

# Audit to benchmark the epidemiology of hand and wrist fractures in Malta

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## INTRODUCTION

Hand and distal forearm fractures are among the most common injuries worldwide. To date there is no data on the extent of hand and wrist fractures diagnosed radiologically in Malta.

This audit aimed to quantify and analyse all hand and distal forearm fractures presenting at the Accident & Emergency (A&E) Department at Mater Dei Hospital. This would be done to establish the amount of hand and wrist injuries, to calculate the potential number of patients requiring specialist hand therapy services and to understand the requirements of the A&E department in the area of hand injuries.

## METHODS

Baseline data was obtained from analysing all orthopaedic X rays over three consecutive months taken in the local A&E department during the study period. Data on hand and distal forearm fractures was analysed.

## RESULTS

Results confirm that 18.6% ( $n=986$ ) of all orthopaedic X-Rays were of the wrist and hand, 37% of which had confirmed fractures. Distal forearm fractures amounted to 58.4% ( $n=213$ ) of all hand and wrist fractures. The most commonly injured hand bone was the 5<sup>th</sup> metacarpal in 24.3%, and 5.9% of all wrist fractures were scaphoid fractures.

## DISCUSSION

Our findings represent our local scenario. In view of an ageing and increasing Maltese population, one should expect numbers of hand and wrist fractures to increase. This data will help ensure the service is prepared with adequate specialised staffing levels to manage these cases. Education programmes that could advise on strategies to prevent such fractures by reducing falls and collaboration with government entities to assist in such prevention, better workplace health and safety and treating osteoporosis early is of crucial.

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## INTRODUCTION

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Hand and distal forearm fractures are the most common types of fractures worldwide.<sup>1</sup> A number of authors have studied the patterns of hand injuries in various Accident and Emergency (A&E) departments around the world.<sup>2-3</sup> Studies have taken into account the parts of the hand or wrist,<sup>4</sup> days of the week on which these injuries have occurred,<sup>2</sup> as well as the demographics of the patients attending the A&E department with such injuries.<sup>5</sup> It is estimated that there are around 16. per 10000 cases of distal forearm fractures in the United States annually.<sup>6</sup> Out of the total number of both fractures and dislocations, 28% occur in the hand while when taking only fractures, 20% of the total number of fractures occurred in the hand.<sup>2,7</sup>

Studies report that males, especially younger males tend to be more at risk of hand and distal forearm injuries<sup>4</sup> following accidents at work and sports injuries. These injuries could have a bearing on socioeconomic factors if the injured individual is required to periodically stop working. Fractures of the hand and distal forearm also have a large economic burden on the health service due to their high frequency and treatment required.<sup>3,8,9</sup>

In order to understand patterns of hand and wrist injuries, a number of studies looked into patient records and radiological images.<sup>2,4,10,11</sup> To date, in Malta, the number of hand and wrist X-rays and injuries diagnosed radiologically has never been studied.

According to the latest estimates in 2017, Malta has a population of 475,701 and there are approximately 5100 more males than females. Statistics show an overall increasing population with an increase of 10000 people between the ends of 2015 and 2016.<sup>12</sup> Malta

has an increasing elderly population together with an increasing life expectancy and an increase in population by immigration.

Therefore, the primary objective of this audit was to quantify and analyse all the orthopaedic X-rays taken in the local A&E department over a period of three consecutive months to establish the amount of hand and wrist injuries, and the potential number of patients requiring specialist hand therapy services. This data would then be presented to hospital management to inform staffing level requirements in this area of interest, including the number of physiotherapists and occupational therapists employed with the necessary hand therapy training. They would also give an understanding of the requirements of the A&E department in the area of hand injuries such as orthopaedic surgeons, physiotherapists and occupational therapists available to offer immediate care when necessary.

A secondary objective was to obtain baseline data on hand and wrist fractures to be able to compare future trends in Malta. Understanding patterns of injury could be used to better understand potential input of the physiotherapists and occupational therapists in terms of education and prevention.

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## MATERIALS AND METHODS

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A descriptive retrospective audit was carried out by reviewing X-rays ordered by physicians at the A&E Department at Mater Dei Hospital, the only public general hospital in Malta. Permission to perform this audit was obtained from the Chairman of the A&E department as well as from Director of Information Technology at Mater Dei Hospital as per Maltese ethical approval requirements.

Patient identification details were kept confidential.

The X-rays for all orthopaedic adult and paediatric patients were reviewed on the Hospital's Patient Archiving and Communication System (PACS) (GE Healthcare Centricity Universal Viewer), for a period of 3 months between 1<sup>st</sup> of February 2018 and 30<sup>th</sup> of April 2018. Eventually, X-rays for the hand and distal forearm were extracted including distal forearm, carpal bones, metacarpals and phalanges. The number of different fractures were recorded from these X-rays. Patient information including gender, age and the mechanism of injury available on the X-ray requests was noted.

In order to compare data obtained in Malta to that in similar audits around the world, a thorough literature search was completed. All published data readily available was utilized. Much of the literature data available was older than 10 years, however, it was still used for analyses and comparison.

## RESULTS

A total of 5302 orthopaedic X-rays were ordered at the A&E department during the study period of which, 986 (18.6%) were hand and distal forearm X-rays. Of these, 365 (37%) had a reported fracture. The data of these patients was reviewed. The results obtained are illustrated in the tables below.

The demographic data and characteristics of all wrist, carpus and hand fractures ( $n=365$ ) is shown in Table 1. Men sustained 55% of the injuries and the most common fracture was of the distal forearm (58.4%) and more commonly, the left hand was injured.

Table 2 highlights the large age range of the population who sustained these injuries. Small

peaks are seen in the age group 21-30, 51-61 and 71 to 80.

Table 3 shows the demographic data and characteristics of distal forearm fractures ( $n=213$ ). The largest number were sustained by men (59.6%) and distal radius fractures (63.8%) were most common.

Reviewing distal forearm fracture data (Table 4) more closely illustrates a range of age groups who experience this injury. However, the most common age group was 71 to 80

Table 5 shows the demographic data and characteristics of hand and carpus fractures presenting ( $n=136$ ). These were found predominantly in males (77.2%), with an equal left to right hand distribution.

Table 6 shows the age groups for all patients who suffered a carpus or hand fracture and highlights as expected that the largest number (30%) were found within the 21 to 30 age group.

**Table 1** Demographic data and characteristics of all fractures ( $n=365$ )

|                           | n (%)      |
|---------------------------|------------|
| Mean age (years): 46      |            |
| Males                     | 202 (55)   |
| Females                   | 163 (45)   |
| Right Upper Limb          | 176 (48)   |
| Left Upper Limb           | 189 (52)   |
| Distal Forearm Fractures  | 213 (58.4) |
| Hand and Carpus Fractures | 152 (41.6) |

**Table 2** Age groups for all fractures ( $n=365$ )

| Age Group | n (%)     |
|-----------|-----------|
| 0 to 10   | 28 (7.7)  |
| 11 to 20  | 45 (12.3) |
| 21 to 30  | 54 (14.8) |
| 31 to 40  | 35 (9.6)  |
| 41 to 50  | 34 (9.3)  |
| 51 to 60  | 47 (12.9) |
| 61 to 70  | 38 (10.4) |
| 71 to 80  | 46 (12.6) |
| 81 to 90  | 33 (9)    |
| 90+       | 5 (1.4)   |

**Table 4** Age groups for distal forearm fractures ( $n=213$ )

| Age Group | n (%)     |
|-----------|-----------|
| 0 to 10   | 21 (9.9)  |
| 11 to 20  | 27 (12.7) |
| 21 to 30  | 11 (5.2)  |
| 31 to 40  | 11 (5.2)  |
| 41 to 50  | 15 (7)    |
| 51 to 60  | 30 (14.1) |
| 61 to 70  | 32 (15)   |
| 71 to 80  | 36 (16.9) |
| 81 to 90  | 25 (11.7) |
| 90+       | 5 (2.3)   |

**Table 3** Demographic data and characteristics of distal forearm fractures ( $n=213$ )

|   | n (%)             |
|---|-------------------|
| <b>Mean age (years): 51.5</b>           |                   |
| Males                                   | 127 (59.6)        |
| Females                                 | 86 (40.4)         |
| <b>Fracture on left side</b>            | <b>114 (53.5)</b> |
| Distal Radius Fractures                 | 136 (63.8)        |
| Distal Radius and Distal Ulna Fractures | 25 (11.7)         |
| Distal Radius Fracture and Ulna Styloid | 49 (23)           |
| Distal Ulna Fracture                    | 2 (1)             |
| Ulna Styloid Fracture                   | 1 (0.5)           |

**Table 5** Demographic data and characteristics of hand and carpus fractures ( $n=136$ )

|                             | n (%)      |
|-----------------------------|------------|
| <b>Mean age 38.8</b>        |            |
| Males                       | 105 (77.2) |
| Females                     | 31 (22.8)  |
| Right:Left Distribution 1:1 |            |

**Table 6** Age groups for all carpus and hand fractures ( $n=136$ )

| Age Group | n (%)     |
|-----------|-----------|
| 0 to 10   | 7 (5.1)   |
| 11 to 20  | 16 (11.8) |
| 21 to 30  | 41 (30.1) |
| 31 to 40  | 20 (14.7) |
| 41 to 50  | 16 (11.8) |
| 51 to 60  | 15 (11)   |
| 61 to 70  | 6 (4.4)   |
| 71 to 80  | 8 (5.9)   |
| 81 to 90  | 7 (5.1)   |
| 90+       | 0 (0)     |

Investigating the 136 carpus and hand fractures further in Table 7 highlights the most common bone injured was the 5<sup>th</sup> metacarpal (27.2%), followed by the proximal phalanx of the little finger (11%). Nine patients suffered two co-existing fractures and one patient suffered three. In the analysis, these are considered as separate injuries.

**Table 7** Fractures in the carpus and hand (n=136)

| Bone Fracture                  | n (%)     |
|--------------------------------|-----------|
| 1st Metacarpal                 | 5 (3.7)   |
| 2nd Metacarpal                 | 9 (6.6)   |
| 3rd Metacarpal                 | 3 (2.2)   |
| 4th Metacarpal                 | 3 (2.2)   |
| 5th Metacarpal                 | 37 (27.2) |
| Proximal Phalanx Index Finger  | 2 (1.5)   |
| Proximal Phalanx Middle Finger | 2 (1.5)   |
| Proximal Phalanx Ring Finger   | 2 (1.5)   |
| Proximal Phalanx Little Finger | 15 (11)   |
| Distal Phalanx Thumb Finger    | 4 (2.9)   |
| Distal Phalanx Index Finger    | 7 (5.1)   |
| Distal Phalanx Middle Finger   | 8 (5.9)   |
| Distal Phalanx Ring Finger     | 8 (5.9)   |
| Distal Phalanx Little Finger   | 10 (7.4)  |
| Middle phalanx Little Finger   | 2 (1.5)   |
| Middle Phalanx Middle Finger   | 2 (1.5)   |
| Middle Phalanx Ring Finger     | 5 (3.7)   |
| Scaphoid                       | 8 (5.9)   |
| Triquetrum                     | 3 (2.2)   |
| Pisiform                       | 1 (0.7)   |

The data analysis also reviewed the documented mechanism of injury for all hand and forearm fractures sustained during this three-month period (Table 8). The largest number of fractures (46.6%) occurred due to falls followed by (40.3%) listed under the

general term of trauma with no details of the type of trauma suffered.

**Table 8** Mechanism of Injury for all fractures audited (n=365)

| Mechanism of Injury | n (%)      |
|---------------------|------------|
| Amputation          | 4 (1.1)    |
| Crush Injury        | 14 (3.8)   |
| Fall                | 170 (46.6) |
| Fight               | 2 (0.5)    |
| Hit                 | 3 (0.8)    |
| LCW                 | 4 (1.1)    |
| Mallet              | 1 (0.3)    |
| MVA                 | 11 (3)     |
| Pain                | 1 (0.3)    |
| Punch               | 4 (1.1)    |
| Sports Injury       | 2 (0.5)    |
| Trauma              | 147 (40.3) |
| Twisting            | 1 (0.3)    |
| Swelling            | 1 (0.3)    |

## DISCUSSION

This audit provided baseline data of current hand and wrist fractures within the small population of the island of Malta, which can be used for comparison in future repeat studies. Studies around the world have shown changing patterns of distal forearm fractures.<sup>13</sup>

In Malta, the number of hand and wrist fractures confirmed from the total number of orthopaedic X-rays is slightly higher than those confirmed in a similar audit in Saudi Arabia.<sup>4</sup>

The gender distribution data of the hand and forearm fractures in Malta is 1.2:1. However, data from Saudi Arabia showed a higher male dominance a 2.8:1 ratio<sup>4</sup>, and Amsterdam 1.8:1<sup>7</sup>. If the Malta data is analysed for the hand injuries only (excluding wrist joint

injuries) the male to female ratio changes to 3.2:1 male to female ratio. This therefore shows a much higher incidence among males, similar to another international audit identifying a distribution of 3:1.<sup>2</sup> This is probably due to injuries in manual jobs performed more commonly by males in addition to certain sports.

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#### FRACTURES OF THE DISTAL FOREARM

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In Malta, fractures of the distal forearm of the total fractures of the hand and wrist is quite a high percentage when compared to other studies which reported 30% in the distal forearm while another reported an incidence of 44%.<sup>3,4</sup>

The gender distribution for specifically distal radius fractures is of 1.5:1 female to male ratio. In Oslo, the female to male ratio is of 3.5:1 showing a much higher distribution among females compared to our cohort,<sup>8</sup> possibly due to a higher incidence of osteoporotic fractures in Oslo. The causes are not properly understood<sup>8</sup> In this audit, the male to female ratio for the age group above 50 is in line with the estimated worldwide ratio for distal forearm fractures.<sup>1</sup> The large number of distal forearm fractures in the 60+ age group occur in females, possibly explained by a decrease in bone mineral density (BMD) in post-menopausal females compared to males. Women over 65 were 4.88 times more likely to have a fracture of the distal forearm when compared to males,<sup>14</sup> similar to that found in this audit, showing that women above 60 are 4.2 times more likely to suffer such a fracture. This is important when considering that life expectancy for Maltese females is 83.3 years and there is an increasingly ageing population.<sup>15</sup>

The peak age for a fracture of the distal radius in Malta was found to be in the 71 and 80 age

group, followed by the decade between 61 and 70. This is an important issue for such patients since a higher incidence of osteoporotic fractures and increased mortality has been documented for these types of fractures.<sup>1</sup> In the younger population, the peak age group occurs between ages 11 and 20, possibly due to more people participating in sports activities. The incidence then decreases and increases again after 50 years of age. The peak incidence in Malta is similar to that in Saudi Arabia,<sup>4</sup> the 70+ age group, and in Oslo, also showing a peak in the 70 to 80 age group.<sup>8</sup> There is a significant difference from the audit in the United States where a peak is seen in the 5 to 14 year age group and a reduction in the numbers following that age group.<sup>7</sup> This highlights the need to further understand the incidence of fractures in Malta in the distal forearm.

Analysis of the mechanism of injury revealed that 65% of all fractures of the distal forearm occurred due to a fall, which is the most common mechanism of injury.<sup>3</sup> 40% of X-Rays requested identified the mechanism of injury to be trauma, with no further description of the type of trauma. It is noted that a proportion of those described as trauma could also have suffered a fall, which would result in a higher number of injuries with this mechanism.

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#### FRACTURES OF THE HAND

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Locally, the most commonly injured bone in the hand was the 5<sup>th</sup> metacarpal responsible for 24.3% followed by fractures of the little finger. This is in line with other reported studies where the 5<sup>th</sup> metacarpal was also the most commonly fractured bone with the little finger suffering most fractures.<sup>2,10,16</sup> Our audit shows that 60% of fractures of the

metacarpals occur in the right hand in line with other reports.<sup>4,7</sup>

The phalanges are the most commonly injured group of bones, as the distal aspect of the hand is more susceptible to injuries similar to our local results.<sup>4,7</sup> Interestingly 85.7% of fractures of the metacarpals in Malta occurred in males.

In Malta, the peak occurs in the 31 to 40 years old age group followed by a steady decline in the numbers of hand injuries, similar to the audit in Amsterdam<sup>5</sup> and British Columbia<sup>17</sup>. In another audit, the peak observed was in the age group between 11 to 20 years followed by a decline.<sup>2</sup>

The most common age group for fractures of the phalanges was in the 21 to 30 age group. This is similar to that reported by an audit in Groningen.<sup>5</sup> In Malta, males were 3.1 times more likely to injure the phalanges, higher than results in Groningen where there was a 2.5 times in males compared to females.<sup>5</sup>

Reviewing hand fractures data alone highlighted 75.7% occurred in males of a range of ages, similar to that observed in an audit in British Columbia.<sup>17</sup> It could be speculated that these occurred due to manual labour, however, more information is needed to confirm this. These injuries are likely to result in the need for time off work and have economic implications. Early rehabilitation is essential as this group of people need to return to work as soon as possible with little or no disability, ideally to the same job. Studies have found that 41% of hand injuries occur due to sport injuries and fighting and only 9% occur at work, therefore these facts could explain why the younger population tend to suffer such fractures.<sup>2,17</sup> The impact of these fractures would affect the income of these patients and their families.

More detail of the patients mechanism of injury for these fractures was not available on the X ray request forms studied in this data collection but would have informed this discussion further. How many injuries were sustained due to sports/hobbies or occupational injuries? Common finger injuries in young children occur when their hands get stuck in doors.<sup>5</sup> Keeping these mechanisms in mind would be useful when planning prevention strategies.

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### CARPAL FRACTURES

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The most commonly injured carpal bone in previous studies is the scaphoid.<sup>7,17</sup> They are reported to constitute 5%<sup>7</sup> to 10.6%<sup>17</sup> of all hand fractures. In this audit, 5.9% of all hand fractures were scaphoid fractures. In this group, 83.3% were males while 16.7% were females.

The most common mechanism of injury reported in this audit are trauma and falls which make up 83.3% (10) of the mechanisms described. The literature confirms that younger people have a larger chance of suffering a fracture scaphoid other than a Colles' fracture following a fall.<sup>18</sup>

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### HAND DOMINANCE

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Although 90% of the world's population is right handed dominant.<sup>18</sup> this audit data showed a fairly equal distribution of hand injuries on the left and right side with slightly more on the left. This finding is similar to previous studies,<sup>2,7</sup> implying that dominance does not equate to an increased risk of injury on one side or another. However, fractures of the distal radius occurred more commonly on the left possibly due to lower bone mass on the non-dominant hand.<sup>11</sup> When looking at distal radius fractures, there is also a slight difference as left-sided fractures where

slightly more common locally similar to an audit in Riyadh.<sup>4</sup> Hand dominance is an important issue for the therapist during rehabilitation. This is important due to occupational issues and even in the case of students who need to write frequently. The non-dominant hand tends to be weaker than the dominant hand in right hand dominant people,<sup>20</sup> and therefore might lead to a longer rehabilitation period.

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#### ROLE OF THE HAND THERAPY SERVICE

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The physiotherapists and occupational therapists working in the hand therapy service, as well as rehabilitating patients post injury have a vital role providing advice on accident and fall prevention. In the 60+ age groups, the percentage of fractures of the distal forearm rose to 75% compared to the age group below 60, which shows a further increase in the risk of such injuries due to falls. Due to favourable weather conditions in Malta throughout most of the year it is very common for the population of all age groups to go out frequently, possibly leading to an increased risk of falls and consequent fractures. The data helps inform potential risk factors and Professionals working in hand therapy may now embark on educational programmes which could include visiting day centres and local councils, advising retirement homes and media appearances to help reduce potential falls. Future similar audits should be carried out to compare the impact of prevention strategies, such as fall prevention programmes.

Diagnosing and treating osteoporotic fractures ensures that these patients are also managed to prevent further fractures.<sup>1</sup> Fractures of the distal radius in the elderly could actually be used as a predictor for other types of fractures.<sup>12</sup>

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#### LIMITATIONS

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The largest limitation of this audit is that the mechanism of injury reported on the X-ray request was not recorded in enough detail to clearly inform the discussion. Information taken from the PACS was discovered to be too generic. It has since been suggested that more details about the mechanism of injury are documented when requesting imaging to better understand the reasons behind such injuries and inform further audits. Ideally, patients should have been interviewed to obtain more details of the mechanism of injury, any medication, smoking history and occupation to provide more information regarding causes of fractures.

The audit should, ideally, be performed over a year in order to understand seasonal variation for these injuries. However, this audit provided an initial snapshot of the situation in Malta which has helped in service planning.

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#### CONCLUSION

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Since Mater Dei Hospital caters for the majority of the Maltese population, this audit reflects and benchmarks the situation across Malta. The data analysed demonstrates similar patterns of hand and forearm injuries when compared to the available literature. Data was found to have similar trends to these international studies suggesting that Malta can follow international management strategies when dealing with distal forearm, carpal and hand fractures.

Following the setup of an official hand therapy service in 2010, currently manned by 3 physiotherapists and 3 occupational therapists, this audit gives us an indication of the staffing levels required, for capacity building and the need for further training to



keep up with the demands on the service keeping in mind the increasing population.

The most common fractures include the distal radius in the elderly and the 5<sup>th</sup> metacarpal in the younger population. As well as providing effective early rehabilitation after these fractures it is important to implement strategies to prevent such fractures. Involvement in education programmes and collaboration with government entities, better workplace health and safety and early treatment for potential osteoporosis. In view of an ageing and increasing Maltese population, one should expect that the numbers of hand and wrist fractures will increase and therefore, the service must ensure preparedness with adequate numbers of trained therapists to manage these cases.

Therapists in Malta also need to play a larger role in development of prevention strategies both for the elderly population and the younger working population. Prevention is of utmost importance to limit the burden both economically health services as well as on the patient's.

This audit successfully provided a baseline of such fractures and calls for repeat analysis in the future to compare trends and patterns.

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