

The Changing Shape of Hand Trauma: An Analysis of

Hospital Episode Statistics in England

Manley OWG¹, Wormald JCR^{1,2}, Furniss D²

1. Department of Plastic Surgery, Stoke Mandeville Hospital, Aylesbury, Buckinghamshire, United Kingdom, HP21 8AL
2. Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, Botnar Research Centre, University of Oxford, Oxford, United Kingdom, OX3 7LD

Mr. Oliver Manley MBChB MRes MRCS

Core Surgical Trainee, Stoke Mandeville Hospital, Oxford Deanery, UK

Mr. Justin C R Wormald MBBS MRes MRCS

NIHR Academic Clinical Fellow and Specialist Registrar in Plastic and Reconstructive Surgery, University of Oxford, UK

Prof. Dominic Furniss DM MA MBBCh FRCS(Plast)

Associate Professor of Plastic and Reconstructive Surgery, University of Oxford, Oxford, UK

Corresponding author:

Justin C R Wormald

justin.wormald@ndorms.ox.ac.uk

Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences

Botnar Research Centre

University of Oxford

Oxford

UK

OX3 7HE

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Funding:

Justin Wormald is an NIHR Academic Clinical Fellow

DF is supported by an Intermediate Clinical Fellowship from the Wellcome Trust (097152/Z/11/Z).

The research was also supported by the National Institute for Health Research (NIHR) Oxford Biomedical Research Centre (BRC).

Conflict of Interest:

None

ABSTRACT

Hospital Episode Statistics include freely accessible records of all hospital episodes in England. We analysed hospital episode statistics from 1998-99 to 2014-15 for diagnoses of hand fractures, tendon injuries, nerve injuries, blood vessel injuries, traumatic amputations, and nail bed injuries. Population data was used to calculate the incidence. There was a 76% increase in the total number of hand injuries, with the overall incidence of the injuries increasing from 70 to 110 per 100,000. The incidence of fractures, nerve injuries and nail bed injuries increased over the study period. There were especially large increases in incidence of fractures in the over 75 age group and nail bed injuries in the 0-14 age group. This analysis demonstrates that the burden of hand trauma is increasing. This information is useful to help plan service provision, and also to highlight important clinical problems that may benefit from further research.

Level of evidence: N/A

INTRODUCTION

Hand trauma encompasses a range of soft tissue and bony injuries that are treated in the emergency department, and by orthopaedic and plastic surgeons in specialist hand clinics. The hand's importance to social and occupational function, and the complexity of these injuries, often requires treatment in dedicated hand units. Hand trauma is common; previous work estimated that it accounts for up to 30% of Emergency Department attendances (Angermann and Lohmann, 1993; Clarke et al., 1985). It is known to affect the young, male, working population most commonly, with the majority of injuries sustained either at work or during sport (Clarke et al., 1985). While there have been a number of local and regional epidemiological studies looking at hand trauma presenting to emergency departments, there is little national data published (Clarke et al., 1985; Hill et al., 1998).

The most frequent presentations of hand trauma are wounds, followed by contusions and fractures (Angermann and Lohmann, 1993). The prevalence of these injuries amongst the young, working age population means they have significant economic impact. In the United States of America, hand and wrist injuries cause a higher economic cost than knee and lower limb fracture, or hip fractures (de Putter et al., 2012). These costs take into consideration both direct healthcare costs and loss of productivity.

By understanding the burden of hand trauma on the National Health Service (NHS) and observing temporal trends, services can be better planned. In addition, understanding injury patterns allows targeted preventative strategies to be considered. Lastly, analysis of injury burden allows clinical research to be directed towards better understanding and managing the most prevalent and impactful injuries.

Recent data suggested an increase in the rate of diagnosis and treatment for elective hand conditions through analysis of national Hospital Episode Statistics (HES) (Bebbington and Furniss, 2015). These data are freely accessible online, and record all diagnoses and procedures performed in England within the NHS. We used a similar methodology to obtain an understanding of the current burden of

44 hand trauma on the NHS in England, and observe recent trends. We also combined HES data with
45 Office for National Statistics (ONS) population data to calculate trends in incidence.

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METHODS

Data

We accessed HES data detailing all finished consultant episodes in England between April 1998 and March 2015. Finished consultant episodes include time spent by a patient under the care of a particular consultant and can include emergency admissions, day cases, and patients admitted from a waiting list. This does not include all patients seen in the emergency department with a particular condition if they are not then referred on and seen by a specialist team. Primary diagnosis was recorded using the International Classification of Diseases, 10th revision (ICD-10) classification system, and operative procedure recorded using Office of Population Services and Censuses, 5th edition (OPCS-5) codes (<https://digital.nhs.uk>). Data were extracted onto a Microsoft Excel spreadsheet.

For diagnostic data, we recorded the number of finished consultant episodes for each diagnosis; fractures of the hand and wrist (S62), tendon injuries of the hand and wrist (S66), nerve injuries of hand and wrist (S64), traumatic amputation of hand and wrist (S68), vessel injuries at hand and wrist (S65), and nail bed injuries (S61.1). Fractures of the hand and wrist include phalangeal fractures, metacarpal fractures and carpal bone fractures, including scaphoid injuries, but does not include distal radius fractures that are recorded by a separate code in ICD-10.

Operation data was recorded from April 2000 to March 2015, and could only be accurately collected for nail bed repair (S66.2) and replantation (X01). Operation data could not be accurately subdivided into hand and wrist compared to other body sites for the other injuries, so was excluded. Sub-classification of injury diagnosis by type of tendon, nerve or bone injured was also available. To minimise duplications we only recorded data for the primary diagnosis for each consultant episode. HES is subdivided by sex and age group (0-14, 15-59, 60-74, 75+). Population data for England was therefore obtained from ONS stratified by age group and by sex (www.ons.gov.uk). Incidence of each injury by age group and sex was calculated. Ethical approval for this study was not required as the HES data we used is publicly accessible and anonymised.

78 **Statistical Analysis**

79 We used simple descriptive statistics to compare diagnostic incidence and operations between age
80 groups over the period studied. Temporal trends were described by plotting both total numbers and
81 incidence of diagnoses and operations over time. Where anatomical sub-classification of type of injury
82 was available, we analysed the percentage of each injury in a given time period.

RESULTS

In the 17-year period studied 845,890 episodes of hand injury were recorded in HES data. 76% of injuries occurred in males. The total number of each injury, and the proportion of the total, is shown in Table 1.

Population Growth

The overall population in England increased by 11.4% over the period studied from 48,820,583 to 54,316,618. The greatest rate of change in population was seen in the 60-74 years age group (24.4%) and the smallest growth, 2.9%, in the under 14 age group.

Increased Incidence of Hand Injuries

The absolute number of hand injuries per year was 33,948 in 1998-99, increasing to 59,830 by 2014-15, a 76% increase. The incidence of hand injuries also increased in this period from 70 to 110 injuries per 100,000 population, a 57% increase.

Fractures

Hand fractures were the most common recorded hand injury, accounting for 49% of injuries in 1998-99, and 53% in 2014-15. Hand and wrist fractures were also the fastest growing injury with incidence increasing steadily from 34 to 60 fractures per 100,000. The vast majority of these injuries were in the 15-59 age group (Figure 1a); the incidence in this age group was also highest (Figure 1b). However, the incidence in the over 75 years age group was the fastest growing, doubling from 31 to 68 per 100,000 by 2014-15, almost equal to the incidence in the 15-59 group. There was also a large increase in injury incidence in the 60-74 age group.

Analysis of fracture type in 2014-15, revealed the most common injuries were to the fingers (45.8%) and metacarpals (35.6%). Figure 1c shows the breakdown of fractures by type in different age groups in the year 2014-15. Finger fractures are most common in all age groups. However, a high proportion of fractures were of unspecified type in the over 75 age group, indicating one of the limitations of working with routinely collected data.

Tendon Injuries

Injuries to tendon and muscle at the hand and wrist level are most common in the 15-59 age group, with an incidence of 29 per 100 000 in 2014-15. Whilst there was an initial rise in the incidence of these injuries between 1998-99 and 2006-07, this appears to have plateaued in all age groups (Figure 2a). Overall, in 2014-15 there were 10,717 tendon and muscle injuries, figure 2b shows the breakdown of tendon injuries by type of tendon in this year.

Blood vessel injuries

There were very few instances of blood vessel injuries recorded as the primary diagnosis, and the incidence was less than 1 per 100,000 in all age groups, which remained constant throughout the period analysed.

Nerve injuries

The incidence of nerve injuries followed a slight upward trend in all age groups except paediatric cases. The total number of nerve injuries increased from 3400 in 1998-99 to 4790 in 2014-15. The majority of injuries were digital nerve injuries in the finger (55%), and thumb (14%).

Traumatic Amputations

Traumatic amputation at the level of the wrist was uncommon, occurring between 1 and 12 times per year in the whole of England. The absolute number of traumatic amputations of the fingers and thumb increased slowly over the study period, although the incidence of these injuries is low and did not change significantly in this time. Partial or complete amputation of the finger was the most common injury occurring 2562 times in 1998-99 and 3495 times in 2014-15.

Replantation operations were performed much less commonly than recorded amputations. On average, 115 finger and 37 thumb replantations were performed each year; this equates to 3.3% of amputated fingers and 7.5% of amputated thumbs. Traumatic amputations may include distal injuries that are not suitable for replantation.

143 **Nail bed injuries**

144 The overall number of recorded nail bed injuries quadrupled between 1998-99 (1858) and 2014-15
145 (7987). The incidence rose in all age groups but was highest in children (0-14), where incidence of
146 these injuries was 35.4 per 100,000 in 2014-15. The number of nail bed repairs parallels the number
147 of nail bed injuries, suggesting that the indication for surgery remains constant.

DISCUSSION

Analysis of routinely collected HES data shows that the numbers of hand injuries in England increased between 1998-99 and 2014-15 due to a combination of an increasing population and increasing incidence of these injuries. The burden of these injuries on hand surgery services is considerable, and this increasing workload must be considered when allocating resources. The majority of all injuries were within the 15-59 age group in males, reflecting the known association between hand injuries, work, and recreation (Hill et al., 1998; Anakwe et al., 2011).

Fractures of the hand and wrist were the most common hand injury seen, accounting for over half of all episodes. We suspect that the rising incidence in the over 75-years age group reflects an increase in the number of frail elderly patients who are susceptible to falls. Falls are a common cause of disability in the elderly and with our ageing population multiple schemes have been suggested that may reduce falls risk (Gillespie et al., 2012). Patients with a fall related hand fracture are likely to be at risk of further falls, and should be signposted to fall prevention services as indicated. Older patients with hand fractures are likely to be managed non-operatively and may have significant problems with activities of daily living (Nankhonya et al., 1991; Madhok and Bhopal, 1992; Madhok and Green, 1993). Clinicians should consider that older patients with hand fractures may require access to the same services as if they sustained a distal radius fracture, such as osteoporosis screening and treatment (Benzvi et al., 2016).

Nail bed injuries are increasingly common, especially in children. They are most often caused by crush injuries in doors (Pearce and Colville, 2010). In children, repair of these injuries often requires general anaesthesia, which carries risks and potential long term sequelae (Weiss et al, 2016; US Food and Drug Administration, 2018). Our data show that the incidence of nail bed repairs rose in line with the number of nail bed injuries, meaning it is unlikely that there is a decreasing threshold for operative intervention in these patients. The rising incidence of nail bed injuries will have a significant effect on hand surgery workload. The Nail bed Injury Analysis (NINJA) trial is currently studying the surgical management of nail bed injuries in children and outcome, and may help guide optimal

practice in this area (Greig et al., 2017). An interesting avenue for future research may be to compare operative versus non-operative treatment of nail bed injuries.

Nerve injuries of the hand and wrist are increasing in number. Although we were unable to access data on the number of operative nerve repairs performed, if a nerve laceration is suspected, exploration and repair using microsurgical techniques is usually recommended (Paprottka et al., 2013). The incidence reported in our study of 7 – 10 cases per 100 000 is similar to a Swedish study that reported an incidence of 6.2 per 100 000 (Thorsén et al., 2012). With the number of these injuries rising in England, continued access to microsurgical services is important.

The rate of replantations in this study was low. HES data cannot distinguish between complete and partial amputations, or the level of amputation in the finger or thumb. This will mean that many recorded traumatic amputations are optimally treated with terminalisation. In cases where there has been complete finger amputation, there may remain a contra-indication to replantation. The low number of replantations performed per year suggests the volume at each hand surgery centre is likely to be low, and this may reduce success rates (Mahmoudi and Chung, 2017). We therefore suggest that each centre regularly audits the results of replantation surgery.

A limitation of HES data is that the accuracy of data is dependent on the accuracy of clinical diagnosis, clinical coding, and therefore documentation by the clinical team. Accurate coding is in the interests of hospitals and departments as this determines pay by activity. Conversely, the use of coding for financial reasons may also lead to distortions in the way hospitals record diagnoses and procedures. The improvement in coding over the period studied can be seen by the decreased proportion of ‘unspecified’ diagnoses in 2014-15 compared to 1998-99. A further limitation of this study is the lack of OPCS data to describe the number of operations on tendon injuries, nerve injuries and fractures within the hand.

Finally, a large number of patients with hand lacerations present to minor injury units or emergency departments, have no structural injury, and therefore may not be referred for specialist assessment. Equally, many patients will be assessed by a specialist hand service and deemed to have no

207 structural injury on clinical examination, and therefore not included in our dataset. Both animal and
208 human bites are common injuries that are not specifically coded, and therefore could not be analysed
209 in our study. This means that the true workload of a specialist hand trauma service is somewhat
210 higher than presented here.

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CONCLUSION

Our analysis of HES data demonstrates that the burden of hand trauma in the English NHS has steadily increased over the past 17 years. HES data has limitations but provides a useful means to study longitudinal trends and highlight particular areas for further study, for example the increased incidence of fractures in the elderly and nail bed injuries in children.

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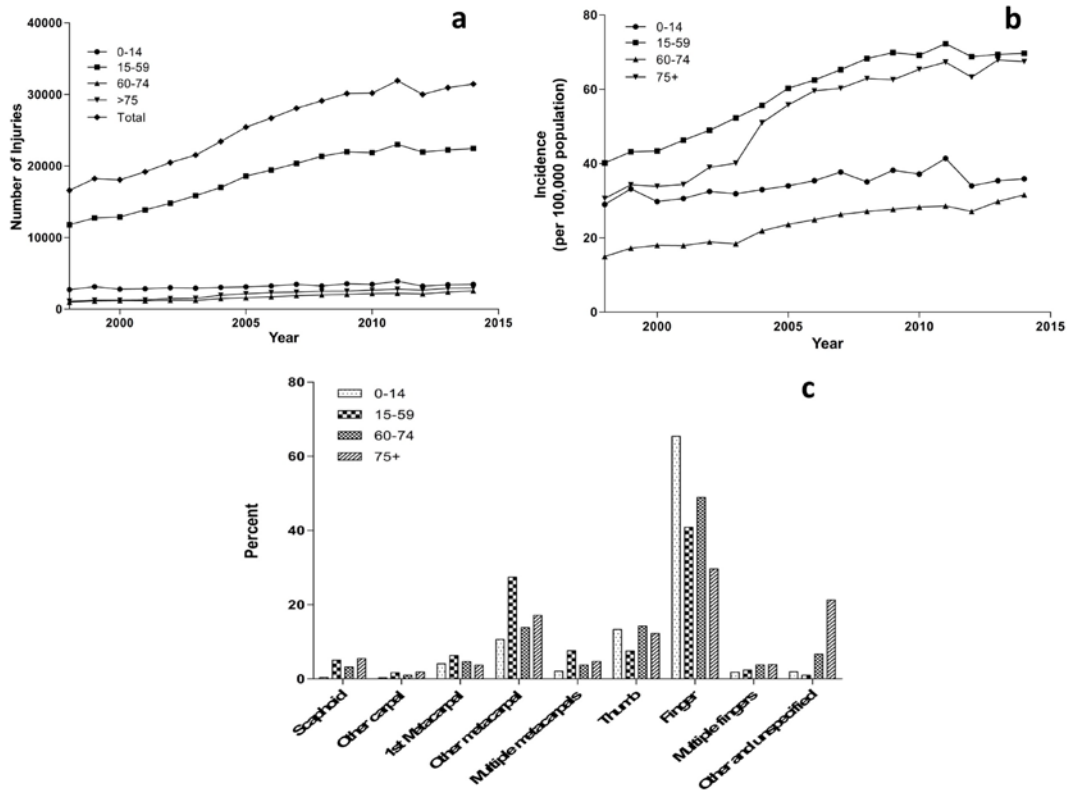
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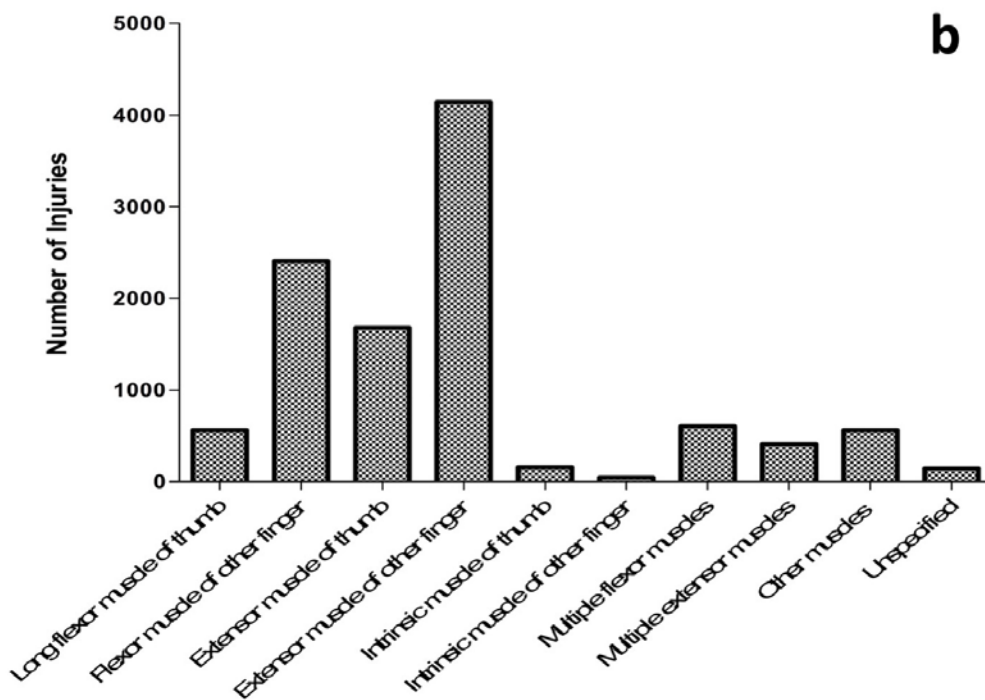
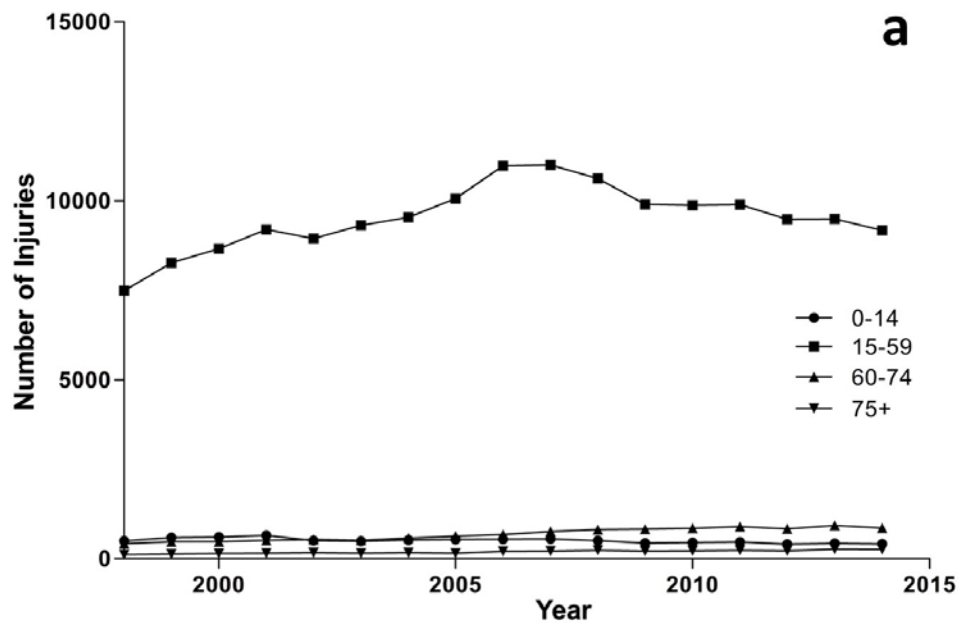
FIGURE LEGENDS



1a. Overall number of hand injuries stratified by age group between April 1998 and March 2015

1b. Incidence of hand injuries per 100,000 population stratified by age group between April 1998 and March 2015

1c. Detailed analysis of fractures according to anatomical site and stratified by age group for the year 2014-2015



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297 2a. Overall number of flexor or extensor tendon/muscle injuries stratified by age group between April

298 1998 and March 2015

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300 2b. Detailed analysis of tendon/muscle injury according to anatomical group

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302 Table 1

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Table 1: Total number of hand injuries from 1998-2014 by type and gender			
Injury	N	Proportion of injuries (%)	Male sex (%)
Fractures	431,540	51	75
Nerve	74,384	9	72
Vessel	6,918	1	78
Muscle and tendon	185,483	22	81
Amputation	66,508	8	80
Nail bed contusion	1,865	0	58
Nail bed laceration	79,192	9	67

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