprepared to make drug substitutions, it did do so in its 1909 second report.<sup>35</sup> Hakims and vaidyas continued to be employed in subordinate medical positions, especially in rural locations, up until the 1880s, by which time sufficient Indians had been trained in western medicine for these posts, although hakims were still recruited during emergencies such as the plague epidemics in the 1890s.<sup>36</sup> However, it is unclear how many of the 2,782 government, municipal and licensed vaccinators employed by the sanitary commissioner for Bengal, in 1891, had been trained in traditional medicine.<sup>37</sup>

### ***From miasmatic to germ theory***

The application of rigorous methodology and translation of mid nineteenth century notions on chemistry to the concept of the disease process, were to prove more decisive than the

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<sup>31</sup> Harrison, ‘Orientalism’, p. 81; Charters identifies divergence earlier – at the conclusion of the Seven Years’ War, in 1763 – *Disease*, p. 169.

<sup>32</sup> Arnold, *Colonizing*, pp. 43-60.

<sup>33</sup> R.H. Irvine, *Some account of the medical and general topography of Ajmeer* (Calcutta: Thacker & Co., 1841), pp. 153-4; Irvine admits that some botanics were added to the pharmacopoeia.

<sup>34</sup> Charters, *Disease*, pp. 150, 171.

<sup>35</sup> Kumar, *British medical*, pp. 111-20; *Second report of the indigenous drugs committee* (Simla: Government Monotype Press, 1909). The first report cannot be located. By the end of the nineteenth century, doses of even botanic medicaments had been standardized.

<sup>36</sup> Harrison, ‘Orientalism’, p. 76; Attempts were made to educate traditional healers in western ways, e.g. at Lahore’s Oriental College in the 1850s and 1870s.

<sup>37</sup> BL IOR/P/3885, pp. 487-8.

anticontagionist speculations of the sanitary movement (*vide supra* Chapter 3). In this, works of the medical statistician, William Farr, were central. Farr, the long-serving superintendent statistician (1839-80) to the General Register Office, was influenced by theories of the German chemist Justus von Liebig (1803-73), that pathological changes analogous to fermentation or putrefaction occurred during the process of contagious and epidemic diseases.<sup>38</sup> This led Farr to his zymotic thesis, in which he postulated, in 1842, that non-living organic ‘poison’, specific to a disease, multiplied many times in the disease process, to produce new material that could itself be passed on to another person, in his belief, usually through the atmosphere.<sup>39</sup> Farr included in his zymoses, not only diseases acknowledged by all as contagions but also epidemic disorders such as plague, typhus and influenza, though he specifically separated off intermittent and remittent fevers and yellow fever, describing these as being due to a ‘miasm, properly so called [as it] causes disease without being itself reproduced’.<sup>40</sup> John Eyler sees Farr’s zymotic theory as having miasmatic elements, and as accepting airborne filth as a generator of zymotic material.<sup>41</sup> However, Farr’s views were to evolve with his own statistical observations of successive cholera epidemics, on the back of the epidemiologic findings of Budd and Snow on water-borne transmission, and through the research of Louis Pasteur (1822-95) and others on fermentation.<sup>42</sup> By the time of his 1868 report on the cholera epidemic of 1866, Farr accepted water-borne transmission and had modified his zymotic theory to adopt transference by infective agents he termed ‘vibrions’.<sup>43</sup> Farr’s change of heart mirrored that of Sir John Simon (1816-1904), the first chief medical officer to the General Board of Health and then the Privy Council (1855-76), and architect of the 1866 Sanitary Act.<sup>44</sup> Contemporaneously with

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<sup>38</sup> J.M. Eyler, ‘William Farr on cholera: the sanitarian’s disease theory and the statistician’s method’, *Journal of the History of Medicine and Allied Sciences*, 28 (1973), pp. 79-100.

<sup>39</sup> W. Farr, ‘Statistical nosology’, *Fourth Annual Report of the Registrar General*, in: *Parliamentary Papers XIX* (London: Clowes, 1842), pp. 118-22.

<sup>40</sup> *Ibid.*, pp. 118-19.

<sup>41</sup> Eyler, ‘William Farr’, p. 86.

<sup>42</sup> W. Budd, *Malignant cholera: its mode of propagation and its prevention* (London: Churchill, 1849); Snow, *Cholera*; Eyler, ‘William Farr’, pp. 82-3, 95; Farr’s ‘waterfield’ study of the 1866 cholera epidemic in London compared mortality rates in geographic areas supplied by different water companies. Some of the areas were supplied by water contaminated by sewage. These had the highest mortality rates.

<sup>43</sup> W. Farr, *Report on the cholera epidemic of 1866 in England: supplement to the twenty-ninth annual report of the registrar-general of births, deaths, and marriages in England* (London: Eyre and Spottiswoode, 1868), pp. lxx-lxx.

<sup>44</sup> C. Hamlin, ‘Simon, Sir John (1816-1904)’, *ODNB* online, (Oxford: OUP, 2004, 2009), <https://ezproxy-prd.bodleian.ox.ac.uk:2102/10.1093/ref.odnb/36097> [25 September 2020]; Eyler, *Victorian*, p. 107.

epidemiological developments on epidemics, empirical observations on surgical wound infections – both on the ward and in the laboratory – had a bearing on widening acceptance of germ theory. Observations of Ignaz Semmelweis (1818-65) in Vienna, in 1847, Carl Mayrhofer (1837-82), also in Vienna, in 1864, Joseph Lister (1827-1912), in Glasgow and, later, Edinburgh, then London, Johann von Nussbaum (1829-90), in Munich, and the Viennese surgeon, Theodor Billroth (1829-94), all supported this and owed much to the work of Berlin-based Robert Koch (1843-1910).

Koch's work on the microorganisms that cause anthrax, tuberculosis and cholera was to prove central to advancing germ theory, no more so than in India, whose authorities were late and reluctant adopters, and where Koch eventually was to isolate the *vibrio*. Technical innovations, such as growing microorganisms on solid agar in Petri dishes, facilitated his research.<sup>45</sup> Koch's 'postulates', the rules affirming a microbe as the cause of a disease, devised in the 1880s, were to secure wide acceptance of germ theory through a scientific *reductio ad absurdum*.<sup>46</sup> He described the cause of anthrax, *Bacillus anthracis*, in 1876, and then *Mycobacterium tuberculosis* in 1882, for which he was to receive the 1905 Nobel Prize for medicine.<sup>47</sup> The major public health crisis provoked by the 1883 cholera epidemic in Egypt, with its threat to Mediterranean commerce, led the German Government to send Koch and his team to investigate. Koch isolated *Vibrio cholerae* from patients' faeces and from water samples, and reported this the same year.<sup>48</sup> In December 1883, the German Cholera Commission had been directed on to Calcutta, and by February the next year, Koch had isolated the *vibrio* at Saheb-Bagan, in a water tank from which several people who

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<sup>45</sup> R. Koch, 'Die Ätiologie der Tuberculose', *Berliner Klinische Wochenschrift*, 19 (1882), pp. 221–30; Better staining methods to show up bacteria microscopically were developed by Koch's collaborator, Paul Ehrlich (1854-1915). Microscope optical technology had improved in the 1870s.

<sup>46</sup> H.E. Kaufmann, U.E. Schaible, '100th anniversary of Robert Koch's Nobel Prize for discovery of the tubercle bacillus', *Trends in Microbiology*, 13 (2005), pp. 469-76; Koch's postulates state that a microorganism is always isolated from someone suffering from a disease, can be grown in culture, can be transmitted to and cause the disease in an experimental host, and (added later), can then be isolated from that host and shown to be identical to the original microbe from the diseased person. These postulates, which incorporated the ideas of Jakob Henle (1808-85) and Friedrich Loeffler (1852-1915), are no longer thought to hold true but were helpful to understanding of microbial disease in the nineteenth century.

<sup>47</sup> *Ibid.*, pp. 470-1; Koch, 'Tuberculose', pp. 221-30.

<sup>48</sup> R. Koch, 'Der zweite Bericht der deutschen Cholera Kommission', *Deutsche Medizinische Wochenschrift*, 19 (1883), pp. 743–4.

developed cholera had drunk.<sup>49</sup> He additionally identified the bacillus in the intestines of several people who had died from the disease. These inferences of the germ theory went against the official line of the government of India, and its sanitary commissioner, Dr J. MacN. Cuningham, who for some years had espoused a variant of miasmatic theory for cholera, promoted by Professor Max von Pettenkofer (1818-1901) of Munich, in which a high level of water in subsoil was seen as paramount.<sup>50</sup> The anticontagionist view of the Indian government, opposing quarantine and all that it implied, had been built up over several years, largely using epidemiological data amassed by Dr James Bryden, statistician to the sanitary commission.<sup>51</sup> The weakness of Koch's argument was that he had not proven his third postulate, that of transmission to an experimental host. In response to Koch's findings, the president of the medical board of the India Office in London, Sir Joseph Fayrer (1824-1907), issued a rebuttal, denying that: 'the cause of cholera has been discovered any more than it was before'.<sup>52</sup> Nonetheless, the British government was concerned enough to dispatch to India, a cholera commission consisting of Edward Klein (1844-1925) of St Bartholomew's Hospital, and Heneage Gibbes (1837-1912) of Westminster Hospital. Their negative conclusions, in 1885, were roundly criticized by *The Lancet*.<sup>53</sup>

The *Lancet* article reports that Dr Michael C. Furnell (1829-88), sanitary commissioner to the Madras presidency, dissented from the view of the official report and took a contagionist line.<sup>54</sup>

There was sufficient concern at the India Office for the setting up of a research laboratory in Calcutta. This was established in December 1884, headed by Dr D. Douglas Cunningham (1843-

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<sup>49</sup> W. Coleman, 'Koch's comma bacillus: the first year', *Bulletin of the History of Medicine*, 61 (1987), pp. 315-42; Saheb-Bagan is a locality north of Kolkata (Calcutta), near the Hooghly river.

<sup>50</sup> W.G. Locher, 'Max von Pettenkofer (1818-1901) as a pioneer of modern hygiene and preventive medicine', *Environmental Health and Preventive Medicine*, 12 (2007), pp. 238-45; M. Harrison, 'Cuningham, James MacNabb', *ODNB* online (Oxford: OUP, 2004), <https://ezproxy-prd.bodleian.ox.ac.uk:2102/10.1093/ref:odnb/32664> [1 October 2020].

<sup>51</sup> Harrison, 'Bryden' [1 October 2020].

<sup>52</sup> *Proceedings of the sanitary commission for Madras for the year 1884* (number 42), memo of 19 May 1884 (quoted by Harrison, *Public health*, pp. 111-12).

<sup>53</sup> Editorial, 'Special commissioners sent by the home government', *Lancet*, 125 (1885), pp. 69-70.

<sup>54</sup> J.D. Isaacs, 'D.D. Cunningham and the aetiology of cholera in British India, 1869-1897', *Medical History*, 42 (1998), pp. 279-305; S.J. Watts, 'From rapid change to stasis: official responses to cholera in British-ruled India and Egypt: 1860 to c.1921', *Journal of World History*, 12 (2001), pp. 321-74; Furnell was 'taken to task' for this dissention.

1914), an Edinburgh medical graduate, who was professor of physiology at Calcutta Medical College and an officer of the IMS. D.D. Cunningham was a devotee of Pettenkofer's theory of the precedence of local conditions in cholera.<sup>55</sup> He produced a succession of papers that, although progressively ceding ground on the role of the *vibrio* in producing cholera, stubbornly refused to concede a role for 'localistic' environmental factors, especially soil and groundwater.<sup>56</sup> The denouement came, for the views of D.D. Cunningham and others in the British-Indian medical establishment, in the 1890s, through a combination of conclusive science and political consensus.<sup>57</sup> The science arrived in proof, by Georg Gaffky (1850-1918), that the Hamburg-Altona cholera epidemic of 1892-93 was due to transmission of the bacillus in drinking water, and, in 1894, at *Institut Pasteur* in Paris, when Élie Metchnikoff (1845-1916) – who cited a study in which live *vibrio* bacilli induced cholera in human guinea pigs – succeeded in replicating the disease experimentally in rabbits, hence finally satisfying Koch's third postulate.<sup>58</sup> Thus, by the mid 1890s, germ theory had gained wide acceptance among practitioners and governments alike, not only in Europe but in India as well.<sup>59</sup>

The impact of the transition in theorems will be considered in detail first for fevers, as they were the commonest presentation among both soldiers and civilians at the start of the nineteenth century. In the late eighteenth and early nineteenth century, in Cullen's nosology, fever was considered a single

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<sup>55</sup> D.D. Cunningham, 'Are choleraic comma-bacilli, even granting that they are the approximate cause of choleric symptoms, really efficient in determining the epidemic diffusion of cholera?' in B. Simpson, ed., *Scientific memoirs by medical officers of the army of India* (Calcutta: SGP, 1889), pp. 1-20.

<sup>56</sup> D.D. Cunningham, 'The results of continued study of various forms of comma-bacilli occurring in Calcutta', in W.R. Rice, ed., *Scientific memoirs by medical officers of the army of India* (Calcutta: SGP, 1894), pp. 1-57.

<sup>57</sup> The term 'Anglo-Indian' has often been used by historians to describe the views of European-trained medical officers working in the Indian subcontinent, who, for example, felt that special topographic circumstances led to exceptionalism of disease behaviour. 'Anglo-Indian' though is a label also applied to persons of mixed Indian and European heritage, and so to avoid confusion, the description 'British-Indian' will be used instead.

<sup>58</sup> Coleman, 'Comma bacillus', pp. 341-2; E. Metchnikoff, 'Researches on cholera', *Public Health (London)*, 7 (1895), pp. 38-9 (translated from an article in the *Annales de l'Institut Pasteur*, August, 1894); Editorial, 'Metchnikoff's researches on the cholera vibrio', *IMG*, 29 (1894), pp. 421-3.

<sup>59</sup> The transition is well documented by several historians, viz. – Chakrabarti, *Medicine and empire*, pp. 85-92, 144-5; Arnold, *Colonizing*, pp. 189-99; Harrison, *Public health*, pp. 117-38, Pelling, *Cholera*, pp. 62-80, 258-9, 304-7.

disease entity with myriad manifestations.<sup>60</sup> In describing his case mix in 1782, after a sea battle with the French off southern India, Charles Curtis, surgeon to the Royal Navy frigate *Medea*, noted: ‘Wounds, ulcers, and burns from the explosion of gunpowder, made up the bulk of surgical cases: fluxes and fever diseases, the chief part of the remainder’.<sup>61</sup> Curtis, writing in 1807, believed that disease classification should be adapted to the Indian situation – a notion echoed by many British-Indian authorities. Curtis split off what he saw as ‘simple bilious fever and flux’ from other fevers, recognizing both intermittent and remittent types, and from dysentery, viewed as different from the European disease.<sup>62</sup> He rationalized many conditions, including ‘exanthematous’ fevers (those with a rash), on the basis of the effect on the intestines of diseased bile, the production of which he saw as: ‘a diathesis in some measure common to all tropical countries’ – the so-called ‘bilious theory of fevers’.<sup>63</sup> Treatments prescribed by Curtis were mostly generic, based on symptomatology or perceived causation. Thus, fever and a rapid pulse, indicating inflammation, required bleeding, with mercury or the local application of a blister, whereas discerned retained or abundant bile needed purgatives such as senna, to ‘carry down diseased secretions’.<sup>64</sup> Subsequent medical authors of the first half of the nineteenth century followed in a similar vein with therapeutic variations.<sup>65</sup> Indeed, Martin’s stance in 1861, admittedly a very conservative one still wedded to miasm, continued essentially along these lines, prioritizing bloodletting as a preparatory for purgatives and mercurials

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<sup>60</sup> In considering management of disease in the eighteenth and nineteenth centuries, the temptation to retrofit a modern interpretation of what the disease might be, will be resisted. Where possible the situation will be considered from the viewpoint of the day, though evolving chronologically as ideas changed.

<sup>61</sup> C. Curtis, *An account of the coastal diseases of India as they appeared in the English fleet, and in the naval hospital at Madras, in 1782 and 1783; with observations on ulcers, and the hospital sores of that country, etcetera* (Edinburgh: Laing and Longman, 1807), pp. v, 46.

<sup>62</sup> Curtis, *Coastal 1807*, pp. xx, xxvi-xxvii, 118-19, 157, 166.

<sup>63</sup> Harrison, *Commerce*, p. 151.

<sup>64</sup> Curtis, *Coastal 1807*, pp. 105-6, 109, 157; Mercury was given either as an ointment rubbed into the skin or by mouth in the form of calomel pills. Other oral purgatives mentioned by Curtis include: manna, rhubarb (*Rhei*), cream of tartar, tamarind and castor oil. Sometimes he recommends glysters, rectal injections of a purgative, especially for tenesmus – the sensation of a desire to defaecate, potentially induced by products retained in the rectum.

<sup>65</sup> As regards treatment – basically bleeding, purging and emetics – Don Bates is of the view that Willis’s doctrine of fevers of 1659 did not propose new therapies but introduced novel ways of understanding the rationale for existing ones – by which he means that Willis replaced concepts that fevers resulted solely from actions of living phenomena (such as humours, bodily functions, or putrefaction of the once-living) with inanimate things chemical (‘atoms’) – D. Bates, ‘Thomas Willis and the fevers literature of the seventeenth century’, in Bynum, Nutton, *Theories*, pp. 45-70 – Bates tends to focus on events surrounding Willis’s treatise rather than its contents, and does not concern himself with treatments; Sigal, ‘Fever’, p. 577.

(which he saw as cholagogues) or sometimes arsenic.<sup>66</sup> Notwithstanding Martin's assertions, Joseph Fayrer (physician to Queen Victoria, late of the Bengal medical service) gives a different account. In his 1882 Royal College of Physicians' Croonian lectures, Fayrer makes it clear that by then there were more specific definitions of the various types of fever and, he says, for what was by now recognized as malaria, 'The days of bleeding and mercurialism had passed, or nearly so, when I went to India in 1850'. Treatments were more disease-targeted, with a focus on quinine, arsenic and opium, and use of cold sponging, though with the persisting prescription of purgatives.<sup>67</sup>

It is worth noting that the term 'malaria' was only adopted as a specific diagnostic category for use by British army medical officers in their monthly reports, in 1908. However, it seems clear that the term 'ague' or 'marsh fever' employed typically for intermittent fever by nineteenth century medical writers from about the first quarter-century point on, was used to refer to, in the main, protozoal diseases we now call 'malaria'. Ague, in miasmatic theory, was thought to be associated with the rotting vegetation of marshes. Relapsing or continuous types were postulated to result from putrefaction. According to Cullen, the appropriate treatment for fever depended on which stage of 'the disease' was exhibited at the time: anti-inflammatory ('antiphlogistic') bloodletting at one stage, stimulatory tonics, wine, opium or cinchona bark at another.<sup>68</sup> However, James Lind, physician to Haslar Hospital, Portsmouth, and Clark, advised caution.<sup>69</sup> The 'marsh fever' described by John MacCulloch, physician to Prince Leopold of Saxe-Cobourg, in 1830, as being able to cause both intermittent and remittent fevers, periodicity, and a number of sequelae such as splenomegaly,

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<sup>66</sup> A cholagogue is a substance that promotes flow of bile from the gallbladder – calomel was thought to do this (*vide infra*). Purgatives favoured by Martin were colocynth (a herb), James's powder (antimony oxide and calcium phosphate), magnesium sulphate, and jalap – *Influence 1861*, pp. 326, 333-6, 358.

<sup>67</sup> J. Fayrer, *On the climate and fevers of India* (London: Churchill, 1882), pp. 104-16.

<sup>68</sup> John Huxham (c.1692-1768), a physician in Plymouth and a contemporary of Cullen's, favoured venesection: 'In the Beginning of their Fevers Bleeding is exceedingly proper, and that more, or less, in Proportion to the Symptoms' – J. Huxham, *Works*, 2 vols. (London: Bent, 1788), vol. 2, p. 68; Harrison describes both Huxham and Clark as empiricists, and notes that, in the 1780s, surgeons to the EICo, most of whom at that time did not have medical degrees, 'paid little heed to criticism from doctors in Britain' (Harrison, *Commerce*, pp. 60, 75-6, 150).

<sup>69</sup> Writing on Europeans in hot climates, Lind stated: 'With this view he [the physician] is to consider how far the violence of the fever in its first attack will admit of bleeding: but he must always remember that this operation is in general used with great caution, and the repetition of it with still greater, in those climates' – Lind, *Essay*, p. 232; Clark, *Observations*, pp. 13-14. Clark was not keen on bloodletting and did not regard fevers as inflammatory.

is likely to be protozoal malaria.<sup>70</sup> MacCulloch is dismissive of previous authors' attempts to write persuasively on the matter, suggesting that, prior to this point, recognition of ague as a specific disease might have been suspect. Throughout the first three-quarters of the nineteenth century, the word 'malaria' is used synonymously with miasm. Thus, Johnson and Martin, in their 1841 edition of *Influences*, on discussing MacCulloch's work, agree 'that there is hardly a better fact established in medicine, than ague is caused by malaria', meaning a miasm.<sup>71</sup> Martin, in his 1861 volume, uses 'ague' to describe conditions that today would pass for protozoal malaria, as do subsequent authors.<sup>72</sup> But when he expounds his 'laws of malaria' he clearly exhibits miasmatic beliefs: 'The malarious poison ... is extricated in greatest abundance in low, marshy, and alluvial soils', and that topographic or man-made barriers could: 'preserve an individual from the pernicious effects of the miasmata on the opposite side'.<sup>73</sup> Advisors to the United States Sanitary Commission, on the question of 'marsh miasmata or malaria', admitted ignorance, but advanced theories that are more germ-suggestive than reliant on soil and atmosphere: 'the most plausible [hypotheses] are those which refer the morbid influence to the sporules of cryptogamic plants, or to infinitesimal ova of infusoria'.<sup>74</sup> Sanitary commissioner Cuningham was perhaps more open minded, but medical statistician Bryden adhered to the miasmatic view. Alexander Garden (1794-1845), a civil surgeon in Saharunpore district, points this out: 'Dr Cuningham expresses his belief that there are causes at work of which we are not as yet cognizant, in addition to those ordinarily accepted [i.e. miasma] as giving rise to malaria', but observes that Bryden holds an uncompromising stance: 'the fact is evident that it is an airborne miasm which has covered the area ... called into epidemic vigour by special meteorology'.<sup>75</sup> C.M. Jessop (dates unknown), a surgeon with the 4th Hussars, allows for

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<sup>70</sup> J. MacCulloch, *An essay on the remittent and intermittent diseases, including generically marsh fever, and neuralgia* (Philadelphia: Carey and Lea, 1830), pp. 17-34, 76-9.

<sup>71</sup> Johnson, Martin, *Influence 1841*, p. 138.

<sup>72</sup> Martin, *Influence 1861*, p. 376.

<sup>73</sup> Martin, *Influence 1861*, pp. 293, 312, 318; Laws of malaria were compiled by 'Rigaud de Lisle and Drs Aiton and Parkin'.

<sup>74</sup> J.T. Metcalf, 'Miasmatic fevers', in Hammond, *Military medical 1864*, pp. 207-36; J.B. Upham, 'Continued fevers', in Hammond, *Military medical 1864*, pp. 237-66.

<sup>75</sup> A. Garden, 'An epidemic and endemic fever in the Saharunpore district', *IMG*, 7 (1872), pp. 100-2: Garden's dates are unknown.

germ theory with an atmospheric influence: ‘If the poison of malaria is previously in the system, it is either a living or a dead poison. If living, it exists in the blood, waiting for favourable conditions to become developed’.<sup>76</sup>

Hence, disease theory in British India’s medical circles can be traced from the contagionism of the early-to-mid eighteenth century, through Cullen and Brown’s Edinburghian nosologies, with a passing nod to the morbid anatomy of the Parisian school of the 1820s, on to miasmatic anticontagionism, encompassing exceptionalist empiricism, to arrive back again at contagionism – in the form of germ theory – by 1890. Often there was a range of views and, not infrequently, the simultaneous holding of apparently jarring contradictory positions, which can be seen as a means by which opinion transitioned, for example, from miasmatic to germ theory. The ways in which these changes in beliefs on causation of disease, especially delayed official acceptance of germ theory in India, affected the therapeutic approach of medical officers to common diseases encountered on the subcontinent, will now be considered. Theories of disease generally underscore treatments offered, bearing in mind that therapeutic scope is limited by the medicinal options available. However, prescribing tradition has a long tail, as John Warner has noted ... ‘Most of the drugs and practices common in heroic antiphlogistic treatment [available in the 1820s] were still in use in the 1880s, albeit less frequently and in smaller doses’.<sup>77</sup> The evolution in descriptions and treatments of the common diseases in nineteenth to early twentieth century India will be critically evaluated, based on contemporary textbooks and medical journals.

### ***Therapeutic empiricism linked to disease specificity replaces theory-based practice***

Charting treatments longitudinally over the long nineteenth century allows explanation for their evolution. During the course of the nineteenth century, and especially from its mid-point, physicians, by the empiricist process of trial and error and word of mouth, reflected then in case

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<sup>76</sup> C.M. Jessop, ‘Irritant causes of disease’, *IMG*, 7 (1872), pp. 8-10.

<sup>77</sup> Warner, *Therapeutic*, p. 102.

reports and small series rather than the detailed clinical trials of today, demoted what are seen now as harmful remedies based on traditional views of disease virtually medieval in origin. Most treatments that remained had to pass the acid test of an increasingly observation and science-based attitude to medicine, to retain their place in the pharmacopoeia. By the first decade of the twentieth century, the time of Osler's 1909 edition of *Principles*, the medical approach to disease in general, lasting up to the end of the 1930s and the start of the antibiotic era, essentially had been set, so there will be little consideration beyond this date. Much of the reduction in the *incidence* of disease over the nineteenth century, observed in many geographies but pronounced for the well-documented British armies in India, especially the European cohort, has been ascribed to improvements in sanitation. However, as demonstrated in this thesis, case fatality rates, which can act as a proxy for the effectiveness of medical management of disease, fell for several diseases over the course of the nineteenth century. This appears to counter the assertion made by some historians that declines in overall *mortality* in this period were almost solely the result of improvements in sanitation, nutrition and housing, though it is noted that these arguments often have been made for a western community setting, and the present work relates to military forces in India.<sup>78</sup>

The empiricist views of the medical men who contributed to the 1864 US Sanitary Commission, which rejected several traditional procedures of the first half of the century such as bleeding and the virtually ubiquitous use of mercury, are at odds with the values clung to by the government of

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<sup>78</sup> Arnold, in *Colonizing*, does not consider the effects of therapeutics, and regards reduced troop mortality in India as due to improved living conditions (pp. 74-5). Curtin, in *Migration*, acknowledges that quinine, along with smallpox vaccination had a small effect on overall mortality, but considers for troops, that barrack sanitary measures and empirical avoidance, such as moving soldiery to highlands to escape malaria, were most important (pp. 42, 58, 61, 159-60). Harrison, in *Public health*, sees preventive measures as having effected reductions in mortality and sickness – medical interventions were not considered in this publication (p. 228). Quinine is recognized as being effective in malarial fevers by Ramanna, in *Western Medicine*, but she does not comment on whether it or other medicaments had an effect on overall mortality rates (p. 147). In *Population*, Guha does consider the effectiveness of treatments on the soldiery of the British armies, but concludes that 'improvements in health, down to the beginning of the 20th century, were almost exclusively due to better prophylaxis resulting from environmental hygiene, rather than to any other cause' (pp. 118-19). Vaughan Dutton, in his DPhil thesis *Mortality decline in the Royal Navy, 1850-1899*, ascribes the reduced mortality observed in seamen to falls in deaths due to cardiovascular disease and tuberculosis, which he relates not to treatments but to a diet containing less salty meat and improved nutrition generally. Harrison, in *Commerce*, examining the period 1660-1830, records contemporary accounts of the successes of some treatments, such as nitric acid in dysentery or bleeding in fevers, but does not voice an opinion on the impact these may have had on overall mortality rates (pp. 169, 180, 183, 189).

India's medical hierarchy – the likes of Drs Cuningham, Bryden, and Martin.<sup>79</sup> Christopher Bussano, assistant surgeon to the 70<sup>th</sup> foot regiment, in 1851 recognized that the hierarchy of the AMD was too bound in tradition:<sup>80</sup>

I perceive that Dr Smith is to take Sir James [‘s] place and I am very glad of it for several reasons ... I now begin to look forward for some changes in the medical department better adapted for the times we live in and the advancements lately made in science ... Perhaps also a few newly discovered diseases and medicines will be added to the list, and the vast number of old and useless ones be erased.

Similarly, judging from papers published in the *IMG*, regimental medical officers – Drs Barnard and Jessop are examples – in distinction to some of their superiors, often seem to have been flexible empiricists, looking to adapt their treatments when things seemed to work, and less bogged down by dogma, though still acknowledging some topographic influences.<sup>81</sup> Indeed, Indian exceptionalism was manifest in several ways though these lessened as the nineteenth century progressed. For more than fifty years from the turn of the century, accounts, for example, that of Curtis, indicate that surgeons saw disease presentations that were more violent than they had known in Europe, notably for ‘fluxes’, and some appeared to represent new diseases, which in the case of cholera, was indeed the case.<sup>82</sup> India's unique geography and climate were held responsible for this until germ theory became the new explanation – hence the obsession with medical topography.

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<sup>79</sup> For example, Dr Albert Stillé was therapeutically minimalist when treating simple dysentery – A. Stillé, ‘Dysentery, in Hammond, *Military medical 1864*, pp. 329-84; Stillé was professor of medicine at Pennsylvania Medical College – see: Alfred Stillé (1813-1900), *Penn University archives and records center*, <https://archives.upenn.edu/exhibits/penn-people/biography/alfred-stille> [13 November 2020].

<sup>80</sup> Wainwright, *Brothers in India*, p. 214; Bassano, writing from Meerut to his father in April 1851, is referring to Sir James McGrigor (1771-1858), AMD director general 1818-51, replaced by Sir Andrew Smith (1797-1872), director 1853-58, later accused of incompetence over medical management of the Crimean War, though exonerated by a commission of enquiry.

<sup>81</sup> For example, Surgeon G. Barnard of the 3rd Regiment, Bengal native infantry, described artificial respiration for heat apoplexy – G. Barnard, ‘Pathology and treatment of coup-de-soleil or insolation’, *IMG*, 3 (1868), pp. 78-80; Barnard performed resuscitation by pressing the side and ribs ‘seventeen or eighteen times in a minute’, for between 10 and 20 minutes. The full name and dates of Barnard are unknown; Surgeon C.M. Jessop of the 4<sup>th</sup> Hussars was an early adopter of the cold douche for heat apoplexy – C.M. Jessop, ‘Treatment of heat apoplexy or sunstroke’, *IMG*, 10 (1875), p. 168; Jessop states: ‘In Campbellpore in 1858 cases of sunstroke were treated in two ways, by cold douche and dry cupping with strict attention to condition of the colon, and which all the patients recovered; and by general bleeding, under which they all died. At first this plan [bleeding] seemed successful, but coma soon supervened’. He continues, ‘Dr Sheldon Furlong at Mhow in 1875 had a drop-bath erected under which all patients were placed after a preliminary cold douche, and it answered very well.’

<sup>82</sup> Curtis believed disease classifications should be adapted for the Indian situation – Curtis. *Coastal 1807*, pp. v, 46.

Some clinical signs differed: for example, jaundice, frequent with ‘hepatitis’ in Europe, was less commonly a feature in India.<sup>83</sup> Disease in sepoys was often managed differently from that in European troops because of perceived disparities in the constitution of the two soldieries – for example, they were bled and purged less often and less vigorously, no doubt to their advantage!<sup>84</sup> Medical obsession with the weather, around the mid-century point, was much less of an issue in Europe and North America, though American physicians took account of it in their prescriptions for fevers, favouring bleeding and mercury in northern states and quinine in southern.<sup>85</sup>

It is argued here that some therapies which had evolved for the main conditions, by the end of the nineteenth century, *did reduce fatality*. However, this may have been through the overall approach to treatment, considering supportive and nursing measures, and not solely due to the disease-destroying action of pharmacologically active drugs. For example, Dr Austin Flint (1812-86) of the US Sanitary Commission, on the treatment of pneumonia, makes the major point, largely under-appreciated by previous historians, on the imperative of maintaining the overall sustenance of the body: ‘To support the powers of life, is the leading general indication in the second stage of [the disease]’.<sup>86</sup> Flint points out that, hitherto, excessive attention had been given to ‘means of subduing inflammation’, and ‘too little to the patient.’ Flint’s empiricist approach is a revelation as it puts the patient and not the disease at the centre of treatment, and it dismisses Cullenian notions. He is reflecting the ‘nature trusting movement’ of Bostonian physicians influenced by the teachings of Jacob Bigelow (1786-1879) on ‘self-limiting diseases’.<sup>87</sup> These disclosures took time to diffuse into the conservative medical traditions of nineteenth century British India. McKeown may be right in

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<sup>83</sup> J. Annesley, *Researches into the causes, nature, and treatment of the more prevalent diseases of India and of warm climates generally*, 2<sup>nd</sup> edn (London: Longman, 1841), pp. 220, 229, 242. James Annesley had been president of the medical board at Madras. Martin describes a report by Dr Arnott of the Bombay fusiliers, at an average strength of 957, over eight years, of 483 cases of hepatitis, of whom 89 had jaundice – Martin, *Influence 1861*, pp. 472-4.

<sup>84</sup> Martin, *Influences 1861*, pp. 357-8.

<sup>85</sup> Warner, *Therapeutic*, pp. 70-1.

<sup>86</sup> A. Flint, ‘Pneumonia’, in Hammond, *Military medical 1864*, pp. 297-328; Austin Flint was professor of medicine, successively, at Chicago, Louisville, Buffalo and New York.

<sup>87</sup> J. Bigelow, *Nature in disease as illustrated in various discourses and essays* (Boston: Ticknor and Fields, 1854), pp. 1-58; Bigelow, was professor of *materia medica* at Harvard University. See Warner, *Therapeutic*, pp. 22-3.

his proposition that there were few effective drugs at that time – he mentions only mercury for syphilis and cinchona for malaria, though this seems too small a number.<sup>88</sup> But McKeown *ignores* the non-pharmacological measures demonstrated here – one of the major new findings in this thesis – to seemingly have a beneficial effect on patient survival, as judged by falling case fatality rates, and which have been largely passed over by other historians as well. Disentangling the overall effect of sanitation-based disease decline, though, from therapy-related mortality reduction for the soldiery in British India is difficult. McKeown's view that pre-twentieth century medical interventions had an insignificant effect on the overall growth of the adult population in England and Wales still might be correct.<sup>89</sup>

Over the nineteenth century in British India, it is apparent that not only were relatively few new drugs developed, but that some doctors, Martin is a particular case, were slow to change tradition-based practices despite the developing empiricism, and that, even when theories of disease altered, treatments were not always modified that much. The concept of the clinical trial had taken hold, but – as this thesis has uniquely demonstrated – there was a mid-century pivot-point: practice was more swayed in the first half of the century by disease theory, and in the second half by peer-reported simple observation. The development of disease managements which, seen retrospectively, might be regarded as beneficial or at least, not detrimental, was in many cases a matter of stripping away theory-based interventions such as diaphoretics, or methods that seemed to produce an immediate though temporary effect such as bleeding. In some instances, for example pneumonia, what was left

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<sup>88</sup> McKeown, *Population*, pp. 106-7; McKeown reflects Bigelow's stance – 'processes may vary with the constitution and condition of the patient, and may tend to death, or to recovery, but are not known to be shortened, or greatly changed, by medical treatment' (Bigelow, *Nature*, p. 4).

<sup>89</sup> One of the central tenets of McKeown's hypothesis relates to infant mortality rate, which he admits was reduced by improvements in hygiene at delivery in the nineteenth century – McKeown, *Population*, pp. 104-6. McKeown's hypotheses have not been without their critics. For example, Simon Szreter argues that McKeown downplays the role of public health measures and primarily emphasizes the role of improved nutrition to account for the rise in population that occurred in England and Wales over the course of the nineteenth century – S. Szreter, 'The importance of social intervention in Britain's mortality decline c.1850-1914: a re-interpretation of the role of public health,' *Social History of Medicine*, 1 (1988), pp. 1-28 (at p. 26). However, McKeown clearly acknowledges the effect of sanitary initiatives, as in: 'From the second half of the 19th century a substantial reduction of mortality from intestinal infections followed to the introduction of hygienic measures – purification of water, efficient sewage disposal and improved food hygiene, particularly in respect of milk. It is unlikely that such influences were effective before that time, since initially industrialization led to crowding and deterioration of hygienic conditions' (*Population*, p. 153).

was the realization that nature alone could make the best healer, given adequate supportive measures. The appreciation that certain treatments did indeed work, the best example is cinchona for malaria, came about because of the gradual dissection of the causes of fever, one from the other. Thus Curtis, in 1783, for prolonged fever, found: ‘No perfect or lasting cures were made by bark [cinchona], unless a long course of purging had gone before it’, and Ballingall was disappointed in cinchona for intermittent fevers, ‘particularly at Trichinopoly’, preferring arsenic, whereas, once ague had been split off from other fevers, Bristowe notes: ‘Cinchona, indeed, its alkaloids, and arsenic are true specifics’.<sup>90</sup>

### ***Critique of evolution of therapies for the main diseases***

Looking at the specific management of fever, the enthusiasm for bleeding and purging were considerably toned down, including in India, in the last third of the nineteenth century (Table 4.1). This is also when calomel was largely dispensed with, and, for intermittent or remittent pyrexias, when cinchona or quinine became *de rigueur*. Opium assumed popularity, as did temperature manipulation by cold or hot bath or atmosphere. Some authorities persisted with an emetic in certain situations, and others found arsenic an alternative to cinchona. For cholera, bleeding was never as popular as it had been for fevers, but it was recommended in the second quarter of the century (Table 4.2).<sup>91</sup> Purgation, rubefacients (which make the skin red, as in irritant-induced vasodilatation) and the warm vapour bath were in vogue in the first third of the century for cholera, with calomel favoured over the middle third, before the realization that these measures were pointless. Cholera treatments described by John Smet in 1821, for the 8<sup>th</sup> Regiment at Meerut, were

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<sup>90</sup> Curtis, *Coastal 1807*, pp. 105-6, 109, 157 – This idea that purging is a necessary preparation for subsequent effectiveness of cinchona is one that pertains throughout the first half of the nineteenth century; G. Ballingall, *Practical observations on fever, dysentery, and liver complaints as they occur amongst the European troops in India* (Edinburgh: Black, 1823), pp. 43-4; Ballingall later became professor of military surgery at Edinburgh; J.S. Bristowe, *A treatise on the theory and practice of medicine*, 4th edn (London: Smith, Elder, 1882), pp. 129-31, 275, 282; John Bristowe (1827-95) was senior physician to St Thomas’s Hospital, London. His book was one of the standard texts of its day, used extensively in the English-speaking world.

<sup>91</sup> Bloodletting seems to have been consigned to the past following publication of the report of William Baly (1814-61) and William Gull (1816-90) – W. Baly, W. Gull, *Report on epidemic cholera drawn up at the desire of the cholera committee of the Royal College of Physicians* (London: Churchill, 1854), pp. 113-17, 214-15.

**Table 4.1: Fevers – treatments used, according to major textbooks: 1807-1909.**

Textbook	Bleeding	Purgative	Calomel/ mercury	Cold affusion	Cinchona	Arsenical	Diaphoretic	Emetic	Opium	Alternatives and notes
1807, Curtis	✓	✓	✓		(✓)		✓	✓		blister; purgative before cinchona
1823, Ballingall	✓✓	✓✓	✓	✓	(✓)	(✓)				enema of sodium or magnesium sulphate
1841, Annesley	✓✓	✓	✓		✓		✓	✓		rubefacient; warm bath; oral stimulant; oral antimonial
1861, Martin	✓✓	✓	✓		✓	✓	✓	✓	✓	poultice; oral antimonial; warm bath; local leeches
1864, Harris		✓		✓✓	✓✓		✓	✓	✓	purging toned down
1882, Bristowe	(✓)	✓			✓✓	✓✓		(✓)	✓	occasional bleeding during cold stage
1909, Osler		(✓)		✓	✓✓					oral antipyretic

largely Cullenian: the physical – attempts (often futile) at bleeding and poultices; the chemical – stimulants; and the botanic – opium.<sup>92</sup> Annesley in 1841, had been unimpressed by the use of opium, supported rubefacients, but thought calomel useful for: ‘removing this particular vitiated secretion’ in the intestine, that is thick, viscid, and tenacious matter, seen on autopsy.<sup>93</sup> Assistant-surgeon Patrick Laing (1821-92), on treating epidemic cholera on campaign in Scinde in 1847, found that: ‘Remedies appeared to have no effect. Calomel, opium, croton oil, antispasmodics of all kinds proved of not the slightest service’.<sup>94</sup> W. Baker (dates unknown), in the subordinates’ *Madras Journal of Medical Science* of 1851, dismisses bleeding not because it was inappropriate – ‘by lessening the amount of blood in the system, we give the heart less work to do’ – but because in a moribund patient, ‘we can scarcely extract more than a few drops’.<sup>95</sup> He favours stimulants –

<sup>92</sup> Smet, ‘Case book’ RAMC/204/2; For Smet, dysenteries merited purgatives, e.g. castor oil, calomel, antimonials, opium and ipecacuanha, whereas remittent fever determined one bleed, cold affusion, leeches to the shaven head, and calomel.

<sup>93</sup> Annesley, *Researches 1841*, pp. 472, 476-87, 495-7.

<sup>94</sup> Wellcome Collection; RAMC/1582: ‘The journal of Patrick Sinclair Laing, assistant surgeon, 86<sup>th</sup> (Royal County Down) regiment of foot, 1842-47, in India’; Laing opines a miasmatic explanation for the presence of cholera: ‘The air of Karachi must even now be strongly impregnated with the exciting [cause].’

<sup>95</sup> W. Baker, ‘Cholera’, *Madras Journal of Medical Science*, 1 (1851), pp. 260-8, 326-33.

**Table 4.2: Cholera – treatments used, according to major textbooks: 1807-1909.**

Textbook	Bleeding	Purgative	Calomel/ mercury	Rubefacient	Opium	IV fluid	Astringent	Alternatives and notes
1807, Curtis		✓		✓	✓			warm bath
1832, Corbyn	✓✓	✓✓	✓	(✓)				camphor vapour bath; blisters; mustard poultice; sedative; antacid
1841, Annesley	✓✓		✓	✓				
1861, Martin			✓		✓		✓	focus on prevention
1882, Bristowe						✓	✓	cold water by mouth; cupping; oral bismuth or Dover's powder
1903, Manson						✓		supportive measures; stimulant e.g. hypodermic ether or brandy
1909, Osler					✓	✓	✓	cocaine; enema with soap or tannic acid; stomach lavage with hot water

principally alcoholic, e.g. brandy, but also ammonia and oxygen – with opium, calomel, and ‘the saline treatment’, meaning oral rehydration with a salt solution, recognizing that ‘the blood has been deprived of its watery part’. R. Dane (dates unknown), surgeon to the 29<sup>th</sup> regiment of foot, in August 1853 recommends extract of hemp or ganja (*Cannabis indica*) in a letter to assistant surgeon Bussano of the 70<sup>th</sup> (Surrey) regiment, which was troubled by a cholera outbreak at the time.<sup>96</sup> Symptom-driven attempts at stemming the choleric flux, with astringents or opium, continued from the 1850s onwards, e.g. a formulation for ‘cholera pills’ in 1866 consisted of lead acetate, calomel, camphor, chili, and cantharides in a spice powder base,<sup>97</sup> accompanied by stabs at intravenous rehydration, but the latter only succeeded after the 1908 publication of Leonard Rogers (1868-1962) and John Megaw (1874-1958), who, in the cholera wards of the Calcutta Medical College, found a

<sup>96</sup> Wainwright, *Brothers in India*, p. 244; Dane quotes the work of the medical botanist William O’Shaughnessy, ‘On the preparations of the Indian hemp or gunjah’, *Provincial Medical Journal*, 5 (1843), pp. 363-9.

<sup>97</sup> M. Iyasawmy, ‘Prescription for Cholera pills’, *Madras Quarterly Journal of Medical Science*, 11 (1867), p. 178.

0.7 percent saline solution to be of a suitable tonicity.<sup>98</sup> With this treatment, mortality due to cholera was reduced to 25 percent (251 of 1003) over 1909-1915, from 59 percent (783 of 1243) during the period 1895-1905, when rectal and subcutaneous saline was in use.<sup>99</sup> Christopher Bayly makes the point that the failure of British medical men to conquer cholera held back their hegemony over traditional Indian healers.<sup>100</sup>

For dysentery, the striking feature is the popularity of combining purgatives and calomel, often with an emetic diaphoretic (usually ipecacuanha), which endured for the entire nineteenth century, and beyond (Table 4.3). Mercury as a treatment was known to the ancients, but Oswald Croll (c.1563-1609), an alchemist and professor of medicine at the University of Marburg, is credited with bringing its effects as a purgative to the attention of physicians in the early modern era.<sup>101</sup> From the eighteenth to the twentieth centuries, mercury was usually administered as calomel, mercurous chloride (Hg<sub>2</sub>Cl<sub>2</sub>), but sometimes the metal in an ointment was rubbed into the skin.<sup>102</sup> Calomel became a purgative of choice and the medication for liver complaints most favoured by medical officers in India from the late eighteenth through well into the nineteenth century. This and similar habits were spread to other theatres of the British empire, including Britain itself, Catherine Kelly asserts, via the parliamentary route and by military surgeons assuming a privileged place in civic society once through with army service, rather than by published experience.<sup>103</sup> Part of this

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<sup>98</sup> L. Rogers, J.W.D. Megaw, 'A preliminary note on blood pressure as a guide in transfusion for cholera', *IMG*, 43 (1908), pp. 90-2; Rogers was professor of pathology; Megaw was a captain in the IMS. Both were later knighted. Rogers founded the Calcutta School of Tropical Medicine; Megaw was a pioneer of air conditioning in the tropics – see Obituary, 'Sir Leonard Rogers', *British Medical Journal*, 2 (1962), pp. 862-3; Obituary, 'Sir John Megaw', *British Medical Journal*, 2 (1958), pp. 1166-7.

<sup>99</sup> L. Rogers, 'Results of the hypertonic and permanganate treatment in 1000 cases of cholera,' *Lancet*, 186 (1915), pp. 219-23; Potassium permanganate was given by mouth from 1909.

<sup>100</sup> Bayly, *Information*, p. 275.

<sup>101</sup> O. Croll, *Bazilica chymica & praxis chymiatricae or Royal and practical chymistry*, 3 vols., tr. J. Hartman (London: Starkey and Passinger, 1670), p. 20; Croll also claims therapeutic effect for antimony, sulphur, gold, coloquintida (colocynth), scammony (*Convolvulus scammonia*), amber, salt nitre (probably saltpetre, potassium nitrate), spirit of tartar, balsam of fennel, opium and laudanum, liquor of tin, and a variety of topical concoctions including some described as 'cosmetick'.

<sup>102</sup> Curtis, *Coastal 1807*, p. 108.

<sup>103</sup> C. Kelly, *War and the militarization of British army medicine, 1793-1830* (London: Pickering and Chatto, 2011), pp. 155-8; M. Harrison, 'Disease and medicine in the armies of British India, 1750-1830', in G.L. Hudson, ed., *British military and naval medicine, 1600-1830* (Rodopi: Amsterdam, 2007), pp. 87-119; Harrison, *Commerce*, pp. 146-71.

**Table 4.3: Dysentery – treatments used, according to major textbooks: 1807-1909.**

Textbook	Bleeding	Purgative	Calomel/ mercury	Diaphoretic	Emetic	Astringent	Opium	Silver nitrate	Alternatives and notes
1807, Curtis		✓	✓						nitric acid by mouth
1823, Ballingall		✓	✓	✓	✓	✓			blisters, poultice, leeches; oral antimonial
1841, Annesley	✓✓	✓	✓	(✓)			(✓)		topical antimony, leeches, blisters, poultice
1861, Martin	✓	✓	✓	✓	✓	(✓)	(✓)		poultice, warm bath; oral diuretic or antimonial
1864, Stillé		✓	✓		✓		✓	✓	silver nitrate or lead acetate by mouth
1882, Bristowe	(✓)	✓	✓	✓	✓		✓	✓	oral lead, silver nitrate, iron perchloride, copper salt or sulphuric acid
1903, Manson		(✓)	((✓))	(✓)	(✓)	(✓)	(✓)	(✓)	favoured supportive measures, bedrest; oral bismuth; silver nitrate enema
1909, Osler		✓		✓	✓			(✓)	oral bismuth; silver nitrate enema; sodium sulphate laxative; oral acetozone

influence, as Harrison points out, was due to their ability to correlate the ante-mortem picture with the post-mortem one – autopsies were a regular feature of medical practice in India and other outposts, where soldiers’ bodies were unimpeded by legal or relatives’ concerns.<sup>104</sup> A pertinent example is the advocacy by Dr Paisly, surgeon-general at Madras in the late eighteenth century, of the inspissated bile theory for bowel disorders and fevers, and its treatment by calomel – based on autopsy liver changes described by Dr John Wade (dates unknown), findings of bile ducts engorgement in fever and flux cases by James Johnson, and of intestinal pathology in dysentery by

<sup>104</sup> M. Harrison, ‘Racial pathologies’, in Pati, Harrison, *Social history*, pp. 173-94.

William Twining.<sup>105</sup> Kelly argues too that military surgeons at outposts where they faced new disease presentations affecting large bodies of men, ‘fevers’ is such an instance, were forced to reassess both *causation* – pulling away from eighteenth century humoral assertions and instead emphasizing behavioural and organizational hygiene origins – and *therapy* – adopting an empirical observation-based approach, rather than being theory-led.<sup>106</sup> Simultaneously they developed their own style of manpower economic management in order to assert their status in the face of opposition from army officers or civilian practitioners. Indian army surgeons’ ability to correlate pre- and post-mortem findings paralleled the clinico-pathological model of the Parisian school of the 1820s and contributed to a more empiric and observational basis for medical thought after the mid-century point.<sup>107</sup> Differences in post mortem appearance for common diseases between native Indians and Europeans contributed, after publication of Allan Webb’s *Pathologia Indica* in 1848, to concepts of racial differences, including on therapeutic approach (e.g. prescribing).<sup>108</sup>

Bleeding was briefly approved for treatment of dysentery, according to Annesley and Martin, in the 1840s to 1860s, after which opium was often prescribed.<sup>109</sup> Martin gives a detailed description of his approach, though he emphasizes prevention by attention to ‘diet, clothing, protection from weather...’ He adopts a Brunonian ‘rationalist’ approach, and divides the disease presentation into *sthenic*, in which the patient had strength, and *asthenic*, in which the patient was debilitated.<sup>110</sup>

Bleeding was appropriate in the congested inflammatory first type, but not in the latter. For an

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<sup>105</sup> J.P. Wade, *Paper on prevention and treatment of the disorders of seamen and soldiers in Bengal* (London: J. Murray, 1793), pp. 117, 133-4, 151; Paisly’s first name and dates are unknown; W. Twining, *Clinical illustrations of the more important diseases of Bengal* (Thacker: Calcutta, 1832), pp. 7-14; For Twining, bile was often a symptom of disease rather than the cause (pp. 39-40).

<sup>106</sup> Kelly, *Militarization*, pp. 155-8.

<sup>107</sup> *Ibid.* For example, Dr William Saunders of Guy’s Hospital – a British authority on the liver – was convinced by post mortem-led arguments coming out of India.

<sup>108</sup> A. Webb, *Pathologia Indica* (Thacker: London, 1848), p. 128; Webb’s dates are 1808-63.

<sup>109</sup> Annesley, *Researches 1841*, pp. 425-6, 429-32; Annesley’s preferred enemas contained potions of linseed or tartar, or extracts of hyoscyamine, or rice water. These could be combined with opium. Part of the rationale for use of diaphoretics was: ‘to determine the circulation to the surface of the body, and thereby to take off the tendency of fluids to flow to the seat of disease’; Martin, *Influence 1861*, pp. 429-30, 435, 440-1; Stillé, ‘Dysentery 1864’, pp. 371-3, 378.

<sup>110</sup> Warner describes how, between 1820 and 1850, the practice of New England physicians progressed from the therapeutic activism of a ‘rationalist’ approach – based on Cullenian and Brunonian certainties of disease classification, to an empiricist one – which favoured practical experience and observation (Warner, *Therapeutic*, pp.37-46). This transition occurred later in the medical circles of British India.

uncomplicated case, his formula is straightforward though scattergun: bleed, calomel with James's powder or ipecacuanha, hot fomentation or warm bath, a sudorific and a diuretic.<sup>111</sup> He tailors the prescription and does not feel that mercury is invariably needed. As convalescence approaches, Martin tones down the vigour of his medication, preferring: 'mild aperients, cold water enemata with or without lead and opium, anodynes by the stomach and rectum, warm baths, demulcent drinks, and farinaceous diet'.<sup>112</sup> Potentially fatal haemorrhagic dysentery was treated immediately with lead astringents and opium by mouth and rectum. Iatrogenic disease was recognized.<sup>113</sup> For natives with dysentery, Martin, like previous writers, moderated his use of bleeding and purgation: 'Excepting in instances of powerful and athletic sepoy, and those mostly of the better-fed Mahomedans, I seldom had recourse to general bloodletting'. Chronic dysentery, separated from acute forms since the early nineteenth century, was approached by Annesley in 1841 with more focus on local treatments.<sup>114</sup> Thus 'depletions' were by leeches, and blisters, poultices and flannel bandaging were employed, but calomel with opium or ipecacuanha, or Dover's powders were still given systemically. By the 1850s, farinaceous foods, with small doses of opium, silver nitrate or lead acetate, were used for the chronic form. The popularity of high dose ipecacuanha, brought to the fore by surgeon E.S. Docker (dates unknown) of the 7<sup>th</sup> Fusiliers, on Mauritius in 1858, was emphasized for the Indian setting by assistant surgeon W.R. Cornish (1828-96) of Madras in 1861 – the *IMG* indicates its wide acceptance for acute dysentery from the mid 1860s.<sup>115</sup> By the late 1870s, Bristowe mentions venesection and calomel, but states that: 'Ipecacuanha has enjoyed a long but various reputation. It was formally regarded as an almost unfailing specific, and at the present day is very highly esteemed'.<sup>116</sup> By the turn of the nineteenth century, Sir Patrick Manson's prescription still betrayed a polypharmaceutical approach: ipecacuanha, rest, barley-water diet, 'a minute dose of

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<sup>111</sup> Martin, *Influence 1861*, pp. 441-3, 446; Sudorific means sweat inducing. Farinaceous implies starchy.

<sup>112</sup> Anodyne here is thought to indicate an analgesic.

<sup>113</sup> Martin, *Influence 1861*, pp. 444, 459, 466; Martin states, without realizing the irony: 'Over-treatment is always a cruel infliction upon the sick.'

<sup>114</sup> Annesley, *Researches 1841*, pp. 452-6, 473.

<sup>115</sup> E.S. Docker, 'Treatment of dysentery by large doses of ipecacuanha', *Lancet*, ii (1858), pp. 113-15; Cornish, 'Ipecacuanha', pp. 41-52; N. Jackson, 'Ipecacuanha in dysentery' *IMG*, 1 (1866), p. 253 and others in the same volume.

<sup>116</sup> Bristowe, *Treatise* 2nd edn (London: Smith, Elder, 1878), p. 638.

castor oil with or without opium’, an ‘intestinal antiseptic, as salol or beta-naphthol’, or, if these failed, silver nitrate enemas and ‘systematic washing out of the bowel daily with warm boracic water’.<sup>117</sup> Hence, in the second half of the nineteenth century, ipecacuanha was a focus of treatment for dysentery, and silver nitrate and lead acetate, both now recognized for their astringent properties despite potential toxicity, were being employed by mouth or enema for serious sequelae.<sup>118</sup> Wine was used throughout the century as a tonic or stimulant, or as a vehicle in which to deliver ipecacuanha, opium, antimony or arsenic.<sup>119</sup>

The treatment of hepatitis, as loosely defined by British-Indian practitioners, was marked, according to lore, by the use of bleeding with calomel right up to the 1860s.<sup>120</sup> After this, both were dispensed with, though purgation prospered for the entire hundred years plus, sometimes accompanied by an antimonial, a diuretic (typically taraxacum), or topical counterirritants – the poultice and cupping – which were also often employed as secondary measures for other conditions.<sup>121</sup> In the second half of the century, the symptoms of hepatitis were still recognized to be vague, but more emphasis was placed on physical detection of liver enlargement and greater weight given to jaundice. ‘Iodide of potassium, chloride of ammonium, taraxacum and nitro-hydrochloric acid’ now were being prescribed, but ‘Febrifuge or alkaline medicines, and saline purgatives or mild laxatives,’ and local fomentations, were still in vogue.<sup>122</sup> Hence, by the time of the 1882 edition of Bristowe’s *Treatise*,

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<sup>117</sup> Stillé, ‘Dysentery 1864’, pp. 371-3, 378; P. Manson, *Tropical diseases – a manual of the diseases of warm climates* (London: Cassell, 1903), pp. 404-7; Salol is phenyl salicylate, a derivative of aspirin. The enemas may also have contained linseed, milk, alum, copper sulphate, or tannin. Alum is hydrated potassium aluminium sulphate, and an astringent. Boracic acid, now called boric acid, is an antiseptic and astringent. Bismuth can have a constipating effect.

<sup>118</sup> Stillé, ‘Dysentery 1864’, pp. 371-3, 378; Manson, *Tropical 1903*, pp. 404-7.

<sup>119</sup> Ballingall, *Practical 1823*, p. 74; Annesley, *Researches 1841*, p. 559; Martin, *Influence 1861*, pp. 342-3; Bristowe, *Treatise 1882*, p. 144; Manson, *Tropical 1903*, p. 373; Brandy, occasionally champagne, ammonia and camphor and, counterintuitively, opium, were also employed as stimulants.

<sup>120</sup> In the early 1860s, Martin was still managing hepatitis as follows: After ‘general bloodletting, repeated as symptoms demand’, patients were daily subjected to calomel, James’s powder, a saline purge or jalap powder, leeches to the abdomen, diaphoretics and diuretics – Martin, *Influence 1861*, pp. 478-9; James’s powder contains antimony oxide. Opium was substituted for the antimonial preparation if diarrhoea threatened. Mercury was given to the point of: ‘producing a gentle action on the gums, salivation being unnecessary’ (p. 479). In the human body, mercury is an immunosuppressant: see P. Moszczynski, ‘Mercury compounds and the immune system: a review’, *International Journal of Occupational Medicine and Environmental Health*, 10 (1997), pp. 247-58.

<sup>121</sup> Antimonials are discussed below. Extract of *Taraxacum officinale*, dandelion, is a diuretic.

<sup>122</sup> Bristowe, *Treatise 1882*, pp. 742-6, 752.

inflammation was seen as a tissue-focussed process, rather than having the vascular basis assumed by Martin. Potential causes of hepatic disease had been expanded beyond fevers and bowel disorders to include cardiac failure and ‘toxic effects of phosphorus and certain metallic poisons’.<sup>123</sup> Hepatitis was acknowledged to follow some cases of dysenteric enteritis.<sup>124</sup>

Hepatic abscess, ‘announced by irritative fever, followed by profuse cold sweats ... [and] when the abscess is large, by a perceptible tumour of the right hypochondrium’, was associated with a poor prognosis throughout the nineteenth century. Curtis, in his 1807 *Coastal diseases*, makes the link between intestinal disorders and hepatitis and was keen to start treatment early because: ‘When the inflammation was not soon resolved by exhibition of mercury, the substance of the liver ran speedily into a state of suppuration. An abscess formed, too often of very large extent’.<sup>125</sup> Local surgery was an option but: ‘Out of ten patients in which the abscesses were opened [incised], we only saved two.’ Annesley was more advanced surgically as he decompressed hepatic abscesses on external pointing, packing the cavity, and changing dressings daily, whereas Martin avoided operating.<sup>126</sup> Later in the nineteenth century surgical methods had progressed. Dr J.F.P. McConnell (1848-96), later professor of *materia medica* at Calcutta Medical College, describes pneumatic aspiration using a trocar and syringe-cylinder for liver abscess in 1873 and observed a connection with dysentery in almost half his cases.<sup>127</sup> Of 14 patients with hepatic abscess, who had up to 4 liters of pus aspirated, eight recovered and six died, representing a distinct advantage over conservative treatment. It is unclear how widely this was adopted, though it must have been taken up as Bristowe supported aspiration and drainage in 1882.<sup>128</sup> Emphasis was understandably on early

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<sup>123</sup> *Ibid.*, Diseases related to occupation were being identified in the nineteenth century, as workers were intensively exposed to industrial processes in factories.

<sup>124</sup> Annesley, *Researches 1841*, p. 23.

<sup>125</sup> Curtis, *Coastal 1807*, pp. 89-92.

<sup>126</sup> Annesley, *Researches 1841*, pp. 261, 266-71, 275-6, 303-4; Martin, *Influence 1861*, pp. 478-9.

<sup>127</sup> J.F.P. McConnell, ‘Remarks on pneumatic aspiration with cases of abscess of the liver treated by this method’, *Indian Annals of Medical Science*, 31 (1873), pp. 1-78.

<sup>128</sup> Bristowe, *Treatise 1882*, p. 746; Aspiration and drainage might be causally related to the observed fall in case fatality from ‘hepatitis’ in the 1880s. Its apparent generalized use from the 1870s fits temporally – cases of hepatic abscess often seem to have been labelled as ‘hepatitis’.

treatment with the intention of preventing abscess formation. Manson records, on liver abscess, that: ‘*Amoeba coli* can be detected in considerably over half the cases’, and that fatality was usually due to rupture into the peritoneum.<sup>129</sup>

Typhoid fevers only assumed epidemic proportions in the final third of the nineteenth century. The mortality in European troops of India peaked in the late 1880s despite falls in diarrhoeal diseases – the apparent paradox much exercised medical officers at the time and led to the development of vaccines.<sup>130</sup> Tracing the history of the diagnosis of enteric fever, later specified as typhoid, and typhus, is complicated because the two conditions were not clinically differentiated until the 1850s.<sup>131</sup> Until ‘enteric fever’ was split off to become its own diagnostic category for army medical officers at different times in the presidencies from 1861, typhus and typhoid were combined with other causes of fever, in the ‘continued’ and ‘remittent’ categories of returns.<sup>132</sup> Annesley, in 1842, uses the term *typhoid* as an adjective to describe a type of fever that is ‘adynamic’, characterized by an absence of vigour.<sup>133</sup> Martin’s *Influence*, in 1861, clearly recognizes typhoid as a fever entity, characterized by dysenteric features, haemorrhage from the bowel, splenic enlargement, and an excess mortality, but he does not attach to it any specific treatment.<sup>134</sup> By the latter part of the nineteenth century, hypothesis-driven prescribing had been superseded by an empiricist symptom-based rationale, such that bleeding, purgatives and calomel received short shrift, and the focus was on the use of a variety of astringents, orally or by enema, both to staunch diarrhoea and to prevent

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<sup>129</sup> Manson, *Tropical 1903*, pp. 454-69, 472; R.J. Godlee, ‘Lectures on surgical aspects of hepatic abscess’, *British Medical Journal*, i (1890), pp. 61-4.

<sup>130</sup> For example: J.B. Hamilton, ‘Enteric fever in India’, *British Medical Journal* 2 (1890), pp. 787-9. Almroth Wright (1861-1947), professor of pathology at Netley, developed an anti-typhoid vaccine that had definite protective qualities, though its introduction was controversial – see M. Worboys, ‘Almroth Wright at Netley: modern medicine and the military in Britain, 1892-1902’, in R. Cooter, M. Harrison, eds., *Medicine and modern warfare* (Rodopi: Amsterdam, 1999), pp. 77-97.

<sup>131</sup> Curtin, *Migration*, p. 150; McKeown in *Population*, notes that the registrar general’s classification separated typhus from typhoid in 1869 (p. 50).

<sup>132</sup> As cited in sanitary commissioners’ reports, enteric fever became a diagnostic category for medical officers’ returns in 1861 for European troops of Madras and Bombay presidencies, 1862 for European soldiers in Bengal, 1867 for native forces in Madras, 1870 for sepoys in Bombay and 1871 for those in Bengal.

<sup>133</sup> Annesley, *Researches 1841*, pp. 381, 543; Annesley does not use the term typhoid as an exact disease category.

<sup>134</sup> Martin, *Influence 1861*, pp. 333, 437, 447, 459, 500-3, 571.

bowel perforation, and the cool bath to reduce pyrexia.<sup>135</sup> A trend towards supportive, non-interventional or ‘mild’ treatments for typhoid had appeared in the United States around the mid-century.<sup>136</sup> A novel approach mentioned in an *IMG* article of 1880, of ‘ergotine injected hypodermically’ to arrest bowel haemorrhage, as suggested by ‘Dr Little’, would have been quite a therapeutic *active* advance.<sup>137</sup>

Symptoms compatible with typhus had been recognized from the sixteenth century, though there are prior descriptions.<sup>138</sup> Cullen’s nosology, whilst not specifically including ague, did extend to ‘typhus or nervous fever’.<sup>139</sup> James Hamilton (1749-1835), senior physician to the Royal Infirmary of Edinburgh, writing in his 1811 treatise on use of purgatives in a multiplicity of conditions, describes an outbreak of typhus in Leith, in 1780, aboard two warships, the Suffolk and the Egmont, arrived from Jamaica, of 166 seamen, of whom 31 expired.<sup>140</sup> He notes symptoms of fever, loss of appetite, constipation, headache, and debility, complicated by twitching of muscles, hiccups and delirium. Hamilton mentions ‘reddish spots’ in one of eighteen on whom he gives more detail. Antimony nitrate and a purgative were prescribed based on relieving constipation to restore normal alvine function.<sup>141</sup> The clinical description, though reminiscent of typhus, is insufficient to be confident that cases of typhoid were excluded. MacCulloch, in 1830, noted that there was lumping

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<sup>135</sup> Bristowe supports the cool bath, used until the ‘patient’s temperature has become sensibly reduced, or shivering comes on’, and a mild laxative in the first week, but: ‘when diarrhoea is present it should be restrained either by tannic acid, lead and opium, sulphuric acid, compound kino powder, or by opium or morphea [sic] suppositories, or opiate enemata’. To prevent bowel perforation, with its attendant mortality, he suggests avoiding strong purgatives, and the control of diarrhoea – Bristowe, *Treatise 1882*, pp. 224-6; Bristowe favoured castor oil or rhubarb as a mild laxative. Diarrhoea is typically absent in the first week of typhoid fever.

<sup>136</sup> Warner, *Therapeutics*, pp. 215, 226.

<sup>137</sup> E. Sexton, ‘A synopsis of recent views regarding treatment of enteric fever’, *IMG*, (1880), pp. 33-9; Dr Sexton (dates unknown) was a civil surgeon at Poona; Ergotine, now known as ergotamine, is a vasoconstrictive alkaloid extracted from the ergot fungus *Claviceps purpurea* that grows on rye. It was responsible for the medieval phenomenon of St Anthony’s fire, when ergot-contaminated bread was consumed.

<sup>138</sup> D. Raoult, T. Woodward, J.S. Dumler, ‘The history of typhus’, *Infectious Disease Clinics of North America*, 18 (2004), pp. 127-40.

<sup>139</sup> Exanthemata, such as measles and scarlatina, were already differentiated in the eighteenth century by their specific cutaneous signatures.

<sup>140</sup> J. Hamilton, *Observations on the utility and administration of purgative medicines in several diseases*, 4th edn (Edinburgh: Ramsay, 1811), pp. 31-49.

<sup>141</sup> *Ibid.*, p. 41; Hamilton’s preferred purgatives were calomel, jalap, aloes, neutral salts, and senna. He does not describe the eruption of typhus, which was an important differentiator – typically petechial (small purple spots) – as opposed to the rose-coloured macular or slightly papular rash of typhoid.

of a variety of conditions under the heading ‘typhus’.<sup>142</sup> By the 1850s, specific features of typhoid allowed its disentanglement from typhus.<sup>143</sup> This had occurred by the 1853-56 Crimean War, during which, of the 309,268 strong French army, eleven percent contracted typhus, of which a half perished.<sup>144</sup> Typhus was not reported as a major problem in the armies of India.

Of the remaining multiple causes of fever, mention must be made of two specifics, plague and dengue. The first because of its fearful reputation throughout human history, and the second because it was and still is a common, though rarely fatal, cause of fever in India. For the first 70 years of the nineteenth century, plague, due to *Yersinia pestis*, caused sporadic epidemics throughout India. After 1871 and up to 1921, it was a major source of mortality among civilians.<sup>145</sup> Armies, however, in nineteenth century British India, were little troubled by plague. For early-to-mid nineteenth century medical writers, plague occurred in Egypt or Asia Minor. In his 1828 first edition, Annesley mentions outbreaks of ‘the plague’ in Cairo ‘after inundations of the Nile’, which persuaded him of the involvement of vegetable and animal matter.<sup>146</sup> As for dengue, first described as ‘break-bone fever’ in 1780 by Dr Benjamin Rush (1746-1813), of Philadelphia, due to the severe skeletal pains that accompanied the fever, headache, nausea, vomiting and rash – it is not usually fatal.<sup>147</sup> A similar illness was reported in Calcutta and Berhampore in 1824-25, by Dr James Mellis (1781-1846), surgeon to the Bengal marine establishment.<sup>148</sup> Treatment was variable – including a mild purgative, a sudorific, opium for pain, and cold affusion for head pain, but some physicians were more aggressive, prescribing bloodletting, cathartics and emetics. Neither Annesley, in his

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<sup>142</sup> MacCulloch, *Essay*, pp. 28, 33, 70-1, 99, 104, 107.

<sup>143</sup> Curtin, *Migration*, p. 150.

<sup>144</sup> A. Post, W.H. van Buren, ‘Military hygiene and therapeutics’, in Hammond, *Military medical 1864*, pp. 11-44; Typhus was the leading cause of death in the French army of the Crimea.

<sup>145</sup> Arnold, *Colonizing*, pp. 200-39; Harrison, *Public health*, pp. 81, 113, 133; Arnold records the mortality rate from plague as ‘41.3 per 1,000 of the population in the 1880s’ (p. 200).

<sup>146</sup> J. Annesley, *Researches into the causes, nature, and treatment of the more prevalent diseases of India, and of warm climates generally*, vol. I (London: Longman, 1828), p. 84.

<sup>147</sup> R.M. Packard, ‘Break-bone fever in Philadelphia, 1780: reflections on the history of disease’, *Bulletin of the History of Medicine*, 90 (2016), pp. 193-221; Benjamin Rush was a signatory to the United States Declaration of Independence. He had graduated in medicine from the University of Edinburgh.

<sup>148</sup> S.H. Dickson, *On Dengue: its history, pathology and treatment* (Philadelphia: Haswell, Barrington and Haswell, 1839), pp. 11-13; Dickson explains that dengue or *dunga* is Cuban slang for ‘dandy’, used to describe the stiff gait of those affected by the condition (p. 6).

1841 edition, nor Martin, in 1861, mention dengue or break-bone fever, but it was clearly a diagnosis considered by doctors in post-rebellion British India. Thomas Edmonston Charles (1834-1906), of Calcutta General Hospital medical college, reminded his students in 1872, ‘that dengue is a specific disease, and runs a certain course of its own, uninfluenced by remedies’.<sup>149</sup>

Pneumonia was not a prominent cause of death before 1860, but after that it assumed greater significance as dysentery and cholera reduced in frequency. Around the turn of the eighteenth into the nineteenth century it became differentiated from other respiratory conditions and indeed, split off from fevers generally. ‘Pneumonia’, Alexander Philip (1780-1851) records in his 1813 *Treatise on febrile diseases*, ‘is Dr Cullen’s eleventh genus – it is defined by him, “*Pyrexia, dolor in quadam thoracis parte, dyspnoea, tuffis.*” He divides it into two species, the peripneumonia and pleuritis’.<sup>150</sup> Philip’s own description of the symptoms of pneumonia, especially shortness of breath, cough and chest pain, mean that it should not have been confused with other causes of fever. The first use of the term ‘bronchitis’, to distinguish the condition from other respiratory disorders, is attributed to Charles Badham (1780-1845), who, in the 1814 second edition of his *Essay on bronchitis*, defines it as: ‘An acute inflammation of the air passages, attended with fever, cough and shortness of breath’.<sup>151</sup> Flurin Condrau and Michael Worboys explain that in and even up to the end of the nineteenth century, pneumonia and also bronchitis were primarily viewed as inflammatory lung conditions, and not communicable, even if, in the later decades microorganisms were isolatable.<sup>152</sup> Recognition of tubercles in the lungs, and of *phthisis pulmonalis*, was established in the eighteenth

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<sup>149</sup> T.E. Charles, ‘Clinical lectures on dengue delivered at the Medical College’, *IMG*, 7 (1872), pp. 121-3.

<sup>150</sup> A.P.W. Philip, *A treatise on febrile diseases: including the various species of fever, and all diseases attended with fever*, vol. II, 3rd edn (London: Underwood, 1813), pp. 228-42; The Latin translates as ‘Fever, pain in some parts of the chest, dyspnoea, cough.’ Philip was a physician who worked in Winchester, Worcester and London.

<sup>151</sup> C. Badham, *An essay on bronchitis: with a supplement containing remarks on simple pulmonary abscess, etc.* (London: Callow, 1814), p. vi; The first edition appeared in 1808. The term *peripneumonia notha* seems to have been used for what Badham re-names as bronchitis. Badham became regius professor of medicine at the University of Glasgow.

<sup>152</sup> F. Condrau, M. Worboys, ‘Second opinions: final response. Epidemics and infections in nineteenth-century Britain’, *Social History of Medicine*, 22 (2009), pp. 165-71.

century, as in the 1793 edition of *Morbid anatomy* by Matthew Baillie (1761-1823).<sup>153</sup> Baillie also describes the pathological appearances of pneumonia but does not use the term. Despite clear descriptions of these respiratory diseases by the early 1800s, medical observers of British India in the first quarter of the nineteenth century, such as Curtis and Ballingall, write little on chest problems. The explanation must be that, in this period, gastro-intestinal diseases so predominated in their incidence and fatality, that they dwarfed pathology from lung diseases, and that cases of pneumonia were assigned to the continuous fever category. In the first half of the nineteenth century, pneumonia was treated like any other fever, but in the second half it was realized that active general support, leaving the healing to nature, was appropriate. This did not stop secondary therapeutic tinkering with, for example, antimonial ‘sedatives’, alcoholic stimulants or poultices, and bleeding might still be employed for high fever or for severe breathing problems, but generally, as personified by the approach of Flint, the medicinal touch was lighter.<sup>154</sup> Flint’s philosophy is partly reflected in the initial approach of surgeon C.M. Jessop of the 4th Hussars, who wrote in 1875, that ‘for simple or slight cases [of pneumonia] the expectant method of treatment, i.e. rest in bed, &c., when the tongue is not loaded, answers very well’.<sup>155</sup> Oxygen was introduced after 1900.<sup>156</sup> The management of heat apoplexy, tracked over the course of the nineteenth century, continued to show, by the 1900s, the ancient with the modern. The mid-century keenness for bleeding and purgation,<sup>157</sup> was replaced, from the late 1860s, by the cold affusion<sup>158</sup> and even by

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<sup>153</sup> M. Baillie, *The morbid anatomy of some of the most important parts of the human body* (London: Johnson, 1793), pp. 42-54; Baillie writes: ‘When tubercles are converted into abscesses, it forms one of the most destructive diseases in this island, viz. pthisis [sic] pulmonalis’ (pp. 48-9). Matthew Baillie was physician to St George’s Hospital, London, and physician-in-ordinary to King George III.

<sup>154</sup> Annesley, in 1841, still favoured diaphoretics, depletions, and blisters, with: ‘gum ammoniacal mixture [derived from the stem of the plant *Dorema ammoniacum*, native to India and Iran], with camphor, hyoscyamus [henbanes], conium [hemlock], sp. aether. nitr. [*spiritus aetheris nitrosi*, or ‘sweet spirit of nitre’ – an alcoholic solution of ethyl nitrite and aldehyde], and antimonials’ – Annesley, *Researches 1841*, p. 587; Geddes mentions ‘venesection or leeches, blisters, calomel combined with opium, and administration of purgatives’, bleeding up to 20 fluid ounces, that is 0.57L – W. Geddes, *Clinical illustrations of the diseases of India: as exhibited in the medical history of a body of European soldiers for a series of years from their arrival in that country* (London: Smith, Elder, 1846), pp. 285-303.

<sup>155</sup> C.M. Jessop, ‘Irritant causes of disease: pneumonia’, *IMG*, 10 (1875), pp. 259-61; Jessop also favoured the application of counterirritants, ‘a large mustard poultice’ or croton oil liniment; Flint, ‘Pneumonia’, pp. 297-328.

<sup>156</sup> W. Osler, *The principles and practice of medicine*, 7th edn (New York: Appleton, 1909), pp. 602-6.

<sup>157</sup> Geddes, *Clinical 1846*, pp. 199-202; Martin, *Influence 1861*, pp. 391-401.

<sup>158</sup> The cold application was in the form of by a douche of cold water, ‘falling from the height of a few feet’ – Martin, *Influence 1861*, p. 405; Success was judged by a reduced skin temperature, ‘restoration of nervous and vascular powers’

artificial respiration for cessation of breathing,<sup>159</sup> but Osler, as late as 1909, tenaciously advocated bleeding for ‘intense asphyxia’.<sup>160</sup> By the early 1900s, the cold bath has been refined to an iced water drip onto a sheet covering the patient, given until the rectal temperature has sunk to 104°F, and incorporates a hypodermic injection of digitalis, ‘preceded in the case of plethoric patients showing much arterial tension (but not otherwise) by a small bleeding’.<sup>161</sup>

### ***Evaluation of specific treatments in nineteenth century British India***

The value of venesection as a therapy was a bone of contention during the long nineteenth century in British India. It had gone out of fashion, as noted by Harrison, in the second half of the eighteenth century, reflecting the concerns of Lind and Clark, but in the second quarter of the nineteenth century, surgeons in India again employed it for many potentially fatal diseases, most consistently fevers and hepatitis, and then dysentery and cholera – credited largely to William Twining, and Henry Goodeve (1807-84), a professor at Calcutta Medical College (1835-45) (Tables 4.1-4.3).<sup>162</sup> Bloodletting, as outlined previously by Martin, had a tradition going back centuries, even to Galen (c.AD 129-200).<sup>163</sup> Even though it had been played down by Pierre Louis, François-Joseph-Victor Broussais (1771-1838), his near contemporary at the Paris school, who taught a physiological approach to medicine as opposed to Louis’ anatomical style, encouraged a resurgence in Parisian practice in the 1820s and 1830s.<sup>164</sup> This chimed with the then prevalent view of medical

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and normalization of bowel habit. The rate and volume of the pulse was heavily relied upon, since blood pressure could not be measured; C.M. Jessop of the 4th Hussars, in 1875, preferred the cold bath to venesection, *vide supra* – ‘Heat apoplexy.’

<sup>159</sup> Barnard, ‘Coup-de-soleil’, pp. 78-80.

<sup>160</sup> Osler, *Principles 1909*, pp. 385-7; Osler defines heat apoplexy as ‘a condition in which the existing effect of heat paralyses the centre in the medulla [of the brain]’ – The medulla oblongata is in the lower half of the brain stem and contains regions that regulate cardiac and respiratory function.

<sup>161</sup> Manson, *Tropical 1903*, p. 291.

<sup>162</sup> Harrison, *Commerce*, pp. 107, 126-7.

<sup>163</sup> Galen was a Greek physician from Pergamon, who went on to practice in Rome. For a full exposition of his theories and practice on phlebotomy, see – P. Brain, *Galen on bloodletting: a study of the origins, development and validity of his opinions, with a translation of the three works* (Cambridge: CUP, 2010).

<sup>164</sup> Louis, who developed the ‘numerical method’, made a statistical comparison of patients with pneumonia (he termed it ‘pneumonitis’) who were bled early with those bled late, and found a higher mortality for those bled early. He concluded that the influence of bloodletting was limited but felt it ‘*should not be neglected in inflammations which are severe and are seated in an important organ*’ [his italics] – P.C.A. Louis, *Researches on the effects of bloodletting in some inflammatory diseases and on the influence of tartarized antimony and vesication in pneumonitis*, tr. C.G. Putnam (Boston: Hilliard, Gray, 1836), pp. 9-10, 13-14, 23; Bynum, *Science*, pp. 44-6.

practitioners in the tropics, a Cullenian advocacy that fever was a condition of the nervous system.<sup>165</sup> Bleeding was performed either for a specific volume, e.g. six or twelve fluid ounces (170 or 340 mL), or until the amplitude of the pulse weakened or a feeling of faintness was induced.<sup>166</sup> As demonstrated by Louis in 1830s Paris, contemporary evidence that bloodletting improved outcome was lacking – its use mostly was dictated by the prevailing theories of disease. Nevertheless, it would be churlish to infer that doctors took no account of clinical response. Warner records mid-century observations of the immediate effects of bloodletting at the Massachusetts General Hospital, given as part of a therapeutic package. House physicians found a reduction in the rate and force of the pulse, alleviation of pain, reduction in body temperature and respiration rate, soothing of headache, and of anxiety with induction of sleep, and the return of a flushed complexion to normal – all can be interpreted as a reduction in inflammation.<sup>167</sup> The bradycardia seems at variance with the increase in heart rate that follows an acute haemorrhage of twenty fluid ounces (570 mL), slightly more than was typical for a therapeutic bleed, representing about eleven percent of blood volume, but the elevation in peripheral vascular resistance characterized by reduced blood flow to the abdominal organs, and to the skin, which would seem to cool, is compatible.<sup>168</sup> Apart from that of Louis, finding eighteenth or nineteenth century clinical studies of bloodletting has proved difficult. Robert Jackson (1750-1827), a surgeon with the British army in North America and Jamaica, refers to its use, in yellow fever, as being: ‘found to moderate the violence of local pain, particularly the violence of the head-ach [sic], and to be not altogether without effect, in retarding the usual rapid progress of the disease’.<sup>169</sup> For other fevers he notes that, with early phlebotomy: ‘the disease will, for the most part, be instantly removed, or, were it not

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<sup>165</sup> Harrison, *Commerce*, pp. 172-3, 179; In Brunonianism, bleeding still applied when the *sthenic* was ascendant.

<sup>166</sup> Warner, *Therapeutics*, p. 131.

<sup>167</sup> *Ibid.*, p. 133; Longer term efficacy is not recorded.

<sup>168</sup> J. Freeman, ‘Physiological effects of haemorrhage’, *Annals of the Royal College of Surgeons of England*, 33 (1963), pp. 138-49; The effect could be described as a reactive vasoconstriction.

<sup>169</sup> R. Jackson, *A treatise on the fever of Jamaica: with some observations on the intermitting fever of America, and an appendix, containing some hints on means of preserving the health of soldiers in hot climates* (London: Murray, 1791), p. 268.

removed entirely, so broken and disturbed as to assume an intermitting or remitting form'.<sup>170</sup> The denouement for venesection in British Indian medical practice came about after the 1860s, based not so much on the studies of Louis in Paris, but on empirical observations of army surgeons such as Metcalf and Stillé in America, Elliotson and Watson, later Bristowe, and others in India, who found that whatever benefits it lent, other treatments afforded the same but without the drawbacks.<sup>171</sup> In Britain, the practice had declined considerably by the mid-1850s, influenced by the unequivocal demonstration by the Edinburgh physician, John Bennett (1812-75), that it was not only ineffective but actually hazardous in pneumonia.<sup>172</sup> This flew in the face of the Edinburghian medical establishment, epitomized by the professor of physic, William Alison (1790-1859), who, notwithstanding his position, lost the argument. Despite this, venesection was not totally discarded until into the twentieth century. Osler was still recommending it, in 1909, for life-threatening pneumonia or heart failure.<sup>173</sup> Warner charts the decline in bloodletting (together with a reduction, by the 1880s in use of calomel, blistering and antimonials), from the 1820s to the 1880s, at the Massachusetts General Hospital, Boston, finding a near halving by the 1850s, and virtual disappearance by the 1880s (Table 4.4).<sup>174</sup> From a present-day standpoint, bloodletting might be seen as providing a temporary fix in some extreme situations, such as reducing an acute fever, alleviating pain, or providing some relief for shortness of breath associated with pneumonia or heart failure, though longer lasting benefit seems unlikely.

Bloodletting was never a treatment on its own. It was combined consistently with one or more medicaments, most commonly a purgative or calomel. Purgatives proved popular throughout the nineteenth century and beyond. Indeed, many of those employed were traditional botanically-based concoctions, now known to contain laxative chemicals that work by stimulating peristaltic

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<sup>170</sup> R. Jackson, *An outline of the history and cure of fever, endemic and contagious* (Edinburgh: Murray, 1808), pp. 280-2.

<sup>171</sup> Metcalf, 'Miasmatic 1864', p. 231; Stillé, 'Dysentery 1864', pp. 360-1, 363; Martin, *Influence 1861*, pp. 381-3; Bristowe, *Treatise 1882*, p. 656.

<sup>172</sup> L.S. King, 'The blood-letting controversy: a study in scientific method', *Bulletin of the History of Medicine*, 35 (1961), pp. 1013.

<sup>173</sup> Osler, *Principles 1909*, pp. 190, 817.

<sup>174</sup> Warner, *Therapeutics*, pp. 116-28.

**Table 4.4. Changes in therapies selected for individual patients (diagnoses unspecified; as percentages, rounded to whole number), Massachusetts General Hospital, Boston, 1820s to 1880s.**<sup>175</sup> It is not recorded how case mix, which might account for some of the variations, changed over these years.

<b>Therapy</b>	<b>1820s</b> n = 175	<b>1850s</b> n = 251	<b>1880s</b> n = 222
Alcohol	<b>16</b>	<b>30</b>	<b>25</b>
Bloodletting (any method)	<b>26</b>	<b>14</b>	<b>1</b>
Blistering / cantharides	<b>46</b>	<b>20</b>	<b>7</b>
Calomel	<b>57</b>	<b>21</b>	<b>4</b>
Cinchona	<b>9</b>	<b>6</b>	<b>4</b>
Dover's powder	<b>0</b>	<b>22</b>	<b>7</b>
Ipecacuanha	<b>23</b>	<b>20</b>	<b>6</b>
Opiate (any compound)	<b>45</b>	<b>63</b>	<b>35</b>
Quinine	<b>6</b>	<b>15</b>	<b>21</b>
Tartar emetic (antimonial)	<b>21</b>	<b>7</b>	<b>0.5</b>

contractions of the gut musculature.<sup>176</sup> Some, like senna, are still available in the twenty-first century. Others are simple chemical compounds, such as magnesium sulphate, known as Epsom salts – effective by osmotically promoting water retention in the bowel lumen.<sup>177</sup> Purgatives were usually administered orally, but sometimes by enema, suppository or rectal injection (glyster). What is in question is whether purging in nineteenth century medicine, for conditions other than constipation, was effective. Acceptance of the ubiquitousness of laxatives seems to have closed off critical minds, even after empirical rationalization had demoted bloodletting and calomel, since reports of clinical trials of aperients *per se* for these indications are lacking.<sup>178</sup> In twenty-first century medicine, laxatives are simply used for constipation, and then only reluctantly.

<sup>175</sup> *Ibid.*, pp. 115-18.

<sup>176</sup> To some authors the term purgative implies a more vigorous action than laxative. Here the labels are used interchangeably.

<sup>177</sup> A. Emmanuel, 'Current management strategies and therapeutic targets in chronic constipation', *Therapeutic Advances in Gastroenterology*, 4 (2011), pp. 37-48.

<sup>178</sup> Medicaments that had an effect in addition to that of a laxative, should be excluded from this statement. It is tempting to view the nineteenth century use of purgatives, and calomel, according to Ackerknecht's 'panacea' principle, but he may have seen them as 'bit players'. Ackerknecht proposed bloodletting, digitalis, iodine and perhaps cinchona, for this role (Ackerknecht, 'Therapeutics', pp. 402-7, 410-11).

General purging, like the use of emetics, was broadly employed as an adjuvant by doctors in nineteenth century British India, whereas some medications, such as calomel in particular,<sup>179</sup> were relied upon to provide the core therapeutic thrust. In this sense, calomel was a panacea for its time and place. In addition to a role in syphilis, discussed elsewhere, it was venerated as having special powers for hepatitis, and was widely employed for dysentery and, in the first two-thirds of the century, for fevers, cholera and pneumonia (Tables 4.1 to 4.4).<sup>180</sup> Calomel was the main constituent of the ubiquitous ‘blue pill’, which varied in its make up.<sup>181</sup> The side effects of mercury, notably salivation, were a guide to titrate prescription, but poisoning from excessive dosage or accidental exposure was recorded.<sup>182</sup> George Sigmond describes calomel as a ‘moderate laxative when given alone’. ‘Its primary effect’, he says, ‘seems to be on the biliary secretions and on the mucous membranes’.<sup>183</sup> ‘Hepatitis’ was the indication *par excellence* for calomel in early-to-mid nineteenth century India. Several authors sing its praises, though only anecdotally.<sup>184</sup> Eventually, side effects, realization of toxicity and questionable benefits weighed against it, but calomel continued in use for venereal disease well into the twentieth century.<sup>185</sup> Warner’s New England data indicate a shift from a predominantly depletive approach to therapeutics in the 1830s to primarily the use of stimulatory medicines from the 1850s (Table 4.4).<sup>186</sup> Indexed papers in the *IMG*, reflective more of

<sup>179</sup> Cinchona, ipecacuanha, arsenic and antimonials also might be included, depending on circumstance.

<sup>180</sup> See for example, Curtis, *Coastal 1807*, pp. 99-100, 105-9; For hepatitis, mercury was first applied as an ointment, then continued as oral calomel, six grain per day, to the point of salivation, whereupon a reduced dose was given for 2-3 weeks or until symptoms resolved. One grain is 64.8 milligrams.

<sup>181</sup> Ballingall, *Practical 1823*, pp. 82-8; The blue pill contained about a third mercury (or a mercurial salt) by weight, the rest being liquorice, *Althea* (hibiscus), glycerol and honey or similar. Some preparations, such as that of assistant-surgeon W. Mortimer of Madras, contained other active ingredients such as ipecacuanha (Harrison, *Commerce*, p. 212).

<sup>182</sup> G.G. Sigmond, *Mercury, blue pill and calomel, their use and abuse* (London: Renshaw, 1840), pp. 3, 28, 40; Acute poisoning could result in vomiting, trembling of the hands and feet, and death (pp. 13, 34-5, 105). Chronic toxicity reported by Sigmond, consisted of loss of teeth, neurological signs such as shaking and pain in limbs, and severe headache. Lead poisoning produced similar sequelae (p. 13). George Sigmond (1794 - ?) was lecturer in physic at Sydenham College, a precursor of University College, London.

<sup>183</sup> *Ibid.*, pp. 98-9; Bennett, with others in Edinburgh, in 1867, by way of experiments in dogs, showed that mercury (given as a subcutaneous injection of a mercuric sublimate) had no effect on bile production, in fact large doses diminished it – J.H. Bennett, ‘Report of the Edinburgh committee on the nation of mercury, podophylline and taraxacum on the biliary secretion’, *British Medical Journal*, 436 (1869), pp. 411-20; The current scientific literature affords no support for a role of mercurous chloride in the physiology of bile – see: United States Environmental Protection Agency, *Mercury study report to Congress*, vol. V: Health effects of mercury and mercury compounds (Washington: Environmental Protection Agency, 1997) Reference EPA-452/R-97-007.

<sup>184</sup> Curtis, *Coastal 1807*, pp. 105-9; Ballingall, *Practical 1823*, p. 113; Annesley, *Researches 1841*, p. 275.

<sup>185</sup> W.R. Cornish, ‘Notes on some points affecting the diminution in rates of mortality among Europeans in India’, *IMG*, 2 (1867), pp. 66-7; Manson, *Tropical 1903*, p. 400.

<sup>186</sup> Warner, *Therapeutics*, pp. 166-7.

the rank-and-file medical officers in the subcontinent than of the higher echelons, indicate a similar switch away from depletives in India, by the late 1860s.

Calomel, despite the penchant for its employ in liver disease, was never a ‘specific’ in the way that cinchona became *the* treatment for ague.<sup>187</sup> For much of the first half of the nineteenth century, cinchona was widely prescribed, being one of Ackerknecht’s panacea drugs – tried for everything, certainly most cases of fever.<sup>188</sup> It was only once malaria proper, then referred to as ague, was clearly differentiated from other fevers, around the 1860s in British India, that the specificity of cinchona became apparent.<sup>189</sup> Up to 1820, Peruvian bark was available as a dried powder, usually delivered in wine, and of a variable quality.<sup>190</sup> After that date, quinine and its related alkaloids, quinidine, cinchonine and cinchonidine, became extractable.<sup>191</sup> It is unclear though, up to what date the powdered bark was used in India, in preference to the extract. Both it seems were available.<sup>192</sup> Ballingall in 1824, and Annesley in 1841 each refer only to ‘bark’. Both cinchona and quinine are mentioned by Martin, in 1861. Bristowe, in 1882, implies availability of cinchona *and* quinine but recommends the latter. By 1903, Manson only mentions quinine. From the early twentieth century, quinine was the mainstay of anti-malarial therapy until the 1940s, when the synthetics chloroquine and mepacrine were introduced. If the assumption is made that nineteenth century cinchona, or a derivative, was on sufficient occasions effective for an acute attack of malaria, the question arises as

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<sup>187</sup> Bristowe, *Treatise 1882*, pp. 275, 282.

<sup>188</sup> Ackerknecht, ‘Therapeutics’, pp. 402-7, 410-11.

<sup>189</sup> Martin, *Influence 1861*, p. 376; Martin, in 1861, though clearer than previous writers, is still not specific about separating off ague from other fevers, and his management is polypharmaceutical. Micheal Warboys is of the view that the differentiation occurred after 1850 (M. Warboys, ‘Germs, malaria and the invention of Mansonian tropical medicine: from ‘diseases in the tropics’ to ‘tropical diseases’, in D. Arnold, ed., *Warm climates and western medicine: the emergence of tropical medicine, 1500-1900* (Amsterdam: Rodopi, 1996), pp. 181-207). Jackson observed in 1791 that Peruvian bark did not work in all types of fever (Jackson, *Treatise 1791*, p. 322).

<sup>190</sup> J. Achan, A.O. Talisuna, A. Erhart, *et al.*, ‘Quinine, an old-malarial drug in a modern world: role in the treatment of malaria’, *Malaria Journal*, 10 (2011), pp. 1-12. Jackson records his concerns about adulteration and the inferior quality of ‘much’ imported Peruvian bark (Jackson, *Treatise 1791*, p. 318).

<sup>191</sup> Y.A. Abdi, L.L. Gustafsson, O. Ericsson, U. Hellgren, *Handbook for drugs for tropical parasitic infections*, 2nd edn, (London: Taylor and Francis, 2003), pp. 39, 150; The source of cinchona bark was changed in about 1890 from South America to Java, resulting in an extract that had a higher quinine content.

<sup>192</sup> Harrison infers this and notes that comparative trials of the cinchona extracts were performed in the two decades after isolation of the active substances, including in Madras, by William Geddes, in the late 1820s (Harrison, *Commerce*, p. 197).

to what proportion of fevers were plasmodium-related, and hence susceptible to cure. No definitive answer is possible, but reasoning in Chapter 3 suggests that more than a half the fever cases were malaria and thus potentially ameliorable. The *IMG* was prescient in reporting a comparative clinical trial for the prophylaxis of ‘malarial fever’, prevalent at Peshawar, September to December 1871.<sup>193</sup> Arsenic, quinine, quinidine and extract of cheyretta (an Indian herb) were compared. The first three agents were effective but not cheyretta. The *Memorandum on sanitary improvement*, in 1867, reported use of quinine for the prophylaxis of ‘fever’ in Bengal, finding an admission rate of 10 percent in those taking the drug for one year, compared to 27 percent without it.<sup>194</sup>

Ipecacuanha is another botanic of South American derivation that, like bark, was introduced into Europe in the late seventeenth century.<sup>195</sup> Derived from the roots of *Cephaelis ipecacuanha*, a native of Brazil, the prominent active agent is the alkaloid, emetine. It was used mainly as an emetic, but also has diaphoretic and laxative qualities. Additionally, it is now known to be an antimicrobial, with activity against protozoa such as *Entamoeba histolytica*, the cause of amoebic dysentery and hepatic abscess.<sup>196</sup> Its employment in the pharmacopoeia of nineteenth century British India was predominantly for dysentery, certainly after the 1860s,<sup>197</sup> but also for fevers,<sup>198</sup> and, according to a minority of authors, occasionally for hepatitis and bronchitis.<sup>199</sup> Ipecacuanha was a constituent of Dover’s powders, along with opium and potassium sulphate, often

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<sup>193</sup> K.M. Downie, ‘Prophylaxis in periodic fevers’, *IMG*, 7 (1872); p. 70; Kenneth Downie (dates unknown) was surgeon to the 36th regiment of native Indian infantry. Downie divided men into four groups: 138 received arsenic, 143 quinine, 49 quinidine, and 94 cheyretta. He found rates of admission to be: arsenic 22 percent, quinine 31 percent, quinidine 35 percent, and cheyretta 61 percent.

<sup>194</sup> *Memorandum on sanitary improvement*, p. 66.

<sup>195</sup> H.H. Fisher, ‘Origin and uses of ipecac’, *Economic Botany*, 27 (1973), pp. 231-4.

<sup>196</sup> PubChem, ‘Emetine’, *National Center for Biotechnology Information* (Bethesda, National Institutes of Health, 2020), <https://pubchem.ncbi.nlm.nih.gov/compound/Emetine> [28 December 2020].

<sup>197</sup> Ballingall, *Practical 1823*, pp. 68-81; Annesley, *Researches 1841*, pp. 452-6, 473; Jackson, ‘Ipecacuanha’, p. 253

<sup>198</sup> As early as 1726, Richard Towne (1690- unknown), a surgeon in Barbados, was prescribing for fevers, ipecacuanha as an emetic along with bleeding, and senna with tamarind to purge – though he did not employ mercury – R. Towne, *A treatise of the diseases most frequent in the West-Indies, and herein more particularly of those which occur in Barbadoes* (London: Clarke, 1726), pp. 30, 36, 65-7, 191; Martin reserved ipecacuanha for natives with ‘congestive continued fever of Bengal’. He managed this using a warm bath, application of a large sinapism (a clay poultice, usually applied warm) to the abdomen, use of a few leeches to the epigastric region ‘where the pulse permitted it’, an aperient (i.e. a laxative) by mouth or rectum, succeeded by repeated oral administration of the aperient and sudorific concoction of sodium bicarbonate, rhubarb and ipecacuanha – Martin, *Influence 1861*, pp. 357-8.

<sup>199</sup> Bristowe, *Treatise 1882*, pp. 385-93.

administered for diarrhoeal problems – a combination that rolled the effects of an emetic, a counter-purgative and a sudorific (a sweat inducer) into one handy packet.<sup>200</sup> The use of emetics, always alongside other medication, was based on Cullenian theory, or tradition, though evidence for evaluation of effect is lacking.<sup>201</sup> Use of ipecacuanha in fever and other lesser indications had abated by the end of the century. Manson, in 1903, notes that: ‘some dysenteries are remarkably amenable to ipecacuanha, others appear to be not influenced by this drug’.<sup>202</sup> He is unaware that this may well be a specific therapeutic response to an anti-amoebic agent. Osler accepts its use by repute: ‘ipecacuanha still maintains its reputation in the tropics’.<sup>203</sup> The anti-amoebic effect of emetine was first described by Edward Bright Vedder (1878-1952), a physician in the United States army, in 1911, confirmed by Leonard Rogers in 1914.<sup>204</sup> Hence, the therapeutic benefit anecdotally noted from use of ipecacuanha in the nineteenth and early twentieth century, though serendipitous, has a foundation in antimicrobial science.

Antimonial and arsenical compounds, like botanics, were well established in the pharmacopoeia from before the eighteenth century. Their use continued up to 1900, after which more refined derivatives were developed, for example, arsphenamine. Antimony was normally available as cream of tartar (antimony potassium tartrate –  $K_2Sb_2(C_4H_2O_6)_2$ ) or the oxide ( $Sb_2O_3$  – as in James’s powder, with calcium phosphate).<sup>205</sup> Arsenic was usually prescribed as *liquor arsenicalis* or as a

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<sup>200</sup> *Ibid.*, pp. 238-9.

<sup>201</sup> Other emetics and sudorifics used include antimonial compounds, often as cream of tartar or in James’s powder, and mustard (Martin, *Influence 1861*, p. 33; Bristowe, *Treatise 1882*, p. 732). Sweet spirit of nitre (an alcoholic solution of ethyl nitrite and aldehyde) and a resin from the stem of *Guaiacum officinale* (a tree from the Caribbean) are alternative nineteenth century sudorifics – College Exhibition, ‘Sir Stuart Threipland’s medicine chest’, Royal College of Physicians of Edinburgh, <http://www.rcpe.ac.uk/sites/default/files/Threipland%20medicine%20chest%20list1.pdf> [28 December 2020].

<sup>202</sup> Manson, *Tropical 1903*, pp. 384, 400.

<sup>203</sup> Osler, *Principles 1909*, p. 246.

<sup>204</sup> W.H. Brindley, ‘The alkaloids of ipecacuanha’, (PhD; University of Manchester, 1928), pp. 146-7; L. Rogers, ‘The emetine and other treatment of amoebic dysentery and hepatitis including liver abscess’, *IMG*, 49 (1914), pp. 85-8.

<sup>205</sup> Ballingall, *Practical 1823*, p. 31; Curtis, *Coastal 1807*, p. 70; Geddes, *Clinical 1846*, p. 403; Martin describes ‘tartarized antimony and nitrate of potash’ as having a diuretic action – Martin, *Influence 1861*, pp. 333, 370-80; Hamilton, *Observations 1811*, p. 41. Antimonials were often administered in wine. James’s powder is also said to be an emetic.

pill. In both preparations, oxides of arsenic ( $\text{As}_2\text{O}_3$  and  $\text{As}_2\text{O}_5$ ) were the active ingredient.<sup>206</sup> Antimonial compounds were used for their emetic, purgative and sudorific properties, for fevers,<sup>207</sup> dysentery,<sup>208</sup> hepatitis, pneumonia<sup>209</sup> and bronchitis (Table 4.1).<sup>210</sup> From the works examined, use was mostly in the mid portion of the nineteenth century, but Harrison records consumption of James's powder as a popular remedy for fever, in India and the West Indies, from the late eighteenth through to the nineteenth century.<sup>211</sup> Narrative reports suggest effectiveness in fever.<sup>212</sup> Any antimicrobial effects were then unknown, but may have been in play. In 1918, antimony potassium tartrate was found to be effective against the trematode worms of schistosomiasis, and from 1928, less toxic trivalent antimonial compounds such as sodium stibogluconate (Pentostam) were developed, active against the protozoa of leishmaniasis.<sup>213</sup> Antimonial compounds are toxic. Acute poisoning with antimonials produces vomiting, diarrhoea and a pustular eruption. Chronic exposure results in severe cardiac problems.<sup>214</sup> Arsenical compounds were used in fevers, often being administered when bark had failed. It was widely seen as being as effective as cinchona – with which, indeed, Bristowe lists it as a 'specific'.<sup>215</sup> Arsenic has been known since ancient times

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<sup>206</sup> J. Wilson, W. Meade, *Pharmacopoeia chirurgica*, 1st American edn, from 3rd London edn (Philadelphia: Dobson, 1818), pp. 11, 154, 190; The white oxide,  $\text{As}_2\text{O}_3$ , was used in the pill. Antimony arsenate ( $\text{AsO}_4\text{Sb}$ ), a caustic, was also available. Wilson was a surgeon at Huntingdon. Meade was a 'member of the American Philosophical Society of Philadelphia'.

<sup>207</sup> Ballingall, *Practical 1823*, p. 74; In treating fevers, Annesley found: 'nitrate of potash, acetate of ammonia, camphor, julep, antimonials ... promote the speedy supervention of the sweating stage' (Annesley, *Researches 1841*, pp. 452-6, 473); Martin, *Influence 1861*, pp. 333, 478-9; Martin also considered tartarized antimony to be a diuretic (p. 376); R.I. McCallum, 'Observations upon antimony', *Proceedings of the Royal Society of Medicine*, 70 (1977), pp. 756-63.

<sup>208</sup> Annesley used tartarized antimony ointment as a topical counter-inflammatory, as it induced pustulation (Annesley, *Researches 1841*, pp. 559-63, 570-1, 580, 584-5).

<sup>209</sup> Flint employed antimony with *Veratrum viride* for 'sthenic' pneumonia, presumed to indicate high fever and tachycardia – *Veratrum viride* (Indian Hellebore) is claimed to reduce blood pressure, control atrial fibrillation and lessen pulmonary congestion. (Flint, 'Pneumonia 1864', pp. 307-8, 312-14).

<sup>210</sup> Osler, *Principles 1909*, pp. 602-6.

<sup>211</sup> Harrison, *Commerce*, pp. 142-44.

<sup>212</sup> For example: J. Lind, *An essay on diseases incidental to Europeans in hot climates, with the method of preventing their fatal consequences*, 1st American edn, from 6th London edn (Philadelphia: Duane, 1814), pp. 179-83.

<sup>213</sup> McCallum, 'Observations', p. 762; Sodium stibogluconate was introduced into clinical practice in the 1940s.

<sup>214</sup> K.A. Winship, 'Toxicity of antimony and its compounds,' *Adverse Drug Reactions and Acute Poisoning Research*, 6 (1987), pp. 67-90.

<sup>215</sup> Ballingall, *Practical 1823*, pp. 43-4; Martin, *Influence 1861*, pp. 338-41 – additionally, Martin lists arsenic as a tonic; Downie, 'Prophylaxis 1872', p. 70; Bristowe, *Treatise 1862*, p. 282; In the nineteenth century, and also into the twentieth, arsenicals were effective in the treatment of psoriasis – see L. Shapter, 'The treatment of psoriasis by arsenic in large doses', *Lancet*, 112 (1878), pp. 474-6.

as a potentially fatal poison, but knowledge of its non-lethal toxic effects is more recent.<sup>216</sup> Skin cancer from chronic exposure was recorded by John Paris (1785-1856), physician to the Westminster Hospital, in his *Pharmacologia* of 1820 and the palmar and plantar keratoses were described in 1868 by Erasmus Wilson (1809-94).<sup>217</sup> Arsenic as a therapeutic agent came into its own with arsphenamine. Subsequently, in the 1940s, derivative compounds with inhibitory actions against bacteria other than spirochetes were synthesized, but never reached the market.<sup>218</sup> Carbarosone, in use from 1931 to 1991, is effective against *Entamoeba histolytica*, but was withdrawn due to toxicity.<sup>219</sup> Thus, nineteenth century surgeons in India who prescribed antimonial and arsenical compounds for their emetic, purgative, sudorific or febrifuge qualities, unwittingly may have been administering drugs with antimicrobial effects.

Simple salts of other common elements, notably iodine, silver, lead and bismuth, were similarly employed in the nineteenth century pharmacopoeia. Potassium iodide was used by some practitioners around the mid-century for fevers,<sup>220</sup> and in the last quarter century, for hepatitis, tuberculosis and syphilis.<sup>221</sup> Evidence that iodide works in malaria is limited.<sup>222</sup> It has a marginal effect in pulmonary tuberculosis but is useful for tropical cutaneous fungal infections.<sup>223</sup> Silver, though, has a strong evidential base. Silver nitrate sticks were available, in the early nineteenth

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<sup>216</sup> Both acute and chronic poisoning with arsenic may be fatal. Acute symptoms include vomiting, diarrhoea, psychosis, fits, respiratory and kidney failure. Chronic exposure often affects the skin, but liver, kidney, heart and lung diseases, and cancers, occur. See – R.N. Ratnaike, ‘Acute and chronic arsenic toxicity,’ *Postgraduate Medical Journal*, 79 (2003), pp. 391-6.

<sup>217</sup> J.A. Paris, *Pharmacologia, or the history of medicinal substances*, 3rd edn (London: Phillips, 1820), pp. 133-4; E.J. Wilson, ‘Melasma arsenicale,’ *Journal of Cutaneous Medicine and Diseases of the Skin*, 1 (1868), p. 355; Wilson was professor of dermatology at the Royal College of Surgeon of England, and a founding fellow of that college in 1843.

<sup>218</sup> Arsenoxide (*m*-amino-*p*-hydroxyphenylarsenoxide) is active against clostridia, streptococci, staphylococci, proteus and *Escherichia coli*, see – A. Albert, J.E. Falk, S.D. Rubbo, ‘Antibacterial action of arsenic,’ *Nature*, 153 (1944), pp. 712-13.

<sup>219</sup> S. Gibaud, G. Jaouen, ‘Arsenic-based drugs: from Fowler’s solution to modern anticancer chemotherapy,’ *Topics in Organometallic Chemistry*, 32 (2010), pp. 1-20; The formula of carbarosone is C<sub>7</sub>H<sub>9</sub>AsN<sub>2</sub>O<sub>4</sub>.

<sup>220</sup> Martin, *Influence 1861*, p. 380; Martin describes use of iodide for ague by Mr E.F. Sankey.

<sup>221</sup> Bristowe, *Treatise 1882*, pp. 257, 746; Iodide replaced mercury and venesection for managing hepatitis. This substitution in the 1880s coincided with a reduced case fatality from ‘hepatitis’, and might be connected.

<sup>222</sup> J.J.A. Brachio, ‘Iodide in the treatment of malaria, kala-azar and small-pox’, *IMG*, 58 (1923), pp. 311-13.

<sup>223</sup> Editorial, ‘New form of iodine treatment for tuberculosis’, *JAMA*, 19 (1892), p. 676; J.B. Sterling, W.R. Heymann, ‘Potassium iodide in dermatology: a 19th century drug for the 21st century’, *Journal of the American Academy of Dermatology*, 43 (2000), pp. 691-7.

century, to cauterize skin lesions, ulcers, and venereal chancres, and to stop bleeding after surgery.<sup>224</sup> Silver nitrate, usually administered as an enema but sometimes by mouth, was used in India for lower intestinal disorders such as dysentery or typhoid, especially if ulceration was suspected or if there had been bleeding.<sup>225</sup> The rationale was and is that the cauterizing effect would help seal the ulcerated gut mucosa. The now appreciated antibacterial action of silver could have been an additional benefit.<sup>226</sup> Long-term use of silver products results in grey skin pigmentation, argyria, a marker of systemic toxicity. Lead acetate, as an enema or sometimes orally, was likewise applied in India for dysentery or typhoid, particularly in severe cases or when there had been haemorrhage, with apparent benefit.<sup>227</sup> Topically, lead is an astringent, a property potentially beneficial to compromised bowel mucosa.<sup>228</sup> Toxicity, described as ‘painter’s colic’ was recognized but unlikely with short-term application.<sup>229</sup> Another heavy metal, but one with low toxicity, bismuth, was appreciated to have antacid qualities, for ‘gastrodynia’, from 1828, but additionally, later, was used when bowel ulceration was suspected, as in some cases of dysentery or typhoid.<sup>230</sup> Bismuth is now identified as having broad spectrum antibacterial actions.<sup>231</sup> So, once again, empirical nineteenth century administration for infective diarrhoea or ague, of salts of heavy metals or of iodine, may inadvertently have included an antimicrobial therapy.

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<sup>224</sup> Wilson, Meade, *Pharmacopoeia 1818*, pp. 12-16.

<sup>225</sup> T. Aiken, ‘On the internal use of nitrate of silver in obstinate diarrhoea and dysentery’, *American Journal of Medical Science*, 15 (1848), pp. 541-2; Stillé, ‘Dysentery 1864’, p. 378; Manson, *Tropical 1903*, pp. 406-7; Osler, *Principles 1909*, pp. 246-7.

<sup>226</sup> D.J. Barillo, D.E. Marx, ‘Silver in medicine: a brief history BC 335 to the present’, *Burns*, 40S (2014), pp. S3-S8; In the twentieth century a proteinaceous preparation of silver called argyrol was used for eye infections and occasionally in ulcerative colitis – W.B. Lancaster, ‘Argyrol’, *Boston Medical and Surgical Journal*, 183 (1920), pp. 565-8; W.A. Ardagh, ‘Argyrol for ulcerative colitis’, *British Medical Journal*, i (1906), p. 80.

<sup>227</sup> A.B. Price, ‘Acetate of lead in cholera and dysentery’, *Boston Medical and Surgical Journal*, 15 (1836), pp. 5-9; Ballingall, *Practical 1823*, p. 81; Martin, *Influence 1861*, p. 444; Stillé, ‘Dysentery 1864’, p. 378; Bristowe, *Treatise 1882*, p., 732.

<sup>228</sup> R.W. MacKenna, *Diseases of the skin* (London: Bailliere, Tindall, Cox, 1923), p. 18; Formerly, lead acetate solution was used for acute dermatitis, lead ointment for chronic eczema, and lead plasters for skin fissures. Lead acetate lotion is included in Wilson and Meade’s 1818 *Pharmacopoeia* for venereal ulcers (p. 109).

<sup>229</sup> Price, ‘Acetate of lead’, p. 9.

<sup>230</sup> J. Murray, *A system of materia medica and pharmacy: including translations of the Edinburgh, London, and Dublin pharmacopoeias*, 4th edn (New York: Duyckinck, Collins, Hannay, 1828), p. 128 – John Murray, 1778-1820, was an Edinburgh-based lecturer in chemistry; In the eighteenth century, bismuth was of little medical import, as it seemed ‘to have little or no effect’ – W. Lewis, *The new dispensatory*, 4th edn (Dublin: Potts, 1778), p. 541; Manson, *Tropical 1903*, pp. 406-7 – Manson noted bismuth to have a constipating effect; Osler suggested bismuth for chronic dysentery – *Principles 1909*, pp. 246-7; Sexton, ‘Enteric 1880’, p. 34.

<sup>231</sup> F. Thomas, B. Beatrix, R. Hensel, ‘Medical uses of bismuth: two sides of the coin’, *Journal of Clinical Toxicology*, S3 (2012), pp. 1-5.

Simple acids were also tried for the systemic treatment of disease. Nitric acid was touted as a remedy for hepatitis, as well as for syphilis, fevers, and sometimes dysentery or diarrhoea, from the late eighteenth and into the nineteenth century.<sup>232</sup> Helenus Scott (c.1758-1821), an Edinburgh-trained military surgeon with the EICo in Bombay, who later practiced in Bath and London, observed ‘the most agreeable consequences’ resulting from use of nitric acid by mouth (or by bathing in it) in an unspecified number of persons with hepatitis, although his paper focusses mostly on its use in syphilis.<sup>233</sup> The importance of Scott is that he clearly demonstrates the connections between practitioners in imperial outposts and those in Britain, and shows that colonial locations could be centres of innovation.<sup>234</sup> Scott had been influenced by the pneumatic chemist Joseph Black (1720-1799) when a medical student at Edinburgh – which led him to investigate the therapeutic potential of nitric acid – and was friendly with the influential figures Joseph Banks (1743-1820) and Thomas Beddoes (1760-1808), both of whom propagated Scott’s concepts in the late 1790s on receipt of his correspondence, causing others to experiment. Interest mostly centred on Scott’s belief that nitric acid was as effective as mercury for syphilis, based on experience treating soldiers in his regiment in Bombay, though he also thought it appropriate for hepatitis and fevers in general.<sup>235</sup> James Currie (1756-1805), physician to the Liverpool Infirmary, trialled nitric acid in his own fever patients, and was reported to rebuff Scott’s claims, saying rather generously and with

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<sup>232</sup> Sulphuric acid received much less attention. One report, in 1852, of its use for diarrhoea and dysentery was never followed up – E. Sheppard, ‘On the treatment of diarrhoea and dysentery by sulphuric acid’, *Provincial Medical and Surgical Journal*, 16 (1852), pp. 471-3.

<sup>233</sup> H. Scott, ‘Account of the effects of nitrous acid on the human body, extracted from the Bombay Courier, April 30, 1796’, *Annals of Medicine*, 1 (1796), pp. 375-86; Nitrous acid is mentioned in the paper’s title, nitric acid is used in the text. Scott describes taking the acid himself, feeling a warmth in his stomach and irritation of his gums (p. 380). In another paper, he also describes use of nitro-muriatic acid (nitro-hydrochloric acid, a mix of one part nitric with three parts hydrochloric) in mild fevers, syphilis, hepatitis, and as a tonic, though he shows no results, giving merely an anecdotal account of benefits – H. Scott, ‘On the internal and external use of the nitro-muriatic acid in the cure of diseases’, *Medico-Chirurgical Transactions*, 8 (1817), pp. 173-200; Scott’s rationale was that nitric acid oxygenated those that took it. See Harrison, *Commerce*, pp. 158-71, and P. Wallis, ‘Scott, Helenus’, *ODNB online* (Oxford, OUP, 2004), <https://doi-org.ezproxy-prd.bodleian.ox.ac.uk/10.1093/ref:odnb/24873> [5 July 2023].

<sup>234</sup> M. Harrison, ‘Medical experimentation in British India: the case of Helenus Scott’, in H. Ebrahimnejad, ed., *The development of modern medicine in non-western countries: historical perspectives* (London: Routledge, 2009), pp. 23-41.

<sup>235</sup> Scott, ‘Nitrous 1796’, pp. 375-86.

mild humour that success had been ‘exaggerated by a warm imagination’.<sup>236</sup> The effectiveness of nitric and nitrous acids as a cure for syphilis was brought into doubt by John Pearson (1758-1826), surgeon at the London Lock Hospital, in 1807. Pearson describes twenty luetic cases of which only four might have responded to nitrous acid – though they could have resolved spontaneously.<sup>237</sup> Scott’s accounts of the ‘successes’ of nitric acid in all the diseases he treated are imprecise – observations in syphilis are especially problematic as its manifestations may wain with the disease still being present.<sup>238</sup> Nitric (or nitrous) acid was a constituent of the pharmacopoeia, but never caught on as a primary treatment in the nineteenth century,<sup>239</sup> despite a mention for dysentery by Curtis in 1807, and one report in 1853 of its use in cholera and diarrhoea.<sup>240</sup> It remained an ancillary treatment in India, employed by mouth, or topically, for a variety of purposes.<sup>241</sup> In the twentieth and early twenty-first centuries, nitric or nitrous acids internally have no role as medicinal agents, though nitrates and nitrites do.

### ***Evidence for effectiveness of nineteenth century medical treatments***

Without the benefit of proper clinical trials, evaluation of the effectiveness of medical treatments in the nineteenth century is inherently insecure. Retrospective data, such as that forming the substance of this thesis, are hampered by a wide range of competing forces. These include the year-to-year

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<sup>236</sup> Editorial, ‘Medical report on the effects of water, cold and warm, as a remedy in fever, by James Currie’, *Annals of Medicine*, 3 (1798), pp. 1-33; The problem in not having a control group is that a certain proportion of people, given no treatment, get better anyway.

<sup>237</sup> J. Pearson, *Observations on the effects of various articles of the materia medica in the cure of lues venerea* (London: Callow, 1807), pp. 198-224.

<sup>238</sup> Scott, ‘Nitrous 1796,’ p. 386.

<sup>239</sup> Wilson and Meade, in the 1818 edition of *Pharmacopoeia*, list nitric acid as ‘a very powerful styptic and escharotic’, ‘a powerful caustic in the hands of the surgeon’, and of use in indolent ulcers (pp. 3-4). Wilson and Meade note the one-time zeal for a role in syphilis but comment: ‘Experience, however, soon rejected what enthusiasm, in its eagerness for innovation, had too hastily adopted, and practitioners, we believe, now, one and all, make use of mercury, as the only safe and certain means of curing lues’ (pp. 4-6). In secondary syphilis the rash will abate without treatment, but the infection is still present.

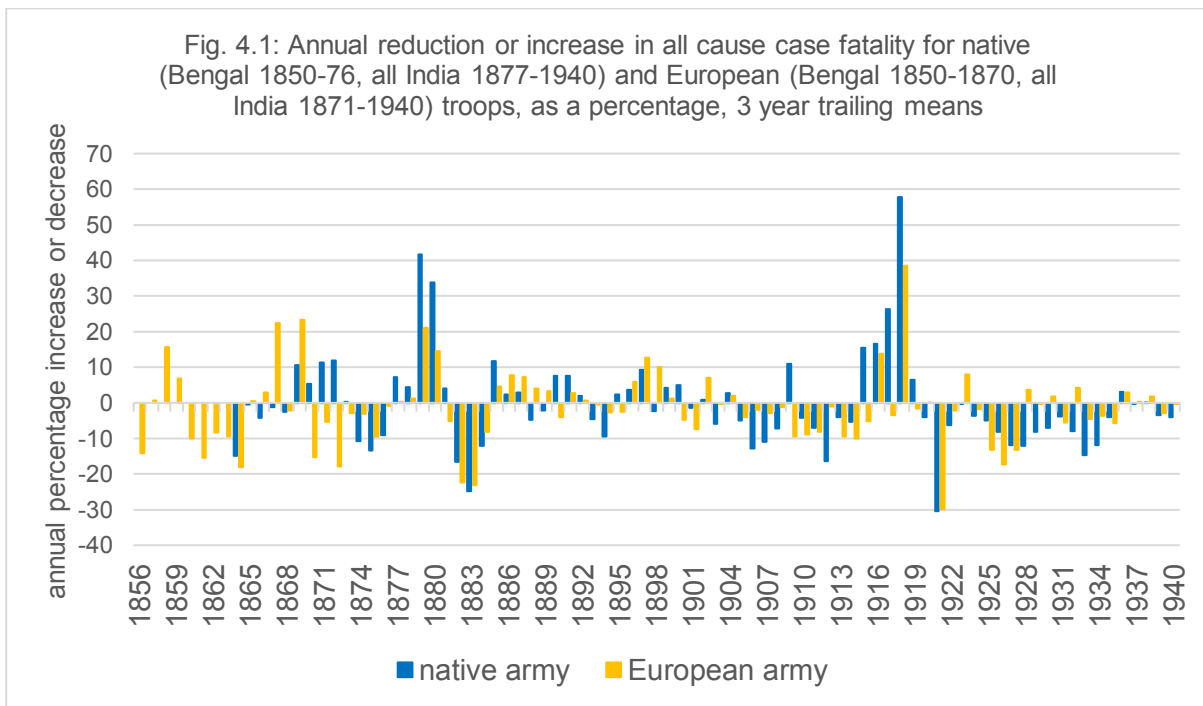
<sup>240</sup> Curtis used nitric acid for the ‘Hepatic or Bilious Dysentery of India’ (*Coastal* 1807, pp. 166-7); R.H. Whiteman, ‘On the value of nitrous acid in the treatment of cholera and choleraic diarrhoea’, *Association Medical Journal*, 1 (1853), pp. 1063-5; Martin regarded nitrous acid, along with sulphuric, as ineffective in cholera – *Influence* 1861, p. 552.

<sup>241</sup> Annesley employed nitric or nitrous acid, or nitro-muriatic acid, internally, after venesection, and alongside blisters and poultices, for hepatitis (*Researches* 1841, p. 271); Geddes saw nitrous acid as a restorative tonic (*Clinical* 1846, p. 406).

variation in disease prevalence, the unpredictability of epidemics, changes in reporting procedures and diagnostic categories, alterations in hospital admissions policy, the availability of medications, trends in prescribing, the vagaries of reporting, host susceptibility (for example, nutritional status), the treatment milieu and the changing virulence of microorganisms (most diseases described in this thesis are infections). Notwithstanding recognition of these sources of error, it is intended to attempt comment based on a macroscopic analysis of the large data here presented. Success or otherwise of medical therapy and the overall setting in which it is delivered, can be indicated by the case fatality rate – the proportion of individuals presenting with a disease who die from it. Case fatality is independent of disease prevalence – except when numbers presenting increase so much as to overload the capacity of medical services to deal equitably with each case. A reduction in case fatality over a run of years, other things being equal, suggests improved success in treatment. An increase infers the opposite. Looking at the figures for the European army from 1856 to 1864 (on and after the latter date, data for the native force also become available), annual reductions in overall case fatality of around ten percent or more are seen in five of the eight years, suggesting improvements in medical treatments or the activity of other agencies. After 1864, the data for the native and European forces change in near unison (Figure 4.1).<sup>242</sup> Periods of sustained reduction of annual case fatality rate in the European army are evident over the years 1870-75 (1874-76 for native), 1881-84 (1882-84 for native), 1905-15 (1905-14 for native), and 1921-39 (1920-35 for native). There are, however, interval runs when the change in the annual case fatality rate increases, suggesting medical therapies were less successful than previously or that other negative factors were in play. Figures for the European and native soldiery on this are less closely aligned. Two episodes of increase in overall case fatality rate are clear for the native army – 1877-81, and the First World War period, 1915-19, partially mirrored in 1879-80 and 1916 with 1918, for the European force, which additionally shows in the years 1885-89.

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<sup>242</sup> Source data as for Fig. 2.12.



The number of compounding variables makes explanation of variations up or down in the case fatality rate over relatively short periods of time, such as five years, inherently difficult unless the change can be linked to a specific event. Peaks in the 1877-81 and 1915-23 incidence of pneumonia and intermittent fever/malaria (less so for the second period) were evident in both armies (see Chapter 2). The influenza epidemic affected both forces in 1918-19. Small increments in admissions due to dysentery were noted for both armies in 1878-80 which coincides with the Second Afghan War, and European troops were affected by cholera in 1879. Enteric fever, though accountable for an epidemic in European soldiery between 1883 and 1909, with mortality peaking in 1898, was associated with a falling case fatality rate over this time. The increases in the overall case fatality rates for both armies in ~1877-81 and ~1915-19 might be explicable based on capacity being overwhelmed by larger numbers of cases of pneumonia and malaria, and unfavourable conditions during the First World War, possibly with dysentery and cholera in play for the first dates. Influenza undoubtedly adversely swayed the rates in the second period. No rationale is offered for the 1885-89 observation in European troops. The dates do not accord with any major military campaign.

Sustained year-on-year trends in case fatality for specific diseases can hint at the success of medical management among other factors. For cholera, treatments did not improve one jot until 1910. However, for dysentery, case fatality fell rapidly from 1850 to 1870, while that for enteric fever reduced more slowly in a near linear fashion from 1850 to 1940. In hepatitis, there was an abrupt fall in case fatality in 1889, perhaps related to adoption of ipecacuanha as a standard treatment for dysentery in preceding years.<sup>243</sup> The picture for intermittent fever/malaria is not clear cut. An initial decrement in case fatality from 1850 to 1870 in European troops, 1861-75 for native ones, is followed by wild oscillations, though with a trend downward after 1928 – the latter could be due to improvements in the quality of quinine. Pneumonia and, more prominently, pulmonary tuberculosis, both show a steady exponential decrease in case fatality over the ninety years from 1850, most remarkable in the European force from 1850 to 1872 for phthisis. These might be partially related to improved nursing care, as a better nutritional state seems unlikely. The biggest decrement in case fatality, though, going from 66 percent in 1854 to 5 percent in 1934, is in heat apoplexy, related to perfecting cold affusion treatment. Case fatality trends alone might intimate improvements in the *nineteenth century* medical management of dysentery, malaria, enteric fever, pneumonia and heat apoplexy, but not of cholera. This is not proof though, and changes especially in virulence, environment and host susceptibility almost certainly will be in play in some and probably all diseases mentioned here – as an example, indubitably for pulmonary tuberculosis.

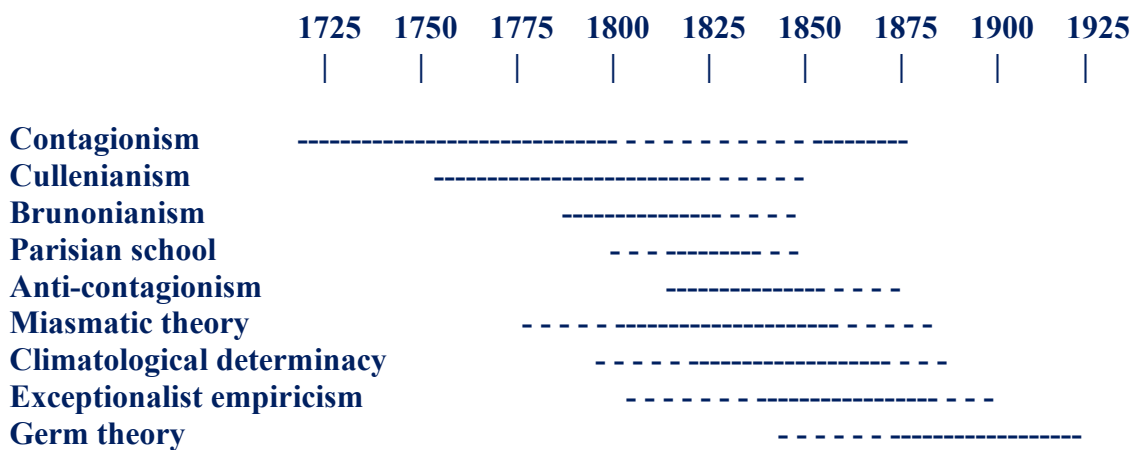
### ***Conclusions***

In summary, the Cullenian theory of disease, and its Brunonian derivative, which held sway, in the British medicine of India and in Europe, at the start of the nineteenth century, transited, via the influence of the Parisian school, to an empiricist approach, albeit one tinged with Indian exceptionalism, after about the 1860s (Figure 4.2). The sanitarian movement, active from the 1830s,

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<sup>243</sup> A. Faulkner, 'Treatment of dysentery', *IMG*, 22 (1887), p. 351; W. Weston, 'Treatment of dysentery', *IMG*, 22 (1887), p. 383; The substitution of iodide for calomel in hepatitis and surgical drainage of hepatic abscess might also be considered.

**Fig. 4.2: Disease theories and their approximate periods of predominant influence in the medical halls of eighteenth to twentieth century British India.<sup>244</sup>**



and largely adherent to anticontagionism and the miasmatic theory, was the mover for the major sanitary structural reforms initiated for the British army in India from the 1860s, though improvements had begun in the 1850s. These measures appear to have proved effective for the population upon which they were enacted. The overall mortality rate for European troops, for example, in the Bengal presidency fell progressively from 67 per thousand for 1848-57, to 37 for 1859-63, to 27 for 1864-69, to 19 for 1870-76, and to 18 for 1877-94.<sup>245</sup>

Contagionism, the basis of quarantine, and the assumption that had held sway up to the near end of the eighteenth century, began to regain favour amongst practitioners after the 1850s, and especially in the 1870s.<sup>246</sup> It led, though indirectly, to its successor, germ theory, which gradually achieved pretty much complete acceptance by the century's end. This was despite the prominence being given to the anticontagionist views of Drs Bryden and Cuningham by the government of India, which, fearing the effects on trade from quarantine as a reaction to epidemics of cholera and plague, had ulterior motives for preferring certain opinions. Ultimately the government had to give way, largely influenced by the undeniable work of Koch. Fevers and fluxes were now recognized as

<sup>244</sup> Climatological determinacy here means the belief that climate in India and other tropical locales both directly caused illness and indirectly influenced the character and behaviour of other diseases. Medical topography – by which physical geographic features are noted from systematic surveys, and presumed to influence health – is one science behind this along with meteorology.

<sup>245</sup> *Royal commission 1863*, p. 28; *RSCGI*, p. 19.

<sup>246</sup> Ackerknecht, 'Anticontagionism', pp. 8, 14.

being comprised of specific diseases, albeit with manifold presentations. The fixed idea that contagion had to mean direct person-to-person passage by touch or breath, over a short distance, hampered acceptance by some authorities. Certain concepts of germ theory though, for example, the role of insect vectors, were only arrived at in the late nineteenth and early twentieth centuries. It is doubtful whether the delay in the official acceptance of the germ theory had a negative effect on implementation of preventative public health installations, since the measures adopted according to the anticontagionist views of the sanitary commission often overlapped with those which contagionists might have demanded.<sup>247</sup> Removal of the filth of the anticontagionist also influenced the means of transmission of the contagionist, though in the 1850s the latter would have been unaware of the mechanism. Though drinking water purity was addressed, the means of purification utilized were insufficient until later in the century.

Cullenian medicine relies on a theoretical response to simple observations, using the toolkit available. Bleeding, purging, vomiting and sweating were the instruments of therapeutic interventions. The Brunonian offshoot had the appeal of simplicity in diagnosis and treatment. Parisian physicians of the 1820s and 1830s helped move decisions on therapy to a more anatomical, physiological and pathological basis. In India and, to some extent elsewhere in the tropics, for most of the nineteenth century, many medical officers believed that, due to unique topography, diseases presented differently from the picture in Europe and North America, and they adjusted their views and administrations accordingly. The empiricist approach which asserted itself in the second half of the century relied upon the developing scientific milieu through published anecdotal reports, short case series and some clinical trials. Medical literature in British India was plentiful after 1860, and allowed revision of practice, but some traditions, for example, the keenness to purge, persisted into the twentieth century. In the second half of the nineteenth century, by and large doctors did not

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<sup>247</sup> *Ibid.*, pp. 16-17: Ackerknecht gives the example of the 'enviable health record during the construction of the Suez canal in the 1850s and 1860s'. The scheme had employed, as medical officer, the anticontagionist Louis Aubert-Roche (1818-74).

seem to persevere with a treatment if they did not perceive benefit from it, but there was scope for individual experimentation. A degree of therapeutic nihilism stepped in, with the realization that sometimes nature was the best healer, and more emphasis was placed on measures such as supportive care.

It is suggested here that some hitherto unregarded treatments which survived the scrutiny of extensive use in nineteenth century India genuinely had a positive therapeutic effect. For most of these remedies, there was an element of serendipity. Among the effectives were: cinchona for ague (malaria, mostly), ipecacuanha for dysentery (the anti-amoebic effect of emetine was recognized in the twentieth century), calomel for syphilis (discussed elsewhere) but not for anything else, silver nitrate and lead acetate enemas as astringents for bleeding *per rectum* in dysentery and typhoid, and opium and its derivatives as analgesics. Cold affusion, an empirical measure introduced from 1875, turns out to have been near the present-day preferred management for heat apoplexy. Intravenous infusion of a saline solution of the correct tonicity, for treating cholera, was finally arrived at in 1908. Nothing worked, prior to that. Any effect of potassium iodide on pulmonary tuberculosis, though, is dubious. Bloodletting was largely discarded by the end of the nineteenth century, except for severe dyspnoea in pneumonia or heart failure. None of the treatments meted out for ‘hepatitis’ in the nineteenth century, except ipecacuanha for amoebic hepatitis or draining hepatic abscesses, from a twenty-first century viewpoint, make any sense. Simply improving support and nursing care seems to have enhanced survival in, for example, pneumonia and probably typhoid.<sup>248</sup> The toxic effects of several metal-based medicaments came to the fore in the last quarter of the nineteenth century, leading to roll back in their use. It is impossible to quantify the negative effect of potentially harmful treatments such as mercury, heavy metals and venesection, though the narrative of several authors gives an indication that unnecessary mortality was recognized. Arsenical and

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<sup>248</sup> A modern-day example is the increased survival rate achieved with full supportive care for people with Ebola virus infection – F. Lamontagne, R.A. Fowler, N.K. Adhikari, *et al.* ‘Evidence-based guidelines for supportive care of patients with Ebola virus disease’, *Lancet*, 391 (2018), pp. 700-8.

antimonial compounds, administered for a wide range of conditions on account of their tonic, sudorific, emetic or purgative properties, in certain instances may have added benefit, unwittingly, due to their antimicrobial qualities. Their true antimicrobial effectiveness in less toxic formats had to await arsphenamine, for syphilis, the first synthetic antimicrobial, in 1907, and sodium stibogluconate, for bilharzia, in 1928. A broad range of medical developments appeared from then on. The effect of the inadvertent prescription of medicines now known to have an antimicrobial effect, however, cannot be quantified, and can only be hinted at. Some effect, though, for example from the use of ipecacuanha in amoebic dysentery, should be accepted. These observations challenge the starkness of McKeown's assertion that, with few exceptions, drugs were ineffective before the twentieth century, by adding one or two more effectives to the list.

## Chapter 5: Degeneracy from the twin vices – venereal disease and alcohol

The army authorities in British India, during the eighteenth and nineteenth centuries, saw their European soldiers as prone to intemperance, sexual incontinence, and ‘recklessness of character’, mostly on account of their lowly status as members of the labouring classes.<sup>1</sup> They were seen as ‘idle and dissipated’, men ‘whose follies and vices have alienated them from their friends, and rendered them unfit for the duties of civil life’.<sup>2</sup> The army sought to mould these stigmata into an aggressive masculinity, later in the century sanitized and romanticized into the concept of ‘martial races’.<sup>3</sup> Pre-mutiny, it had been realized that the ‘dissolute’ and ‘unrelieved’ monotony of barracks life was not conducive to the men’s moral improvement – quite the reverse.<sup>4</sup> William Geddes (dates unknown), surgeon to the Madras European regiment, in 1846, describes ‘the necessity of use of ardent spirits by European troops’, and noted that ‘many circumstances lead to recruits becoming thus accustomed to such a stimulus; and there are few, accordingly, who omit during the remainder of their service, to swallow their daily allowance of arrack’.<sup>5</sup> Martin, in 1861, referring to the British soldier’s ‘habitual indulgence in an over-full animal diet, and his abuse of ardent spirits’, was of the opinion that: ‘drunkenness leads, in a moral point of view, to every crime, so, in a physical point of view, it promotes the invasion, and retards cure, of every tropical or other disease’, and that it was ‘not merely culpable in destroying his [the soldier’s] individual health, but as deteriorating the European character in the eyes of natives’.<sup>6</sup> The twin transgressions of alcohol and fornication, so intimately conjoined in the lives of the European soldiery of nineteenth century British India, are discussed in this chapter. Alcohol abuse mattered because it threatened discipline, carnality because venereal disease sapped military effectiveness.<sup>7</sup>

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<sup>1</sup> Parkes, *Hygiene 1866*, p. 30; Editorial, ‘Soldiers; their morality and mortality’, *Bombay Quarterly Review*, II (1855), pp. 167-218.

<sup>2</sup> Editorial, ‘Soldiers’, pp. 171-2.

<sup>3</sup> Streets, *Martial*, pp. 1, 4, 9; Highlanders, Sikhs and Gurkhas were the archetypal martial races.

<sup>4</sup> Editorial, ‘Soldiers’, pp. 170-4.

<sup>5</sup> Geddes, *Clinical 1846*, pp. 15-16.

<sup>6</sup> Martin, *Tropical 1903*, pp. 171-2, 560.

<sup>7</sup> The term ‘venereal disease’, which appears in the source documentation, has been retained to avoid anachronism. Such disorders are currently referred to as ‘genito-urinary infections’ or ‘sexually transmitted diseases’.

The prevalence of venereal disease and of alcohol-related problems are presented here, along with details of the measures by which authorities tried to control soldiers' behaviour, an analysis of diseases involved, therapies employed, and their effectiveness. Data on venereal disease have been extracted from sanitary commissioners' reports, which date from the early 1860s, and from various documents pre-mutiny. Figures on alcoholism are more difficult to uncover, partly because, although excessive drinking was widely recorded, alcoholism was poorly defined at the time, and is not reported *per se* except for the years 1883-92. However, returns made for delirium tremens can act as a proxy for alcohol excess. Information on the means by which authorities sought to control drinking and sexual behaviour, including parliamentary acts, comes from both primary and secondary sources. Medical treatments are gleaned from contemporary textbooks and papers. The hypothesis to be tested is that the twin vices eventually responded to the authorities' coercions, which were mostly legalistic and aimed at constraint of the soldier's person. Although issues of alcohol and venereal disease are habitually entwined, here they will be presented separately, and in chronologic order, to allow a clear exposition.

### ***Historiography on venereal disease in nineteenth century India***

It is worth developing further points raised in the Chapter 1, made by Philippa Levine and Erica Wald, both of whom have written extensively on venereal disease in the barracks of nineteenth century India.<sup>8</sup> Levine sees venereal diseases not only as sapping the efficiency of the army, but also identifies anxieties that inter-racial sexual conduct might threaten the imperial system itself.<sup>9</sup> Notwithstanding this, concubinage had been tolerated by the EICo up until the early part of the nineteenth century. Levine's account is light on the experience of the individual prostitute,<sup>10</sup> only mentioning the tale of one Fanny Epstein, a Jewish woman from London who worked the brothels of Bombay in the 1890s, and Levine does not explore the subaltern nature of the interaction

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<sup>8</sup> Wald, *Vice*; Levine, *Prostitution*.

<sup>9</sup> Levine, *Prostitution*, pp. 45, 89; Levine regards medicine as an agency of colonial power (p. 9).

<sup>10</sup> The term 'prostitute', used in the source material, has been retained to avoid anachronism. Currently people in this employ are referred to as 'sex workers'.

between the Indian prostitute and her soldier client, keeping to an imperial scale.<sup>11</sup> Harlad Fischer-Tiné notes that European prostitutes in Indian brothels were favoured as they were more likely to submit themselves to medical examination than their Indian counterparts.<sup>12</sup> Levine argues that the Contagious Diseases Acts – the ins and outs of which she enumerates at length – were a manifestation of colonial subjugation, seeing them in terms of misogyny, implying as they do that venereal disease can pass only one way, from the infected woman to a man, but recognizing that the authorities saw prostitution in India as a necessity that had to be regulated in order to buttress the health of the European soldiery.<sup>13</sup> Male-to-male prostitution is barely dealt with by Levine, and not at all by Wald, who like Levine, gives little voice to the prostitutes themselves nor to the functioning of brothels, though she does outline how the registration system worked.<sup>14</sup> Wald's main thrust concerns the official and unofficial mechanisms which sought to control prostitution. She argues that, when the legal regulatory system failed, the military and civil authorities believed it did so not because it was inherently incompetent, but due to non-compliance of the two parties subject to its controls – though she finds that there was often no alternative course of action.<sup>15</sup> Fiscal concerns, Wald states, were often the over-riding factor in deciding on the use or not of lock hospitals.<sup>16</sup>

### *Statistics on the incidence of venereal disease*

Sexuality and armies are longstanding bedfellows – sexual violence being commonplace in war.<sup>17</sup>

Venereal disease in the soldiery has frequently proved difficult to control. Officials of the EICo, in

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<sup>11</sup> *Ibid.*, p. 241.

<sup>12</sup> H. Fischer-Tiné, 'White women degrading themselves to the lowest depths: European networks of prostitution and colonial anxieties in British India and Ceylon circa 1880–1914', *Indian Economic and Social History Review*, 40 (2003), pp. 163-90.

<sup>13</sup> Levine, *Prostitution*, pp. 9, 45, 268-9.

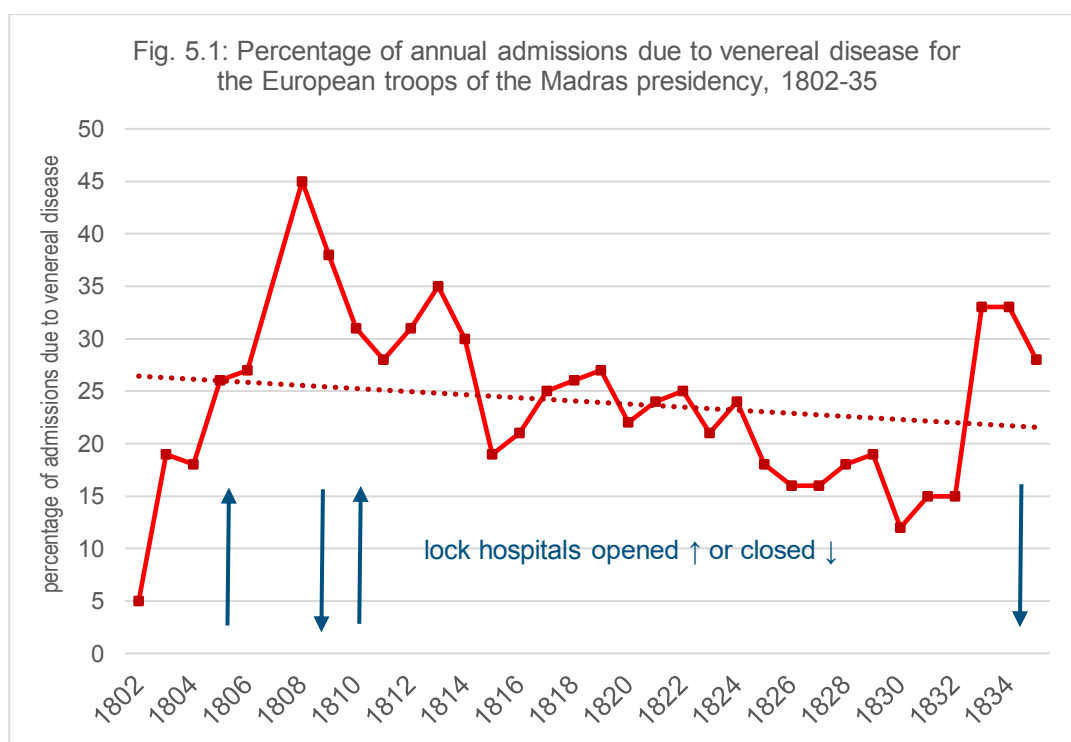
<sup>14</sup> Levine, *Prostitution*, pp. 292-3; Wald, *Vice*, pp. 140-1, 177, 186; Both authors mention the authorities' abhorrence at sexual relations between soldiers. Levine gives a paragraph to male brothels in India (p. 292).

<sup>15</sup> Wald, *Vice*, pp. 72-3.

<sup>16</sup> Wald, *Vice*, pp. 176-86; Governor-General Bentinck's closure of lock hospitals in 1831 was perhaps partly in step with the liberal ideals of the time (pp. 81-3). Wald claims when this happened venereally-infected prostitutes turned to dispensaries (p. 172).

<sup>17</sup> E. Vikman, 'Ancient origins: sexual violence in warfare', *Anthropology and Medicine*, 12 (2005), pp. 21-31.

1766, initially tried financial penalty – this failed and they resorted to the establishment of lock hospitals by the end of the century.<sup>18</sup> Early data, for the European army of the Madras presidency, show that, in the first decade of the nineteenth century, 26 percent of all admissions were venereal cases (Figure 5.1).<sup>19</sup> There was a slow decrement in the second and third decades, to 12 percent by 1830, but a subsequent increase. Numbers remained high into the 1830s. Venereal disease accounted for a mean of 19 percent of admissions for Bengal’s European army, and 28 percent for that of Madras, and, in the 1840s, 19 percent of admissions at Trichinopoly and 36 percent at Bellary (both in Madras presidency).<sup>20</sup>



In its 1863 report, the commission into the health of the army found venereal disease: ‘a frequent concomitant of intemperate habits, and, like these, fostered by want of occupation’.<sup>21</sup> Rates reported by witnesses to the inquiry, most likely for the years 1859-60, using a proforma, varied considerably. Several cantonments disclosed that a half or more of cases of sickness in their

<sup>18</sup> J. Long, *Selections from unpublished records of government for the years 1748 to 1767, inclusive, relating mainly to the social conditions of Bengal*, vol. 1 (London: Trubner, 1869), pp. 454-5.

<sup>19</sup> *Annual report on the military lock hospital of the Madras presidency for 1871* (Madras: Hill, 1871).

<sup>20</sup> Wald, *Vice*, pp. 165-78; Wald quotes data from letters written by Mr Steel, secretary to the government, in 1839, and by Surgeon A. Lorimer in 1849.

<sup>21</sup> *Royal commission 1863*, pp. 126-7.

European soldiers was due to venereal diseases – for example, Dinapore, 58 percent; Wellington (Jachatulla), 57 percent; Bangalore, 50 percent; in some it was less – Secunderabad, 35 percent; Trichinopoly, 20-25 percent; Kurrachee [sic], 20 percent, but only a few declared a rate of ten percent or less – Jaulnah, 10 percent; Meean Meer, 8 percent; Vizagapatam, 6 percent; Malligaum, 2.9 percent.<sup>22</sup> Rates in native troops, though less than for their European cadres as a proportion of overall sickness, varied, encompassing 14 percent at Poona; 10 percent at Berhampore; 8 percent (artillery) and 3 percent (cavalry) at Seetabuldee; 8 percent at Dharwar; 2.9 percent at Rajcote, and 1.7 percent at Cochin.<sup>23</sup> Staff-surgeon Grierson of the native 1st Grenadiers at Kurrachee (Karachi) expressed the figure as 15 cases per mille for 1858.<sup>24</sup> At Ferozepore and Jhansi, reporters noted venereal disease to be common in the general population, but provided no prevalence figures.<sup>25</sup>

Sanitary commissioners' annual reports present incidence of venereal disease, rather than prevalence.<sup>26</sup> They indicate lower rates in native troops than responders to the 1863 commission suggest, though sanitary reports do not include figures for sepoys before 1861. In the presidency European armies in Bengal, venereal disease accounted for 14 percent of hospital admission over the period 1860-69. For sepoys of the Bengal presidency, the figure was only 3 percent over the same period. Annual rates of admission in the European presidency armies, over the years 1850-76, ranged between a low of 94 (Bengal, 1856; per mille strength) and a high of 359 (Bengal, 1859) but were generally about 200 – around ten times higher than amongst native troops. For the armies of all India, the picture was similar. Consistently, admission rates for venereal diseases were higher in European troops, usually substantially so, compared to their native brethren, with the exception of 1915 and 1916, when sepoy rates were slightly greater (Figure 5.2).<sup>27</sup>

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<sup>22</sup> *Royal commission* Volume I, pp. 358, 385, 411, 416, 419, 423, 429, 433, 457, 473; At Trichinopoly, in one European corps, half the army strength, numerically, were in hospital during the year from 'syphilis', with an average stay of 20 day (p. 423).

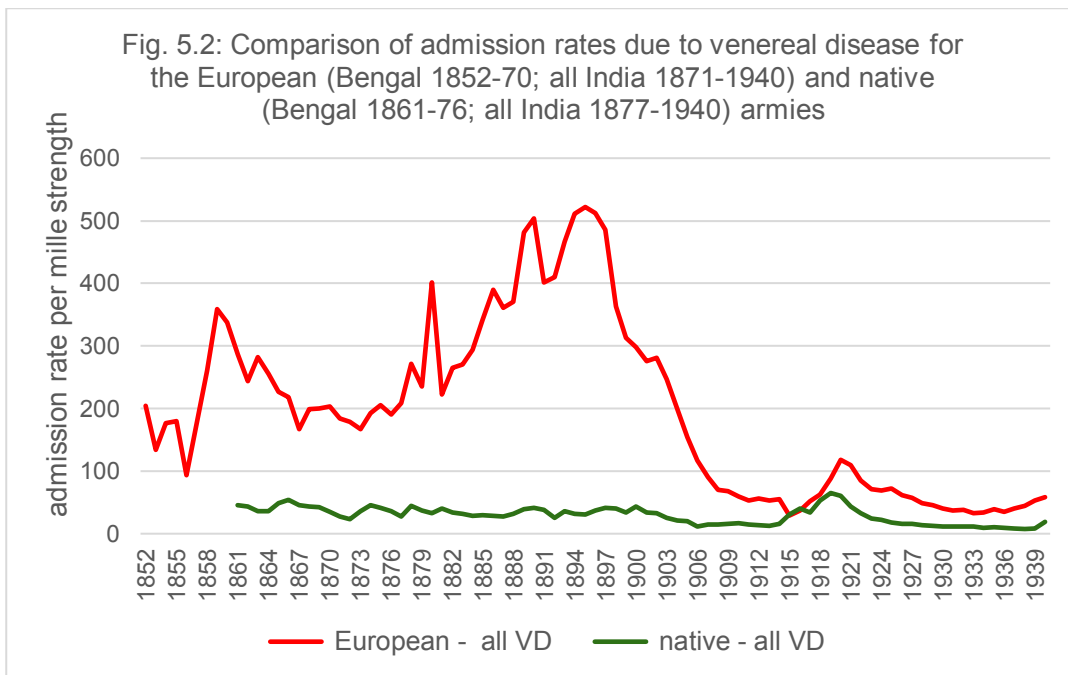
<sup>23</sup> *Ibid.*, pp. 402, 439, 442, 447, 478, 481.

<sup>24</sup> *Ibid.*, p. 496; Further details on Dr Grierson are unavailable.

<sup>25</sup> *Ibid.*, pp. 369, 381.

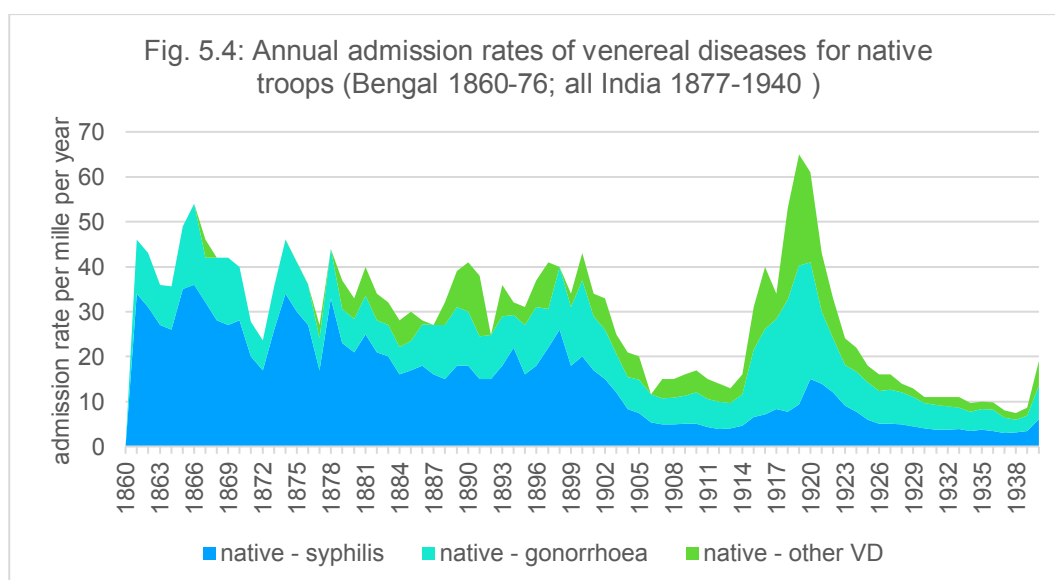
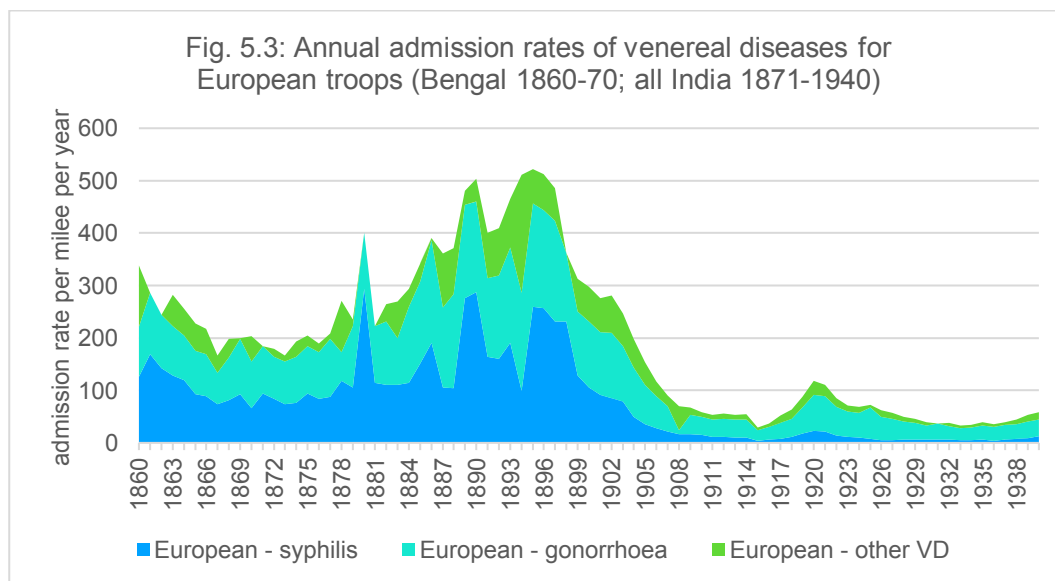
<sup>26</sup> *Incidence* is the number over a period of time, usually here one year. *Prevalence* is the spot count, that is the number at any one time.

<sup>27</sup> Source data as for Fig. 2.12.



Conflicts and their aftermath years tended to magnify the rates several-fold, as witnessed in 1858-60 for the European force (data for the native soldiery are unavailable), and the First World War for European (1919-23) and native (1915-23) troops. However, the massive problem that venereal diseases presented in the European army in the last quarter of the nineteenth century was not associated with war. The predicament was of a staggering magnitude and reached a peak in the last decade of the century. In the years 1890 and 1894-96, the rank-and-file admission rate for venereal diseases was more than 500 per mille. Some of these would have been re-admissions so it would be incorrect to state that a half of all European soldiers had had venereal disease in those years, but nonetheless the rates are extraordinarily high. The problem was only mastered in the first decade of the twentieth century, *before* introduction of arsphenamine, when the rate was cut dramatically, such that in 1908 it was only 70 per mille. Reasons for this will be discussed. For comparison, reported annual admission rates per mille in the native army over the period 1861 to 1914 was bound within the range 11.5 to 54, more so towards the lower end of this scale, especially in the decade before World War One.

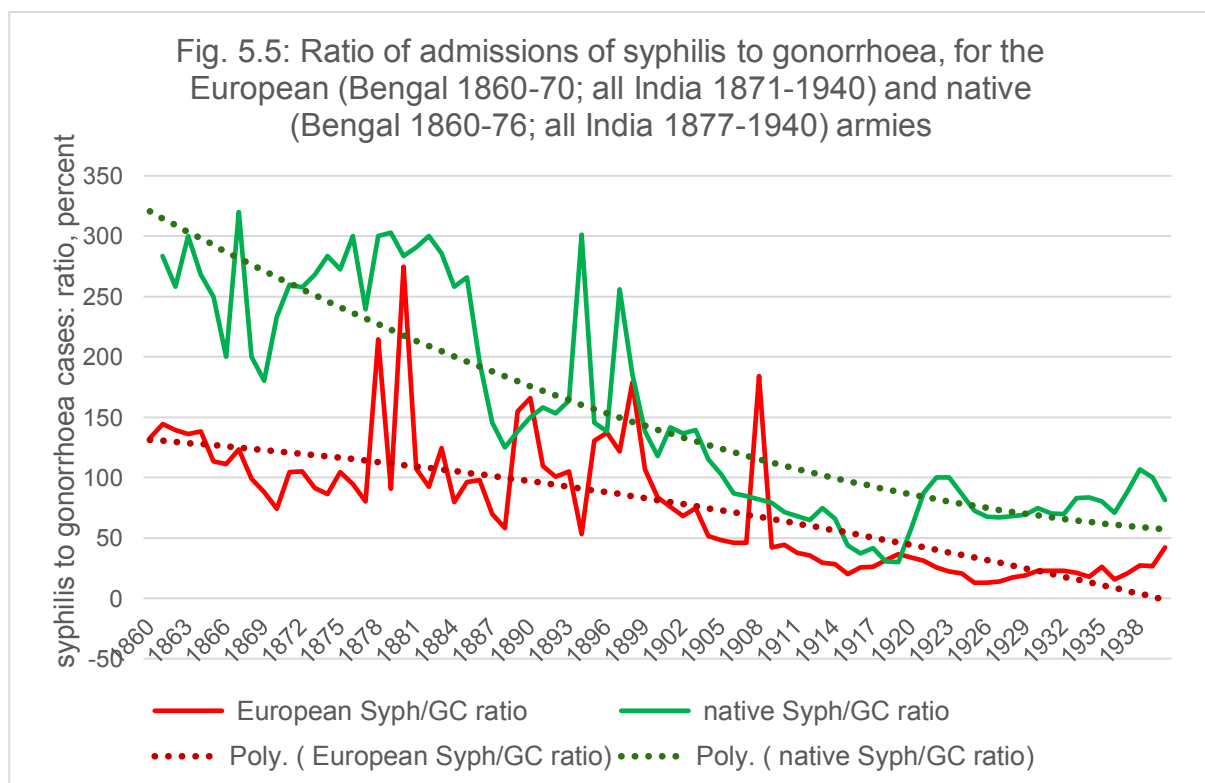
For the European army, the most common venereal disease in the period 1860 to 1900 tended to be syphilis (Figures 5.3 and 5.4).<sup>28</sup> Numbers were roughly matched and occasionally exceeded by



gonorrhoea in the years 1865-88, but syphilis showed a preponderance of 20 percent for the 1890s decade. The contribution from other conditions such as chancroid or lymphogranuloma venereum was much smaller up to 1907. After 1908, gonorrhoea was the predominant genito-urinary infection. The proportional contribution of ‘other’ conditions increased, so that numerically they exceeded syphilis in importance. Recognition of gonorrhoea as a separate diagnostic category became established during the second half of the nineteenth century. The effect of this on reliability

<sup>28</sup> Source data as for Fig. 2.12.

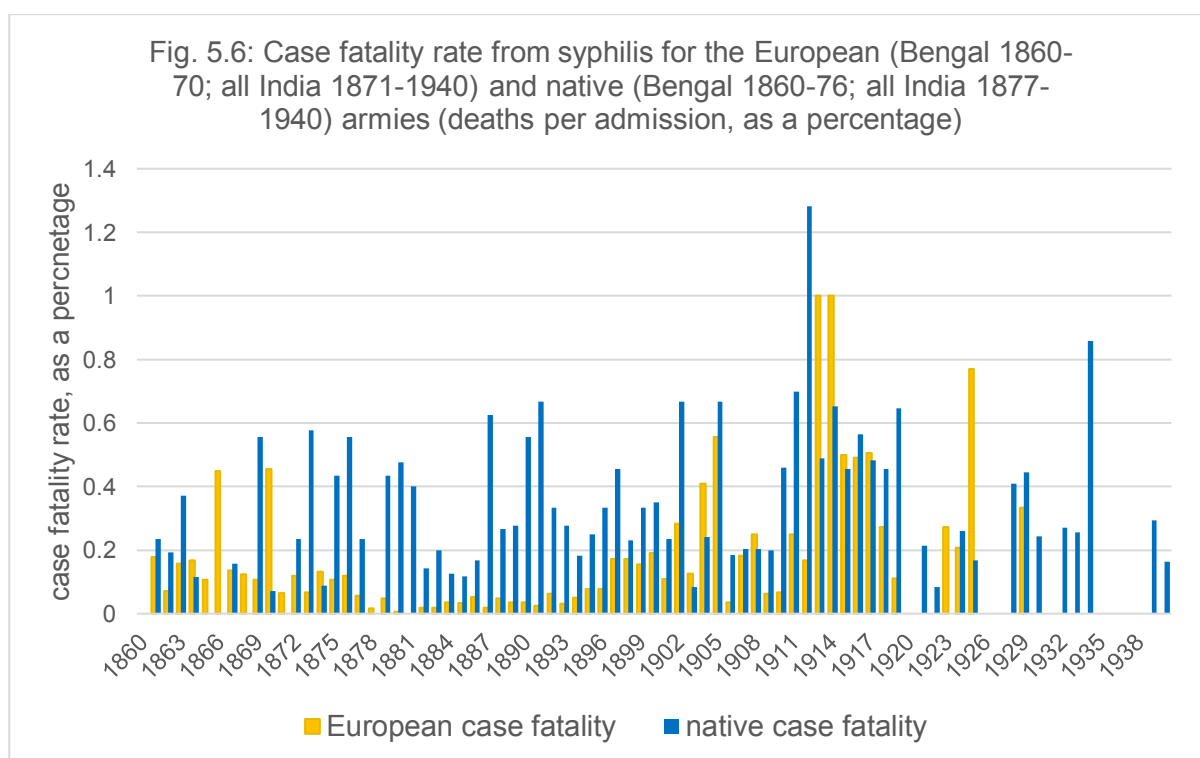
of diagnostic returns will be considered. In the native army, with its reportedly much smaller absolute numbers of venereal disease, syphilis predominated from 1861 up to 1906, sometimes by a factor of two or three-fold, though this lessened to near par in the first years of the twentieth century (Figure 5.4). After 1906, gonorrhoea was the main sexually transmitted disease, prevailing over syphilis by a ratio of two or three times up until 1919, after which its preeminence was around 50 percent. The ratio of cases of syphilis to gonorrhoea was almost always greater in the native soldiery than in its European counterpart, but it fell consistently and switched over in both: in sepoys from 283:100 in 1861 to 81:100 in 1940, and in Europeans from 144:100 to 42:100 over the same period (Figure 5.5).<sup>29</sup> There was a significant contribution from the ‘other’ category in 1916, and 1918-22. The admission rates of all venereal diseases in the native force did not fall back to pre-World War One levels until 1926.



The case fatality rate for syphilis was much lower than that for the main diseases of mortality such as dysentery, cholera and malaria. It usually ran at less than 0.5 percent in the second half of the

<sup>29</sup> Source data as for Fig. 2.12.

nineteenth century (Figure 5.6).<sup>30</sup> In the last quarter of the century, case fatality was higher for native soldiers than for their European counterparts, though the overall mortality was larger for the latter. Case fatality increased to a similar degree in both armies for the duration of the First World War in comparison to years before and after. Invaliding from syphilis was a significant problem by the end of the nineteenth century, though that from alcoholism, included under mental illness, apparently less so. By 1894, syphilis had become *the* predominant cause of invaliding in the European army, and, in 1899, it was the third most frequent among sepoys. Its importance, though, declined considerably as the twentieth century progressed.



### *The response of authorities to the epidemic of venereal disease*

The governing authorities of India, like those of Great Britain, sought to temper this scourge that sapped military strength. The matter was seen as one of controlling the health of the European soldier whilst allowing his primitive urges to be satisfied. Solutions, some of which also pertained for alcoholism, revolved around four themes: acceding to informal liaisons with local ‘mistresses’ – even extending, in earlier days of the EICo, to intermarriage; allowing an increase in the proportion

<sup>30</sup> Source data as for Fig. 2.12.

of soldiers permitted to bring wives from Britain or to marry local women; provision of recreational entertainments to divert sexual interest; and official or semi-official tolerance of prostitution with regulation and health inspections.<sup>31</sup> The usual approach was the latter, though alternatives were considered. For sepoys, the majority were married. In the Madras army, native soldiers often took their wives and children with them, but for the Bengal and Bombay forces, wives normally stayed in their villages, though shorter service time and frequent leave compensated.<sup>32</sup> In this respect, sepoys had better terms of service than did their European counterparts.

In the late eighteenth and early nineteenth century, the EICo, and even the Madras Medical Board (in 1810), had a relaxed attitude to its soldiers, including officers, cohabiting with or marrying local women ('*bibis*'), as long as they were not Catholics.<sup>33</sup> Whilst these liaisons were not discouraged at the turn of the eighteenth century, children of mixed relationships, from 1791, began to be viewed as problematic.<sup>34</sup> The expense involved in supporting official and unofficial families started to weigh on the Company and the British government, especially after 1824, when the military granted a monthly stipend to wives and widows.<sup>35</sup> A further dampener to local liaisons came after 1813, the date when missionaries were permitted to enter India. Their disparagement of native morality contributed to the eventual end of unofficial monogamous relationships in the immediate post-Mutiny period, and drove the single soldier into more dangerous fleeting dalliances.<sup>36</sup>

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<sup>31</sup> Medical prophylaxis was not considered until the turn of the twentieth century. It became important in some armies during the First World War.

<sup>32</sup> *Royal commission 1863*, p. 42; Omissi, *Sepoy*, p. 64. Omissi records that, by 1921, married quarters were provided for 9 percent of native soldiery, though for Gurkhas this was 27 percent.

<sup>33</sup> P.J. Marshall, 'British society in India under the East India company', *Modern Asian Studies*, 31 (1997), pp. 89-108 at p. 93; Wald, *Vice*, pp. 24-30; Erica Wald notes that soldiers were encouraged to seek brides from the 'orphan schools' – institutions for illegitimate children fathered by European soldiers, of Indian or mixed-race mothers.

<sup>34</sup> Wald, *Vice*, pp. 30-3; Wald notes that the Cornwallis reforms of 1791 excluded persons of mixed ethnicity from political or military service with the Company, musicians excepted, on the basis of political reliability; Ronald Hyam reasons that the slave rebellion and subsequent massacre of French settlers on Santo Domingo in 1791, contributed to unease about intermarriage – Hyam, *Empire*, p. 117.

<sup>35</sup> Wald, *Vice*, pp. 32-7; The soldier required government assistance to maintain his wife and family, see – W.C. Maclean, 'Marriage of soldiers', *Royal commission* Volume I, p. 209.

<sup>36</sup> Hyam, *Empire*, pp. 118-19; This also coincided with the arrival of more young British women in India looking for husbands – the 'fishing fleet', and an increasing gulf between British and Indian civilian societies.

From the point of view of the Company and government, more married soldiers meant greater expense, with responsibility for hospitals and schools, not to mention moral concerns about European women and children living in an inhospitable climate. Balanced against this was the better health and efficiency of the married man.<sup>37</sup> The Indian census of 1861 showed that, for the British army, only 6.5 percent of other ranks were married, compared to 19.2 percent of officers, 28.8 percent of EICo European troops and 45.4 percent of British-born civilians.<sup>38</sup> The proportion of the British Army rank-and-file allowed to marry was 12 percent in India (against 6 percent in Britain), a figure not reached in practice.<sup>39</sup> Even so, responders to the 1863 commissioners almost uniformly supported an increase to 25 percent, despite a fifth of stations lacking married facilities.<sup>40</sup> Colonel George Campbell (1816-75) of the 52nd regiment dissented from these views: he thought venereal disease could be otherwise controlled.<sup>41</sup> Contrary to prevailing opinion, in 1877, the married establishment was *reduced* to 6 percent for cavalry and artillery, and 4 percent for infantry.<sup>42</sup>

The earliest recorded efforts in India to restrict venereal disease in troops, by action on contagious bodies, date from 1766. Concern about suppression of effectiveness led the army to attempt to dissuade European soldiers from contracting the disease by deducting pay from those admitted to hospital with venereal afflictions, as well as financial penalties to the Company and contractors.<sup>43</sup> This was ineffective, led to concealment, and excited dissent. Erica Wald argues that authorities instead turned to a system of regulated prostitution in *lal* (red) bazaars, with medical examination of women and forceable treatment and detainment of those found infected, until ‘cured’, in lock

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<sup>37</sup> Married officers belonging to the Bengal Military Fund died at an annual rate of 27 per mille, compared to 38 for unmarried (figures for the rank-and-file are not available) – *Royal commission 1863*, pp. 46-7.

<sup>38</sup> *Ibid.*, pp. 46, 196; The text on p. 128 gives a figure of 12 percent for married soldiery. This possibly refers to an ‘amalgamated’ force including troops of the EICo.

<sup>39</sup> *Royal commission* Volume I, p. 339.

<sup>40</sup> *Ibid.*, pp. 83, 264, 286, 358, 380.

<sup>41</sup> *Ibid.*, p. 243.

<sup>42</sup> A.H. Safford, ‘Venereal disease amongst British troops in India’, *Journal of the Royal Army Medical Corps*, 43 (1924), pp. 252-63; All non-commissioned officers were permitted to marry.

<sup>43</sup> Long, *Selections*, pp. 454-5.

hospitals.<sup>44</sup> The first of these seems to have been at Berhampore in 1788, with others following at Cawnpore, Dinapore and Futtygurh in 1797, and at Madras and further afield by the early 1800s.<sup>45</sup> Cantonment magistrates were tasked with ordering the detection, examination, then treatment of women suspected of being prostitutes, even though the definition of who was included was nebulous. Wald sees this as official misogyny, ‘to avoid inflicting prolonged and unpleasant treatment on the men’, but, in reality, affected men were going to need medicating as well.<sup>46</sup> The system was regulated through informers, native police, and madams, with hospital ministrations, overseen by an assistant surgeon, performed by native assistants. The position in Madras exemplifies a wider trend in lock hospitals in the early nineteenth century. After their initial establishment in Madras presidency in 1805, concern about their effectiveness led to disbandment in 1809, but a surge in venereal cases around 1810 induced re-opening of some, with, over the successive twenty years, a slow but limited decline in case incidence, until another rise, in 1833, suggesting the system was ineffective and uneconomical, promoted closures by 1835 (Figure 5.1).<sup>47</sup> Some surgeons operated a modified lock hospital system during these years, substituting dispensaries and designated hospital wards.

The impact of venereal diseases on the soldiery came to the attention of the British public through the 1857 Army sanitary commission’s review of mortality during the Crimean War, and its Indian counterpart, which reported in 1863.<sup>48</sup> Campaigns in the *Times* and *Lancet*, together with ascendent Christian militarism (Chapter 1), pressurized parliamentarians, in the face of criticism from the

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<sup>44</sup> Wald, *Vice*, pp. 55-7; The *lal bazaar* was the red-light brothel. The original lock hospital was founded by William Bloomfield at Grosvenor Place, London, in 1747, for treatment of venereal disease. The origin of use of the word ‘lock’ in this context is unclear but it possibly derives from ‘lazar’ hospitals for lepers, dating from medieval times – see K.P. Siena, ‘Poverty and the pox: venereal disease in London hospitals, 1600-1800’ (PhD, University of Toronto, 2001), pp. ii-iii, 55-6.

<sup>45</sup> Wald, *Vice*, pp. 57-9.

<sup>46</sup> Wald, *Vice*, pp. 61-3.

<sup>47</sup> *Annual report on the military lock hospital of the Madras presidency for 1871* (Madras: Government Press, 1871) – The Governor-General of India, Lord Bentinck, sanctioned closure of lock hospitals in 1831.

<sup>48</sup> *Report of the commissioners appointed to inquire into the regulations affecting the sanitary condition of the army, the organization of military hospitals, and the treatment of the sick and wounded* (London: Eyre and Spottiswoode, 1858); *Royal commission 1863*.

moralistic lobby, to pass the Contagious Diseases Prevention Act in 1864.<sup>49</sup> In this, the jurisdiction of the AMD was extended to seven garrison towns in the British Isles. Within these areas, prostitutes could be compelled to be examined for venereal disease, and detained and treated as necessary in certified premises until cured. The Indian inquiry commissioners, for their 1863 report, took soundings from army officers and surgeons on the ground. Most supported the idea of lock hospitals, when asked on this point. Some stations, such as Bangalore and Meerut, had re-instituted them and started inspections. Others criticized them: 'Lock hospitals [are] of little use as they frequently become instruments of tyranny or revenge'. '[The] disease [is] communicated long before [the] sufferer is aware of its existence'; 'Police surveillance of women in India is most objectionable, and liable to the greatest abuse from bribery of agents. Nothing to be gained from lock hospitals'; '[The lock hospital] diminishes severity but not the number of cases, supervision is difficult'. 'Increase in marriage greatly preferred'.<sup>50</sup> To control venereal disease, the 1863 commissioners suggested: 'repressive measures of police, or marriage and moral restraint'.<sup>51</sup> Whilst acknowledging the ineffectiveness of previous Contagious Diseases Acts and lock hospitals, commissioners advised reorganizing these with improvements based on experience. They leaned towards allowing more soldier marriages, based on the greater effectiveness of married men, but were wary of problems for European women and children living in India, and ultimately sidestepped the issue by reasoning that better recreational facilities would suffice.

As a result of these recommendations, the Cantonment Act, passed in 1864 and applicable to military stations in Bengal but extended to other presidencies in 1866-67, aimed at requiring local governments to make laws to control venereal disease and prostitution.<sup>52</sup> It was not as effective as

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<sup>49</sup> R.L. Blanco, 'The attempted control of venereal disease in the army of mid-Victorian England', *Journal of the Society for Army Historical Research*, 45 (1967), pp. 234-41; The act was modified in 1866, 1868 and 1869.

<sup>50</sup> *Royal commission* Volume I, pp. 358, 385, 419, 423.

<sup>51</sup> *Royal commission 1863* pp. 126-8, 169.

<sup>52</sup> S.S.R. Mishra, 'Laws of pleasure: the making of Indian Contagious Diseases Act, 1868', *Proceedings of the Indian History Congress*, 60 (1999), pp. 550-61; H.J. Wilson, *The history of a sanitary failure: the results of 90 years experiments in the hygienic regulation of prostitution in India*, 5th edn (Westminster: British Committee of the International Federation for the Abolishment of Vice, 1900), p. 24.

anticipated. This led authorities, such as Dr C. Fabre-Tonnerre, health officer for Calcutta, to lobby for greater measures, which came in the form of the Indian Contagious Diseases Act of 1868. This had a greater degree of compunction for detention of infected prostitutes, required establishment of lock hospitals with progress reports, and was wider in geographic scope than its British counterpart.<sup>53</sup> Almost immediately on their introduction, the British and Indian Contagious Diseases Acts excited criticism, on a broad front. Some members of parliament and the National Association for Repeal of Contagious Diseases Acts objected on moral grounds. Indian authorities protested for financial reasons, and the army's own London-based sanitary commission was opposed, freely acknowledging lack of efficacy.<sup>54</sup> The army sanitary commission stated, in its report for 1877-78, 'There is no proof that any improvement in health of British regiments has been effected by lock hospitals'; and, in 1892, 'Not only did these hospitals fail to effect a reduction in the ratio of venereal cases among European troops, but, as it happens, these diseases increased during the term of years in which they were in full operation'.<sup>55</sup>

Financial considerations predominated when the Contagious Diseases Act was terminated by the Governor of Bombay in 1872, though said Act was retrieved in 1880, apparently following an outbreak of venereal disease amongst sailors on shore leave.<sup>56</sup> Lord Ripon (George Robinson, 1827-1909), viceroy of India (1880-84), was minded to repeal the act in 1882, and given permission by Lord Hartington (Spencer Cavendish, 1833-1908), secretary of state for India (1880-82), to prorogue it, but a rebound in cases followed experimental closure in selected cantonments, and

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<sup>53</sup> Mishra, 'Laws', pp. 556-9; Wilson, *History*, p. 24; The law applied to Calcutta, Bombay, Madras, Lucknow and five places in Burma, and had reach up to 5 miles around a cantonment; Between the mid-1850s and 1888, Hyam reports, lock hospitals operated in 75 cantonments, with, he estimates, about 85 prostitutes serving a European station averaging 3750 men – an average of one prostitute per forty-four European soldiers (Hyam, *Empire*, p. 123).

<sup>54</sup> William Fowler (1828-1905), James Stansfeld (1820-98) and Henry Wilson (1833-1914) were prominent dissenting parliamentarians. Florence Nightingale was an objector. Josephine Butler (1828-1906), Dr Katharine Bushnell (1855-1946), and Mrs Elizabeth Andrews (1845-1917) were notable in the 'social purity' movement. See – M. Hamilton, 'Opposition to the Contagious Diseases Acts, 1864-1886', *Albion: a Quarterly Journal Concerned with British Studies*, 10 (1978), pp. 14-27.

<sup>55</sup> Wilson, *History*, pp. 12, 20.

<sup>56</sup> Ramanna, *Western medicine*, pp. 167-8.

suspension was halted.<sup>57</sup> In London, public and parliamentary pressure resulted in repeal, by the Liberal government, of the British act in 1886, and of the Indian Act in 1888, with condemnation of compulsory inspection and licensing of prostitutes. However, the following year a Cantonments Act was passed for India, supposedly aimed, for garrisoned areas, at prevention of ‘contagious disease’ through treatment of persons suffering from it, regulation of hospitals, and expulsion of those refusing medical attention.<sup>58</sup> In other words, continuation of the system under another name. This skulduggery was confirmed by the abolitionists, Dr Bushnell and Mrs Andrews in 1892, after touring cantonments in the Punjab and North-Western Provinces, where they interviewed 300 prostitutes.<sup>59</sup> An official investigation in 1893, chaired by Denzil Ibbertson (1847-1908) of the Indian Civil Service, concluded that: ‘the new rules had generally failed to effect the intended abolition of the old system of regulated and licensed prostitution’, with the effect that the 1889 act was prohibited.<sup>60</sup> Removal of these constraints, though, coincided with an immediate surge in venereal cases in the early 1890s. A departmental committee, appointed in 1896 to look into this, recommended, in tandem with the army’s sanitary commission – which had changed its tune – reintroduction of the old practices to cantonments. These were duly signed into law by the Indian government with a nod from secretary of state for India, Lord (George) Hamilton (1845-1927), in 1897.<sup>61</sup> Cantonment hospitals, which, before they were closed, had replaced lock hospitals, were re-opened in 1899, but now were known as ‘followers’ hospitals and dispensaries’.<sup>62</sup>

The incidence of venereal disease fell rapidly after 1897, for reasons discussed below, to reach a low just before the First World War. During this time prostitutes were supervised, and concern

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<sup>57</sup> Wilson, *History*, pp.13-14; Ramanna, *Public health*, p. 174; Brigadier-General J.B. Hamilton reported a surge in venereal cases when four lock hospitals were closed on an experimental basis in North-Western Provinces in 1885 – J.B. Hamilton, ‘Closure of lock hospitals in India’, *Lancet*, 128 (1886), pp. 270-1.

<sup>58</sup> P. Levine, ‘Rereading the 1890s: venereal disease as “constitutional crisis” in Britain and British India’, *Journal of Asian Studies*, 55 (1996), pp. 585-612.

<sup>59</sup> E.W. Andrews, K.C. Bushnell, *The Queen’s daughters in India*, 3rd edn (London: Morgan and Scott, 1899), pp. 26-54.

<sup>60</sup> Levine, ‘Rereading’, pp. 594-5; A Westminster committee also sat – Wilson, *History*, p. 25.

<sup>61</sup> Wilson, *History*, pp. 25-6; Hamilton was secretary of state 1895-1903.

<sup>62</sup> Safford, ‘Venereal’, p. 253.

about trafficking of European women for immoral purposes led to legislation.<sup>63</sup> The upsurge in venereal disease in both European and native forces of the Indian army, in its various deployments, that accompanied the First World War, mirrored the situation on the western front. This prompted, under the 1915 Defence of India rules, in 1918, closure of brothels, which failed to achieve the desired effects.<sup>64</sup> The Royal Commission on Venereal Diseases, which reported in 1916, made recommendations that affected the military, such as debarring discharge of soldiers or sailors with active venereal disease, though mostly it concerned itself with establishing a long-term system for managing these infections in civilian society.<sup>65</sup> Six months after cessation of the war, the Defence of India Act became inoperable, with, once again, acceptance of prostitution without official recognition nor of periodic examination, though instruction on avoidance was given – the National Council for Combatting Venereal Diseases (NCCVD), active in the European theatre, also operated an educative mandate in India from 1922.<sup>66</sup>

### ***The functioning of the lock hospital system: success, failure and success?***

Little has been written on how the lock hospital functioned. Taking the one at Bareilly, in the North-Western Provinces, in 1872, as an example, it was overseen by an assistant surgeon, G.R. Triphook (dates unknown), and staffed by a native doctor, a matron, *chowkeedar* (gatekeeper), *kahar* (carrier), cook and female sweeper.<sup>67</sup> At the start of the year, 216 prostitutes were registered, 29 names were added during the year but 165 women removed their names or ran away, leaving 80 by year end. The average number of women registered per month was 114, but a mean of only 43.4

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<sup>63</sup> Criminal Law Amendment Act of 1912 – *Hansard* online, <https://api.parliament.uk/historic-hansard/acts/criminal-law-amendment-act-1912> [7 March 2021].

<sup>64</sup> Safford, 'Venereal', p. 253.

<sup>65</sup> T. Gibson, 'The final report of the Royal Commission on Venereal Diseases', *Public Health*, 30 (1916), pp. 15-21; The national average rate of infection with syphilis in England and Wales has been estimated at 7.77 percent of males, at this time. See – S. Szreter, 'The prevalence of syphilis in England and Wales on the eve of the Great war', *Social History of Medicine*, 27 (2014), pp. 508-29; A serologic study in 1914 London suggested a prevalence of 12 percent in men and 7 percent in women for syphilis, compared to overall rates of 15 percent in Paris and 12 percent in Berlin. These may be overestimates due to the false positivity rate of the Wasserman Reaction – M.W. Adler, 'The terrible peril: a historical perspective on the venereal diseases', *British Medical Journal*, 281 (1980), pp. 206-11 at p. 207.

<sup>66</sup> National Archives of India, PR\_000003006427, EDUCATION AND HEALTH\_SANITARY\_B\_1922\_AUG\_11-112.

<sup>67</sup> BL IOR/P/525 Oct 1873 nos 52-60 Reports and correspondence regarding the working of the Lock Hospital at Bareilly for 1872.

attended fortnightly for examination. However, Dr Triphook estimated that 300 prostitutes were active, and stated that it was ‘utterly impossible for me to keep the disease down’. Nonetheless, over the year, 265 women, summed monthly, were found at periodic examination to be diseased and detained for treatment, that is 51 percent of the meaned monthly attendees, expressed over twelve months.<sup>68</sup> A total of 282 prostitutes were in hospital over the year. The diagnoses recorded, with percentages of cases, were: ulcers (20 percent), gonorrhoea (43 percent) and primary syphilis (37 percent) (Table 5.1).<sup>69</sup> Comparison can be made, for the year 1872, with the local regiment of the

**Table 5.1: The diagnoses recorded in 282 admissions of prostitutes to the lock hospital at Bareilly during 1872.**

	remaining end 1871	admitted	total	discharged	died	remaining end 1872
ulcers	6	51	57	57	0	0
gonorrhoea	2	118	120	117	0	3
primary syphilis	9	96	105	97	0	8
<b>totals</b>	17	265	282	271	0	11

16th Royal Artillery and 5th Fusiliers, numbering 600 men, amongst whom occurred 129 cases of venereal disease. These comprised: gonorrhoea, 70; primary syphilis, 29; secondary syphilis, 25; balanitis, 3; and gonorrhoeal bubo, 2. The total expense for running the hospital for the year was Rs 1633, consisting of Rs 600 for the medical officer, Rs 480 for establishment, Rs 553 for other expenses, with receipts of Rs 117. Registration fees were not collected from prostitutes. The commanding officer, R. Simson, believed ‘much of the venereal disease’ came from part-time unlicensed prostitutes. The magistrate, G.E. Low, noted ‘the lock hospital management has failed lamentably’. Fortnightly inspections were poorly attended. Stricter enforcement by cantonment police was suggested, though Dr Triphook noted they were subject to being bribed. Elsewhere, Dr Triphook identifies difficulties with the legal definition of prostitute, and with separating them from

<sup>68</sup> Full data not shown.

<sup>69</sup> BL IOR/P/525 records rates of venereal disease amongst European troops at Bareilly as, for 1871, 198 per mille; for 1872, 228.

‘kept women and concubines’ but found a detective constable useful in identifying women engaged in the trade.<sup>70</sup>

The voluntary venereal hospital at Madras, in 1890, serving a population of 398,777 with a staff of eleven and at an annual cost of Rs 7770 (paid by the government), had a different case mix to that at Bareilly, having proportionally more cases of syphilis (Table 5.2).<sup>71</sup> In the year there were 19 deaths in native prostitutes, all due to syphilis, and 2 deaths in European prostitutes, one due to syphilis and the other from complicated gonorrhoea.

**Table 5.2: The 417 diagnoses recorded in 360 admissions of prostitutes to the voluntary venereal hospital at Madras during 1890.**

Syphilis - primary	Syphilis - secondary	Syphilis – tertiary	Gonorrhoea	Bubo	Ulcer	All admissions
303	5	8	94	6	1	417 (360)

Each lock hospital made an annual return, which, by 1877, required the assistant surgeon to answer a 22-point questionnaire. Most replies were similar in nature to those from Bareilly and Madras. Brigadier Robert Phayre (1820-97), commander at Nusseerabad, commented that ‘no medical officer should be appointed to be in charge of the lock hospital who has not passed in Hindustani by colloquial test’.<sup>72</sup> The assistant surgeon was responsible for administration of the hospital and overall management of patients, though most examinations were done by the native doctor. The conduct of the registered prostitute, who was issued with a printed ticket, was set out in Home Department Proceedings, dated March 1877 (derived from the 1864 act).<sup>73</sup> She was required to pay each month into the lock hospital fund, but received an allowance if admitted for treatment.

<sup>70</sup> BL IOR/P/525 Oct 1875 nos 60-64 Reports and correspondence on the working of the Lock Hospitals in the North-Western Provinces for the year 1874.

<sup>71</sup> BL IOR/P/3885 1891. ‘Sanitary proceedings’, pp. 341-44.

<sup>72</sup> BL IOR/P/1003 Apr 1877 no 04 Annual report on the Nusseerabad Lock Hospital for 1876 [Nasirabad, Ajmer].

<sup>73</sup> BL IOR/P/1003 Mar 1877 no 13 Working of Lock Hospitals in Cantonments.

On assessing effectiveness of the thirteen lock hospitals in the Madras presidency in 1875, the Army sanitary commission found that: ‘the results have barely justified the trouble, outlay, and interference with personal liberty which they have involved, and there is no evidence to show that they have materially lessened the amount of venereal disease among British troops’.<sup>74</sup> It is self-evident that the men did not heed advice on avoidance of exposure. Several observers at the time opined that lock hospitals did not capture most ‘unofficial’ or part-time prostitutes who plied their trade.<sup>75</sup> Looking at the situation in 1896, Sir Oliver Newmarch (1834-1920), military secretary to the India Office, surmised that lock hospitals had had a limited effect, not as much as was hoped for, he admitted, but, he estimated, responsible for a reduction of around one hundred cases per mille annually in the European soldiery.<sup>76</sup> The surge after the 1870s, he put down to an influx, in 1870-72, of naive young recruits on short-term enlistment and to ‘reduction in the married establishment’. Sir Oliver thought voluntary lock hospitals would be ‘useless’. Despite noting that successive attempts at education and the provision of recreational facilities had not had the desired effect, he suggested a committee be formed, referred to above, to enquire into what more could be done.<sup>77</sup> The reduction in venereal cases at the turn of the twentieth century, Colonel A.H. Safford (dates unknown), dermatologist to the RAMC, believed, in 1924, was down to greater interest in the welfare of the soldier: ‘... institutes were improved, encouragement given to sport, trade, and craftsmanship, education improved, and instruction given in prevention of disease’.<sup>78</sup>

### ***Trends in diagnosis and treatment of venereal diseases from the eighteenth century***

Early nineteenth century textbooks that emanate from Indian experience, such as that of Curtis, do not mention venereal afflictions, presumably since fevers and fluxes overwhelmingly occupied the time. However, other generally available texts of the first quarter century refer back to the 1786

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<sup>74</sup> BL IOR/P/1003 Oct 1877 no 84 Memorandum of the Army Sanitary Commission on the Report of Lock Hospitals of the Madras Presidency for 1875.

<sup>75</sup> BL IOR/P/525 Oct 1873 nos 52-60 ‘Bareilly’.

<sup>76</sup> BL IOR/L/MIL/17/5/2008 Sir Oliver Richardson Newmarch, Memorandum on venereal disease (India Office 1896).

<sup>77</sup> Wilson, *History*, pp. 25-6.

<sup>78</sup> Safford, ‘Venereal’, p. 253.

seminal work of John Hunter (1728-93), the diagnostic and therapeutic content of which still held primacy.<sup>79</sup> Hunter recognized that venereal disease, which he nominated as an ‘infection’, could cause systemic ‘constitutional’ effects, remote from those ‘local’ to site of entry of the ‘poison’. He noted two ‘immediate’ symptoms – gonorrhoea and chancre – seeing them as different manifestations of one entity, ‘the venereal virus in gonorrhoea and chancre, being the same’.<sup>80</sup> Hunter identified a range of severities, described evolving symptomatology for both women and men, and reported that treatment with mercury was specific for chancre, whereas it aggravated gonorrhoea.<sup>81</sup> For the latter, he resorted to ‘the antiphlogistic regimen’ (bloodletting), avoidance of liquor, mild laxatives, ‘[urethral] injection of tepid mucilaginous watery liquids, destitute of stimulating particles – oil of almonds – emulsion – milk and water, &c’, and application of ‘compresses, dipt [sic] in cold lead water’, followed up by a ‘grain or two’ of opium.<sup>82</sup> The degree of inflammation dictated the type of injection given, ranging from the astringent – containing mercuric chloride, to the ‘sedative’ – with lead acetate or opium. Hunter defines chancre as: ‘a spreading venereal ulcer, with ragged, callous, prominent edges, and unequal surface’, which may start like a blister. Cure, he affirms, ‘may be shortened, by destroying it by caustic or excision, while the blood is well charged with mercury’ or, if too large for surgery, by application of a mixture of mercuric chloride and metallic mercury in lard, covered with a lead water poultice.<sup>83</sup> Hunter observes that: ‘if the chancre be destroyed early, no other symptoms will follow; but if matter has been absorbed, its effects will appear in other parts in the form of lues’. If given by mouth, it was recommended that mercury be continued beyond the time when the chancre has healed. Hunter describes *lues venerea*, later stage disease – the copper-coloured scaly papular rash,

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<sup>79</sup> J. Hunter, *A treatise on the venereal disease* (London: Castle Street, 1786) – The abridged North American first edition has been accessed (Philadelphia: Charles Cist, 1787).

<sup>80</sup> Hunter, *Treatise*, pp. 56-7; He based this view on observations that a woman with gonorrhoea gave one man a chancre and another gonorrhoea, and that others who had had gonorrhoea, later developed delayed lues.

<sup>81</sup> *Ibid.*, pp. 1-3, 9-11.

<sup>82</sup> *Ibid.*, pp. 14-15, 18-19; Lead water is a solution of lead acetate. The injection is intra-urethral.

<sup>83</sup> *Ibid.*, pp. 25-7, 34; The caustic is likely to be silver nitrate. The dose of mercury should ‘affect the mouth slightly’ (p. 34).

naso-pharyngeal signs, and bone involvement, for all of which he prescribes a course of mercury.<sup>84</sup> He sees the blood as ‘the vehicle of our medicine’, but prefers transcutaneous administration to oral as it ‘affects the constitution much less’, that is, has fewer side effects. Guaiacum, a gum from a Caribbean plant, is mentioned as an alternative to mercury for ‘slight cases’.

Texts on skin disease of the first quarter of the nineteenth century tended to emulate Hunter, in viewing venereal afflictions as a single malady, relying on mercury for cure, and being indefinite on the later consequence of lues.<sup>85</sup> However, even at the turn of the century, there was dissent from these views. Benjamin Bell (1749-1806), surgeon to the Royal Infirmary of Edinburgh, set out clearly, in 1792, evidence that lues and gonorrhoea had separate origins and needed different treatments.<sup>86</sup> Bell judged that systemic mercury did not work for gonorrhoea and that, combined with ‘other corroborates’ such as purgatives, ‘nitre’ and bark, it debilitated. He favoured mucilaginous injections *per urethra* tailored to the symptoms, often though not necessarily containing calomel or metallic mercury. By the time of Robert Willis’s *Illustrations of cutaneous disease*, in 1839, the term syphilis has virtually displaced lues, and the *syphilides* are better defined, especially constitutional symptoms.<sup>87</sup> To Willis, evidence suggested gonorrhoea and chancre were caused by the same ‘poison’, but he felt that venereal afflictions with a systemic manifestation may have a different origin from those that displayed only locally. Philippe Ricord (1800-89), physician to l’Hôpital du Midi in Paris, in his seminal work of 1840, corrects this when he reaffirms Bell’s view that chancre and gonorrhoea are separate, and he classifies the stages of lues into primary,

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<sup>84</sup> *Ibid.*, pp. 44-50, 89-90; Later stages of syphilis in the present day are divided into secondary, e.g. truncal eruption and oral ulcers, and tertiary, which includes bone, neurological and vascular disease. With mercury, Hunter advises caution in pregnant women, children and those with co-existing pathologies. Hunter also mentions venereal warts, treated with caustic.

<sup>85</sup> J. Wilson, *A familiar treatise on cutaneous disease*, 2nd edn (London: Callow, 1814), pp. 211-14, 249-50; The diagnostic difficulties of luetic eruptions are recognized. Wilson does not use the term ‘syphilis’. Wilkinson employs ‘syphilitic’ to describe the luetic truncal rash; he mentions mercury only in passing – J.H. Wilkinson, *Remarks on cutaneous diseases* (London: Arch, 1822), pp. 86-7

<sup>86</sup> B. Bell, *Treatise on gonorrhoea virulenta and lues venerea*, 2 vols. (Albany: Backus, 1814), vol. I, pp. v, viii, 17-37, 50-62; vol. II, pp. 313-14.

<sup>87</sup> R. Willis, *Illustrations of cutaneous disease* (London: Balliere, 1839), pp. 2, 5; Treatments are not discussed as this is an atlas; Willis, on page 136, states the term syphilis was first used by Jean-Louis-Marc Alibert – *Description des maladies de la peau* (Paris: Caille et Ravier, 1806), p. 51; Robert Willis (1799-1878) was a London surgeon.

secondary and tertiary.<sup>88</sup> London dermatologist Thomas Burgess (?-1865), in 1842, following the Parisian line after attending l'Hôpital St Louis, uses the term 'syphilis' for the panoply of cutaneous expositions rather than to describe primary chancre, and introduces the term 'gummy' for indurated tumescences that ulcerate.<sup>89</sup> He describes several post-chancral *syphilides* for which he recommends mercury in a variety of formulations, sometimes prescribed with a sudorific, whilst vaunting that 'the antiphlogistic method', that is bloodletting, is ineffective.<sup>90</sup> Alternative treatments include: 'Tizan of Feltz' (antimony sulphate), 'muriate of gold' (probably, potassium gold (III) chloride), 'subcarbonate of ammonia' (ammonium carbonate), and nitric or sulphuric acids.<sup>91</sup> Venereal ulcers were tackled with ointments containing the oxide, iodide, cyanide or nitrate salts of mercury. Burgess does not concern himself with remedies for gonorrhoea.

Specialist texts proliferated from the mid nineteenth century. New York surgeon, Homer Bostwick (1806-83), in his 1848 *Treatment of venereal diseases*, suggests, for 'gleet', injections of solutions of copper or zinc sulphate or, if these astringents are ineffective, solutions of silver nitrate, ammonium copper sulphate ((NH<sub>4</sub>)<sub>2</sub>Cu(SO<sub>4</sub>)<sub>2</sub>•6H<sub>2</sub>O) or mercuric chloride.<sup>92</sup> In his 1852 *Syphilis, constitutional and hereditary*, London surgeon Erasmus Wilson (1809-84) still held that gonorrhoea was caused by 'syphilitic poison'.<sup>93</sup> Wilson expounded myriad manifestations of lues, utilized the term 'gumma' for late ulcerating tumours, and catalogued the full sweep of treatments then in vogue. He advocated preventive measure of washing the genital areas with soap and water, and then, for women, diluted vinegar. As a caustic for primary chancre, Wilson preferred *potassa fusa*

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<sup>88</sup> P. Ricord, *A practical treatise on venereal disorders* (Philadelphia: Haswell, Barrington and Haswell, 1840), pp. 8, 10-11, 15, 18; Albert Neisser, in Breslau, discovered the gonococcus in 1879 – Editorial, 'Albert Neisser and the gonococcus', *American Journal of Public Health*, 45 (1955), pp. 95-7.

<sup>89</sup> T.H. Burgess, *Manual of diseases of the skin* (London: Renshaw, 1842), pp. 271, 281; Burgess's book is an English translation of the French text by Pierre Cazenave and Henri Schedel, based on lectures of Laurent-Théodore Bielt (1781-1840); Late signs of syphilis are described but not labelled as 'tertiary'.

<sup>90</sup> *Ibid.*, pp. 288-90, 308-15; Nasopharyngeal ulcers were treated with solutions of mercuric salts.

<sup>91</sup> The experience of Dr Helenus Scott with nitrous acid is discussed in Chapter 4 – Scott, 'Nitrous 1796', pp. 375-86.

<sup>92</sup> H. Bostwick, *A complete practical work on the nature and treatment of venereal diseases* (New York: Burgess, Stringer, 1848), pp. 257-9; 'Gleet' is a euphemism for the discharge of gonorrhoea. Bostwick did not specify treatment duration nor different regimens for men and women, though he was probably referring more to males when he mentions urethral injections.

<sup>93</sup> E. Wilson, *Syphilis, constitutional and hereditary* (Philadelphia: Blanchard and Lea, 1852), pp. vi, 153, 231-2,

(potassium hydroxide) to silver nitrate, on account of the extent of its destructive activity, hoping that early treatment would prevent ‘the poison’ from becoming systematized.<sup>94</sup> When he suspects the latter has occurred, Wilson sought to increase the secretory activity of *all* excretory surfaces and glands, ‘the emunctories’, through stimulation of the bowels – by purgative, liver – by mercurials, kidneys – by water, skin – using antimonial, and generally, with ipecacuanha. Above this, though, he saw mercury, given in a formulation as preferred by the surgeon, as ‘the great antidote of syphilis’ – Wilson prescribed the blue pill, the exact formation of which varied (*quod vide*), combined with a sedative. He anticipated a response at five days, aiming for salivation, which he tempered using ‘chlorinated soda’ or sweetened acidified barley water, continuing treatment until induration of the chancre resolves completely. For ‘constitutional syphilis’, Wilson considered venesection for ‘congestion’ of brain or lungs, suppressed any ‘inflammation’ with calomel, colocynth, senna, Epsom salts, tartarated antimony, and opium, then definitively prescribed mercury (II) iodide (HgI<sub>2</sub>), continued until symptoms subsided, after which nitric acid was exhibited ‘to give tone to mucous membranes’. Wilson anticipated that further attacks may occur and treated them in a similar manner – though with recurrences, mercury was noted to lose its effect – leading to its substitution with potassium iodide, which was also used for tertiary lesions. A case history indicates that three weeks’ mercurial treatment for the primary chancre was insufficient, as recurrence occurred after this.<sup>95</sup> Wilson only mentions gonorrhoea in passing and says little on its treatment. Other dermatology specialist texts of the mid-to-later nineteenth century follow a similar line in luetic therapeutics to Wilson, though London physician, Thomas Hillier (1831-68), adds use of the vapour bath for absorption of mercury.<sup>96</sup>

Views of medical authors with experience in India, in the first half of the nineteenth century, on venereal disease were informed by the works of Hunter and Bell. Ballingall, for example, favoured

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<sup>94</sup> *Ibid.*, pp. 236-62.

<sup>95</sup> *Ibid.*, pp. 83, 138 (treatment of gonorrhoea).

<sup>96</sup> T. Hillier, *Handbook of skin diseases* (London: Walton and Maberly, 1865), pp. 334-6; R.M. Simon, *Lectures on the treatment of the common diseases of the skin* (Birmingham: Cornish, 1888), p. 78.

mercury over sarsaparilla, which was being touted as an alternative at the time. He found that, between 1810 and 1811, out of 86 soldiers of the second battalion of the Royals at Masulipatam, treated with a four-to-six week course of mercury for chancre, only seven developed progression of signs.<sup>97</sup> Nearly forty years later, Martin, in his 1861 *Influence*, devotes surprisingly little space to venereal disease, considering the size of the burden to the army, and only briefly sketches details on mercury for syphilis.<sup>98</sup> Subsequent authors, however, show more enthusiasm. Freeman Bumstead (1826-79), a professor at New York's College of Physicians and Surgeons, writing for the US Sanitary Commission in 1864, recognized gonorrhoea as separate from syphilis and also saw chancroid as a distinct entity.<sup>99</sup> For gonorrhoea in men he favoured four hourly (intra-urethral) injections of zinc acetate or sulphate solution, with daily laxatives, 'continued for ten days after discharge has ceased', or, if symptoms had not set in, 'the abortive treatment' of two-hourly injections of silver nitrate solution. Few descriptions at the time, and none relating specifically to India, detail treatment given to women with gonorrhoea, though Bumstead furnishes one account. He recommended, with general measures, application using a pump syringe, to the vulva and vagina, every few hours, of an injection containing opium and lead acetate or, especially once inflammation settles, one of potassium aluminium sulphate, zinc sulphate, lead acetate and tannin, supplemented with silver nitrate solution applied by the surgeon, with a lint pessary containing an absorbent powder, changed twelve hourly.<sup>100</sup> It is difficult to conceive of this complex regimen being applied to women in a lock hospital, though the likelihood is that a simple topical lotion of type mentioned could be utilized.

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<sup>97</sup> Ballingall, *Practical* 1823, pp. 125-8, 133, 142; A topical caustic was used as well as systemic mercury. Some cases diagnosed as luetic chancre almost certainly would have been due to other pathologies. Johnson's 1826 *Influence* mentions lues and gonorrhoea only in passing. Annesley, in his 1842 *Researches*, does not concern himself with the venereal, and neither does Geddes in his 1846 *Clinical*.

<sup>98</sup> Martin, *Influence* 1861, pp. 374, 745.

<sup>99</sup> F.J. Bumstead, 'Venereal diseases', in Hammond, *Military medical* 1864, pp. 531-52; Bumstead differentiated chancroid lesions as often being multiple, and showing full thickness ulceration, without induration at the base nor constitutional symptoms. He used nitric acid to destroy true chancres.

<sup>100</sup> F.J. Bumstead, *Pathology and treatment of venereal diseases* (Philadelphia: Lea, 1876), pp. 173-81; Bumstead believes that urethritis in women rarely required treatment.

For luetic chancre, Bumstead recognized an incubation period of, on average, six weeks, between its appearance and onset of systemic features. He treated all syphilis with mercurials, preferring the inunction route – aiming to avoid salivation – and reserved potassium iodide for symptomatic relief of tertiary stigmata.<sup>101</sup> Treatment in India does not seem to have been so thorough. J.B. Hamilton (dates unknown), assistant surgeon to 16th brigade, Royal Artillery, in 1868, records use of bloodletting and blisters for gonorrhoea, with the purgative jalap, and calomel, and self-administration after micturition of an injection of ‘warm starch with water’, then, ‘after a day or two, astringents such as acetate of lead, alum, or sulphate of zinc’, were continued until ‘injections can be employed without pain’.<sup>102</sup> Readers of the *IMG* were familiar with European trends in venereal therapy, as Ricord’s views were reported. In 1873 Ricord recommended systemic mercurialization for all syphilis, even for chancre, continuing this for ‘five to six months’, and following up with six months of iodide.<sup>103</sup> With this he claimed, ‘you will have very few cases of relapse’. Not all authorities agreed with this regimen. Bristowe, in his 1882 edition, admits ‘much difference of opinion’ regarding dosage and time scale. He favours a short duration: ‘treatment should be continued until the lesions have disappeared under its influence, and even for a week or two longer’, though he is a nihilist – ‘it is admitted now that mercury does not prevent either secondary or tertiary symptoms from coming on’.<sup>104</sup> However, in the 1886 *Manual of practical therapeutics*, Edward Waring (1819-91), who had been a surgeon-major in India, goes to the other extreme, suggesting non-salivatory doses of mercury continued for a total of twelve months within which are incorporated two one-month breaks.<sup>105</sup> For gonorrhoea, Waring advocated injection of a solution of mercuric chloride (HgCl<sub>2</sub>), zinc sulphate, or storax balsam (from the bark of *Liquidambar orientalis*), without specifying duration of treatment. It appears likely there was

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<sup>101</sup> Bumstead, ‘Venereal’, pp. 531-52; Inunction means rubbing in an ointment.

<sup>102</sup> J.B. Hamilton, ‘The treatment of gonorrhoea and of syphilitic warts’, *IMG*, 3 (1868), p. 152.

<sup>103</sup> Editorial, ‘M. Ricord on the treatment of syphilis’, *IMG*, 8 (1873), pp. 53-4; The *Gazette* reports the view, in 1876, of London surgeon, Jonathan Hutchinson, that syphilis ‘depends upon introduction into the system of living material’, and that ‘if mercury does not cure syphilis yet it has the power to delay its progress’ – Editorial, ‘Syphilis and recent discussion at the Pathological Society of London’, *IMG*, 11 (1876), pp. 215-18.

<sup>104</sup> Bristowe, *Treatise 1882*, p. 257; Bristowe does not mention treatment of gonorrhoea.

<sup>105</sup> E.J. Waring, *A manual of practical therapeutics* (Philadelphia: Blakiston, 1886), pp. 163, 304-5, 313.

considerable variation in the treatment of venereal infections by army surgeons throughout the nineteenth century in India. By the century's end, however, the best practice for all forms of syphilis was systemic mercurials, delivered by mouth, inunction, hypodermically, or through fumigation, and administered for periods of one and a half to three years, taking care not to induce salivation.<sup>106</sup>

In 1909, Osler reports that not only has the microorganism been identified, but the correct duration of mercury treatment was now clear: 'Acquired syphilis is not cured in a few months, but takes at least three years'.<sup>107</sup> Duration of treatment was problematic in the army. Colonel Lawrence W. Harrison (1876-1964), speaking in 1946, recalled that, as an assistant surgeon in India in 1903, at his station, soldiers with lues were treated with a six week course of oral mercuric chloride, which he recognized at the time would not be curative.<sup>108</sup> Policy in the army was clarified by Major Herbert French (1875-1951), in his 1907 War Office volume, *Syphilis in the army*.<sup>109</sup> French, a venereologist who had worked in India, highlighted diagnostic inaccuracies in data collected on venereal cases and proffered explanations as to why figures in India improved at the turn of the century. French observes that 'application of a caustic does not in reality alter the nature of an *infecting* sore', though it converts it into a 'healing ulcer'.<sup>110</sup> He delayed initiating specific treatment in non-classical venereal sores until 'at least two of the accepted signs of syphilis are present'.<sup>111</sup> French set out a rigid code of rules for army medical officers on hospital management of confirmed syphilitic cases. He specified daily baths, potassium chlorate gargles, avoidance of tobacco, iodoform dressings, bedrest, with daily inunction of mercurial ointment, continued for five or six

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<sup>106</sup> R.H. Greene, 'Treatment of syphilis', in: L.B. Bangs, W.A. Hardaway, eds., *An American textbook of genitourinary disease, syphilis and diseases of the skin* (Philadelphia: Saunders, 1898), pp. 735-56; It took until 1905 for the spirochete of *Treponema pallidum* to be isolated, at Charité Hospital, Berlin, by Fritz Schaudinn, Erich Hoffmann and Fred Neufeld – P.K. Kohl, I. Winzer, '100 years since discovery of *Spirochaeta pallida*', *Hautarzt*, 56 (2005), pp. 112-15.

<sup>107</sup> Osler, *Principles* 1909, pp. 279-80; Osler approved of potassium iodide for tertiary lesions.

<sup>108</sup> L.W. Harrison, 'Half a lifetime in the management of venereal diseases', *Archives of Dermatology*, 73 (1956), pp. 441-54.

<sup>109</sup> H.C. French, *Syphilis in the army and its influence on military service* (London: Bale and Danielsson, 1907).

<sup>110</sup> French, *Syphilis*, pp. 35, 38; French used carbolic acid – phenol (C<sub>6</sub>H<sub>5</sub>OH) – as caustic.

<sup>111</sup> Later venereologists criticized this wait and see approach – Harrison, 'Half a lifetime', p. 443.

weeks, whereupon the soldier was discharged, to continue with intramuscular injections of, for example, mercuric chloride, weekly in six week courses, with one to two month intermissions, for two years.<sup>112</sup> For gonorrhoea, at the Royal Herbert Hospital, Woolwich, French stipulated bedrest, mercuric chloride lint dressing daily, and hourly self-administered urethral syringing with warm water for the first four days until acute inflammation settled.<sup>113</sup> Following this, intra-urethral irrigation was performed, using a potassium permanganate solution, administered through a sterile glass introducer, fed from a reservoir using rubber piping, two or three times daily for three weeks or so, until the urine ran clear and smears were negative for gonococci. Dr Basu Roy states that this method of urethral irrigation, devised at the end of the nineteenth century in Europe and thence introduced to India, remained in use until the late 1930s.<sup>114</sup>

Army medical officers at the turn into the twentieth century encountered problems with compliance, accuracy of diagnosis and effectiveness of treatment. Unpleasant side effects of mercury toxicity easily dissuaded adherence to outpatient therapy, which could negate efficacy. Compliance by soldiers was variable until mandated by Army Order number 158 of September 1903, later enshrined in King's regulations.<sup>115</sup> Difficulties in total reliance on clinical signs and symptoms for a diagnosis of syphilis, especially since chancre was easily confused with chancroid, were, by 1910, assuaged by availability of an antibody test – the Wassermann reaction ('WR'), and by direct visualization of spirochaetes from a lesional smear – dark ground microscopy.<sup>116</sup> Arsphenamine

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<sup>112</sup> French, *Syphilis*, pp. 40-5; French states that the best treatment would be four 5-week courses of inunction over 18 months by trained masseurs. During intermissions, 'mercury is gradually eliminated and poisoning is thus prevented.' If treatment is given by mouth, e.g. of mercuric iodide, it must be closely supervised. Salivation was to be avoided as it could be a prodrome of mercury poisoning. An advisory board of the army medical services to inquire into treatment of venereal disease and scabies, chaired by Sir Alfred Keogh and reporting in 1905, made similar specifications to those of French, but included the possibility of oral mercurial treatment with 'grey powder' or 'blue pill' for syphilis, and microscopic confirmation of the diagnosis in gonorrhoea — J.W. Eames, 'Treatment of venereal diseases in the British army, 1898-1948', *Journal of the Royal Army Medical Corps*, 90 (1948), pp. 282-305.

<sup>113</sup> H.C. French, 'Treatment of gonorrhoea in the army,' *Journal of the Royal Army Medical Corps*, 8 (1907); pp. 620-30; Silver nitrate solution was used in some cases.

<sup>114</sup> R.B. Roy, 'Sexually transmitted diseases and the Raj', *Sexually Transmitted Infections*, 74 (1998), pp. 20-6.

<sup>115</sup> Eames, 'Venereal', p. 287.

<sup>116</sup> Eames, 'Venereal', pp. 282, 288-9; Harrison, in 'Half a lifetime', writes that many cases of true leucic chancre previously had been misdiagnosed as chancroid, especially in women – pp. 443-4. Diagnostic difficulties led the RAMC to devise a points-based sign and symptom score to confirm syphilis clinically.

(Salvarsan) was trialled at Rochester Row military hospital, London, in 1910-11. Although seen as effective, arsphenamine was difficult to administer, requiring two 20mL intramuscular injections into the buttocks, with attendant pain and sometimes tissue breakdown, meaning it was co-prescribed with mercury, though it could be given intravenously. The drug's derivative, neoarsphenamine, from 1912, was more water-soluble, such that an injection of smaller volume was possible. The relapse rate of those receiving arsphenamine was much lower than those treated only with mercurials. Supplies of arsphenamines, manufactured in Germany, were stopped by the onset of World War One, and, although substitutes were made in Britain and France, supplies were limited. Complex regimens involving two arsphenamines and a mercurial, sometimes with potassium iodide, and requiring repeated WR tests, were instituted, resulting in few relapses. The relapse rate for mercurial therapy alone, of unspecified duration, for syphilis, was said to be at least 50 percent.<sup>117</sup> Bismuth salts took the place of mercury in combination treatment for syphilis in 1923, and variations on this, later using intramuscular sulpharsphenamine, were in play until 1939, including in India. Use of penicillin for syphilis in the British army was delayed until 1944.

Once effective treatment regimens had been drawn up, syphilis presented less of a problem during the 1920s and 1930s, to the army than did gonorrhoea. Attempts at devising vaccines and parenteral therapies for the latter came to naught, and, in the mid-1930s, gonorrhoea still required, on average, in India, 47 days of hospitalization, often resulting in permanent complications, and relapse in a quarter of cases.<sup>118</sup> From 1937, sulphonamides seemed to transform treatment of gonorrhoea, improving cure rates, and reducing length of stay and sequelae. For a time, in the early 1940s, according to Colonel John Eames (1901-52), 'gonorrhoea had almost ceased to be a problem'. This

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<sup>117</sup> Eames, 'Venereal', pp. 292-6; Harrison found a relapse rate of 83 percent in 371 Brigade of Guards soldiers receiving mercuric injections over a two-year period around 1910 ('Half a lifetime', pp. 446-7). Addition of arsphenamine to the regimen lowered relapse to 1.3 percent.

<sup>118</sup> Eames, 'Venereal', pp. 299-303; Chancroid, due to *Haemophilus ducreyi*, was treated in the 1900s using topical iodoform – CHI<sub>3</sub>, in 1914-18 and for some years after using a chlorine antiseptic, and, from 1937, more successfully with sulphonamide. 'Non-specific urethritis', neither treponemal nor gonococcal, now known to be due to chlamydia or other microorganisms, was treated using sulphonamide from the late 1930s.

was short-lived. During the 1943 Sicilian campaign, less than a quarter of soldiers with gonorrhoea responded to a sulphonamide.<sup>119</sup> Fortunately, though, once supplies allowed its routine use, from 1944, intramuscular penicillin proved highly effective.

For an entity as destructive to military efficiency in India as venereal disease proved to be, during the nineteenth and twentieth centuries, efforts at personal prophylaxis, as distinct from constraints from enactments and diversionary schemes such as recreation, seemed singularly ineffective.

Multifarious impedances were at work. Exhortations to sexual continence, such as the World War One leaflet issued by Lord Kitchener – ‘In this new experience you may find temptation both in wine and women. You must entirely resist those temptations, and, while treating all women with perfect courtesy, you should avoid any intimacy’ – often fell on deaf ears.<sup>120</sup> In addition to lectures, some armies, such as the French, from the late nineteenth century, subjected their soldiery to monthly genital inspections.<sup>121</sup> This was not a policy for the British military, which, in addition to social coercion, tried disciplinary penalties despite concern about concealment.<sup>122</sup> However, post-coital prevention had been pioneered by the Paris-based bacteriologists, Elie Metchnikoff (1845-1916) and Emile Roux (1853-1933) who, in 1906, claimed that immediate application of disinfectants could prevent syphilis.<sup>123</sup> This led, during the First World War, to prophylactic ‘packages’ containing calomel ointment or a phial of potassium permanganate, to be applied after intercourse, using a cotton swab provided. Issuance to troops from the Dominions and the United States, in Europe, and to European, but not native, forces in India, met with little comment, but potential distribution to British soldiery on the Western Front excited controversy.<sup>124</sup> The National

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<sup>119</sup> The likely explanation is development of microbial resistance to the antibiotic.

<sup>120</sup> Roy, ‘STD’, p. 24; M.W. Adler, ‘The terrible peril: a historical perspective on the venereal diseases’, *British Medical Journal*, 281 (1980), pp. 206-11.

<sup>121</sup> Officers of the RAMC, *A manual of venereal diseases* (London: Frowde, 1907), pp. 29, 35-7.

<sup>122</sup> Roy, ‘STD’, p. 23; Routine genital examinations, so it was argued, would have an adverse effect on self-respect.

<sup>123</sup> M. Harrison, ‘The British Army and the problem of venereal disease in France and Egypt during the First World War’, *Medical History*, 39 (1995), pp. 133-58.

<sup>124</sup> Harrison, ‘Problem of VD’, p. 138, 148-9; Roy, ‘STD’, p. 24; Native Indian troops in Europe were not issued with ‘packages’, though facilities for treatment of venereal infections were provided – Levine, *Prostitution*, pp. 150-1; Safford states that a small charge was made to European soldiers in India for provision of ‘packets’ – ‘Venereal’, p. 259.

Council for Combatting Venereal Disease (NCCVD) preached that ‘packets’ condoned or encouraged fornication.<sup>125</sup> A rival organization, the Society of the Prevention of Venereal Disease (SPVD), whilst sharing some of the moral outrage of the NCCVD, took a more practical line, accepting that information on chemical prophylaxis should not be withheld. A Royal commission on venereal disease, which reported in 1916, sidestepped the issue of ‘packets’, and focussed instead on education and service provision.<sup>126</sup> ‘Packets’ were eventually issued to British troops in France in August 1918.<sup>127</sup> Meanwhile, so-called ‘early treatment rooms’ or ‘disinfecting stations’ were introduced in some arenas of war from 1916, and in India from 1920.<sup>128</sup> In these facilities, soldiers who had exposed themselves to prostitutes were able to wash their genitals with soap and water, and apply calomel ointment or instill a solution of potassium permanganate or silver nitrate into the anterior urethra. Several medical officers doubted the efficacy of such self-administered disinfection, though some thought immediate use of ‘packet’ prophylaxis did work.<sup>129</sup>

An obvious question in the twenty-first century is why condoms were not used, especially since they had been mass produced in rubber from the mid-nineteenth century?<sup>130</sup> The answer seems to be partially one of cost, since condoms were more expensive than other prophylactics, but more fundamental was concern of the military and government authorities about promotion of a

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Distribution of so-called ‘Dreadnaught’ prophylactics, consisting of an application of a silver salt, to sailors of the Royal Navy, passed without vexation – D.M. Simpson, ‘The moral battlefield: venereal disease and the British army during the First World War’ (PhD, University of Iowa, 1999), pp. 76, 112, 145-6. Simpson claims pressure from purity organizations reduced provision of ‘packets’ in India as the First World War went on.

<sup>125</sup> S.M. Tomkins, ‘Palminate or permanganate: the venereal prophylaxis debate in Britain, 1916-1926’, *Medical History*, 37 (1993), pp. 382-98.

<sup>126</sup> This commission’s main achievement was the establishment of a nationwide network of free clinics for the treatment of venereal diseases run by properly trained specialists.

<sup>127</sup> Harrison, ‘Problems of VD’, p. 148; By October 1919, five million ‘packets’ of calomel cream had been distributed to soldiers in the British army (Simpson, ‘Moral’, p. 152).

<sup>128</sup> Safford, ‘Venereal’, pp. 253-5, 260; Harrison, ‘Problems of VD’, p. 147; Roy, ‘STD’, p. 24; Roy claims these early treatments were more effective at preventing syphilis than gonorrhoea. Simpson asserts that ‘rudimentary’ facilities for washing with soap and water after intercourse with prostitutes was available in barracks or brothels in India from 1867 but does not give a reference for this – ‘Moral’, pp. 71, 114, 146.

<sup>129</sup> ‘Skilled disinfection’ by trained personnel, was thought effective – Simpson, ‘Moral’, pp. 117-19, 122-6, 151-3; Colonel L.W. Harrison, one of the most influential venereologists of the period, approved of ‘portable prophylaxis’, though Simpson, quoting two of Harrison’s contemporaries, argues this confidence was grossly misplaced.

<sup>130</sup> H. Youssef, ‘The history of the condom’, *Journal of the Royal Society of Medicine*, 86 (1993), pp. 226-8.

preventative that was primarily a contraceptive.<sup>131</sup> Notwithstanding the risk of venereal disease, contraception in the early twentieth century, as pointed out by Levine, was a taboo subject, unnatural, beset by fears at the time that invoked the eugenic concept of ‘racial degeneration’, and, seemingly, more morally suspect than was acquisition of syphilis.<sup>132</sup> Nonetheless, condoms were both issued and used, although their effectiveness is unrecorded.<sup>133</sup>

Reasons for the failure of attempts at control of venereal diseases in the nineteenth century, and during the First World War, and for success in the battle against these afflictions in the first and third decades of the twentieth century, are considered in the discussion, along with a review of the efficacy of treatments. The effect of the moralistic message of the purity campaigners, too, will be examined, directed as it was not only at fornication, but at intemperance, twin vices they saw as linked. The issue of alcohol and its effects on the soldiery in British India are examined next.

### ***Historiography on alcohol in the British armies of India***

Alcohol consumption from the start of the nineteenth century in India, both by the military and civilians, was ‘prodigious’ and occupied a prominent place in society, as reviewed by Harald Fischer-Tiné and Sam Goodman.<sup>134</sup> Acceptability of inebriation depended on ‘*who drank what and where* [sic]’, with army officers drinking bottled beer and claret in their bungalows, the lower ranks imbibing local spirits such as arrack, or domestically brewed beer in their barracks’ messes, and civilians consuming a variety of imported liquors in their homes or clubs.<sup>135</sup> The drinking habit was often developed on the ship over. The drunkard and vagrant European ‘loafer’ – mostly ex-soldiers, stranded sailors, or unemployed railwaymen – became an embarrassment to the authorities. Fischer-

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<sup>131</sup> Levine, *Prostitution*, pp. 149-51.

<sup>132</sup> *Ibid.*, pp. 149-51.

<sup>133</sup> In a six-month period, November 1917 to April 1918, 50,000 condoms were sold to Australian troops, compared to 75,000 chemical prophylactic ‘packets’ distributed at no cost – Simpson, ‘Moral’, p. 129.

<sup>134</sup> H. Fischer-Tiné, ‘The drinking habits of our countrymen’: European alcohol consumption and colonial power in British India,’ *Journal of Imperial and Commonwealth History*, 4 (2012), pp. 383-408; S. Goodman, ‘Spaces of intemperance and the British rise 1860-1920,’ *Journal of Imperial and Commonwealth History*, 48 (2020), pp. 591-618.

<sup>135</sup> Fischer-Tiné, ‘Drinking’, p. 398; Goodman, ‘Spaces of intemperance’, pp. 592-5.

Tiné sees them as demonstrating that British rule was not always associated with ‘moral progress’, and that they blurred European identity.<sup>136</sup> Indeed, the government of India passed the European Vagrancy Act in 1869 to corral them, including some European female vagrants – mostly soldiers’ wives – into workhouses in presidency capital cities. Whilst surmising that alcohol over-consumption went with their class, authorities, initially the EICo, later the British, had concerns about the high levels of hospital admission with drunkenness, and looked to temper access to alcohol lest the European soldiery become an ineffective force.<sup>137</sup> Sometimes this was by encouragement to use canteens that were ‘dry’, at other times by limiting sale of alcohol in cantonments.<sup>138</sup> From the 1850s, public displays of habitual drunkenness – five occasions within a twelve month period – became a court-martial offence, applying to officers as well as to other ranks.

### *Statistics on alcohol consumption, related diseases and crime*

Ballingall, who spent seven years as an assistant surgeon in India, writing in 1823, confirms a service life centred around alcohol: ‘excessive drinking is considered amongst themselves [the rank-and-file] as a proof of superior manhood ... before they become efficient as soldiers, and capable of making any good use of a firelock, one half of them is consigned to the grave, and the other become confirmed drunkards’.<sup>139</sup> A body of about 500 men of the Madras European army, in 1830, in addition to brandy, gin, wine and beer, consumed 10,309 gallons of arrack in twelve months, equating to 256 mL per man daily.<sup>140</sup> By 1847, volumes were still impressive. In that year, the canteen of a Madras regiment (average strength 892) sold 7679 gallons of arrack, 802 bottles of brandy, 270 of gin, 5613 of beer and 2514 of porter.<sup>141</sup> The teetotal society there had 153 members,

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<sup>136</sup> Fischer-Tiné, ‘Drinking’, pp. 395-9.

<sup>137</sup> *Ibid.*, pp. 384-5; Wald, *Vice*, p.139.

<sup>138</sup> Goodman, ‘Spaces of intemperance’, pp. 603-4.

<sup>139</sup> Ballingall, *Practical 1823*, p. 6.

<sup>140</sup> Geddes, *Clinical 1846*, pp. 15-16.

<sup>141</sup> W.H. Sykes, ‘Mortality and chief diseases of the troops under the Madras government: European and native, for the years 1842 to 1846’, *Journal of the Statistical Society of London*, 14 (1851), pp. 109-42; Alcohol consumption by a European soldier in India was estimated to be six times that of his equivalent in Britain; Drunkenness was greater

and the temperance society, 80. Similar consumptions of alcohol pertained elsewhere. Colonel W.H. Sykes demonstrated the health benefits of temperance. The admission rate, in Madras, for 1849, in teetotal European troops (strength 450, out of a total of 5710) was 1309 per mille, compared to 2148 for those described as 'intemperate' (strength 942), with mortality four-fold lower at 11.1 compared to 44.6.<sup>142</sup> Unsurprisingly, there were fewer cases of venereal diseases in teetotallers (209 per mille to 506), and lesser counts of liver and brain disease, though fevers were more common (313 to 201 per mille). Perhaps predictably, most crime was committed by the intemperate group (1710 per mille, compared to 237 for abstainers). In the Bombay presidency, 1854-55, 3.7 percent of privates and NCOs in the European army (strength 8071) were court-marshalled for drunkenness.<sup>143</sup> Major Ernest Roberts (dates unknown) of the IMS noted that, on average, 34 percent of the European rank and file (58,540 mean annual strength) were convicted of drunkenness as a misdemeanour annually, between 1871-75, whereas this had fallen to 12 percent by 1903-06.<sup>144</sup> Other data, for 1849, show that married soldiers were much less likely to commit offences compared to their single colleagues (3 percent compared to 18 percent). The benefits of temperance were even starker at the end of the century. Criminal convictions in European troops for 1898 (1897 in brackets) were 4.1 (5.1) per mille for abstainers, against 36.4 (34.3) for non-abstainers, with punishments for insubordination less than half in the former, compared to the latter (39.7 per mille, versus 92.3, for 1898).<sup>145</sup> Hospital admission rates were lower as well: 208 and 307 per mille as against 301 and 380, for 1897 and 1898 respectively.

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among Company troops than in the Queen's forces, owing to there being fewer restrictions and, among Company men, more abandonment, as they had less likelihood of returning to Britain – Editorial, 'Soldiers', pp. 192, 198.

<sup>142</sup> Sykes, 'Mortality', pp. 141-2; The excess mortality was from all causes except fever, but especially cholera, dysentery and diseases of the brain.

<sup>143</sup> Editorial, 'Soldiers', p. 196; NCOs were more likely than privates to be court-marshalled – p. 200; Drinking culture was rife in the sergeants' mess.

<sup>144</sup> E. Roberts, *Enteric fever in India and in other tropical and subtropical regions* (Calcutta: Thacker, Spink, 1906), pp. 11-12; Roberts notes that over 1897-1906, one in three of the army rank-and-file belonged to a temperance movement. He also records that later in the nineteenth century soldiers tended to be younger, and that fewer spirits were being consumed.

<sup>145</sup> J.H. Bateson, *Extracts from the British Army Temperance Association for 1898-99*, Document number 210 (Washington DC: United States 56th Congress, 1901), pp. 2-4.

Witnesses to the 1863 commission gave insights into problems of alcohol within the European forces.<sup>146</sup> Florence Nightingale thought the canteen system, which permitting purchase of one gallon of spirits (4.54 L) every 20 days (227 mL per day), encouraged intemperance, and that illicit procurement was too easy, even when sale in the bazaar was supposedly banned, something Thomas E. Dempster (1799-1883), deputy inspector-general of hospitals, and Colonel William Swatman (1822-?) of the Bengal army, confirmed.<sup>147</sup> Nightingale recorded, for the 5th Fusiliers, out of one hundred hospital admissions, seventeen indirectly related to intemperance, and two as a direct consequence, with, at Fort William, seven trials for drunkenness in a three months period, and, over the year 1859, at Allahabad, 36 cases of delirium tremens of which five proved fatal. She blamed government complicity and advocated abolishing issuance of spirits from the canteen, though Swatman argued that sale there was better than illegal purchase of country liquor in the bazaar.<sup>148</sup> Surgeon-major Alexander Grant observed that intemperance often was the result of lax discipline, whilst Dr William Maclean (1811-98), deputy inspector-general of hospitals, found that religious adherence promoted temperance in the 84th, an Irish regiment.<sup>149</sup> Sergeant-major William Walker (dates unknown) supported the view that crime and inebriation were associated: 'A great number of punishments of soldiers are incurred for crimes committed in a state of intemperance'.<sup>150</sup> European civilians were not exempt. Dr John McLennan (1801-74), physician-general in Bombay, found that, excepting fever, intemperance resulting in delirium tremens was the main reason for admission to the city's European General Hospital, with ten percent of those admitted being women.<sup>151</sup> On native troops, Colonel Richard Gall (1815-81), of the 14th light dragoons, opined that they: 'are proverbially sober, generally speaking very sober men, but they chew opium and smoke intoxicating drugs'.<sup>152</sup>

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<sup>146</sup> *Royal commission* Volume I.

<sup>147</sup> *Royal commission* Volume I, viz – F. Nightingale, 'Observations', pp. 313-16; T.E. Dempster, 'Extracts from papers', p. 488; W. Swatman, 'Intemperance', p. 166.

<sup>148</sup> *Ibid.*, viz – Swatman, 'Intemperance', p. 166.

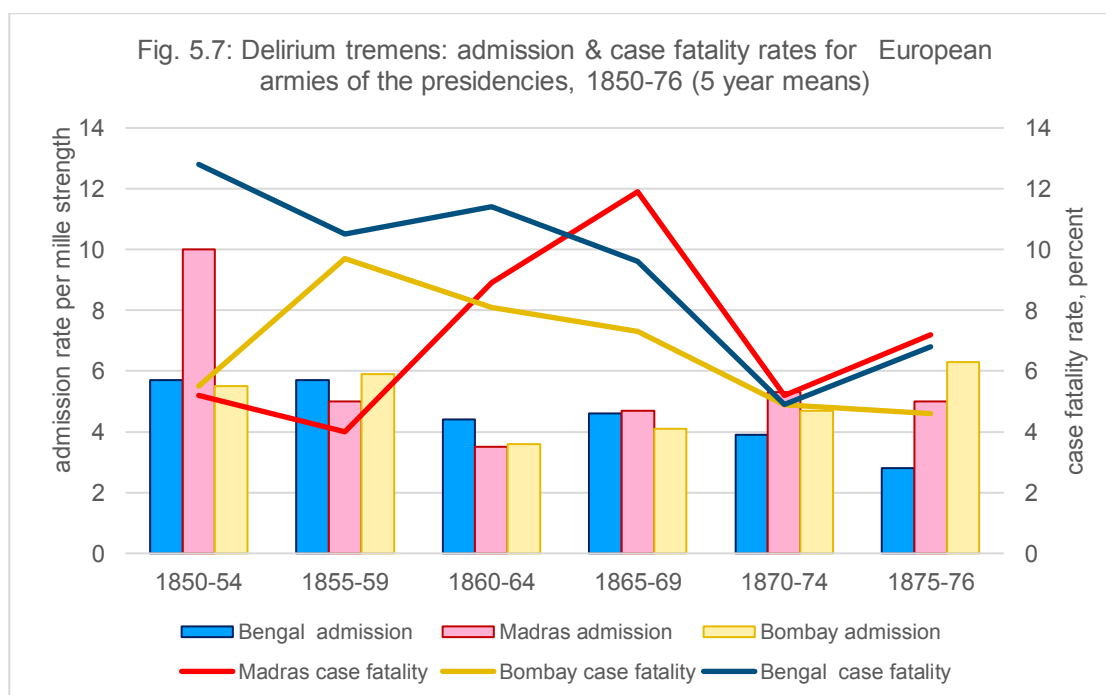
<sup>149</sup> *Ibid.*, viz – A. Grant, 'Intemperance', p. 252; W.C. Maclean, 'Intemperance', p. 208.

<sup>150</sup> *Ibid.*, viz – W. Walker, 'Drink', pp. 292-4.

<sup>151</sup> *Ibid.*, viz – J. McLennan, 'Intemperance', p. 188.

<sup>152</sup> *Ibid.*, viz – R.H. Gall, 'Intemperance', pp. 181-2.

The army medical officer returns give details of delirium tremens rather than alcoholism, which was not a diagnostic category, perhaps due to difficulties in defining it, except for the years 1883-92, when it replaced the former in army nosology. Delirium tremens describes symptoms of tremor, anxiety, hallucination, and delusion that occur on sudden withdrawal of alcohol.<sup>153</sup> Potentially fatal, it infers alcoholism. Martin reports incidence rates for delirium tremens in British troops at various world locations, in, it appears, the 1830s, for varying periods.<sup>154</sup> Annualized rates for the Indian presidencies were: Bengal – 18 per mille (1836-40), Madras – 16 (1832-36), and Bombay – 6 (1836-40), compared to 0.6 per mille for Great Britain and 16 per mille for the West Indies. The annual sanitary commissioners’ reports detail admissions due to delirium tremens among European armies of the presidencies from mid-century. These usually ran at 3 to 6 per mille annually (range 2.8 to 10) between 1850 and 1876, with case fatality, for Bengal, reducing from 12.8 percent in 1850-54 to 6.8 percent in 1875-6 (Figure 5.7).<sup>155</sup> The incidence of delirium tremens in native troops as negligible. Between 1883 and 1892, entries are for alcoholism – not directly comparable

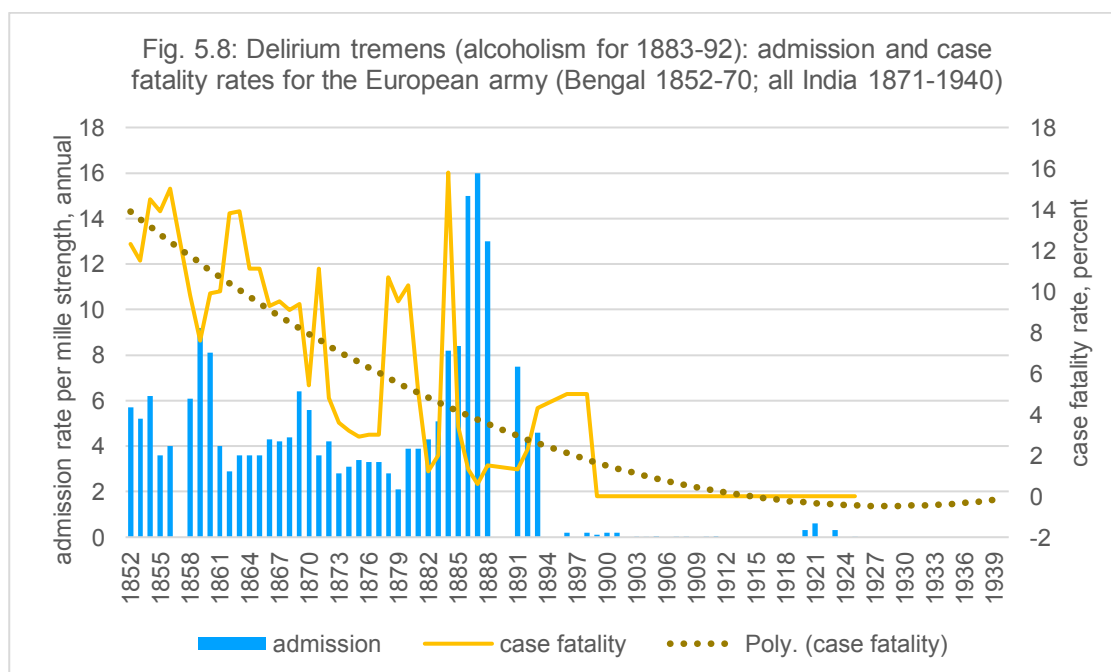


<sup>153</sup> ‘Delirium tremens’ – *OED Online* (Oxford, OUP, 2020), [www.oed.com/view/Entry/49455](http://www.oed.com/view/Entry/49455) [21 February 2021].

<sup>154</sup> Martin, *Influence 1861*, pp. 622-3; Martin provides dates for the Indian data but not for the other locations, though it is assumed these are contemporaneous.

<sup>155</sup> Source data as for Fig. 2.6.

with figures either side of this date, but two to four times higher. After 1893, cases of delirium tremens suddenly fell to very low levels, for reasons discussed below. Case fatality reduced progressively from 1852, such that, in 1900 and thereafter, for the small number of soldiers afflicted, it was zero (Figure 5.8).<sup>156</sup> Other factors such as exposure and hypothermia sometimes contributed to alcohol-related fatality. The unpublished letters of surgeon-captain Alfred E. Master (1816-83), from the 1897-98 North-West frontier campaign, record that he ‘... found a man about 20 feet from the track we had followed, evidently dead about 6 hours from the result of cold on that of a great booze of rum that he had got hold of out of the Comm. Stores which had fallen by the wayside’.<sup>157</sup>



### *The response of the authorities to alcoholism*

Prior to the 1857 mutiny, the British army regarded alcohol misuse amongst its rank-and-file as part and parcel of their class-related warrior aggression.<sup>158</sup> Invaliding and loss of effective strength from alcoholism in the first half of the nineteenth century were small, however, compared to losses from fevers and fluxes. Nonetheless, measures were considered to limit the imbibing of alcohol. Martin,

<sup>156</sup> Source data as for Fig. 2.12.

<sup>157</sup> Wellcome Collection, RAMC/185; A.E. Master, ‘Extracts from private letters re the Tirah campaign, N.W. frontiers, 1897-98’, The dates of Dr Master are not known. The campaign was against the Afridi tribes. Master was with the Queen’s regiment.

<sup>158</sup> Wald, *Vice*, pp. 22-3.

in 1837 Calcutta, simply proposed abolition of issuance of spirit rations to troops, even though illicit procurement was easy.<sup>159</sup> Boredom and a lack of healthy diversions in barracks were identified by authorities as contributing to alcohol consumption, which, they proposed, then led to criminal behaviour, both of which could result in corporal punishment by the army.<sup>160</sup> With this in mind, Colonel Sykes reported that, in the Madras presidency of the early 1840s, steps were taken to ‘withdraw European troops from habits of intemperance, by canteen regulations, by encouraging temperance societies in regiments, by supplying malt liquor to the men so cheap that they prefer it to spirits, and by affording them physical and intellectual amusements’.<sup>161</sup> Sykes records that an artillery unit at Madras had a library, and facilities for rackets, football, skittles, chess and backgammon, though it is unclear how widespread was this sort of provision.

Prior to its consideration in the 1863 commission report, and despite being identified as a problem, alcoholism had been tackled, as in Sykes’ account from Madras, in a sporadic manner. The commissioners sought to address drunkenness more systematically. They recommended cessation of spirit sales in canteens and of its issuance on board ship, and the banning of liquor vending in military bazaars.<sup>162</sup> They looked to improve recreational facilities in barracks by ‘establishment of Institutes, gymnasia, reading and coffee-rooms’, though illiteracy was, in the first half of the nineteenth century, the norm among European soldiery – only a fifth to a third could read.<sup>163</sup>

Substitution of ‘excellent beer at a moderate rate’ for the spirit ration was seen by Parkes, in 1866, as being hardly successful at all at reducing inebriation. Officers were not exempt from intoxicants: ‘a larger number than is generally supposed die or are sent home from abroad from this cause’.<sup>164</sup>

Contrariwise, high caste ‘Hindustanees’ (Hindus), which comprised half the native army of Bombay, were admired for never ‘tasting’ spiritous liquors, nor meat nor fish, though it was noted

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<sup>159</sup> Martin, *Topography*, pp. 160, 165-6.

<sup>160</sup> Jeffreys, *British army*, pp. 213-14.

<sup>161</sup> Sykes, ‘Mortality’, pp. 135-6.

<sup>162</sup> *Royal commission 1863*, pp. 166-7; Exemptions were made for medical officer recommendations.

<sup>163</sup> *Ibid.*, pp. 166-7; Parkes, *Hygiene 1866*, pp. 30-1; Editorial, ‘Soldiers’, pp. 170-4.

<sup>164</sup> Parkes, *Hygiene 1866*, p. 26.

that: ‘all Mahomedans, and all low-caste Hindus are consumers of animal food, spirituous liquors, opium, ganja, or hemp-water’.<sup>165</sup>

### ***Medical approaches to alcohol excess and its attendant diseases***

The definition of alcoholism is unsatisfactory, relying as it does upon nebulous abstractions such as dependency, addiction, and ability to limit consumption. As a concept it was acknowledged, together with its social and behavioural repercussions, by the mid nineteenth century.<sup>166</sup> Medical consequences, most notably delirium tremens, had been recognized by the second decade of that century, sufficiently so for inclusion of this condition on returns of medical officers in the armies of India from 1847.<sup>167</sup> Early texts of diseases of India, such as those of Curtis (1807) and Ballingall (1823) omit mention of alcohol-related disease, though the latter records the commonness of drunkenness. Johnson, in his 1826 third edition, identifies that the drunkard might be protected from some fevers, but suffers more than the sober soldier if afflicted, and mentions delirium tremens, though in a discussion of fevers rather than of alcoholic excess.<sup>168</sup> William Geddes, surgeon to the European regiment in Madras, details, between 1829 and 1833, 27 soldiers with delirium tremens, about a half of whom had been resident in India for more than eight years.<sup>169</sup> Symptoms, in addition to hallucinations, included difficulty with speech, restlessness, headache, epileptic fits, tremor, vomiting and vertigo. Geddes prescribed ‘opium, given to bring on a state of repose’, frequently with calomel in large doses, blisters, leeches to the temples, and purgatives. Admissions were for one or two weeks. Two cases proved fatal. Sometimes recovery was slow, as delusions took time to resolve. Annesley, in his 1841 volume, notes alcohol-related liver disease, tying it to bile theory: ‘In soldiers, especially those addicted to the inordinate use of spiritual liquors, functions of the stomach

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<sup>165</sup> Martin, *Influence 1861*, pp. 423-4,

<sup>166</sup> Alcoholism, ‘The condition of being dependent upon or addicted to alcohol, and unable to limit its consumption to a level which does not produce deleterious physical, mental, or social effects’. *OED online* (Oxford, OUP, 2023), <https://www.oed.com/search/dictionary/?scope=Entries&q=alcoholism> [22 December 2023].

<sup>167</sup> Alcoholism *per se* was not included on returns, except for 1883-92.

<sup>168</sup> Johnson, *Influence 1823*, pp. 24, 29, 361.

<sup>169</sup> Geddes, *Clinical 1846*, pp. 261-81.

are amongst the earliest to suffer, and [in] them will supervene those of deranged secretion of bile, or of inflammation of the liver', but he does not venture into pathologies of the nervous system.<sup>170</sup>

Charles Gordon, as a staff surgeon in 1851 India, expresses little surprise at the frequency of delirium tremens, given the quantities of alcohol in the daily allowance, and that 'soldiers have next to nothing to do during the hot season' – in other words, recognizing boredom as a contributor.<sup>171</sup> The greatest danger of fatality, from apoplexy, was in 'the old and dissipated'. Gordon disliked general bleeding, preferring use of opium or laudanum to sedate, and purging with croton oil. Sometimes he administered beer or spirits, and occasionally applied leeches locally to the temples for 'determination of blood to the head'. By 1866, Gordon, now deputy inspector-general of hospitals, intimates that public concern about drunkenness in India's European soldiery had resulted in restriction on issuance of spirits in canteens and in establishment of diverting activities.<sup>172</sup> That he viewed inebriation as 'a condition natural to the soldier' belies the attitude of the senior army command. Martin, a few years earlier in 1861, identified delirium tremens as occurring in two groups: the young soldier after an alcoholic binge, and the older regular imbiber, deprived of his stimulus.<sup>173</sup> True to his late adopter approach to most diseases, Martin still favoured early bloodletting and purging, but agreed with others that sedation with opiates, in his case combined with an antimonial, warm bath and cold facial compresses, was the prime treatment, sometimes with inhalation of chloroform, and followed up by the ubiquitous calomel. By his 1882 edition of *Theory and practice*, Bristowe defines 'alcoholism' and recognizes, in addition to liver disease and delirium tremens, haematemesis (vomiting blood), epilepsy, dementia and general paralysis as consequences.<sup>174</sup> He is optimistic about the outcome of delirium tremens, expecting recovery within

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<sup>170</sup> Annesley, *Researches 1841*, p. 220.

<sup>171</sup> C.A. Gordon, *Handbook for medical officers of H.M. service in India* (London: Trelawney Saunders, 1851), pp. 88-98.

<sup>172</sup> Gordon, *Hygiene 1866*, pp. 26-31.

<sup>173</sup> Martin, *Influence 1861*, pp. 609-22.

<sup>174</sup> Bristowe, *Treatise 1882*, pp. 587-92; Bristowe lists large doses of digitalis or of potassium bromide as alternatives to opiates and chloral.

3 to 7 days. On treatment, Bristowe acknowledges a change in approach, away from the previously mandated requirement to induce sleep and purge, to a more supportive strategy, but nonetheless, he advocates sedation with opium or laudanum, or chloral, as a mainstay. Osler, in 1909, favoured a similar protocol but preferred potassium bromide or chloral, or an injection of hyoscine, to opiates.<sup>175</sup> Price's *Practice of medicine*, a textbook used in the subcontinent, in 1934, in addition to support, suggests administration of a reducing dosage of alcohol, with calomel as a laxative and potassium bromide as a sedative.<sup>176</sup>

### ***Discussion***

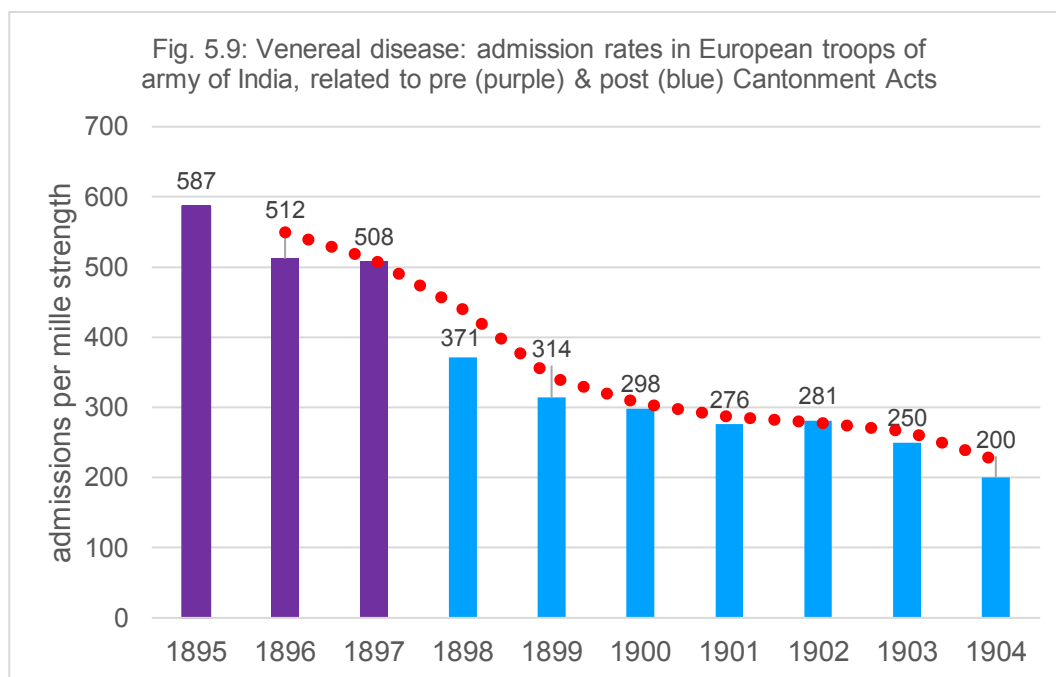
The response of the Company and HM's authorities, in mid eighteenth century India, to excesses of alcohol and venereal disease in their European armies, unsurprisingly were muted at first, considering the threats to military efficiency from these were eclipsed by fevers and fluxes. The venereal menace though, was sufficient by the end of the century, to require action. This materialized in the form of the lock hospital, an institutional and medicalized approach that was to be the legislated backbone of the authorities' response for the next one hundred years, in fits and starts, and in several guises. Awareness of drunkenness as a problem to be addressed, rather than tolerated, was amplified by concerns about the serving conditions of the rank-and-file during the Crimean conflict, and after the 1857 rebellion, and linked to an increasingly moralistic approach to the seemingly dishevelled and debauched life of the soldier – expected because of his class, but nonetheless a target for correction, especially in view of developing Christian militarism. Authorities connected drink with vice. The two often coexisted. Drunkenness was bracketed with crimes that warranted military punishments.

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<sup>175</sup> Osler, *Principles 1909*, pp. 369-73; Hyoscine is an antimuscarinic, and blocks acetyl choline. Osler advises against physical restraint, suggesting a sheet tied across the bed if immobilization was thought necessary.

<sup>176</sup> F.W. Price, *A textbook of the practice of medicine*, 4th edn (London: OUP, 1934), pp. 1799-1800; The nineteenth century liability to purge most diseases persisted well into the twentieth.

Venereal disease affected all armies in the nineteenth and twentieth centuries, though rates in India exceeded those at almost every other British imperial posting.<sup>177</sup> The excess – a rate nearly 50 percent higher than that in Egypt – suggests either a higher rate of disease carriage by prostitutes or greater brothel use by soldiers – neither of which seems likely, or a failure of regulatory mechanisms. It is clear that the lock hospital system, with its enabling legislation of the Contagious Diseases and Cantonment Acts, largely failed in its intent, as recognized by the army’s sanitary commission. Some army surgeons including Newmarch and French argued for a limited effect.<sup>178</sup> The overall data from India (Figure 5.2) and, for syphilis, in the U.K., however, show, at most, minimal impact in the nineteenth century. The numbers for India over the period 1895-1904 are slightly more convincing, such that Arnold Kaminsky regards Cantonment Acts as the explanation at this time, though he seems unaware of concurrent changes in medical treatments (Figure 5.9).<sup>179</sup>



Contagious Diseases and similar acts partly failed since, as was recognized at the time, they did not identify many of the prostitutes who plied their trade. Additionally, and less acknowledged

<sup>177</sup> French, *Syphilis*, p. 87; For the decennial 1893-1902, admissions for venereal disease were 412 per mille for India. Rates at other locations were: Hong Kong 442, Barbados 408, Egypt 281, South Africa 212, Canada 125, and UK 141.

<sup>178</sup> BL IOR/L/MIL/17/5/2008 Sir Oliver Richardson Newmarch, *Memorandum on venereal disease* (India Office 1896); French, *Syphilis*, pp. 1-3, 85.

<sup>179</sup> Source data as for Fig. 2.12; A.P. Kaminsky, ‘Morality legislation and British troops in late nineteenth-century India’, *Military Affairs*, 43 (1979), pp. 78-83; French, *Syphilis*, p. 85.

contemporaneously and in the literature, simple examination of the women would miss many cases of infection, and, furthermore, most treatments given for both syphilis and gonorrhoea would have been suboptimal, failing to eliminate disease, even if any symptoms resolved.<sup>180</sup> The lock hospital system was thus based on a false premise from the outset, and bound to disappoint.

The difference in rates of venereal disease between the native and European armies was stark in the nineteenth century, largely explained at the time by the authorities on the basis that sepoys were mostly married and hence not seeking casual liaisons. Acknowledging some under-reporting by the native soldiery, this observation seems to hold, as during the First World War, when sepoys were away from their families and more open to carnal temptation, admission rates for venereal diseases converge and the numbers for the native army briefly surpass the European figure (Figure 5.2). Army authorities in the nineteenth century, as noted by many at the time, could have used the straightforward manoeuvre of allowing more European soldiers to marry. The calculation, though, seems to have been that the additional expense of this was insufficient to tip the balance in its favour.

One unusual feature identified here is that sepoys reporting venereal disease were proportionally more likely to have syphilis rather than gonorrhoea, compared to their European counterparts, though this declined with time (Figure 5.5). No clear explanation is proffered to account for this, though potential reasons might include a difference in sexual practices – for example, anal intercourse might account for a higher incidence of gonorrhoea, or in the frequency of circumcision – which may protect against some ulcerating sexually-transmitted diseases.<sup>181</sup>

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<sup>180</sup> Safford, 'Venereal', p. 260; Roy, 'STD', p. 23; Gonorrhoea in women is asymptomatic in up to a half of cases. Wald argues that lock hospitals failed as most prostitutes evaded detection, inspection and treatment, but this argument becomes irrelevant if asymptomatic infection frequently would be missed, and treatment would not be curative anyway – *Vice*, pp. 73-4.

<sup>181</sup> Due to rectal gonorrhoea in the prostitute or male recipient. Although sodomy occurred in the Royal Navy, its occurrence in the British armies of India cannot easily be assessed, even from court records, because, as Douglas Peers asserts, there was an official policy of covering it up – those guilty were transported to Australia – A.N. Gilbert, 'Buggery and the British Navy, 1700-1861', *Journal of Social History*, 10 (1976), pp. 72-98; D.M. Peers, 'Privates off

What explains the surge in venereal cases in the European army over the last quarter of the nineteenth century? Newmarch's contention that this was due to an influx of young recruits on short service enlistment, coupled with a *reduction* in the married quota, seems applicable.<sup>182</sup> French saw the dramatic decrement in the first decade of the twentieth century as due to a combination of efforts: lectures by officers 'improving the moral tone and sobriety of the men, encouragement of games and athletics, diminution in the number of prostitutes, and by keeping them away from the neighbourhood of barracks'.<sup>183</sup> However, talks, better recreational facilities and restricted access to prostitutes had been tried before, without effect. Judy Whitehead has proposed 'increased natural immunity and the introduction of Salvarsan' – but evidence for the former is lacking (and unlikely) and the decline preceded general availability of arsphenamine.<sup>184</sup> A more realistic explanation, and one in which French was instrumental, is that by the turn of the century, the treatment of venereal diseases had become more effective, and enshrined in King's Regulations under Army Order 158 of 1903.<sup>185</sup> It was by now of longer duration, meaning that infectivity was reduced, even if cure was still dubious.

Mercury was the established treatment for syphilis, from well before the treatise of Hunter, and its use extended into the third decade of the twentieth century, despite the arrival of arsphenamine.

Evidence suggests that it can modified the signs and course of the disease, but does it effect a cure?

Based on clinical findings after the turn of the twentieth century – that relapses were common even with mercurial courses of two to three years duration – there is little doubt that most treatments for lues throughout the nineteenth century effected only partial control, rendering the disease non-infectious for a time, but not ultimately resulting in a total cure in the majority of cases. The

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parade: regimenting sexuality in the nineteenth century Indian empire', *International History Journal*, 20 (1998), pp. 823-54; A present-day survey showed low circumcision rates in Hindus – S.S. Dave, A.M. Johnson, K.A. Fenton, *et al.*, 'Male circumcision in Britain', *Sexually Transmitted Infections*, 79 (2003), pp. 499-500.

<sup>182</sup> BL IOR/L/MIL/17/5/2008 'Newmarch'.

<sup>183</sup> French, *Syphilis*, p. 3.

<sup>184</sup> J. Whitehead, 'Bodies clean and unclean: prostitution, sanitary legislation and respectable femininity in colonial north India', *Gender and History*, 7 (1995), pp. 41-63.

<sup>185</sup> Hyam believes that diversified recreation made some contribution to reducing venereal disease at the turn of the century – *Empire*, pp 126-7.

situation for gonorrhoea seems different, as the gonococcus does not have the same tendency to disseminate within the body as does the spirochaete. It is believable that the prevailing treatment in the second half of the nineteenth century – intra-urethral irrigation with potassium permanganate or silver nitrate solution, properly administered twice or thrice daily, and continued for at least two weeks – might cure gonorrhoea in a man. Many contemporary textbooks are vague, however, on the therapy of gonorrhoea in women, in whom infection frequently locates to the endocervix, and is asymptomatic.<sup>186</sup> It is not credible that simple douches of astringent solutions could easily cure gonococcal infection in women, considering the added complexity of the disease over that in men, unless applied with the sort of precision detailed by Bumstead.<sup>187</sup> Thus, even if a soldier was cured of his gonorrhoea, his next prostitute consort was quite possibly infected, even if she had no symptoms or had had treatment. Most prostitutes probably harboured venereal pathogens much of the time.<sup>188</sup>

Venereal infections became epidemic during the First World War in both native and European armies, in all theatres of conflict. Such a surge is predictable with war, compounded by social uprooting, abandonment of moral scruples on realization of mortality, casual prostitution by financially distressed civilians, all of which was not helped by disrupted medical services and supplies. Control of venereal disease was only restored in the early-to-mid 1920s, through a combination of prophylactic measures, and the refinement of treatment regimens.

The true extent of alcoholism, as presently defined, in the nineteenth century European army of India is not known. Delirium tremens is an indicator of alcohol excess but the tip of the iceberg. An initial annual figure of 18 per mille for delirium tremens in the European army of Bengal in the

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<sup>186</sup> For example, E.J. Tilt, *Handbook of uterine therapeutics and diseases of women* (New York: Wood, 1881) mentions gonorrhoea but gives no detail as to its treatment.

<sup>187</sup> Bumstead, *Venereal*, pp. 173-81.

<sup>188</sup> This assertion is supported by the available evidence: Colonel Harrison noted that all prostitutes were infected intermittently (Harrison, 'Half a lifetime', p. 442); Colonel Safford quotes one study in 1917 Paris which found 91 out of 100 street prostitutes to be infected, and another showing that 55 of 77 were diseased (Safford, 'Venereal', p. 260).

1830s, had declined to around 5 per mille by the 1850s, whereabouts it remained for at least another thirty years (data not shown).<sup>189</sup> On recording alcoholism rather than delirium tremens, during the period 1883-92, the army detected a rate two to four times higher than the immediately preceding years, giving some idea of the relationship between the diagnoses (Figure 5.8). After 1892, when delirium tremens again became the favoured parameter, the rate had fallen to very low levels, where it remained up until 1940. What accounted for this sudden decline? Perhaps surprisingly, the answer seems to be an uptake in membership of temperance movements. Teetotalist societies were pioneered in the armies of India and later extended worldwide. Lieutenant (later General) Henry Havelock (1795-1857) of the 13th light infantry, founded one in Burma in 1834. By mid-century, fifty regiments boasted a temperance group.<sup>190</sup> The focus of attention on soldiers' welfare after 1857 led to the formation, by Reverend Joseph Gregson (1835-1909), in 1862, across the armies of India, of the Soldiers' Total Abstinence Association, which awarded medals for good adherence and whose motto was 'Watch and be sober'. By 1885 it had 12,000 members across 144 branches.<sup>191</sup> Field Marshal Lord Roberts reorganized this movement in India, into the Army Temperance Society in 1888. By March 1898, 27,574 soldiers in India had joined, out of a total European force of 67,741, that is a membership of 41 percent.<sup>192</sup> In 1902, it is claimed that 40 percent of European soldiers in India were members.<sup>193</sup> Temperance, hence, can be seen as the reason for the decline of alcoholism, and, additional, a contributor to the reduction in venereal diseases, which was less frequent, along with disciplinary offences, in temperance society adherents.

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<sup>189</sup> Martin, *Influence 1861*, pp. 622-3; The rate for Madras was 16 per mille, compared to 6 for Bombay, and 16 in the West Indies.

<sup>190</sup> National Army Museum, *Watch and be sober: the story of army temperance* <https://www.nam.ac.uk/explore/temperance-medals> [18 April 2021].

<sup>191</sup> P. Stanley, 'Army temperance associations', in J.S. Blocher, I.R. Tyrell, D.M. Fahey, eds., *Alcohol and temperance in modern history*, vol 1 (Santa Barbara: ABC Clio, 2003), pp. 55-6.

<sup>192</sup> Bateson, *Temperance*, pp. 1-4; The yearly average strength has been used for the European army.

<sup>193</sup> Stanley, 'Temperance', pp. 55-6; The Army Temperance Association, formed in 1893 under Roberts leadership, applied worldwide to the British army. Twenty-five percent of home-stationed troops were members, it is said, in 1902. Temperance organizations declined after World War One with establishment of the Navy, Army and Air Force Institute (NAAFI) in 1921, and reduced societal tolerance of drunkenness, though drinking remains a feature of service life.

Mid-nineteenth century army medical officers were aware of the association between alcohol and liver disease, as well as its link to delirium tremens, and saw that excessive drinking was contributed to by the boredom of barracks life, and made easier by ready availability of liquor.<sup>194</sup> Later in the century, epilepsy, dementia and general paralysis were recognized as additional sequelae.<sup>195</sup> An overt connection to mental illness was not expressed. On the issue of mental health, John Macpherson (1817-90), in medical charge of the Calcutta asylum, found an annual rate, for ‘insanity’, of 1.2 per mille in the twelve years up to 1856, for European troops in Madras, against 1.0 per mille for native regiments.<sup>196</sup> In Bengal, the annual European figure, for four years to 1852, was higher at 2.7 per mille, compared to 1.0 per mille for native soldiery. Almost all European soldiers who developed ‘insanity’ were sent home as invalids – a small number (one in ten) was admitted to a local asylum.<sup>197</sup> Melancholia, which would now approximate to depression, was an infrequent diagnostic category for returns in the 1900s; for example, for 1908, the prevalence was 0.1 per mille in sepoys, 0.3 per mille in their European counterparts.<sup>198</sup> These figures are extraordinarily low compared to twenty-first century expectations.

For delirium tremens, the fatality rate of 4 to 10.5 percent in the quarter century from 1850, fell to zero by 1900. What changed in medical management to account for this? In the 1850s and 1860s, bloodletting and purging were in vogue, along with sedation using opiates – induction of sleep was seen as paramount. By the final decade of the century, venesection and purgatives have been dropped in favour of a more supportive approach, still at times employing opiates, but now with availability of the specific sedative, chloral. The latter stratagem aims more to maintain vital

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<sup>194</sup> Annesley, *Researches 1841*, p. 220; Jeffreys, *British army*, pp. 213-14.

<sup>195</sup> Bristowe, *Treatise 1882*, pp. 587-92.

<sup>196</sup> J. Macpherson, ‘Report on insanity among Europeans in Bengal’, *Calcutta Review*, 26 (1856), pp. 592-608; Macpherson gives a detailed account of how mental illness was seen in Britain and India. He considered it a ‘disease of the brain, and not a phantom’. The subject was not taught in medical schools. The medicinal treatment available is not specified. The rate of ‘insanity’ in the general populations of Britain was said to be about 1 per 1,000 annually, 1 in 854 if ‘idiots’ were included. Macpherson thought rates in natives of India would be similar. It was discussed whether a hot climate could induce mental disease and it was concluded, probably not (p. 603).

<sup>197</sup> *Ibid.*, pp. 603-4.

<sup>198</sup> RSCGI 1908, Tables XXVI, L111.

functions, though still includes sedation. In the former, preoccupation with the perceived necessity to induce sleep may have been ill-advised if over-dosage with an opiate led to death from respiratory suppression or inhalation of vomit. A further contributor to decreased fatality could have come from reduced consumption of alcohol during binges, even amongst those prone to these, because of lower societal tolerance of a high alcohol intake, by the century's end.

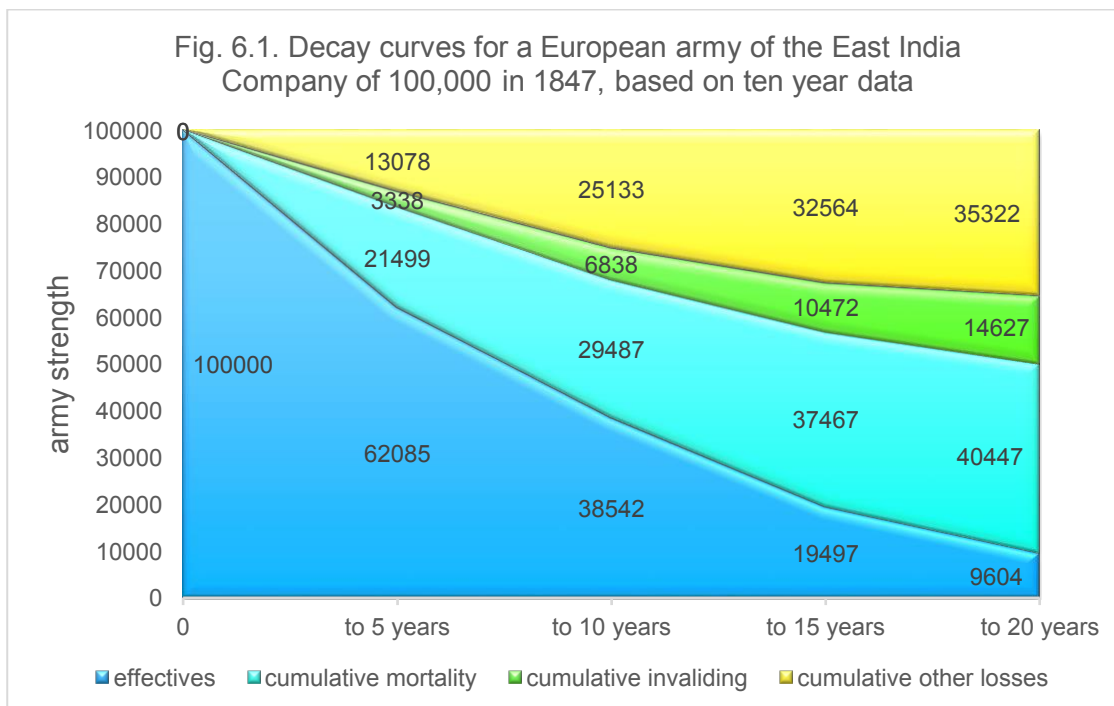
### ***Conclusions***

To summarize, alcohol excess and venereal disease were prominent in nineteenth and early twentieth century military life in India, both being associated in the mindset of army authorities with the social class of the rank-and-file European soldier, and seen as an essential risk-taking accoutrement of his martial aggression. Evidence links alcohol consumption with both criminal behaviour and illness, and an affiliation between drunkenness and the acquisition of venereal disease is not hard to find. Although temperance, notably at the turn of the twentieth century, was crucial to reducing alcohol-associated illness and also, potentially, to a degree, venereal disease, findings here point to better treatments and education, not legislation nor improved recreational facilities, as the key to controlling the latter. Hence the hypothesis stated at the beginning of this chapter, that the twin vices would respond to the imposed coercions of the bureaucracy, is largely incorrect. The authorities preferred option of legal enforcements enacted throughout the nineteenth and twentieth centuries, were singularly disappointing in producing a result. The surge in venereal disease during World War One for some time outran the ability of the medical establishment to assert control, but ultimately, the prevailing of less judgmental societal values that permitted the use of prophylactic 'packages' coupled with better treatments, seem to have capped the epidemic.

## Chapter 6: Discussion and conclusions

This thesis is a study of the health of two relatively enclosed populations, the European and the native armies of British India, well served medically and better documented for the time than most civilian societies. This has made them an ideal subject for an analysis of the relative effects of external and internal forces influencing their health. The dataset did not disappoint. In bringing the totality of this work together, major points from each chapter will be considered with regard to how they interconnect.

The starting point is the condition of the European armies of the EICo and the Crown at the mid-nineteenth century, brought to the attention of the British public by reportage of the Crimean conflict, the 1857 rebellion, and developing Christian militarism. Life tables illustrate the predicament. For European troops of the EICo over the decade 1847-56, losses from deaths, invaliding, desertion, and discharge meant that, after ten years' deployment, only 38.3 percent effectives would be left, falling to 9.6 percent at twenty (Figure 6.1).<sup>1</sup> Life expectancy for the



<sup>1</sup> *Royal commission 1863*, pp. 15-24, 175-8 [Tables 4-12]; Results shown are 20-year actuarial projections.

private European soldier in India, at twenty years of age, was 22 years less than his compatriot in England. Health worsened with increased duration of service. However, the mortality rate of the European soldiery, from around 50 per thousand in the early-to-mid 1850s, had halved by the next decade, converging to approximate to that for the sepoy army by 1875. This dramatic reduction, emphasized by Curtin, was almost entirely due to a decrease in the incidence of the intestinal infections, cholera and dysentery/diarrhoea, with a proportionate fall in deaths.<sup>2</sup> Other diseases, such as ‘hepatitis’ in European troops, declined more slowly. European case fatality fell overall from the late 1850s – though successively less prominent epidemic peaks continued for some years for cholera and dysentery, and there was a later rise for typhoid – see below. Improved sanitary infrastructure in the European barracks is proposed as the main cause for the sustained decline in the diarrhoeal disease, with some contribution from improved robustness of European recruits (*vide infra*). Things were different in the native force. For the sepoy, case fatality, with similar peaks (except for typhoid but including pneumonia), and a much larger one during the First World War (due to malaria) – only properly fell in the 1900s and after 1925 – perhaps finally responding to improved sanitary infrastructure.

Investigation of the height and weight data for the British and Irish recruits which were transferred in the tens of thousands to India after the 1857 mutiny shows that there was a higher than usual acceptance rate – dictated by the needs of the service – and that the anthropometric data suggest reduced nutritional status of some of the incomers. A selection bias thus seems to have been introduced. The influx of a large number of disease-naïve unacclimatized European troops onto the subcontinent thus, it is argued, had a compounding triple effect that promoted the high rates, observed here, in incidence of, and hence mortalities from, diarrhoea and dysentery, cholera, hepatitis, and fevers seen at the end of the 1850s. The already recognized first-year-of-arrival excess in morbidity and deaths from these conditions<sup>3</sup> may well have been exacerbated by a portion of

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<sup>2</sup> Curtin, *Migration*, p. 37.

<sup>3</sup> *Royal commission 1863*, pp. 15-24, 175-8 (Tables 4-12).

troops harbouring a degree of immune compromise based on poor childhood nutrition.<sup>4</sup>

Additionally, the arrival of the men in unprecedented numbers probably overwhelmed the capacity of the existing medical services to deal effectively with them. These things settled in the European army, with falling rates of diarrhoeal disease admission and mortality from the early 1860s – better nutritional status in later recruits and less stress on the system might have contributed.

The 1857 rebellion also introduced bias into selection of native troops. Whereas previously the Bengal native army was recruited largely from high caste Brahmins – entrants to the Bombay and Madras presidency armies had always been more broadly-based – after the uprising recruitment from the martial races of the Punjab, notably the Sikhs, and the Gurkhas of Nepal was favoured for the sepoy force. This not only brought with it a different set of childhood experiences of disease, with reduced exposure to conditions prevalent in the plains, but also, since recruits now were from more rural backgrounds, the possibility of childhood nutritional impairment.<sup>5</sup> Such factors might be contributory when explaining the sepoy army's rise in deaths from intermittent fever noted in the 1870s and increase in mortality from dysentery later in that decade. For example, patterns of exposure to the malaria mosquito may have been different in the martial races compared to Bengalis – malarial resistance may have been lower in some recruits from the mountainous Nepal and from pre-canal system Punjab, though the picture is unclear.<sup>6</sup>

Not all diseases fell in incidence. In the European camp, the incidence of and mortality from enteric fever/typhoid rose exponentially in prevalence to be the major cause of death in the last two decades of the nineteenth century. The reasons are unclear – though the concentrating effect of carriers might be an explanation. It did not decline until the realization was made that flies contaminated food and, contemporaneously, the introduction of inoculation, which afforded some protection. For

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<sup>4</sup> Fogel, 'Nutrition and the decline' p. 481.

<sup>5</sup> Roy, 'Race and recruitment', pp. 110-47; Rand, Wagner, 'Recruiting the martial races', pp. 232-97.

<sup>6</sup> Awasthi, *et al.*, 'Malaria transmission in rural Nepal', pp. 16872; Zurbrigg, 'Hunger and epidemic malaria in Punjab', pp. 2-26.

sepoys, the low rate of typhoid probably indicates immunity from previous contact, but the picture for dysentery was more complicated.<sup>7</sup> Although its incidence in the native force did not fall until 1880 – remaining higher than the European value until 1917 – case fatality was lower until the 1920s, perhaps indicating a degree of resistance from childhood exposure, also likely to be in play for amoebic hepatitis.<sup>8</sup>

Intermittent fever/malaria was both more common in and had a higher fatality for native troops, nevertheless admissions declined to mirror those of the European by 1905. The higher rates are counterintuitive as one would expect sepoys to have prior immunity if they came from malarial areas. Possible explanations for the initially higher incidence include sleeping in the open – until permanently barracked later – or earlier recruitment from non-malarious areas that later became infested and hence then conferred some immunity, e.g. canal areas of the Punjab.<sup>9</sup> An alternative interpretation might be delayed presentation – resulting in more advanced disease – or reluctance to take quinine, or that the drug was ineffective, as in the Mesopotamian campaign, when *vivax* malaria was encountered. Additionally, native troops were exempt from using mosquito nets, and enforcement of prophylaxis was not always strict.<sup>10</sup>

By the 1870s, respiratory diseases such as bronchitis and pneumonia rose to prominence in the native army, but not the European, possibly because of overcrowding, poor air quality in huts, and smoking. Pulmonary tuberculosis affected the European force in the 1860s (declining after this), and transferred to more commonly afflict and be more fatal in his native counterpart from the 1890s onwards – up to that point the Indian population had been naïve to *Mycobacterium tuberculosis* and

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<sup>7</sup> Arnold, *Colonizing*, p. 91.

<sup>8</sup> Possibly as asymptomatic carriers.

<sup>9</sup> S. Zurbrigg, *Malaria in colonial south Asia: uncoupling disease and destitution* (Abingdon: Routledge, 2020), pp. 152, 236; E. Whitcombe, 'Irrigation and railways', in D. Kumar, M. Desai, eds., *Cambridge economic history of India* (Cambridge: CUP, 1983), pp. 671-737.

<sup>10</sup> M. Harrison, 'Medicine and culture of command: malaria control in British Army during two world wars', *Medical History*, 40 (1970), pp. 437–52; Exemptions were on the grounds that nets were unpopular and that sepoys were thought to have some acquired immunity.

hence did not have the herd immunity acquired by Europeans. Analysis of the background health in the third quarter of the nineteenth century for young adult males from Britain and Ireland who constituted the pool from which European army recruits for India were drawn, shows that pulmonary tuberculosis was the predominant cause of death, and it seems likely this group contributed to spread of the disease in India. The rise of tuberculosis in the sepoy army reflected that in the civilian population of India.<sup>11</sup> Case fatality in the native soldiery was higher than in European troops, related perhaps to less adequate accommodation and hospital facilities, and playing into McKeown's notion of a compromised nutritional state.

The sepoy army in the mid-nineteenth century had the advantage of a lower overall mortality than its European counterparts, but by the century's end these rates had converged and indeed crossed over, so the native soldier had worse outcomes for respiratory diseases and malaria. This carried on to the First World War. The increase in overall mortality in native troops can be partly put down, in the latter conflict, to poorer living accommodation and nutritional insufficiencies – *vide* Zurbrigg, together with persistence of the less favourable regimental hospital system – as delineated by Sehrawat – explanations supported by the observed excess of scurvy and scabies in the sepoy force.<sup>12</sup>

The sanitary infrastructure building project of the third quarter of the nineteenth century, which, it is confirmed here, was enacted mostly upon the European army – peaking in 1875, and consuming up to a quarter of the military works budget – was concerned with living space, removal of excreta, and, to a lesser degree, provision of clean water. It had the effect of reducing the incidence of most infective diseases to the extent that, even if case fatality had stayed the same, the overall mortality rate would fall – Szreter's contention on the paramountcy of public health measures fits here.<sup>13</sup>

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<sup>11</sup> M. Harrison, M. Worboys, 'A disease of civilization', in L. Marks, M. Worboys, eds., *Migrants, minorities and health* (New York: Taylor & Francis, 2003), pp. 93-124.

<sup>12</sup> Zurbrigg, 'Famine', p. 16; Sehrawat, *Colonial*, p. 248.

<sup>13</sup> Szreter, 'Social intervention', pp. 27-8.

Analysis of the rollout of infrastructure schemes in the 1860s shows that, whereas construction of more airy barracks, and provision of washrooms, latrines and cookhouses went relatively well, inspecting medical officers regularly commented on concerns about delivery of clean water. This partly explains the incomplete decline in diseases transmitted by contaminated water, such as the dysenteries, and that epidemics of cholera persisted within the army until around 1879. Reliably clean water was only achieved after introduction of the Pasteur-Chamberland and Berkeland filters in the mid-1880s, as affirmed by Harrison and Curtin.<sup>14</sup>

Sanitary proposals made by the 1863 commission were based on anticontagionist theory. A number proved compatible with germ theory though commissioners probably overemphasized the ventilatory space requirement. They were on the mark regarding removal of excreta – although this was sub-optimal when put into practice. They recognized, though anachronistically for ‘wrong’ reasons, that hill stations might have an advantage for what turned out to be malaria, and rightly determined that moving camp on encountering an outbreak of cholera could help. However, the 1863 report rather underestimated the importance of clean water and, through non-appreciation of germ theory and of secondary vectors, completely failed to address the role of insects in the spread of disease. Some improvement in sanitary infrastructure had already commenced in the 1850s, at the initiative of the military authorities, and its benefits thus in play in the early 1860s. On ventilatory space, it is argued this proved beneficial to a reduction in air-borne respiratory infections – especially pulmonary tuberculosis, which declined in the European soldier – among whom immunity was probably building – though it increased in the sepoy, whose habitable air quality was suspect and who were recruited from rural communities in which phthisis was not yet widespread.

The claim of Indian exceptionalism – meant here to convey the observation, frequently recorded by medical officers especially in the early-to-mid part of the nineteenth century – of a more aggressive

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<sup>14</sup> Harrison, *Public health*, p. 68; Curtin, *Migration*, p. 120.

appearance of diseases, some of which already were familiar to them (others were not) – holds, partially, up to the point where better specificity of diagnosis was achieved and, possibly, presentation occurred earlier and hence in a milder form.<sup>15</sup> Early in the nineteenth century, to be presented with a severe case of diarrhoea must have been perplexing and overwhelming for a newly arrived European-trained medical officer. Any exceptionalism declined once diagnoses were clearer, through better medical education and perhaps with earlier presentation of disease, though case mix still remained different to that in Europe and North America.

The relative lack of attention given to the living and sanitary conditions of the sepoy army until later in the nineteenth century is reflected in the high admission rate for dysentery that continued to exceed European levels until the beginning of the First World War (Figure 2.32). Malaria among sepoys – deduced mostly, in the nineteenth century, from cases of intermittent fever – remained high until around 1880, whereupon it reduced progressively, though still in excess of the European value (Figure 2.43). It is unclear whether these reductions can be attributed to the introduction, albeit delayed, of sanitary infrastructure for the native army as details on this are sparse, but it seems possible. The rise in admissions due to pneumonia, bronchitis and pulmonary tuberculosis from the 1860s, has been attributed to exposure to the elements,<sup>16</sup> though overcrowding and poor air quality are also in play. However, comparison with other groups has proved informative in showing that, although the sanitary conditions of the sepoy army were inferior to those of European troops, they were superior to prisoners.<sup>17</sup> Contrasting the health of the native soldiery with that of the civilian population was not possible due to lack of reliable contemporary data for the latter.

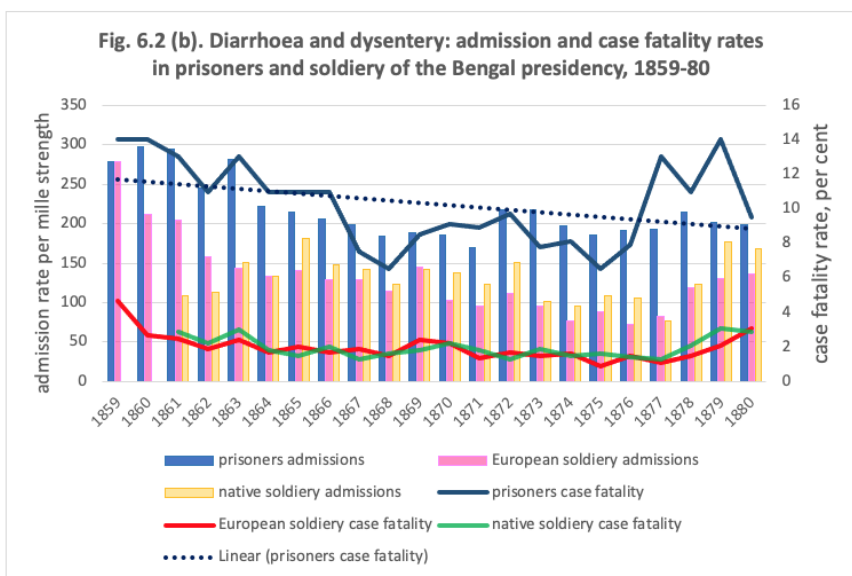
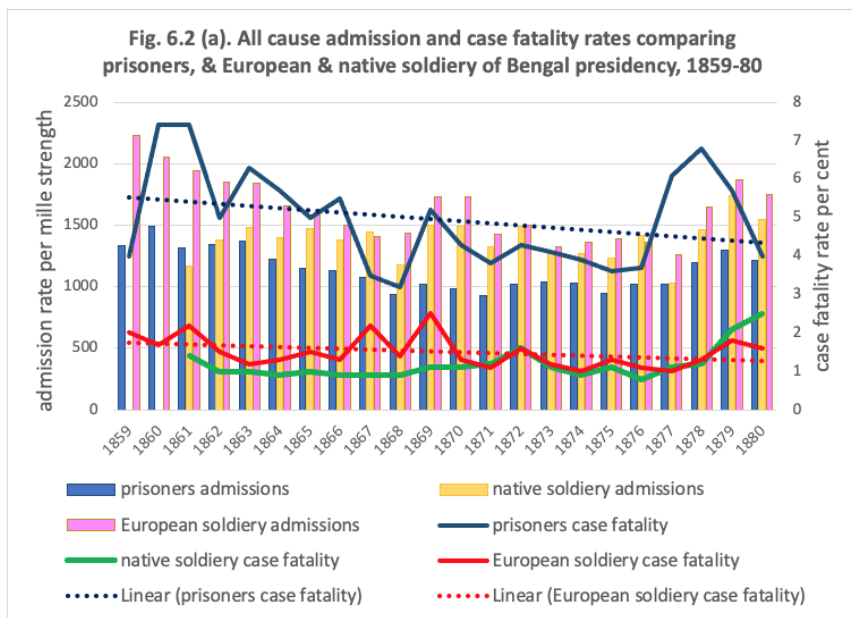
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<sup>15</sup> Morehead, 'Preface', pp. ix-x.

<sup>16</sup> Arnold, *Colonizing*, p. 93.

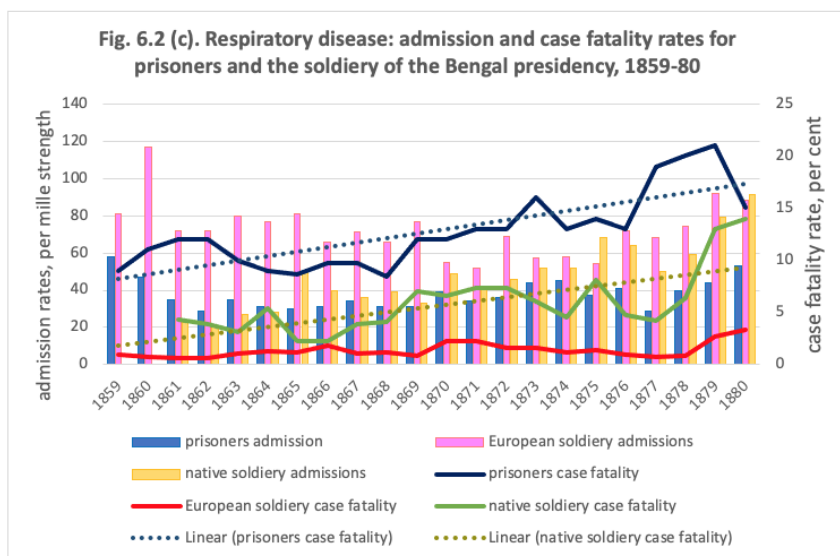
<sup>17</sup> As Ramanna points out, third-quarter nineteenth century civil sanitation was only established in Calcutta, Bombay and Ahmedabad – *Western medicine*, pp. 37, 110; Kumar is critical that this was not more widespread, castigating central government rather than the responsible agents, the municipal administrations – which were dominated by tax-paying rentier classes – *British medical*, p. 141.

Prisoners in Bengal gaols had overall case fatality rates two-to-four times higher than either soldiery, three times higher for dysentery, double those of sepoys for respiratory disease (Figure 6.2 a-c),<sup>18</sup> and higher for pulmonary tuberculosis, but not much different for cholera – reflecting the limitations of treatment for this at the time.



In addition to the declining incidence of intestinal infective diseases seen in the European army and, to a lesser extent, in the native force, improvements noted in case fatality rates for many diseases require an explanation. The approach of medical officers in India to the treatment of fevers at the

<sup>18</sup> Source data as for Fig. 2.6.



mid-point of the nineteenth century retained elements of the late eighteenth century theories of William Cullen and John Brown, interpreted in a light that regarded the Indian situation as unique – that diseases presented differently there, and hence required a modified approach. Medical topography, which encompassed elements of miasmatic theory, flourished in this environment.<sup>19</sup> The consequence was that therapies nowadays seen as inappropriate, such as venesection and the use of purgatives and diaphoretics, were then theorized as completely rational. An empiricist approach, based on the observation of responses to treatment, had been developing for a while – influenced not only by the Parisian school that emphasized correlating clinical signs with morbid anatomy but also by autopsy experience obtained by European surgeons in India – and it came to predominate clinical practice from the mid-century point. It took until the end of the century, though, for the higher echelons of British-Indian medicine to fully accept germ theory. Even then, though, purging remained a habit difficult to break. This work has shown that not all of these often seemingly ill-advised treatments were as ineffective or even as counterproductive as has been suggested, including by Guha,<sup>20</sup> and by McKeown, who denied the substantial efficacy of most treatments before sulphonamides.<sup>21</sup> Running in parallel with the rise of germ theory, the application of scientific method to the diagnostic process, notably in specificity of disease – dissecting malaria

<sup>19</sup> Martin's *Topography* is the prime example.

<sup>20</sup> Guha, *Population*, p. 119; Many historians do not consider benefits beyond quinine for malaria.

<sup>21</sup> McKeown, *Populations*, pp. 106-7, 153.

from fevers and typhoid from typhus are examples – allowed targeting of treatments to conditions in which they worked.

Improving case fatality rates in the European army suggest that either the soldier patients were better at overcoming the disease by, for example, having improved immunity through nutritional status (as McKeown would have it) – analysis here presented of recruitment data has shown some improvement in the anthropometry of recruits by the nineteenth century's three-quarter point, adding support to this conjecture – or through, late in the century and to a limited degree, immunization, or that there was agency through direct medical intervention. If one ignores any potential tapering of microorganism virulence, the present work has identified therapeutic stratagems that seem to have reduced case fatality. Aside from immunization, the modest effect of which kicked in after the late 1890s for typhoid,<sup>22</sup> and perhaps, cholera (excepting smallpox vaccination from earlier), a manoeuvre that appears to have made a difference is simply that of improved support of vital functions, that is provision of hydration, sustenance – nutrition comes in here – and comfort, as furnished by nursing care, largely uncredited by previous historians such as Arnold or Curtin.<sup>23</sup> Improvement in survival from pneumonia can be put down to this, once the negative effects of venesection have been admonished. One specific point of care relating to typhoid was the realization that death could follow bowel perforation. Later nineteenth century texts detail the need to take precautions not to precipitate this, for example, by avoidance of violent purging.

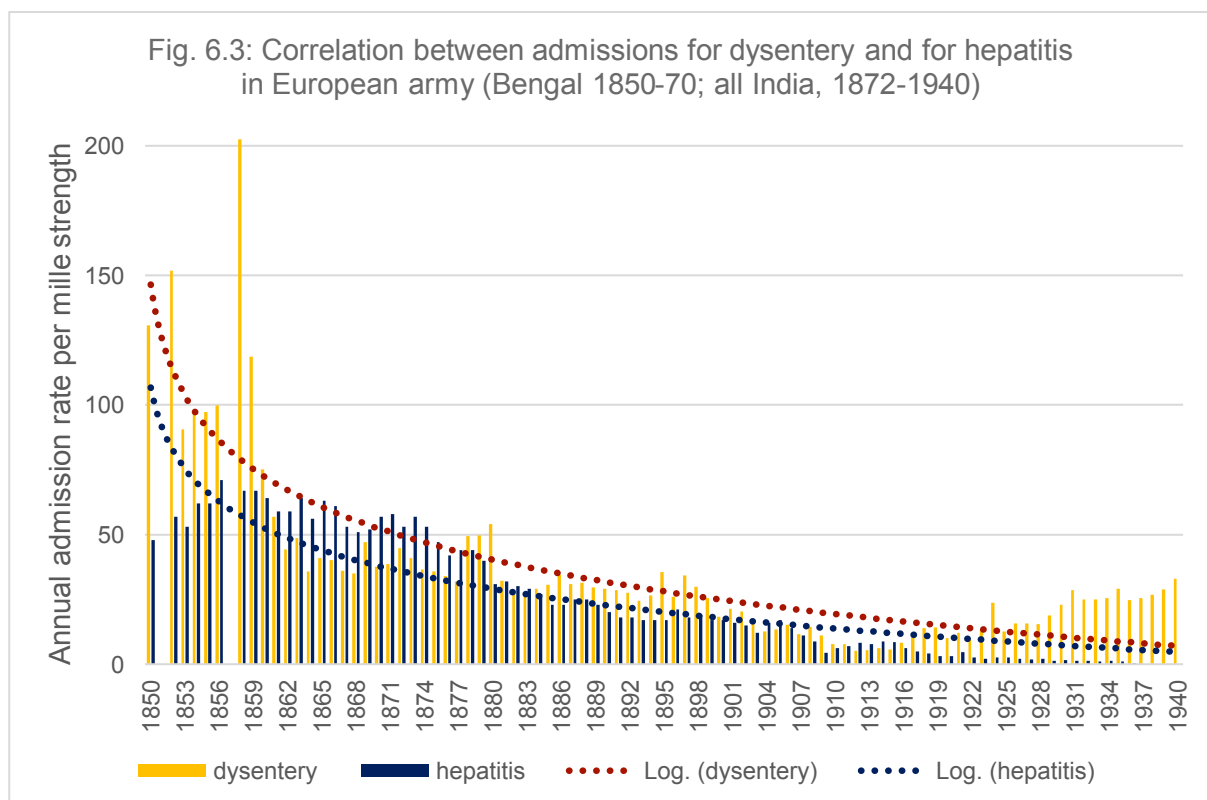
Contrary to most other diseases, case fatality for cholera seemed to worsen to a point where it approached one hundred percent by the end of the nineteenth century. This appears to have been

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<sup>22</sup> W.B. Leishman, 'Anti-typhoid inoculation', *Glasgow Medical Journal*, 6 (1912), pp. 401-10; The turn of the century anti-typhoid vaccine provided about a third reduction in risk of contracting typhoid – protection was much improved by the First World War – Biselli *et al*, 'Historical review'.

<sup>23</sup> A twenty-first century example is the positive role of nursing care for patients infected with Ebola virus, for which there is no therapeutic cure – A.M. Matlock, D. Gutierrez, G. Wallen, C. Hastings, 'Providing nursing care to Ebola patients on the national stage', *Nursing Outlook*, 63 (2015), pp. 21-4.

due to exclusion from labelling as ‘cholera’, of other diarrhoeal diseases with less morbid outcomes. Fatality only dropped, but then to near zero, on discovery of the correct tonicity for intravenous rehydration, around 1910.<sup>24</sup> Heat apoplexy, recorded most often, and without much of a drop in incidence, in the European soldier, is unique in showing a linear decline in case fatality from 1852 to 1936. This can only be due to improved treatment, that is, dispensing with venesection and purging, and instituting and refining the cold-water douche, first described in 1858. Hepatitis has proved difficult to analyze. Not only was the diagnosis in the nineteenth century purely clinical – today’s physicians rely heavily on laboratory tests – nineteenth century descriptions often seem vague, possibly referring to something other than a liver complaint. However, medical officers of the time frequently related hepatitis to dysentery, and if the incidence of the two are co-plotted for the European army, the main victim of this, there is close correlation (Figure 6.3).<sup>25</sup>



This suggests that dysentery, in the amoebic form, was the main cause of nineteenth century ‘hepatitis’ in India. Indeed, just over a half of patients with amoebic dysentery in the late twentieth

<sup>24</sup> Leonard Rogers at Calcutta Medical College found case fatality around 60 percent for civilians, 1895-1905; 75 percent in those aged over 50 – L. Rogers, *Cholera and its treatment* (London: OUP, 1911), pp. 85-7.

<sup>25</sup> Source data as for Fig. 2.6.

century were found to have liver involvement, but only a minority had hepatic abscess.<sup>26</sup>

Standardization of dosage of ipecacuanha, with its anti-amoebic qualities, for dysentery or the use of trocar drainage for hepatic abscess, in the early 1880s, might explain the fall in case fatality for hepatitis in that decade.

Though nineteenth century physicians practiced polypharmacy, they recognized relatively few drugs as ‘specifics’. Cinchona, later replaced by quinine, was used, not with universal success, for all fevers in the first part of the century, then reserved for malaria later on, once this had been differentiated from other pyrexias. Mercury was regarded as a specific for venereal disease and for liver problems. Gonorrhoea, in which it is ineffective, was only split off from syphilis by Ricord in 1840, prior to which it was thought of as an early stage of lues. Twentieth century physicians saw mercury as reducing the manifestations and infectiveness of syphilis, but often not curing it. Nineteenth century doctors believed mercury normalized bile secretion, hence its proposed effect in liver complaints, though evidence is lacking for this. Arsenical compounds do have anti-amoebic properties, hence they might suppress problems associated with *Entamoeba histolytica*.<sup>27</sup> Other nineteenth century preparations in the Indian pharmacopeia – not infrequently also in the armamentarium of traditional practitioners – with undoubted medicinal effects include opium and its derivatives for pain control and diarrhoea, taraxacum (dandelion) as a diuretic, and several laxatives – rhubarb, senna, castor oil, calomel, antimonials, and salines, though none of these stands out as having life-saving properties in an *extremis* situation. By the end of the nineteenth century, empiricist practice had established ipecacuanha as a specific for dysentery, though its use had originally commenced on account of Cullenian logic, for its effect in getting rid of retained upper gastrointestinal secretions, through induction of vomiting, and promotion of sweating.<sup>28</sup> This work

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<sup>26</sup> S. Ramachandran, R. de Saram, C.N.A. Rajapakse, S. Sivalingam, ‘Hepatic manifestations during amoebic dysentery’, *Postgraduate Medical Journal*, 49 (1973), pp. 261-4; Hepatic involvement in bacillary dysentery is uncommon.

<sup>27</sup> M.L. Gonzales, L.F. Dans, J. Sio-Aguilar, ‘Antiamoebic drugs for treating amoebic colitis’, *Cochrane Database Systematic Review* 2019, <https://dx.doi.org/10.1002%2F14651858.CD006085.pub3> [22 December 2023].

<sup>28</sup> Martin, *Influence 1861*, pp. 403-10.

has identified that ipecacuanha, through its constituent emetine, an anti-amoebic, was a likely cure for amoebic dysentery.

Other nineteenth century metal-group compounds, for example those of bismuth, arsenic, and antimony, often prescribed for fevers or gastrointestinal upsets, all show some antimicrobial effect, hence may have ameliorated infections when prescribed on grounds of other reasoning (though toxicity may have been an accompaniment). Silver nitrate, either by mouth or as an enema *per rectum*, has undeniable antimicrobial activity as well as being, like lead acetate – given by the same routes – an astringent with a cauterizing action. Thus both might have therapeutic benefit when administered judiciously for infective diarrhoeas, despite the undoubted risk of toxicity with longer-term use. Similarly, male urethral irrigations of potassium permanganate and silver nitrate in gonorrhoea, established by the end of the nineteenth century, can be expected to work. Some of the proposed benefit of orally-administered metallic compounds is supposition – it cannot be proved – and it is debatable whether it exceeds the benefit of supportive measures. The improvement in case fatality rates is irrefutable, though, and appears related to some medical intervention, thus partly repudiating one of McKeown's theorems.

Thomas McKeown's main thrust, on the centrality of nutrition to the decline in mortality – primarily a reduction in deaths from pulmonary tuberculosis – as the main reason for Europe's population spurt in the eighteenth-to-nineteenth centuries, is not directly testable in the present data. The army did not renew itself through breeding. However, factors involved in mortality decline have been analyzed and it is pertinent to look more at nutrition, or more correctly, nutritional status. Recruitment data for the European soldiery indicate that sometimes childhood nutritional status had been poor, but this does not seem to have had an impact on subsequent immunological capabilities – lack of childhood exposure to pathogens compared to sepoys was more relevant, at least to the

mid-nineteenth century.<sup>29</sup> Similarly, inadequacy of the European army's barracks diet cannot be implicated, barring excess alcohol, as nutritional deficiencies were uncommon except when in the field. Post-rebellion, more recruits to the sepoy army were from a rural background – the Bengal force, in particular, previously had been largely composed of Brahmins – meaning that poorer childhood nutrition and hence a degree of deficient nutritional status might have been in play – this potentially contributing to the apparent decline or stasis, observed here, in some of the health parameters of the native troops around the three-quarter point of the century. Additionally, native troops were noted by several medical officer observers to skimp on their diet in order to send extra money home. They more commonly suffered deficiency diseases like scurvy and beri-beri. Thus poor nutritional status with exposure – from their European counterparts – might be incriminated in their predisposition to pulmonary tuberculosis, a susceptibility even more pronounced in prisoners whose diets, though controlled, had low nutritional and calorific value, and who suffered overcrowding. Hence, for a small segment of morbidity in the population groups of nineteenth century India, McKeown's argument is valid, to be added to Zurbrigg's co-terminus of famine with malaria.<sup>30</sup>

During the entire nineteenth century, both alcohol abuse and venereal disease were major issues for the European soldiery, though not for sepoys. Neither problem responded much to the authorities' attempts at control. Lock hospitals were persevered with over much of the nineteenth century, as shown, despite minimal evidence in their favour.<sup>31</sup> Authorities had little else to offer. Some other policies were recognized at the time as counterproductive, such as the 1877 reduction in married establishment to four percent for infantry. It was changes in societal attitudes at the end of the nineteenth century that were important in bringing both alcoholism and, to probably a limited extent, venereal disease under control. The extraordinary growth of temperance societies in India

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<sup>29</sup> Manson – *Tropical 1903*, pp. 263-70

<sup>30</sup> Guha, though, sees any nutritional effect in India as small – *Population*, p. 134; Zurbrigg, 'Famine', p. 16.

<sup>31</sup> Wilson, *History*, pp. 12, 20; Wald regards the system as official misogyny – *Vice*, p. 193.

made insobriety socially unacceptable – a view underplayed by Wald.<sup>32</sup> Venereal disease it appears, mostly, was brought under control by standardizing treatments – longer courses of mercury for syphilis, and male urethral irrigation for gonorrhoea, possibly with a contribution from better avoidance education, and, perhaps, a small effect from the 1897 reintroduction of the 1889 Cantonment Act.<sup>33</sup> Venereal diseases though, flared up with the First World War, when the incidence spike applied to both European and native troops – despite effective treatments and prophylaxis being available. Lessons from this are mixed. Societal pressure on personal behaviour, including the fad of temperance societies, made drunkenness unacceptable, but did not appear sufficient by itself to limit venereal disease, for which treatment – standardized and only modestly effective – seemed in play, at least for a time, until the macabre conditions of 1914-18 showed the mass effect of personal abandonment.

Is it possible to tease out which parameter – sanitation, selection bias, personal habits, the bodily status of the soldier, immunization, medical interventions and microbial virulence – accounts for which of the epidemiological changes outlined in this thesis – *viz.* the reduced or increased incidences and mortalities, the changing disease profiles, and the falling case fatalities? The answer seems to be that multiple factors, often occurring simultaneously and hence difficult to disassociate, are involved in almost all instances. Thus, reduced overall mortality in the European army after the late 1850s is thought to be partly due to improved sanitary infrastructure, with a contribution from more robust health in the soldiery, but also is, in a smaller measure, the result of better medical attention. These interventions disproportionately reduced incidence and deaths, in the European army, from infective gastrointestinal diseases but not typhoid. The latter, for unclear reasons but perhaps the concentrating effect of disease carrier-spreaders (who may well have imported the disease from Britain), increased up until the decade spanning the turn of the nineteenth century, whereupon a combination of covering food to keep off fly vectors and, less so, immunization,

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<sup>32</sup> Wald sees European soldiery as continuing in British masculinity – *Vice*, p. 156.

<sup>33</sup> Wilson, *History*, pp. 25-6; Legislation cancelling the 1889 Cantonment Act was repealed in 1897.

controlled things. In the sepoy force, overall mortality only reduced after the 1880s, likely also as a response to infrastructural and interventional agencies. The proportions of diseases affecting native troops were modulated, first, by susceptibilities from overcrowding, suboptimal nutritional state and smoking – such that respiratory diseases, especially pulmonary tuberculosis, became more prominent – and secondly, for malaria, from late presentation, an inferior medical system, lack or presence of acquired immunity or prior exposure, dislike of quinine, suboptimal nutritional state and, earlier in the period, from sleeping in the open. Considering the relative impacts on the health of the native troops from both civilian society – into which they were more embedded than the European force – and the military environment – comprising housing, nutrition and access to medical care – their disease pattern (with exceptions such as hepatitis) greater mirrored the European soldiery than that of the general population.<sup>34</sup>

The use of comparators – especially prisoners, but also for the European troops, contemporary males of recruitable age back in the British Isles – has illustrated some effects that the army environment, both physical and service, had on health for native and European forces. For an army in the field, disruption of the regularities of life, notably in hygiene standards, medical service provision and dietary supplies, mean that most background diseases, suppressed when in barracks, boil up – as for dysentery, malaria and venereal disease – whilst some dormant ones, such as scabies and scurvy, break out when conditions like overcrowding and poor diet suit them.

Regarding the McKeown debate, this thesis gives fresh evidence that both supports and refutes. Some findings affirm connections, though limited here – most notable in the prisoner comparator – between nutritional state and disease. Others, for example, the observation of improved case fatality, counter McKeown's assertion of the futility of nineteenth century therapeutic intervention. On Headrick's view of medicine as one of the 'tools of empire', the findings too are mixed.<sup>35</sup>

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<sup>34</sup> Fevers notably were less prominent – Figure 2.17.

<sup>35</sup> Headrick, *Tools of empire*.

Sanitary engineering undoubtedly benefitted the armies and hence contributed to British power in India, but its roll-out to the general population was mostly limited to the largest cities. Touched on briefly but relevant where it might have an effect on military efficiency, the overall impact of western medicine on India's general population was limited to large-scale public health interventions such as *cordon sanitaire*, organization of dispensaries, specific projects such as the Dufferin initiative, and mass vaccination schemes especially for smallpox.<sup>36</sup> The actual influence of effective western prescribed therapeutics to the general population was very restricted in the nineteenth century, being virtually limited to the availability of quinine – though distribution of febrifuges did become quite widespread after 1920. Hence, outside of the military sphere – there was an apparent effect on the armies – the influence of medicine as a tool of empire was considerably hampered by its ineffectiveness for civilians whatever the intention.

Areas for future research suggested by this thesis include detailing the roll-out of permanent barracks for the sepoy army, cataloguing the introduction of nursing to hospitals and improving definition on food handling in the latter nineteenth century. More work is needed on homosexuality and men who have sex with men – a topic avoided by Wald and only briefly covered by other writers on prostitution and venereal disease,<sup>37</sup> on the functioning of lock hospitals, and on the extent to which medical treatments were standardized throughout India.

In summary, this thesis contributes to the wider historiography on the armies in British India, and public health generally throughout the subcontinent, at a number of levels. This work confirms that the fall in diarrhoeal diseases was a response to better sanitary infrastructure, with a contribution

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<sup>36</sup> Additionally, though limited, there were drainage schemes around canals, some village-based sanitary education, and anti-malarial initiatives from the 1920s – promoted by anti-malarial cooperatives.

<sup>37</sup> Wald, in *Vice*, makes no mention of this; Peers indicates that prosecutions for homosexuality were held in closed court and rulings rarely circulated ('Soldiers, surgeons', p. 147); Levine regards male prostitutes in Colombo as then representing 'the unwholesomeness of the colonized world', and sees regulated female prostitution by authorities as a means to restrain 'homosexual connection[s]', though she does not offer detail of male-to-male sexuality within the soldiery – *Prostitution*, pp. 292-3.

from an improved robustness of recruits, and finds that installation of effective sanitation began before the 1860s reforms. Coinciding with decline in the fluxes, typhoid surged – the reasons are unclear but the importation from Britain of carrier-spreaders and their concentrating effect is one speculation. The sepoy army was disadvantaged compared to the European by delayed infrastructure reform with overcrowded accommodation, poorer medical facilities, questionable nutritional status (especially in the post-1857 rural martial race recruits) and poor diet, with consequent predisposition to respiratory disease, pulmonary tuberculosis – partially affirming the McKeown proposition – and poorer outcomes for malaria. Case fatality rates for several diseases indicate a positive response to medical intervention, principally a benefit from supportive care, nursing and, in typhoid, avoidance of intestinal perforation. Though few drugs were curative, the main exception being cinchona, and perhaps mercury which tempered syphilis, others previously unrecognized might have had genuine effect. Revealed here, ipecacuanha seemed effective for amoebic dysentery, silver nitrate and lead acetate enemas cauterized bleeding bowel in diarrhoeal disorders, and some metal-group compounds may have had an antimicrobial effect. Whereas sanitation projects truncated the frequency of intestinal infections, legislation failed to control venereal disease, and lifestyle manipulation was unable to moderate alcohol consumption significantly. Societal mores in the form of the temperance movements for alcoholism, coupled with, for venereal disease, standardization of medication and education, prove more compelling explanations. The story of disease reduction in the soldiery of nineteenth-to-twentieth century India thus intercalates positive effects from public health, the bodily status of the soldier, sociological conformity and therapeutics, in varying degrees, throughout the ninety years of the study.

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