

Management and outcomes of acute hand and wrist infections in low- and middle-income countries

a systematic review and meta-analysis

From Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK

Correspondence should be sent to A. V. Shaw abigail.shaw@ndorms.ox.ac.uk

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A. V. Shaw,^{1,2} A. Saha,³ K. Daneshi,^{4,5} M. I. Andersson,^{6,7} S. M. Graham,^{1,8} D. J. Beard,^{2,9} J. C. R. Wormald^{1,2}

¹Oxford Trauma and Emergency Care, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK

²Surgical Intervention Trials Unit, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK

³Medical Sciences Division, University of Oxford, Oxford, UK

⁴School of Population Health and Medicine, University of Sheffield, Sheffield, UK

⁵Department of Bioengineering, Imperial College London, London, UK

⁶Nuffield Division of Clinical Laboratory Science, Radcliffe Department of Medicine, University of Oxford, Oxford, UK

⁷Department of Microbiology, Oxford University Hospitals NHS Foundation Trust, Oxford, UK

⁸Department of Orthopaedic Surgery, Liverpool University Hospitals NHS Foundation Trust, Liverpool, UK

⁹NHMRC Clinical Trials Centre, Faculty Medicine & Health, University of Sydney, Sydney, Australia

Aims

Acute hand and wrist infections can be devastating, with a substantial burden in low- and middle-income countries (LMICs) compared with high-income countries. Access to treatment, particularly surgery, can be limited. This study aimed to determine the management and outcomes of hand and wrist infections in LMICs.

Methods

A PRISMA-compliant systematic review and meta-analysis was conducted (Prospective Register of Systematic Reviews (PROSPERO) CRD420250631145) within MEDLINE, EMBASE, Global Health, Global Index Medicus, Cochrane Central Register of Controlled Trials (CENTRAL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Web of Science from database inception to December 2024. Studies of acute bacterial hand and wrist infections managed in LMICs, reporting at least one outcome, were included. Primary outcomes were risk of amputation and mortality.

Results

Of 18,208 abstracts screened, 39 full-text studies with 4,130 patients were included. These were mostly retrospective case series, from Africa and Asia. Mean age was 45.0 years (SD 9.3), with a male preponderance (63.3%, n = 1,804). Over half of studies (n = 22) focused on diabetic hand and wrist infections. Deep space infections were the most common infection. Mean delay to presentation was 11.8 days (SD 6.1) and surgery was required for source control in 89.4% of patients (n = 3,693). Mean length of stay for admitted patients was 12.2 days (SD 14.1). Meta-analysis demonstrated a 26.1% (95% CI 16.8 to 36.4) risk of amputation (31 studies), rising to 32.7% (95% CI 21.3 to 45.0) in studies of diabetic patients. Mortality risk was 2.8% (95% CI 1.0 to 5.3; 18 studies). Functional and socioeconomic outcomes were rarely reported. Risk of bias was assessed as moderate or high in 85% of studies (n = 33).

Conclusion

Hand and wrist infections in LMICs often present late and have high rates of amputation and death, particularly among diabetic patients. Future research is needed to mitigate delayed presentation and develop interventions focused on saving life and limb.

Take home message

- Patients with hand and wrist infections in low- and middle-income countries often present late, facing a one in four risk of amputation and one in 36 risk of death. In diabetic patients, amputation risk rises to one in three.
- Urgent health system interventions are needed to reduce preventable morbidity and mortality, particularly through improved diabetic care.
- Future research should include longitudinal data on functional and socioeconomic outcomes.

Introduction

Hand and wrist infections comprise a spectrum of conditions, from paronychia, felons, and pyogenic flexor tenosynovitis, to septic arthritis, osteomyelitis, and necrotizing fasciitis.¹ The hand and wrist are particularly susceptible to infection due to constant exposure to the environment through activities of daily living, occupation, and recreation.² Due to the intricate, compartmentalized anatomy, infections often have distinct patterns of clinical presentation and progression.³ Hand and wrist infections can lead to functional complications such as stiffness and loss of grip strength, and result in soft-tissue and bone loss, which may require reconstruction or, in the worst cases, amputation.⁴ The resulting disability can significantly affect daily life, ability to self-care, and capacity to earn a living.³ Less commonly, these infections are the source of systemic sepsis, which can progress to multi-organ failure and death.⁴

Hand and wrist infections are a common presentation to emergency departments in high-income countries (HICs).⁵ Although data are limited, the burden in low- and middle-income countries (LMICs) is likely to be even greater. This is attributed to an increased risk of hand and wrist injuries driven by a higher number of manual workers, inadequate provision of injury care, and a greater prevalence of diabetes and HIV.⁶⁻¹⁰ The economic impact of these infections is also likely to be substantial in LMICs, where lack of universal health coverage can lead to catastrophic health expenditure for affected households.¹¹ Additionally, there is a higher proportion of workers in the informal economy where social support is lacking.^{6,12}

In HICs, management of hand and wrist infections involves a combination of systemic antibiotics and surgery.¹³ However, access to both is limited in LMICs. Diagnostic services are often inadequate, antibiotic use may be inappropriate, and access to second- and third-line antibiotics is poor.¹⁴ This contributes to the disproportionate burden of antimicrobial resistance in LMICs.¹⁵ Nine in ten people in LMICs lack access to basic surgical care.¹⁶ Hand surgery capacity remains largely unknown, with sporadic availability, mainly confined to major centres, and limited specialist skills in rural areas.^{17,18}

A comprehensive understanding of the current management and outcomes of hand and wrist infections in LMICs is essential in order to inform and optimize

treatment strategies. This systematic review aimed to evaluate and synthesize the existing evidence on the presentation, management, and outcomes of this complex pathology in LMIC settings.

Methods

This systematic review and meta-analysis has been conducted according to the Cochrane Handbook for Systematic Reviews of Interventions guidance and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.^{19,20} The protocol was prospectively registered on the Prospective Register of Systematic Reviews (PROSPERO) database (CRD420250631145).

Search strategy and information sources

Relevant search terms were used to create text-word and medical subject headings (MeSH) term search strategies (Supplementary Material), which were applied to the following databases from inception to 3 December 2024: MEDLINE, EMBASE, Global Health, Cochrane Central Register of Controlled Trials (CENTRAL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, and Global Index Medicus. A manual search of grey literature and reference lists of included articles was performed for further relevant publications. No date restrictions or language limits were applied. Google Translate (Google, USA) was used for non-English articles.

Eligibility criteria

Inclusion and exclusion criteria were determined according to the Population, Intervention, Comparator, Outcome (PICO) framework (Table I). If studies included $\geq 80\%$ eligible patients and data could not be extracted, authors were contacted to request the data. Studies were excluded if no response was received.

Selection process

Citations were imported into Rayyan software (Rayyan, USA).²³ After deduplication, three reviewers (AVS, AS, KD) independently screened titles and abstracts, in duplicate, against a prespecified screening guideline (Supplementary Material). Full-text articles were retrieved to determine final inclusion. Disagreements were resolved via discussion or referred to the senior author (JCRW).

Risk of bias

Risk of bias was assessed at the study level, in duplicate. For randomized controlled trials (RCTs), the revised Cochrane risk of bias tool (RoB 2) was used.²⁴ For non-randomized study designs, the National Institutes of Health (NIH) National Heart, Lung and Blood Institute quality assessment tools were employed for respective study designs.²⁵ For consistency across tools, ratings were converted into low, moderate, and high risk of bias.

Table 1. Eligibility criteria.

Population: patients of any age diagnosed with acute bacterial hand and/ or wrist infections*
Intervention/Comparator: undergoing management (medical, surgical, or rehabilitation interventions) in a low- or middle-income country, according to the World Bank ²¹
Outcome: reporting at least one type of outcome, including clinician-reported, patient-reported, health-economic, and adverse outcomes
Inclusion criteria
<ul style="list-style-type: none"> • Full-text publication of an experimental or observational primary clinical study
Exclusion criteria
<ul style="list-style-type: none"> • Studies of viral and fungal infections† • Studies of surgical site infections • Conference abstracts, trial registrations, opinion pieces, systematic or scoping reviews, meta-analyses • Case series of fewer than five patients‡ • Anatomical, epidemiological, cadaveric, laboratory, or animal studies

*Acute infection was defined as having a duration of less than six weeks.¹

†Viral and fungal infections were excluded, as these are rarely managed with surgical intervention.^{1,22}

‡Case series with fewer than five patients were excluded, as many single case reports or small case series of patients with rare microbiology exist in the literature.

Data extraction and statistical analysis

Three reviewers independently extracted data into Microsoft Excel and accuracy was cross-checked. The unit of analysis was the patient, rather than the digit, hand, or wrist.²⁶ Summary estimates of data were extracted. Where applicable, data for eligible patients were extracted if raw data were available.

Descriptive analysis was performed to summarize study characteristics. For continuous variables, study-level means and sample sizes were extracted to calculate pooled means and SDs when data appeared normally distributed. For variables with skewed distributions, or where normality could not be assumed, medians and IQRs were reported.

Meta-analysis of proportions was performed to calculate pooled risks of amputation and mortality across study populations.²⁷ Analyses were conducted in R version 4.4.2 (31 October 2024; R Foundation for Statistical Computing, Austria), using the 'meta' (version 8.1.0) and 'metfor' (4.8.0) packages. A random-effects model was applied, using the restricted maximum-likelihood estimator and inverse-variance method for weighting. Pooled statistics were weighted according to size of individual study populations.

Studies were divided into those exclusively involving diabetic patients and those reporting a general cohort, in which a proportion had diabetes. Sub-group analysis was conducted using study-level variables in a mixed-effects meta-regression model, with double arcsine transformation to stabilize variance. Statistical heterogeneity was assessed using the chi-squared test ($p < 0.10$ indicating statistical significance) and I^2 statistic.²⁸

Results

Database searches identified 18,208 studies. Following deduplication, 13,069 results were screened (Figure 1). A total of 87 full-text articles were reviewed, resulting in 25 eligible studies. Three papers could not be retrieved, despite library requests (Supplementary Material). Reference lists of included studies revealed eight studies, and six further studies were identified from grey literature and Google Scholar. Therefore, a total of 39 studies were included.

Study characteristics

The 39 included studies had a median of 39 patients (IQR 21 to 87) per study. They were published between 1966 and 2024, and undertaken within Africa (19 studies, 49%), Asia (17, 43%), and North America (three, 8%) (Figure 2). Country of origin was classified by income according to the World Bank;²¹ 21 (54%) studies were from upper middle-income countries, 15 (38%) from lower middle-income countries, and three (8%) were from low-income countries. Most studies were retrospective (23, 59%) and case series (28, 72%) (Supplementary Table i). Median study duration was 26 months (IQR 12 to 58) (38 studies).

Patient characteristics

There were 4,130 patients with hand and wrist infections, with a pooled mean age of 45.0 years (SD 9.3) (31 studies). The male:female ratio was 1.7:1 (38 studies). Over half were manual workers ($n = 606$, 52.2%) (13 studies). Between 9.6% and 60.0% of patients were current smokers (seven studies). Four studies from South Africa reported HIV prevalence between 24.2% and 43.6%.²⁹⁻³² CD4 count was reported in two studies, and viral load and antiretroviral treatment in one.^{30,31}

Studies including solely diabetic hand infections (22 studies, 56.4%) involved 878 patients. Five further studies reported between 9.2% and 34.5% of patients having diabetes. Nine studies evaluated diabetes type; 69 (15.4%) patients had type I and 380 (84.6%) had type II. Pooled mean duration of diabetes at presentation was 7.9 years (SD 2.3) (16 studies) and mean Haemoglobin A1c (HbA1c) was 88.5 mmol/mol (SD 8.3) (10.2% (2.9%)) (eight studies). Ten studies reported patients receiving new diabetes diagnoses at presentation for infection; this occurred in 12 patients (33.3%) in one study from Pakistan.³³

Infection presentation

Pooled mean time to presentation was 11.8 days (SD 6.1) (17 studies). Aetiology of infection was predominantly trauma ($n = 1,208$, 69.1%), followed by spontaneous or unknown cause ($n = 499$, 28.6%) (30 studies) (Supplementary Table

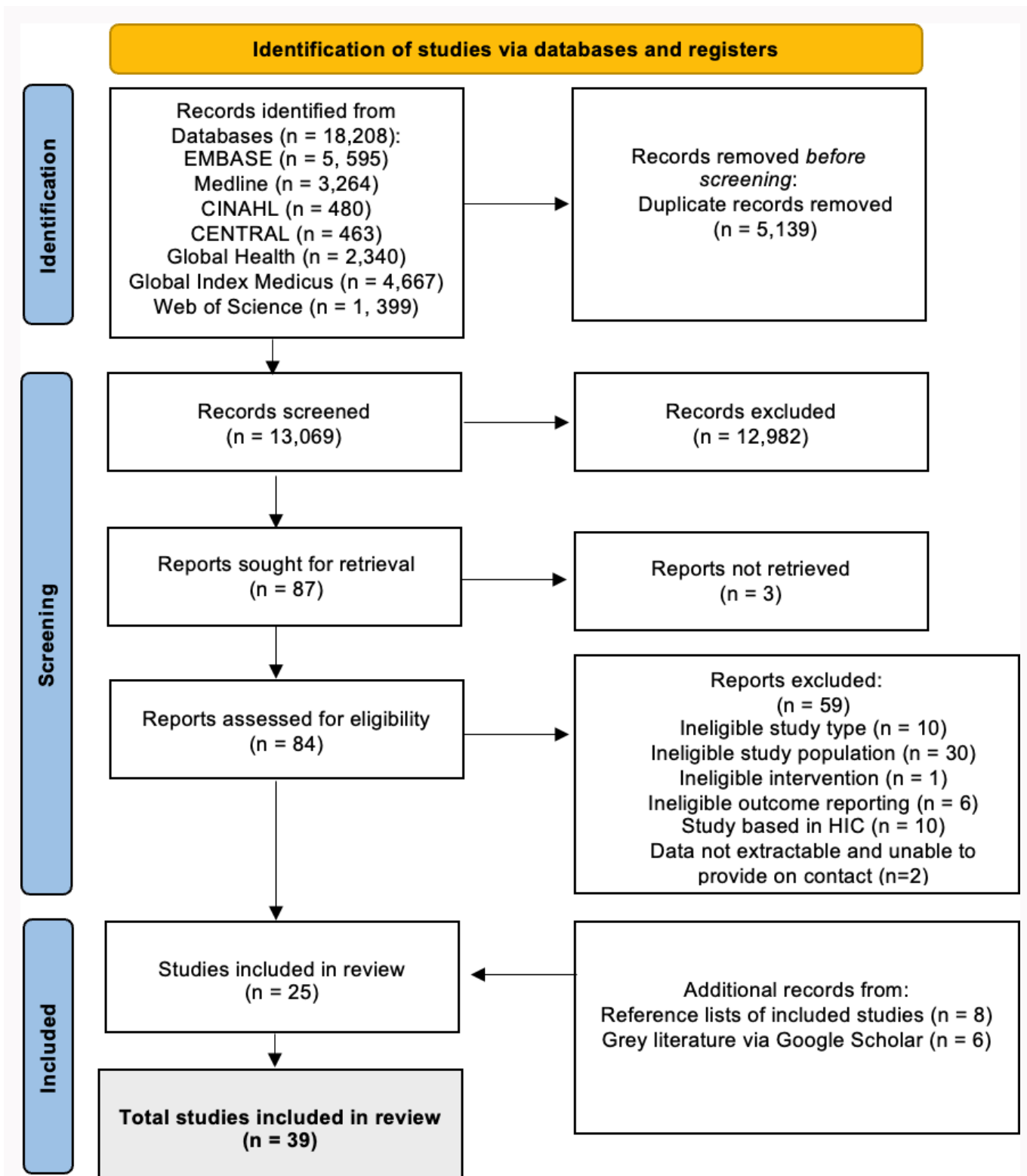


Fig. 1 PRISMA flowchart. CENTRAL, Cochrane Central Register of Controlled Trials; CINAHL, Cumulative Index to Nursing and Allied Health Literature.

ii). Three studies of cutaneous anthrax hand infections were due to contact with infected animals or animal products (n = 39, 2.2%).³⁴⁻³⁶ Over one-quarter of patients had deep space infections, including flexor tenosynovitis (n = 635, 25.3%) (30 studies) (Table II). Felon (489, 19.5%), abscess (406, 16.2%), and paronychia (325, 12.9%) were the next most common presentations.

Microbiology

Microorganisms identified in cultures were quantified in 28 studies (Supplementary Table iii). Most bacteria identified were Gram-positive (2,271, 90.6%), predominantly *Staphylococcus spp.* (2,076, 91.4%) and *Streptococcus spp.* (137, 6.0%). *Staphylococcus aureus* (1,924, 91.2%) and methicillin-resistant *S. aureus* (87, 4.1%) were the most common individual



Fig. 2
World map showing number of studies originating from each country.

Table II. Type of infection (30 studies).

Type of infection	Subtype of infection	Number of patients (%)
Deep space infection		635 (25.3)
	Web space	255 (10.2)
	Flexor tenosynovitis	118 (4.7)
	Mid palmar	32 (1.3)
	Thenar	13 (0.5)
	Hypothenar	1 (0.0)
	Parona's space	1 (0.0)
Felon		489 (19.5)
Abscess		406 (16.2)
	Superficial	171 (6.8)
	Deep	117 (4.7)
Paronychia		325 (12.9)
Cellulitis		218 (8.5)
Gangrene		105 (4.2)
Osteomyelitis		104 (4.1)
Infected ulcer		80 (3.2)
Necrotizing fasciitis		62 (2.5)
Cutaneous anthrax		39 (1.6)
Necrosis		26 (1.0)
Septic arthritis		19 (0.8)
Gas gangrene		4 (0.2)

organisms. Among Gram-negative bacteria (236, 9.4%), *Klebsiella spp.* (67; 40.4%) and *Escherichia spp.* (29; 17.5%) predominated. *E. coli* (29; 32.6%) and *Klebsiella pneumoniae* (19; 21.3%) were the most frequent individual Gram-negative organisms.

Management

Overall, 3,693 patients (89.4%) required surgery. Antibiotics were administered intravenously initially in 13 studies, orally in one study, and route determined by clinical presentation in six (20 studies). One study (Tanzania, 1992) reported irregularity in supply of antibiotics.³⁷ Another study (South Africa, 1966) used antibiotics in only 23% of patients for deep or spreading infections and immunocompromised hosts.³⁸

All patients were admitted to hospital in 24 studies, and there was a combination of inpatient and outpatient management in six. Pooled mean length of stay was 12.2 days (SD 14.1) (12 studies). Hand therapy for early mobilization was reported in 14 studies. Rest or immobilization initially post-surgery was reported in three.^{32,38,39} Otherwise, no postoperative hand movement restrictions were documented.

Outcomes and meta-analysis

Median follow-up was 4.5 months (IQR 1.5 to 7.0) (ten studies). Amputation was the most consistently reported outcome (31 studies), required in 339 patients. Summary risk of amputation was 26.1% (95% CI 16.8 to 36.4). Substantial heterogeneity was indicated by a high I^2 statistic (95.7%). Minor amputation was needed in 161 patients (partial or complete amputation of one or more digit), while 42 required major amputations (23 ray, 11 at the wrist, five forearm, and three above-elbow) (22 studies). Only two studies specified whether amputation involved the thumb; in one study, 22 of 36 patients required thumb amputation.^{33,40}

Table III. Comparison of studies of diabetic patients with a general cohort of patients with hand and wrist infections.

Variable	Studies of diabetic patients with hand and wrist infections	Studies of a general cohort of patients with hand and wrist infections
Number of studies	22	17
Total number of patients in studies	878	3,252
Patients with diabetes in each study, %	100	0 to 34.5
Weighted mean age of patients, yrs (SD)	51.8 (4.4) (20 studies)	37.5 (7.5) (11 studies)
Weighted mean time to presentation, days (SD)	12.9 (5.8) (13 studies)	8.4 (5.8) (4 studies)
Aetiology of infection, n (%)	Trauma: 375 (57.3) Spontaneous: 278 (42.5) Secondary to VTE: 1 (0.2) (17 studies)	Trauma: 833 (76.2) Spontaneous: 221 (20.2) Contact with infected animals: 39 (3.6) (13 studies)
Patients requiring surgery, n (%)	713 (81.2)	2,980 (91.6)
Amputation risk	32.7% (95% CI 21.3 to 45.0) (22 studies; $I^2 = 91.3\%$) 135 major, 52 minor, 72 unspecified	13.0% (95% CI 2.8 to 28.1) (9 studies; $I^2 = 92.7\%$) 7 major, 9 minor, 67 unspecified
Mortality risk	3.3% (95% CI 1.2 to 6.3) (15 studies; $I^2 = 66.9\%$) 33 deaths (15 studies)	1.0% (95% CI 0.0 to 6.1) (3 studies; $I^2 = 0\%$)* 3 deaths (1 of these patients had diabetes)

*The meta-analysis yielded an I^2 of 0%. However, as only three studies were included, heterogeneity tests have limited statistical power. Therefore, the lack of detectable heterogeneity should not be interpreted as evidence of true homogeneity within this model. VTE, venous thromboembolism.

Mortality was reported in 18 studies, with 36 deaths. One study reported surviving patients only.⁴¹ Summary risk of mortality was 2.8% (95% CI 1.0 to 5.3). I^2 statistic was again high at 64.4%. Cause of death was reported in 23 patients; sepsis (n = 13), postoperative cardiac complication (n = 1), end-stage renal impairment (n = 5), heart failure (n = 1), or other comorbidity (n = 1). Two further patients died during the study period from diabetic foot complications.^{40,42}

Fewer than one-third of studies reported hand function (Supplementary Table iv); only two included objective measurement,^{43,44} and one used a patient-reported outcome measure (PROM).⁴⁰ In a South African study of 42 flexor sheath infections, nearly half had less than 45% active range of motion and over 2 cm tip-to-palm distance at a mean of eight weeks.⁴⁴ A Mexican study of 55 diabetic hand infections performed clinical measurements, but did not report numerical values, only 'altered range of motion' (36.3% patients), 'loss of strength' (34.5%), and 'dysesthesias' (14.5%).⁴³ Median Disabilities of the Arm, Shoulder and Hand questionnaire (DASH)⁴⁵ at six months in Kenyan patients with diabetic hand infections was 37 (range 17 to 95).⁴⁰ To our knowledge, normative values have not been published for DASH in LMICs, but a mean 10.1 has been reported in the USA.⁴⁶

Three studies reported treatment costs,^{32,40,47} and two reported return to work.^{38,48} The average treatment cost per patient in these African studies from 2012 and 2013 was \$250 to \$1,934.^{32,40,47} Mean return to work in a South African study (1966) was 10.5 shifts,³⁸ and only four patients (19.0%) in a

study of diabetic hand infections (Nigeria, 2019) returned to their premorbid occupations by three months.⁴⁸

Diabetic hand and wrist infection

Comparison was made between studies of solely patients with diabetic hand and wrist infections (n = 22) and a general cohort, which was composed of between 0% and 34.5% patients with diabetes (n = 17) (Table III). The diabetic studies had a higher mean age (51.8 vs 37.5 years) and presented later for treatment (12.9 vs 8.4 days). Infection aetiology was predominantly trauma in both groups (57.3% vs 76.2%), although there was a higher proportion of spontaneous infections in the diabetes group (42.5% vs 20.2%). The proportion of patients requiring surgery was slightly higher in the general cohort (91.6% vs 81.2%).

Sub-group analysis showed risk of amputation in the diabetic population was 32.7% (95% CI 21.3 to 45.0) compared with 13.0% (95% CI 2.8 to 28.1) in the general cohort (Figure 3). Meta-regression showed that the presence of diabetes explained a significant proportion of the between-study variability (QM(1) = 4.4, p-value = 0.036). There was also a trend towards a higher risk of mortality in the diabetic population (3.3% (95% CI 1.2 to 6.3) vs 1.0% (95% CI 0.0 to 6.1)), but this was not statistically significant (QM(df = 1) = 1.15, p-value = 0.283) (Figure 4). Although all deaths occurred during study periods, not all were directly related to hand and wrist infections; e.g. separate episode of diabetic foot infection. Only two deaths were in non-diabetic patients,

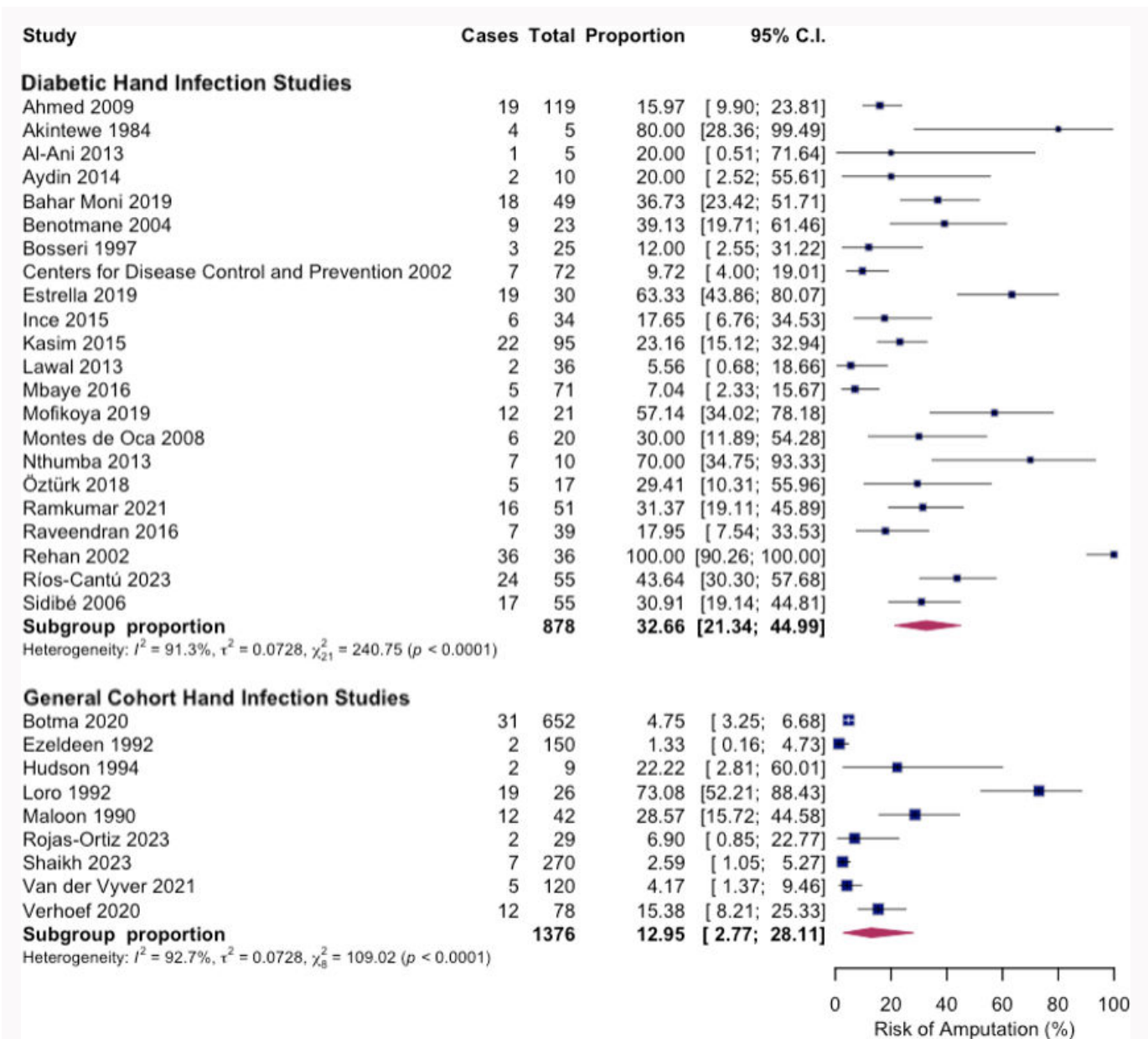


Fig. 3 Forest plot showing amputation risk, with sub-group analysis of studies of diabetic hand and wrist infections compared with studies containing a general patient cohort.

however mortality was reported in just three general cohort studies.

Risk of bias

The majority of studies were at moderate (23, 59%) or high risk (10, 26%) of bias (Supplementary Table v). Case series were frequently limited by invalid or unreliable outcome measures and unclear reporting. Cohort studies had similar problems with outcomes and often lacked sample size calculations, blinding, or adjustment for confounders.

Discussion

This systematic review and meta-analysis summarizes existing evidence for management and outcomes of hand and wrist infections in LMICs. As expected, most studies were from upper middle-income countries, followed by lower

middle-income countries, then low-income countries. Similar to a bibliometric analysis of global surgery research, studies were predominantly from Africa and Asia, where the highest concentration of LMICs are located.⁴⁹ None were from South America or Eastern Europe.

Patient demographic characteristics were similar to hand and wrist infections in HICs (predominantly male, with a mean age of 45.0 years).⁵⁰ There was some geographical variation: studies with a higher proportion of females were clustered in North-Eastern Africa, and males in China and India (Figure 5). This may be due to a higher contribution to manual labour in domestic and small-scale agriculture settings by females in African communities, compared with Asia.^{42,48,51}

Epidemiological data on hand and wrist infection in LMICs are limited, while available data from HICs are often disaggregated single infection types.⁵⁰ Existing reviews from

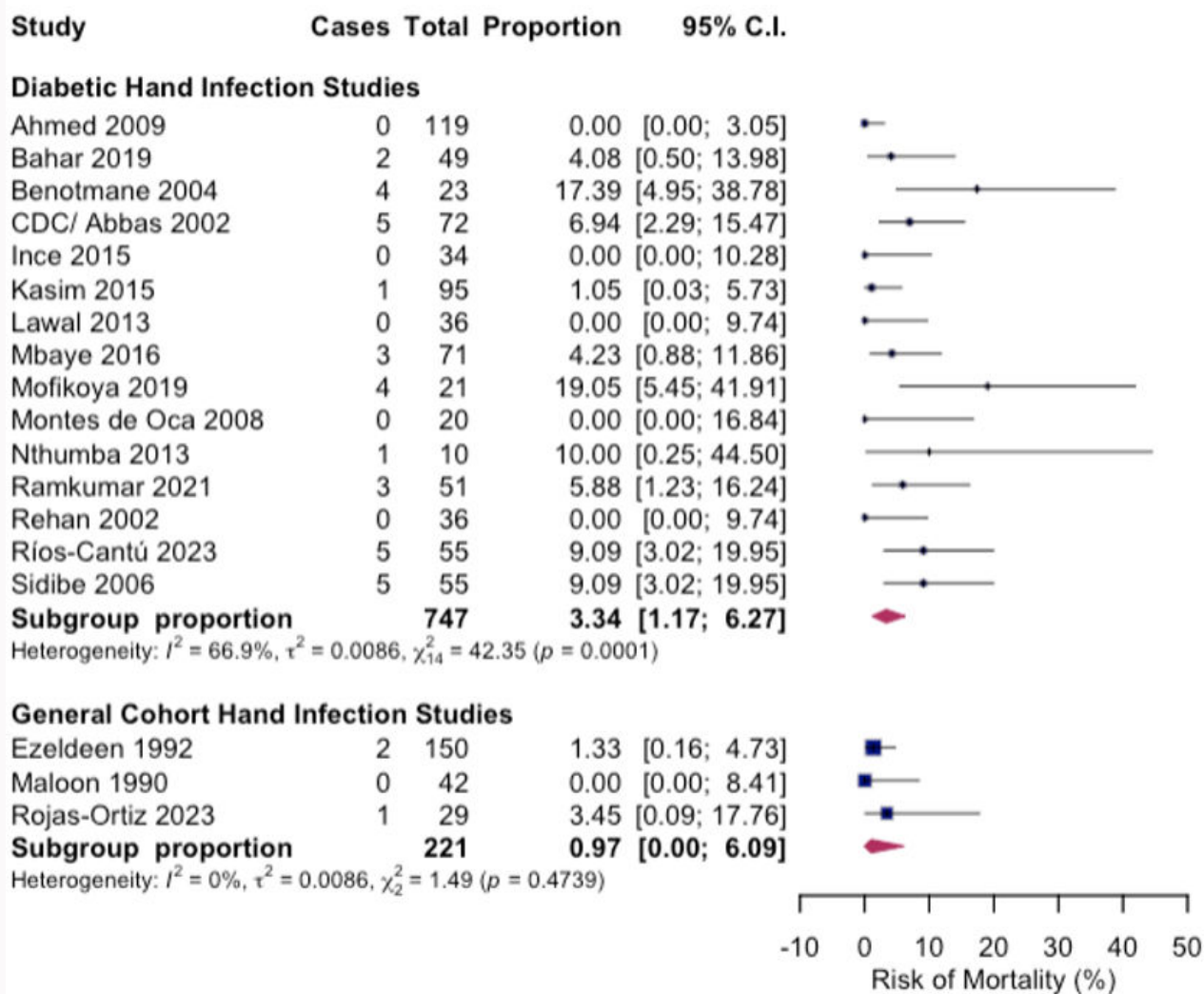


Fig. 4 Forest plot showing mortality risk, with sub-group analysis of studies of diabetic hand and wrist infections compared with studies containing a general patient cohort.

HICs have typically addressed specific conditions, such as pyogenic flexor tenosynovitis and necrotizing fasciitis.^{52,53} In future work, we aim to conduct a comparable analysis of amputation and mortality risk associated with hand infections from HICs to facilitate direct comparison.

Hand infections are estimated to be within skin, nail fold, fingertip pulp, or subcutaneous tissues in 70% to 85%, with paronychia the most common hand infection worldwide.^{1,54} This is mirrored in our review, where paronychia and felons were among the top presentations. Deep space infections typically accounted for 5% to 15% of cases, comprising 25.3% in this review, possibly reflecting higher rates in LMICs or reporting bias.⁵⁵ Delayed presentation, limited access to care, and socioeconomic constraints may contribute to greater severity at presentation.²⁹ The high surgical management rate (89.4%) further suggests selection bias; most included studies were from academic surgical centres, and likely under-report community-managed cases or those lacking access to surgery.¹⁶ For comparison, a large

HIC study reported a 46.6% operative rate.⁵⁶ Definitions of surgical management also vary: at least one study included minor procedures in clinic.³¹

Mean delay to presentation was 11.8 days (SD 6.1). Comparatively, one HIC study reported a mean of under five days for most infection aetiologies, with only intravenous drug misuse approaching nine days, and another reported a mean of seven days.^{57,58} A one-day delay in presentation increased hospital stay by 1.22 days and risk of surgery by 13.59%.⁵⁷ We identified no studies investigating causes of delayed presentation of hand and wrist infections in LMICs. Contributing factors may include insidious disease onset and limited recognition of severity by both patients and clinicians.⁵⁹

A Delphi study of barriers to trauma care in LMICs suggested the most significant obstacles within Delay 2 (reaching care): communication, transport, and distance, and Delay 3 (receiving appropriate care): staff and physical resources.⁶⁰ Our analysis highlights substantial delays in management of hand and wrist infections and suggests an

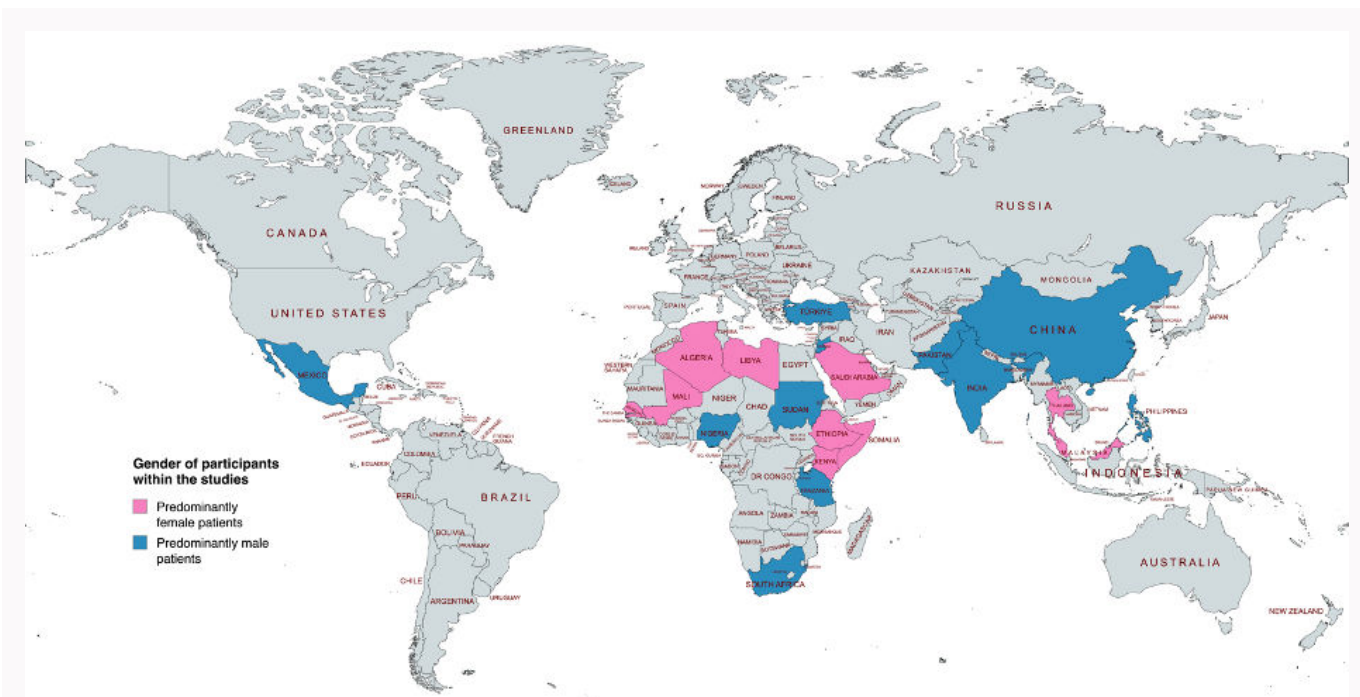


Fig. 5 World map showing predominant sex of participants in studies originating from different countries.

analysis of the causes, using the ‘Three Delays’ framework, and targeted interventions to address them is sorely needed.⁶¹ Potential interventions include educating community health workers to recognize and refer hand infections (Delay 1), decentralizing basic assessment and treatment to local facilities (Delay 2), and establishing clear pathways for timely referral to specialized surgical care (Delay 3). Randomized studies are likely most feasible for Delay 3, as these involve hospital-based interventions.

Overall mortality risk was 2.8%. In HICs, death from hand and wrist infections is rare and often not specifically reported in studies, typically only occurring in severe cases like necrotizing fasciitis, which has an 8% mortality rate in the hand.^{50,53,56,62} All 13 deaths from sepsis were in diabetic patients.^{42,48,63–65} Two of these were also noted to have renal failure.⁶⁵

Four studies reported HIV status, although two did not include HIV-specific outcomes.^{29–32} One retrospective study reported that HIV increased the risk of developing a hand infection, but did not show an increased risk of reoperation or amputation.³⁰ Another did not show that HIV increased the risk of early complications.³¹ However, both of these studies were likely underpowered. An adequately powered study is required to determine the effect of HIV on hand and wrist infection outcomes.

Diabetes increases susceptibility to hand infections due to poor vascularity, neuropathy, and impaired cellular immunity.⁴⁸ Unlike diabetic foot infections, there is limited focus on diabetic hand infections.⁶⁶ Up to 12% of inpatients with hand infections have diabetes, broadly aligning with the background population; globally, one in nine adults have diabetes.^{42,67} Over half of included studies focused on diabetic hand infections, reflecting the fact that 80% of people with diabetes live in LMICs.⁹ Tropical diabetic hand syndrome is

a poorly defined entity, but usually describes progressive, fulminant hand sepsis in diabetic patients, predominantly in Africa and India.⁶⁸

Fewer diabetic hand infections may occur in HICs due to better glycaemic control and patient education.⁶⁹ Even in these settings, diabetes remains a strong risk factor with a two-fold reoperation risk and three-fold amputation risk.⁷⁰ In this review, studies of diabetic patients had a markedly higher risk of amputation (32.7% vs 13.0%) and a non-significant trend towards higher mortality (2.7% vs 0.3%). Reported amputation rates for hand infections in HICs are generally lower than LMICs, ranging from 12% to 35% in diabetic patients, compared with 3% to 4.3% in general patient cohorts.^{58,70–72} Lack of access and affordability of insulin and poor adherence to treatment in LMICs is likely to worsen the disparity in outcomes.⁷³ Future mixed-methods research should explore patient-level barriers to treatment adherence and timely presentation, aiming to improve prevention, early recognition, and aggressive management of infections in this high-risk population.

Fewer than one-third of studies ($n = 10$) reported length of follow-up, with a median of 4.5 months. While appropriate for less severe infections, many may require a minimum of six months to determine final functional outcome and detect late infective complications, such as osteomyelitis. Apart from amputation and mortality, limited outcome measures were reported consistently across studies. Hand function was reported in fewer than one-third of studies, predominantly subjectively. This makes comparison across studies, to HICs and with other hand and wrist pathologies, difficult.

Studies reporting cost of treatment ($n = 3$) and return to work ($n = 2$) were sparse; economic outcomes were over a decade old, making interpretation challenging.⁷⁴ Average

treatment cost in a Kenyan study exceeded the national average salary that year.^{40,74} The International Consortium for Health Outcome Measures (ICHOM) outcome set for hand and wrist conditions, developed mainly by clinicians from HICs or internationally renowned surgical centres in LMICs, may have limited applicability in LMICs due to resource constraints and questionable outcome validity.⁷⁵ Future studies should report functional and economic outcomes of hand and wrist infections in LMICs, using validated, context-appropriate measures. Development or cross-cultural adaptation of PROMs is also essential for standardized outcome reporting.

Despite a comprehensive search strategy created with a healthcare librarian, including seven databases, citation searching, and grey literature, some studies may have been missed. Citation searching revealed relevant studies lacking LMIC-related indexing terms. Expanding the search to include journal titles and author affiliations greatly increased results, but was unfeasible given available resources.

This review focused on acute, bacterial hand and wrist infections, excluding chronic infections, such as tuberculosis and leprosy, as well as viral and fungal infections. Atypical presentations must be considered when assessing hand and wrist infections in LMIC settings.^{76,77} Three studies reported cases of cutaneous anthrax; this has virtually been eradicated by public health measures in HICs.^{34–36,78}

Although this review includes a large patient cohort from LMICs, most studies were low-quality, primarily retrospective case series, with 85% at moderate or high risk of bias. Substantial heterogeneity limits the reliability of pooled results and warrants cautious interpretation. Diabetes-specific data could not be separated in mixed-population studies, with diabetes prevalence ranging from 0% to 34.5%, potentially impacting findings. Included studies are likely to represent some of the most well-funded centres, with hand surgery capacity. These are not representative of broader LMIC settings, where access to care and outcomes may differ significantly.

In conclusion, patients with hand and wrist infections in LMICs often present late, facing a one in four risk of amputation and one in 36 risk of death. In diabetic patients, risk of amputation rises to one in three. Despite the severity of these outcomes, data on long-term impact are limited. Many affected individuals are blue-collar workers, often unskilled or semi-skilled. Loss of hand function can mean loss of livelihood, independence, and financial security, with profound implications for them and their families. Mitigation of delayed presentation and identifying effective interventions are key to developing evidence-based strategies that aim to save both life and limb.

Supplementary material

Search strategies for each database; screening guideline; variables for data extraction; studies unable to be retrieved; references of included studies; tables reporting timing and design of included studies, aetiology of infection, microorganisms identified, outcome measures used across included studies and risk of bias by study design.

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Author information

A. V. Shaw, MBChB, BSc (Hons), MRCS, Doctoral Student (DPhil Candidate)

J. C. R. Wormald, MBBS (Hons), PGDip (Hons), MRes (Hons), DPhil, FRCS (Plast), NIHR Academic Clinical Lecturer and Specialist Registrar in Plastic Surgery
Oxford Trauma and Emergency Care, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK; Surgical Intervention Trials Unit, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK.

A. Saha, BA, Medical Student, Medical Sciences Division, University of Oxford, Oxford, UK.

K. Daneshi, BSc (Hons), Medical Student, School of Population Health and Medicine, University of Sheffield, Sheffield, UK; Department of Biengineering, Imperial College London, London, UK.

M. I. Andersson, MD, DTM&H, MRCP, FRCPath, Associate Professor in Medical Virology, Consultant in Clinical Infection, Nuffield Division of Clinical Laboratory Science, Radcliffe Department of Medicine, University of Oxford, Oxford, UK; Department of Microbiology, Oxford University Hospitals NHS Foundation Trust, Oxford, UK.

S. M. Graham, MBChB, MRCS, MSc (Res), FRCS (Tr&Orth), PhD, Associate Professor of Orthopaedic Trauma, Consultant Orthopaedic Surgeon, Oxford Trauma and Emergency Care, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK; Department of Orthopaedic Surgery, Liverpool University Hospitals NHS Foundation Trust, Liverpool, UK.

D. J. Beard, GDPhys, MCSP, MA, MSc, DPhil, FBOA (hon), FRCS (hon), Professor of Musculoskeletal and Surgical Sciences and Rosetrees Director of the Royal College of Surgeons Surgical Intervention Trials Unit, Professor and Director of Research Partnerships and Surgical & Complex Intervention Trials Lead, Surgical Intervention Trials Unit, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK; NHMRC Clinical Trials Centre, Faculty Medicine & Health, University of Sydney, Sydney, Australia.

Author contributions

A. V. Shaw: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft.

A. Saha: Data curation, Writing – review & editing.

K. Daneshi: Data curation, Writing – review & editing.

M. I. Andersson: Formal analysis, Writing – review & editing.

S. M. Graham: Formal analysis, Supervision, Writing – review & editing.

D. J. Beard: Formal analysis, Supervision, Writing – review & editing.

J. C. R. Wormald: Formal analysis, Methodology, Supervision, Writing – review & editing.

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Data sharing

All data generated or analyzed during this study are included in the published article and/or in the supplementary material.

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