




The prevalence of hand pathology in regional orthopaedic hospitals in KwaZulu-Natal: A cross-sectional study

S Thabit,¹ FC Orth (SA), MMed (Orth), ; M O'Connor,¹ FC Orth (SA), MMed (Orth); ; W Parker,² MB ChB; T Mashishi,³ MB ChB; K Moodley,⁴ MB ChB; A Peer,⁵ MB ChB; K Matanzima,⁶ MB ChB; A J de Villiers,⁷ MB ChB; O Adewusi,⁸ MBBS; R Aboobaker,⁹ MB ChB; AGL Rocher,¹ MB ChB, FC Orth (SA), 

¹ Discipline of Orthopaedic Surgery, Inkosi Albert Luthuli Central Hospital, University of KwaZulu-Natal, Durban, South Africa

² Discipline of Orthopaedic Surgery, Port Shepstone Regional Hospital, University of KwaZulu-Natal, Durban, South Africa

³ Discipline of Orthopaedic Surgery, General Justice Gizenga Mpanza Hospital, University of KwaZulu-Natal, Durban, South Africa

⁴ Discipline of Orthopaedic Surgery, Ngwelezana Hospital, University of KwaZulu-Natal, Durban, South Africa

⁵ Discipline of Orthopaedic Surgery, Addington Hospital, University of KwaZulu-Natal, Durban, South Africa

⁶ Discipline of Orthopaedic Surgery, Prince Mshiyeni Memorial Hospital, University of KwaZulu-Natal, Durban, South Africa

⁷ Discipline of Orthopaedic Surgery, RK Khan Hospital, University of KwaZulu-Natal, Durban, South Africa

⁸ Discipline of Orthopaedic Surgery, Ladysmith Regional Hospital, University of KwaZulu-Natal, Durban, South Africa

⁹ Discipline of Orthopaedic Surgery, Harry Gwala Regional Hospital, University of KwaZulu-Natal, Durban, South Africa

Corresponding author: S Thabit (swalehthabit62@gmail.com)

Background. Pathology of the hand causes functional impairment, with downstream effects for patient occupation, and consequently presents a socioeconomic burden. Investigation of the epidemiology of hand pathology in KwaZulu-Natal (KZN) can help reduce the burden of disease. Identifying where the greatest need is can direct patient awareness initiatives, medical training and appropriate allocation of resources.

Objectives. To establish the prevalence of hand pathology at regional hospitals that offer orthopaedic services in KZN, to describe the patients most commonly affected by these pathologies and to identify the most common pathologies.

Methods. A cross-sectional investigation of hospital records and charts of patients presenting for orthopaedic care across all 10 regional hospitals in KZN that offer orthopaedic services was undertaken for 1 week's duration (June 2022). Patients were categorised into hand pathology (HP) and general orthopaedic pathology (OP) groups, which were each subdivided into trauma and non-trauma subgroups. Demographic details were collected for all patients. For HP patients, additional detail was collected regarding diagnosis, mechanism, admission and management. The prevalence of HP was calculated as a factor of all orthopaedic presentations.

Results. During the investigation, 2 335 patients presented to orthopaedic services. HP represented 21% of these cases. The majority (17%, 406/2 335) were related to trauma and represented 23% of all the traumatic orthopaedic presentations. Distal radius (DR) fractures were the most common hand injury (46%, 188/406) and a large proportion of trauma to the bony elements of the hand were open injuries (23%, 93/406). The remainder of HP cases comprised the non-traumatic group (4%, 91/2 335) and were predominantly infections (68%, 62/91), and many patients with non-traumatic hand pathology required surgery (60%, 55/91) and admission (56%, 52/91).

Conclusion. HP represents approximately one-fifth of all orthopaedic presentations to regional health facilities in KZN offering orthopaedic care, and close to a quarter of orthopaedic trauma occurs in the hand. Based on these findings, targeted efforts to improve community awareness of precautions against trauma to the hand, osteopaenia and hand hygiene are suggested as preventive measures. Medical training should emphasise the appropriate management of DR fractures and hand infections, and resources should be differentially allocated to the management of these debilitating HPs to decrease the burden of disease.

Keywords: South Africa, epidemiology, hand pathology, hand trauma, hand infection

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Hand pathology (HP) has the propensity to cause functional impairment and loss of income, and present significant costs in the form of expenditure on management, and loss of economic contribution from the affected patients.^[1] In the South African (SA) context, investigation has been performed to establish the aetiology of occupational hand trauma in the healthcare system of Gauteng Province.^[1] Studies emanating from occupational therapy journals document a high caseload of hand trauma in SA and the province of KwaZulu-Natal, respectively.^[2-4] Hand infections have also been investigated in SA, and specifically, the most common causative organisms and aetiologies have been explored.^[5,6] Internationally, there is an increased trend in the prevalence of hand pathology,

particularly occupational injuries, and overuse syndromes.^[7] At present, there remains limited quantitative data encompassing all pathological conditions of the hand within the SA context.

HP resulting from trauma is recognised as both a common and a debilitating condition.^[8] A study from the USA reports that 10% of patients with hand trauma never return to their original occupation, either owing to permanent disability or a change in occupation.^[8] Furthermore, residual functional impairment was noted in 59% of patients with hand injuries in this study, despite adequate rehabilitation.^[8] Concerning occupational hand injuries in a SA cohort, one-third of all hand injuries were attributed to occupational causes.^[1] Hand injuries require rehabilitation after

management of the initial injury.^[1,2] A study on hand trauma as managed by occupational therapists in KwaZulu-Natal reported that the predominant hand trauma presentations to therapists were flexor or extensor tendon injuries, fractures and combination injuries.^[4] An additional occupational therapy article outlined the challenges to providing hand therapy in SA, reporting 'high caseloads and quick turnover' as well as 'lack of resources' among several challenges to providing hand therapy in the SA setting.^[3]

Hand infections similarly contribute toward financial and functional losses for the patient, and represent a cost burden to both the global and SA health departments for the management of these conditions.^[6,9] Complications of hand infection can be devastating, occasionally necessitating amputation, with significant associated functional impairment.^[9]

Various other common hand pathologies investigated in the international literature include carpal tunnel syndrome (CTS) and other compressive neuropathies, rheumatoid and osteoarthritis, hand tumours, tendinopathies and congenital deformities.^[10-16] CTS, the most frequent compressive neuropathy, has been shown to have a socioeconomic impact on the patient.^[16] The median number of days away from work as a result of CTS in the USA is 27 days.^[17] Surgical decompressions of CTS in the USA incur an annual economic cost of >USD2 billion.^[16] Degenerative arthropathies also negatively impact quality of life.^[11] Rheumatoid arthritis (RA) of the hand can result in loss of grip strength and pain, impacting hand function.^[11] Osteoarthritis (OA) involves the hands in 30% of cases, and like RA, causes functional deficit.^[12] A study from Singapore showed

in their region that 15% of soft-tissue tumours occur in the hand, and were reported as a common reason for consultation with hand specialists.^[13] Likewise, a review of tendinopathies of the hand and wrist reported that the most common of these is stenosing tenosynovitis of the A1 pulley, or trigger finger, which occurs with a prevalence as high as 2 - 3%.^[14] Finally, congenital deformities of the hand are also more prevalent than previously thought, most notably the case of polydactyly, with a prevalence of 23 per 10 000 live births in a study conducted in New York.^[15]

These studies highlight that HP is common. In the international literature, various pathologies have been investigated, but in SA, epidemiological investigation has been limited to the study of hand trauma and hand infections.^[1-6] The reports have emphasised that HP can cause significant functional impairment and are an economic burden.^[2,8] There remains a paucity of quantitative data on HP, especially non-traumatic, in SA. The present study aimed to provide insight into the burden of all HP in KwaZulu-Natal, SA, to inform future research focus and allocation of resources in this constrained setting.

Method

This epidemiological study was conducted by a cross-sectional patient chart and hospital record review of all orthopaedic presentations to each of the 10 regional hospitals in KwaZulu-Natal Province that offer orthopaedic services, for 1 week. The study was conducted primarily to determine the prevalence of HP among all orthopaedic presentations, and secondarily to describe the patient demographics and common HP presentations. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies was used for reporting.^[18]

Patient charts and hospital records were used to collect patient demographic details and pathology data at each of the 10 regional hospitals in KwaZulu-Natal that offer orthopaedic services for 1 week, from midnight Sunday 19 June 2022 until midnight Sunday 26 June 2022. The data were collected by an on-site investigator at each hospital, and captured on the secure online pre-designed Google Sheets application (Google, USA). The research protocol was disseminated to all on-site investigators for review. Before data collection, an online meeting of all the on-site investigators was conducted by author ST, to clarify the procedures and answer any queries. The Google Sheets were collated on an Excel (Microsoft, USA) spreadsheet for descriptive summaries and exported to Jamovi (Jamovi project, USA) for analysis. For all patients, basic demographic and diagnostic details were captured, including age, gender, date of presentation, whether the pathology was related to trauma and the diagnosis. In addition to these details, patients with HP had further information regarding handedness, mechanism of injury, management and admissions collected.

For this investigation, HP was defined broadly to include inflammatory or osteoarthropathies of the wrist and hand. Infections, tumours, tendinopathies, compressive neuropathies and congenital deformities were included from the level of the elbow, or any region distal to the elbow. Hand trauma (HT) included bone injury to the distal radius and ulna (up to and including 5 cm proximal to the wrist joint) or any bony injury distal to this, tendon injuries distal to the elbow, and nerve injury from the level of the brachial plexus (including root avulsions) or any region peripherally along the course of the nerve. These pathologies would be the typical presentations to a hand unit, or a specialist hand surgeon in KwaZulu-Natal.

Description of the patient demographic and pathology detail for categorical variables were summarised as counts and percentages. For continuous data, means with standard deviation (SD) and range were reported if the data were normally distributed, or medians with

Table 1. Descriptives of all orthopaedic presentations including patient demographics and diagnostic characteristics (N=2 335)

Characteristic	n (%)*
Age (12 missing, n=2 223), median (IQR)	36 (29)
Gender (6 missing, n=2 329)	
Female	1 011 (43)
Male	1 318 (57)
Pathology	
General trauma	1399 (60)
Other general orthopaedic pathology	439 (19)
Hand trauma	406 (17)
Other hand pathology	91 (4)
Regional facility	
1	158 (7)
2	328 (14)
3	303 (13)
4	136 (6)
5	293 (13)
6	172 (7)
7	301 (13)
8	145 (6)
9	118 (5)
10	380 (16)
Classification	
Trauma	1 805 (77)
Non-trauma urgent/emergent	107 (5)
Elective	423 (18)
Where attended to	
Clinic	1 321 (57)
Emergency room/casualty/acute room	1 014 (43)

*Unless otherwise indicated.
IQR = interquartile range.

interquartile range (IQR) and range if data were non-parametric. Prevalence was expressed as a percentage, calculated by the ratio of all HP cases as compared with the total number of presentations to orthopaedic facilities. Similarly, prevalences were determined for hand trauma as a function of the total trauma presentations, and HP of non-traumatic origin as a function of the total non-traumatic general orthopaedic presentations. Where data were missing, the number of missing data was quantified, and summary statistics produced with the remaining data points.

Ethical clearance

The authors declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010. The study complied with the SA Department of Health ethics guidelines (2015), and the University of KwaZulu-Natal policy on research ethics. Prior to commencing this research, the appropriate ethical approval was obtained from the Biomedical Research Ethics Committee of UKZN (ref. no. BREC/00003774/2022).

Results

During the 1-week study period, there were a total of 2 335 patients who presented with an orthopaedic concern to the 10 regional hospitals that offer orthopaedic services (Table 1). Four of the facilities attended to >300 patients during this week. The majority (78%, $n=1\ 809$) of presentations were secondary to trauma (acute or subsequent follow-up visits), 57% ($n=1321$) were attended to in elective clinics and the remainder were managed in casualty, emergency department or acute room settings. The median (IQR) patient age (12 missing) was 36 years (29, 0 - 102) and 57% ($n=1\ 318$) were male patients (6 missing).

The 2 335 total patients were then categorised into HP trauma (HPT) (17%, $n=406$), HP non-trauma (HPNT) (4%, $n=91$), orthopaedic pathology trauma (OPT) (60%, $n=1\ 399$) and orthopaedic pathology non-trauma (OPNT) (19%, $n=439$) groups. The prevalence of all cases of HP among all orthopaedic presentations was 21% (497/2 335), the majority of which were secondary to trauma 82% (406/497).

Concerning trauma, the prevalence of HPT among all traumatic presentations was 23% (406/1 807). Table 2 (appendix <https://www.samedical.org/file/2267>) compares the variables collected for both HPT and OPT groups. The median (IQR) age of presentation for patients with HPT was slightly younger than the OPT group, 32 years (29, 0 - 88, 2 missing) as compared with 36 years (27, 0 - 102, 10 missing) and the majority were male patients in both groups: 65% (264/405, 1 missing) and 58% (808/1 398, 3 missing). In both traumatic groups, the percentage of polytrauma cases was 2% (8/406 in the HPT group, and 22/1 401 OPT group), but compound injuries were more prevalent in the HPT cohort at 23% (93/406) than the OPT group 4% (57/1 401).

Specific to the HPT group, a fall onto an outstretched arm was the most common mechanism of injury, in 53% (186/352, 54 missing), followed by blunt and penetrating trauma in 15% (53/352) and 16% of cases (55/352), respectively. The majority of injuries were bony. DR fractures accounted for 46% of cases (188/406) and fractures or dislocations of the phalanges 13% (52/406). Most soft tissue injuries were to the flexor tendons, at 7% (28/406). In 4% (15/406) of cases, there was a combination of bony and soft tissue injury. There were 25% (100/406) of hand injuries that required admission for surgery, 31% (31/100) for fracture fixation and 44% (44/100) needed exploration and repair of either single or multiple nerves and tendons.

There were relatively fewer cases of non-traumatic pathology overall, 23% (528/2 335). The prevalence of HPNT in this group was 17% (91/528) and OPNT comprised the remaining 83% (437/528) (Table 3, appendix <https://www.samedical.org/file/2267>). Patients in both non-traumatic groups were older than the patients in the traumatic groups, with a mean (SD, range) age of 38 years (18, 0 - 84) in the HPNT group and a median (IQR, range) of 44 years (41, 0 - 82) in the OPNT group. Hand infections predominated the HPNT group (68%, 62/91), followed by arthropathy (10%, 9/91). In the OPNT group, 56% (245/437) of diagnoses were attributed to osteoarthritis and 13% (56/437) to infection. The majority of HPNT patients, 57% (52/91), required admission and 60% (55/91) required surgery either as an inpatient or in the outpatient setting. Surgical debridement or incision and drainage was necessitated in 89% (49/55) of cases. The limited number of other surgeries that were performed included ganglion excision (4%, 2/55), carpal tunnel release (2%, 1/55), De Quervain's decompression (2%, 1/55), trapeziectomy (2%, 1/55) and repair of tendons from attenuation and rupture in a patient with rheumatoid arthritis (2%, 1/55).

Discussion

We undertook this study to determine the burden of HP in regional orthopaedic hospitals in KwaZulu-Natal, a province with a limited number of hand specialist units and hand rehabilitative services. Secondly, we aimed to identify the most common HPs and describe the demographics of patients typically presenting with them. We determined that the prevalence of HP in this setting is 21% (497/2 335), and is predominantly comprised of traumatic injuries (82%, 406/497), which equates to 17% (406/2 335) of all orthopaedic presentations. Patients presenting with HP had a median (IQR, range) age of 32 years (28, 0 - 88) and the majority (64%, 315/494, 3 missing) were male. These figures represent a significant burden of disease, both to regional orthopaedic hospitals in KwaZulu-Natal, and to the local labour force.

While we did not collect disability measures in these patients, extrapolation of the data from Trybus *et al.*^[8] who reported 59% residual impairment following hand trauma despite adequate rehabilitation would mean that on average, 240 patients per week (958 per month) have residual functional impairment following trauma to the hand in KwaZulu-Natal. This is particularly concerning following the Statistics SA (Stats SA) disability report in 2014 (the most recent disability report, compiled from the 2011 census).^[19] The report stated that KwaZulu-Natal's disability prevalence was 8.4%, higher than the national average of 7.5%, and that KwaZulu-Natal had the second-highest percentage of persons with disability who were unemployed.^[19]

Regarding the traumatic injury prevalence, a 2017 Global Burden of Disease study analysis determined that high sociodemographic index (SDI) countries (SDI >0.8) have the greatest prevalence of hand injuries.^[20,21] Low-middle (SDI between 0.45 and 0.6) and middle SDI (SDI between 0.6 and 0.68) countries had the greatest increase in prevalence rates over the preceding 27 years, but the authors commented that there was significant geographic variation.^[20,21] For comparison, Warwick *et al.*^[22] in their white paper for the British Society for Surgery of the Hand reported that 20% of patients attending emergency services in Britain (high SDI of 0.85 - 2019) presented with hand injuries.^[21,22] A Brazilian cohort (middle SDI of 0.64 - 2019) reported 21% of orthopaedic presentations were for hand injuries, and in our SA cohort (middle SDI of 0.68 - 2019) the prevalence of hand trauma was 17% of all orthopaedic presentations.^[21,23] A Ugandan (low SDI 0.4 - 2019) report documented a prevalence rate of 4.7%.^[21,24]

On review of the hand trauma within our cohort, 46% of hand injuries were DR fractures. Although the median age in the DR group was 31 years, the data were widely spread. There was a peak in childhood around 10 years old, and from 30 - 65 years of age there was an even distribution of cases, after which case numbers tapered off. The findings in paediatric patients are consistent with previous investigation.^[25] Shah *et al.*^[25] reported that one-quarter of all paediatric fractures occur at the DR. By indirect comparison, we were able to determine that in children aged ≤ 18 years who sustained traumatic injuries (i.e. not only fractures), 17% were DR fractures. Furthermore, in Shah *et al.*'s epidemiology investigation of DR fractures, the mean age at injury was 9.9 years, similar to our findings. In adult patients, the epidemiology of DR fractures typically follows a bimodal distribution.^[26] Broadly speaking, younger adult males usually sustain DR fractures from high-energy mechanisms, and elderly women sustain fragility fractures from low-energy mechanisms.^[26] This was not true of our patient data, as we did not have two distinct peaks in the age distribution for our cohort, and only 7% of patients in whom the mechanism was known had a high-energy mechanism reported, such as a MVA. Only one of these patients was a male <45 years. The vast majority (88%) of adult patients sustained DR fractures from low-energy falls. This raises the concern that reduced bone mineral density (BMD) may be prevalent locally from a younger age. Both HIV antiretroviral therapy, and the viral infection, are established causes of reduced BMD.^[27] Considering that KwaZulu-Natal Province has the highest prevalence of HIV in SA, it could be anticipated that osteopaenia will be more prevalent, with a consequently higher incidence of fragility fractures.^[27,28]

Also in contrast to both a local and an international study, only 7% of cases in our study were documented occupational injuries.^[1,29] In Warsaw, Poland, in a tertiary plastic surgery unit, occupational hand injuries accounted for 46% of traumatic hand injury cases seen.^[29] Notably different from our investigation, however, was the documented exclusion of isolated bony trauma and closed tendon injuries, which were referred to the orthopaedic department of that facility. Occupational injuries are usually a result of high-energy trauma by power tools and machinery. The energy imparted results in open fractures and injures multiple structures. For the Polish study, injuries such as these were preferentially managed by the plastic surgery (as opposed to the orthopaedic) department, and may explain their high percentage of occupational injuries.^[1] Irrespective of the true prevalence rate of occupational hand injuries, surgeons responsible for the management of occupational hand trauma should be cognisant of the employment status of the patient. Treatment has implications for future work opportunities. Surgeons should utilise the patient interaction to advise caution with machine operation and promote safety glove use.

Considering the soft tissue envelope of the hand, it is foreseeable that compound injuries will be more prevalent in the hand. We found 23% of hand trauma cases to be compound, lower than the 37% reported by Frazier *et al.*^[30] in the UK. Nevertheless, this subgroup of patients with trauma to the hand frequently complicate with infection, chronic pain and functional impairment, and should be managed expediently to minimise these complications.^[8]

Hand infection, of spontaneous onset unrelated to trauma, was the most common presentation in the non-traumatic HP group, representing 62 cases. Greyling *et al.*^[6] reported 66 cases of spontaneous-onset hand infection over 6 months at a hospital in Bloemfontein, SA.^[6] This equates to three cases of hand sepsis a week, approximately half the number of cases seen weekly per hospital in our investigation. What could account for this difference

is unclear, although one consideration would again be the high prevalence of HIV in KwaZulu-Natal Province (27%).^[28] Van der Vyver *et al.*^[5] theorised that immunocompromise could account for the relatively high number of spontaneous onset hand infections (58%) in their local KwaZulu-Natal investigation, as compared to international cohorts where infection was more commonly related to trauma.^[5,9] They advocated for hand hygiene awareness initiatives for immunocompromised patients.^[5] They also recommended that healthcare workers be cognisant of the increased risk of complications in hand infections in the immunocompromised cohort, and suggested regular follow-up and attention to wound care for these individuals to prevent morbidity and disability.^[5]

Limitations

This study had several limitations. Firstly, the cross-sectional study was conducted for 1 week. This was a considered decision based on the knowledge that KwaZulu-Natal medical records are still largely paper-based and of poor quality, which makes longitudinal data collection very difficult.^[31] Owing to the short duration, however, we were able to extend the investigation to all the regional hospitals that offer orthopaedic services, to get a generalisable 'snapshot' of the burden of HP across the KZN province. It should be borne in mind that seasonal variations in infections, trauma and arthropathies can be anticipated, and so simple extrapolation of this data for longer durations will not reflect the true epidemiology. Secondly, the investigation was performed exclusively at regional facilities. While this would mean that complex injuries and pathologies seen at referral institutions would not have been included, it was intentional that the burden of HP seen by generalist orthopaedic units be delineated. However, we do recognise that cases managed at primary healthcare facilities would have been unaccounted for utilising this approach.

Conclusion

HP comprises 21% of all orthopaedic presentations to regional health facilities in KwaZulu-Natal offering orthopaedic care. HPT represents 23% of all the traumatic orthopaedic presentations, and a disproportionate number of these injuries are compound, 23% v. 4%. The prevalence of HPNT is 17%, predominated by infections, and often requires admission and surgery. Based on these findings, targeted efforts to improve community awareness of precautions against trauma to the hand, osteopaenia and hand hygiene are suggested as preventive measures. Medical training should focus on the appropriate management of DR fractures and hand infections, and resources allocated to the management of these debilitating HPs to decrease the burden of disease.

Data availability. Data are available at request from the corresponding author.

Declaration. This research was conducted for ST's MMed (Orthopaedics).

Author contributions. ST: Study conceptualisation, data capture, first draft preparation, manuscript revision. MO: Study design, data analysis, manuscript preparation, critical review of final manuscript. WP: data capture, manuscript review. TM, KMo, AP, KMa, AD, OA, RA: data capture, manuscript review; AR: Study conceptualisation, critical expert review of draft and final manuscript.

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