

# Incidence estimates of hand and upper extremity injuries in Italy

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## Abstract

**Objective.** The purpose of this investigation is to estimate the incidence rates of upper extremity injuries and to give an overview of the most frequent diagnoses.

**Materials and methods.** Two population databases were queried for all injuries in the upper extremities, the SINIACA-IDB (S-IDB: Emergency Department Injury Database in Italy) and the Hospital Discharge Register (HDR). The diagnoses codes of hand trauma were selected from both databases in order to estimate the national incidence rate.

**Results.** According to the S-IDB data of year 2011, total 1 479 510 ED attendances per year in Italy were estimated with an upper extremity injury (incidence rate: 2491 per 100 000 persons/year). About 880 816 Emergency Department (ED) attendances per year are due to hand injuries, while over 653 336 attendances per year concern arm injuries. The incidence rates are 1483 and 1100 per 100 000 person/year respectively. About 201 940 hospitalizations are observed in the HDR because of upper extremity injuries (incidence rate: 340 per 100 000 persons/year). Males have higher incidence rate (387 vs 280 per 100 000 persons per year). The trend in the incidence rates for the age group of inpatients shows two peaks: at age 12 (400 cases per 100 000 persons/year), and in the older age groups (700 cases per 100 000 persons/year).

## Key words

- arm injuries
- upper extremity
- epidemiology
- incidence
- population surveillance

## INTRODUCTION

According to several sources, incidence rates of the most common upper extremity injuries vary broadly internationally as for the other types of injuries [1, 2]. The incidence rates of scaphoid fractures ranged from 1.47 to 26.0 per 100 000 people [3, 4]. An UK study reported an incidence of finger fractures of about 380 per 100 000 people [5].

Between year 1997 and 1998, 1 out of 55 Dutch population and 1 out of 28 Danish people attended Emergency Department (ED) because of hand injuries [6]. A Dutch study [7] reported that fractures of the hand are 19% of all fractures observed in the ED in a large university hospital in The Netherlands. In the USA, 35% of ED lacerations between 1992 and 2002 involved the upper extremity [8]. Some studies evaluated the economic burden and the health care resource

consumption of upper extremity injuries [9, 10]. It is estimated that in Germany 33% of all occupational injuries and 9% of all invalidity pensions are due to severe hand trauma [11].

No studies were reported regarding the epidemiology of upper extremity injuries that bring patients to ED in Italy. ED attendances are rising, and ED crowding is a worldwide increasing problem [12]. Our study is aimed to estimate the incidence of upper extremities injuries in Italy by means of the injury data of the surveillance network of the external causes of injuries SINIACA-Injury Data Base (S-IDB) and the Hospital Discharge Records (HDR).

The IDB is the ED injury data collection hosted by the European Commission (EC) that in Italy has been integrated in the National home injuries surveillance system (SINIACA System). The S-IDB contains stan-

standardized information on the external causes of injuries treated in selected emergency departments in Italy. A detailed description of upper extremity injuries and characterization by external cause is provided according to the World Health Organization injury surveillance guidelines [13]. This surveillance system produces fundamental measures for programming public health interventions, such as injury prevention actions, trauma care resource allocation, and fixation of training priorities.

The extension of the surveillance network in Italy leads us to calculate incidence rates for injuries.

## MATERIALS AND METHODS

This is a cross-sectional descriptive epidemiological study.

All data were obtained from the S-IDB and HDR database. The Italian National Institute of Health as IDB National Database Administrator proceeded with the data analysis on anonymous records.

The S-IDB system is structured on two levels. The first level consists of a synthetic coding procedure (Minimum Data Set: MDS) and is active during year 2011 in 113 hospitals in 3 regions (Piedmont, Tuscany and Sardinia) in which injury coding conversion from standard national ED register codes to European IDB-MDS ones has been performed. The second level consists of an analytical coding procedure (Full Data Set: FDS), compatible with IDB-FDS codes, that is active in 30 sample hospitals of 9 Italian regions (Piedmont, Aosta Valley, Province of Trent, Liguria, Emilia-Romagna, Umbria, the Marches, Molise and Sardinia). Both levels have information about the treatment and follow up including patients which are sent at home after ED visit.

These ED attendances and HDR data have been analyzed considering upper extremity injuries by geographic location, age, gender, injury body part and nature, length of stay and surgical procedures (for inpatients).

S-IDB MDS data are coded according to the IDB-MDS coding [14]. In the S-IDB MDS register, the injury ED cases have been included for which the 8 fundamental variables required on the Minimum Data Set for injury surveillance are retrieved according to the WHO specific guidelines: anonymous record number, age, sex, intent, place of occurrence, activity when injured, nature of injury (plus body part) and mechanism of injury. The ED information encoded according to the Italian National Register of Hospital Emergency (EMUR: EMERGENCY and and URGENCY register) is convertible into European MDS format for all the injuries attendances observed at ED with concern to the nature of injury, body part, treatment (coded as International Classification of Diseases 9th revision Clinical Modification: ICD-9-CM) and follow-up. Whilst the information on the external causes of injuries is convertible into European MDS format only for the patients sent from the 118 health emergency rescue service (about 16% of all the ED injury patients).

For the purposes of this study, in order to estimate the incidence rates of ED attendances due to upper extremity injuries we used the diagnoses and treatment information from the S-IDB MDS register only, provid-

ed for all the ED injury cases. In this register we selected data from Piedmont, Tuscany and Sardinia, regions sited in northern, central and southern Italy respectively (16.3% of the Italian population).

A similar analysis on injury information from diagnoses and treatment was performed on HDR national data coded according to the ICD-9-CM. In the analysis the cases of hospitalization with one or more diagnosis compatible with injuries to the upper limb have been considered, both in the main and in the secondary diagnoses. The incidence rates of inpatients because of upper extremity injuries have been calculated on data from HDR only.

For both ED and HDR records the following variables have been investigated: date of attendance (admission for the HDR), age, sex, nature of injury, body part, treatment (surgical procedures) and follow-up (e.g., treated and sent home, treated and admitted, etc.).

Univariate and bivariate analyses were performed. For the continuous variables, mean, median and percentiles were calculated.

The diagnoses codes for upper limb injuries were selected from S-IDB (Piedmont, Tuscany and Sardinia) and HDR (whole Italy) databases in order to estimate the incidence rates. Data were analyzed according to a body part diagram. The upper extremity includes the following regions: shoulder (clavicle and scapula), upper arm (proximal humerus and humeral shaft), elbow (distal humerus, proximal radius and ulna), forearm (ulna e radius), wrist (distal ulna and radius, carpal bones), hand and fingers (metacarpal bones and phalanges).

The specific nature of injury categories used in the S-IDB or in the HDR database were amputation or avulsion, contusion/bruise, crush, dislocation, foreign body, fracture, open wound, injury to nerves, strain or sprain, burns and others.

For each upper limb region, we calculated the frequency distribution of patients by nature of injury for each body part.

For each main body part (hands and arm) we selected the first 10 diagnoses according to their frequency ranking and estimated the morbidity incidence rates of ED attendances and hospital admissions. Finally, we analyzed the reference population by age groups, diagnoses and treatments groups in order to define the most frequent clinical conditions and interventions.

## RESULTS

As previously said, we describe the epidemiology of the upper extremity injuries according to two levels of health care reflecting the injury severity: ED attendances derived from S-IDB and inpatients from HDR data. For the ED attendances we used MDS data from S-IDB system. The coverage of S-IDB sample was equal to 16.3% of the national population in the year 2011. There was a high concordance between the age-sex distribution (for single year of age) of the reference population of the S-IDB sample and the one of the entire Italian population (males: Kendall's tau = 0.879,  $p < 0.0000$ ; females: Kendall's tau = 0.883,  $p < 0.0000$ ).

This agreement, as well as the sample size and the identification of the catchment population with regard

to the entire resident population of the three regions and all the hospitals of these territories with all clinical disciplines and type of hospitals included (*i.e.* regional hospitals, general hospitals, trauma centres, children hospitals, university hospitals) makes us consider the observed one as a reasoned sample allowing to extrapolate the data to national level. The extrapolation factor was calculated as:

$$F = \frac{P}{p}$$

and the incidence of upper limb injuries was obtained as

$$e \times F$$

where:

e = the incidence of ED attendances because of upper limb injuries observed in the S-IDB sample

p = the reference population of the S-IDB sample (resident population of Piedmont, Tuscany and Sardinia: 9 663 289 inhabitants)

P = the resident population of Italy (59 394 207 inhabitants).

We estimate in Italy 1 479 510 (95% CI: 1 473 024-1 485 995) ED attendances per year with upper extremity injuries, meaning that a person resident in Italy has more than 2-in-100 chance of attending to ED with an upper extremity injury in a given year with an incidence rate of 2491 per 100 000 persons/year (95% CI: 2480-2502). Upper extremity injuries accounted for 20.5% of all ED visits for injuries. 880 816 patients per year are estimated accessing the ED because of hand injuries (95% CI: 875 812-885 820), while over 660 000 (95% CI: 649 026-657 646) per year are affected by arm injuries. The incidence rates are 1.48 (95% CI: 1.47-1.49) and 1.10 (95% CI: 1.09-1.11) per 100 000 persons/year respectively.

Incidence rates vary by gender and age. Males have higher rates than females; the weighted mean rates: 3042 males and 2061 females per 100 000 persons/year. Consequently, the males vs. females Incidence Rate Ratio (IRR) of ED attendances for upper limb injury is equal to 1.48 (95% CI: 1.40-1.56). The male/female IRR ranges from 0.8 (age group > 66 years old) to 2.5 (19-30 years old). According to the attendance incidence rates the 10-14 years old group has the higher incidence rate of ED attendances in both genders: 8033 males and 4697 females per 100 000 persons/year for. The IRR in this age group is 1.71 (95% CI: 1.65-1.77). The trends of gender-specific incidence rates are similar until the age of 30 years. Then in females there is an upward tendency of the trend that in males is observed only above 80 years of age

More than 1 out of 10 ED attendances are urgent with a yellow triage code (delayed – severe non life threatening injury) or a red one (immediate – life threatening injury). According to the S-IDB database the average hospitalization rate is about 10% but with great differences between hand or arm injured (5.1% vs 17.4% respectively).

Table 1 and Table 2 show the most common types of injury of the upper extremity that bring patients to ED in Italy, for hands and arms respectively. For the hands the most frequent types of injuries are open wounds of

**Table 1**

Hand injuries (Emergency Department – ED attendances): percentages top 10 diagnoses. ED surveillance Italian sample SINIACA-IDB (S-IDB: Emergency Department Injury Database in Italy) year 2011 (n = 119 017)

Diagnosis	%
Open wound of finger(s), without mention of complication	20.8
Contusion of finger	8.3
Closed fracture of phalanx or phalanges of hand, unspecified	7.9
Contusion of wrist	6.4
Open wound of hand except finger(s) alone, without mention of complication	5.4
Closed fracture of metacarpal bone(s), site unspecified	4.1
Sprain of wrist, unspecified site	3.9
Sprain of interphalangeal (joint) of hand	3.0
Finger injury	2.9
Sprain of hand, unspecified site	2.8

**Table 2**

Arm injuries (Emergency Department – ED attendances): percentages top 10 diagnoses. ED surveillance Italian sample SINIACA-IDB (S-IDB: Emergency Department Injury Database in Italy) year 2011 (n = 88 280)

Diagnosis	%
Contusion of shoulder region	9.8
Closed fracture of unspecified part of radius (alone)	5.8
Contusion of elbow	5.5
Closed Colles' fracture	4.1
Closed fracture of unspecified part of upper end of humerus	3.6
Closed dislocation of shoulder, unspecified	3.4
Elbow, forearm, and wrist injury	3.4
Open wound of forearm, without mention of complication	3.0
Closed fracture of lower end of forearm, unspecified	2.8
Sprains and strains of unspecified site of shoulder and upper arm	2.7

fingers (20.8%), contusions of fingers (8.3%) and closed fractures of phalanges (7.9%). In terms of incidence rates we estimate 316 (95% CI: 312-320) ED attendances per 100 000 persons/year for open wounds of fingers, 126 (95% CI: 124-128) ED attendances per 100 000 persons/year for contusion of fingers and 120 (95% CI: 118-122) ED attendances per 100 000 persons/year for closed fractures of phalanges.

The most frequent diagnoses for arm injuries are contusions of shoulder region (9.8%), closed fracture of part of radius (5.8%), and contusion of elbow (5.5%). In terms of incidence rates, we estimate 111 (95% CI: 109-113) ED attendances per 100 000 persons/year for contusion of shoulder, 65 (95% CI: 63-67) ED attendances per 100 000 persons/year for closed fracture of

part of radius, and 62 (95% CI: 60-64) ED attendances per 100 000 person/year for contusion of elbow.

The top 5 most frequent diagnoses within the 9 age groups form a cluster of 14 diagnoses. It is possible to identify five different situations: 1) in the age group of 0-4 years the most frequent ED diagnosis is the closed dislocation of elbow (incidence rate: 382.9 per 100 000 person/year); 2) in the age groups 5-9 years and 10-14 years the most frequent diagnosis is the contusion of fingers (incidence rate: 349.0 and 717.8 per 100 000 persons/year respectively); 3) from 15 to 18 years of age the most frequent diagnosis is the closed fracture of phalanges of hand (incidence rate: 291.4 per 100 000 persons/year); 4) from 19 to 80 years of age the most frequent diagnosis is the open wound of fingers with incidence rates ranging from 219.9 down to 531.2 per 100 000 person/year with a decreasing trend by age. Finally in the age group  $\geq 81$  years the most frequent diagnosis is the closed fracture of unspecified part of the upper end of humerus (incidence rate: 175.3 per 100 000 persons/year).

According to HDR data in Italy there are 201 940 hospitalizations with one or more diagnosis of upper extremity injury in the year 2011. In 81.3% of cases these diagnosis codes are the main cause of hospitalization (primary diagnosis). In the remaining cases these diagnoses occur in one of the 5 possible levels of secondary diagnoses. This corresponds to an estimated incidence of 340 per 100 000 persons per year. Males have higher incidence rate with respect to females (387 vs 280 per 100 000 persons per year). The trend by age of incidence rates shows 2 peaks, the first (400 cases per 100 000 inhabitants/year) at 12 years of age, the second (700 cases per 100 000 inhabitants/year) at older ages.

The mean age of inpatients is 40.2 years for males (sd  $\pm$  26.1) and 60.5 years for females (sd  $\pm$  29.8). We observe differences in terms of age in relation to the injury body part. The mean age of the patients injured

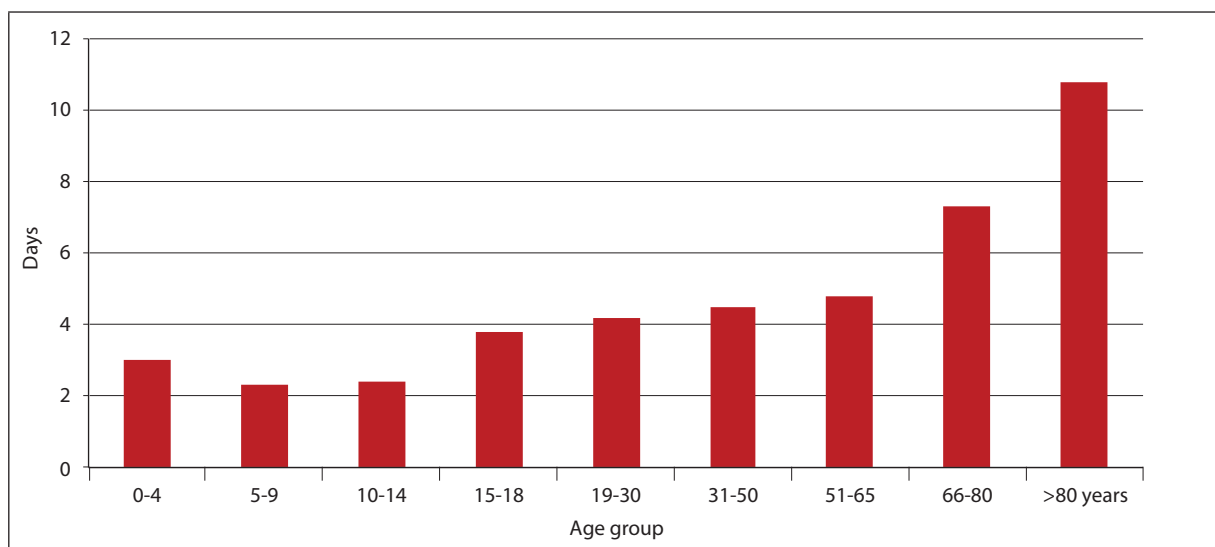
to the arms is 50.2 years (sd  $\pm$  29.0) vs 39.4 years for the patients with injury to hands (sd  $\pm$  26.5).

For the most part these are ordinary inpatients (81.3%) in case of trauma to the upper extremity, however for trauma to the hands the proportion of patients in day hospital rises up to 26.6% regardless of the gender of the hospitalized person. The Average Length Of Stay (AVLOS) of patients is 4.6 days for males (sd  $\pm$  8.9) and 6.6 days for females (sd  $\pm$  10.1). The average length of stay of arm injured is almost double than for hands injured (4.5 vs 2.4 days respectively; sd  $\pm$  6.4 vs  $\pm$  2.4). The length of stay rises slowly until the age of 65 years, increasing dramatically in the elderly population (Figure 1).

The admitted patients for the most (58.3%) are injured to a single part of the body (hand or arm only), especially in case of hand injury, where the percentage of admissions with injuries to a single body part rises up to 65.1%. However, the cases of multi-trauma show a greater severity, measurable as a proxy with an average length of stay 3 times higher than the injuries to a single body part (8.8 vs 2.9 days of hospitalization). Data showed different age distribution between single vs multi trauma groups ( $p < 0.01$ ) with the latter subset more skewed towards elderly people ( $\geq 65$  years old) showing high mean age (55.9 vs 44.1; Student  $t = 117.3$ ;  $p < 0.01$ ).

Referring to the main diagnosis only and taking into account the 35 most frequent ICD-9-CM diagnoses (90.5% of all cases) about 1 out 5 (19.4%) upper extremity injuries were associated with an other body part, mostly fracture of femur (7.7%), intracranial injury (2.2%), concussion (1.9%), fracture of pelvis (1.5%) and fracture of vertebral column without mention of spinal cord injury (1.3%).

The distribution of hospitalized cases by gender and injured body part shows a strong association between the masculine gender and presence of hand trauma ( $p < 0.001$ ), while injuries to the arm do interest for the



**Figure 1**

Upper extremity injuries: average length of stay of inpatients by age group. Hospital Discharge Register Italy 2011.

most females.

The most frequent hand injuries are the closed fracture to the metacarpal bones (17.5%), followed by wound of fingers with tendon involvement (16.0%), traumatic amputation of the fingers of the hand (9.4%) and by the closed fracture of phalanges (8.9%). These four diagnoses together reach more than half of the total (Table 3).

The most frequent diagnosis for arm injuries consists in the late effect of fracture of upper extremities (11.6%), followed by closed Colles' fracture (9.6%), by unspecified closed fracture of lower end of forearm (8.2%) and by the closed fracture of unspecified part of upper end of humerus (7.0%). These four diagnoses together reach more than 1/3 of the total cases (Table 4).

Data in Table 5 show the main procedures according to the age class. In children (0-14 years) the most frequent procedure is the reduction of forearm fracture without internal fixation (18.2% of the procedures in the age group); in young people (15-30 years) the open reduction of carpals and metacarpals fracture with internal fixation is frequently performed (10.3% of procedures), while in adults (31-65 years) is the open reduction of radius and ulna fractures with internal fixation (9.1%), and among the elderly (over 65 years) prevails the open reduction of humerus fracture with internal fixation (13.3%).

## DISCUSSION

According to the incidence rates we estimate 1 479 510 ED attendances due to upper extremity injuries per year in Italy. In Italy, upper extremity injuries accounted for about 20% of all ED visits for injuries. Our findings show that open wounds and contusions of fingers and of shoulder are the most common diagnoses for the upper extremity injuries observed in the Italian EDs. This scenario is similar to other studies that found high percentages of upper extremity injuries [15, 16].

As shown in previous studies [17] the injuries to upper extremity seem to be age-related with the fractures mostly present among the older, open wounds among adults and contusions and dislocations among children. The overall estimate of incidence rate is higher than that found in other studies [15, 16]. This is due to different case definitions. We used a broad definition of upper extremity injury, involving also the region of hands compared to the study of Polinder [15] where the upper extremity injuries are involving only shoulder, arm, and wrist. Adopting the same inclusion criteria of Polinder, we estimate an incidence rate of 844 per 100 000 person/year during 2011 in Italy, not far from the value found in the Dutch study [15] (1089 per 100 000 person/year) and from the study of Ootes [16] (1130 per 100 000 person/year). We decided to include in our analysis the injuries to the hand because they are a major proportion of the injuries observed in many hospitals worldwide [18]. Nevertheless the hand injuries are often neglected, especially when they occur in combination with injuries to other parts of the body [19].

The incidence rates of ED attendances show that both age and gender play an important role. The peak in rates in the age group 10-14 years is quite similar to

**Table 3**

Hand injuries: percentages top 10 diagnoses of admission. Hospital Discharge Register Italy 2011 (n = 52 469)

Diagnosis	%
Closed fracture, metacarpal bones, not specified site	17.5
Wound of fingers with tendon involvement	16.0
Traumatic amputation of the fingers of the hand	9.4
Closed fracture, one or more phalanges, unspecified	8.9
Closed fracture, one or more proximal or middle phalanges	4.2
Closed fracture, wrist navicular (scaphoid)	3.6
Wound of fingers with complications	3.4
Closed fracture, the body of the metacarpal	2.9
Fracture, one or more phalanges, unspecified	2.6
Closed fracture of carpal bone	2.2

**Table 4**

Arm injuries: percentages top 10 diagnoses of admission. Hospital Discharge Register Italy 2011 (n = 149 471)

Diagnosis	%
Late effect of fracture of upper extremities	11.6
Closed Colles' fracture	9.6
Closed fracture of lower end of forearm, unspecified	8.2
Closed fracture of unspecified part of upper end of humerus	7.0
Other closed fractures of distal end of radius (alone)	5.4
Rotator cuff (capsule) sprain	4.5
Closed fracture of shaft of humerus	4.2
Lesion of ulnar nerve	4.2
Closed fracture of shaft of radius with ulna	3.8
Closed fracture of olecranon process of ulna	2.8

that found in the other study [15, 20]. According to Borse and Sleet [20] in this age group a maximal skeletal growth associated with increased calcium demand combined with an increased physical activity leads to several type of injuries, mainly contusions of fingers and wrist and fractures of phalanges of hand.

Males aged 5-65 years old have higher incidence rates of upper extremity injuries than females of the same age. This is in line with other findings, which indicate that males experienced more road traffic accidents and sport injuries [9, 21].

The most frequent surgical procedure in the paediatric population is the reduction of radius and ulna without internal fixation. Surgery becomes more aggressive with increasing age by prescribing the internal fixation after reduction. Procedures to metacarpus and to the hand (fractures of hand, sutures of nerves and tendons) increase after 15 years old. The involvement of tendons is recurring in adults, the more the activities of the person increase; the more the procedures to the hand (sport-related and work-related lesions and the open wounds) are applied. In the elderly population, where falls are common and lesions to elbow and humerus are

**Table 5**

Top 10 surgical procedures in inpatients for upper extremity injuries: percentage of treated inpatients by procedure and age. Hospital Discharge Register Italy 2011 (n = 149 471)

Procedures	0-4 (%)	5-9 (%)	10-14 (%)	15-18 (%)	19-30 (%)	31-50 (%)	51-65 (%)	66-80 (%)	> 80
Other peripheral nerve or ganglion decompression or lysis of adhesions	0.1	0.1	0.1	0.4	1.5	4.4	4.1	2.5	0.7
Closed reduction of fracture without internal fixation, radius and ulna	13.4	20.4	18.0	4.9	1.9	2.0	3.8	0.1	5.1
Closed reduction of fracture with internal fixation, humerus	7.4	7.3	2.7	0.8	0.4	0.6	1.3	2.5	3.1
Closed reduction of fracture with internal fixation, radius and ulna	2.5	8.4	9.0	3.1	1.4	2.2	4.3	5.2	3.5
Other suture of other tendon of hand	1.0	0.3	0.7	1.9	3.2	3.3	2.5	1.2	0.3
Closed reduction of fracture with internal fixation, phalanges of hand	0.9	1.0	2.8	5.1	3.8	2.9	1.6	0.8	0.3
Open reduction of fracture with internal fixation, humerus	5.3	5.9	4.1	4.5	3.6	5.1	9.0	13.8	12.7
Open reduction of fracture with internal fixation, radius and ulna	2.5	8.5	9.7	8.0	7.1	8.4	10.0	9.7	7.0
Open reduction of fracture with internal fixation, carpals and metacarpals	0.1	0.2	1.6	9.9	10.4	5.0	1.9	1.0	0.4
Open reduction of fracture with internal fixation, phalanges of hand	0.8	0.6	1.9	3.5	3.4	2.9	1.6	0.8	0.2

recurring, surgery is the indicated treatment while the fractures of radius and ulna are treated with immobilization by cast, like in children. The majority of decompressions of peripheral nerve or ganglion (80.6%) are due to lesions of ulnar nerve (cubital tunnel syndrome, tardy palsy of ulnar nerve) or to lesions of radial nerve (acute palsy of radial nerve).

The main strength of our study is that we used data from a population-based large sample of ED attendances (S-IDB) and from the national Hospital Discharge Register (HDR). This leads to a more reliable representation of the burden of the upper extremity injuries than the extrapolation of data from one hospital or from one clinical trial only [22].

One of the main problems in dealing the estimate of injuries is the linkage between trauma and its external cause. In fact, in the Italian HDR database in 2011 the trauma aetiology in 52% of the cases is not recorded and in the other 30% there is no specific information about it. In the inpatients for which a specific aetiology is reported, the majority of injuries occur at home (43.0%) followed by road traffic accidents (32.2%). However, a great percentage of upper extremity injuries is work related (19.6%) mostly in patients injured to the hand (the proportion is three times higher than of injuries to the arm).

## CONCLUSION

The upper extremity injuries are a relevant part of all ED attendances related to injury in Italy as well as of all hospital admissions due to trauma. There is a high burden of disease due to injuries considering that children are a population group at high risk of upper extremity injuries, so that many years of life in good health condi-

tion may potentially go lost. The elders are the other group at risk with a large impact on the offer of health care services considering that they have the greatest risk of hospitalization because of upper extremity injuries and the longest AVLOS in hospital.

The burden of this kind of trauma is not due only to the severity of injuries but also to the organizational problems. The emergency network could have troubles about where to carry patients with a severe hand trauma because of the lack of awareness on where distinguished experts for microsurgery and surgery of the hand are available. Often patients are treated first of all at the general surgical emergency and only then forwarded to a micro surgeon. This uncertainty can cause delays in the care and treatment.

According to Giunta [23], hand trauma centers should work in a network exploiting synergy effects optimizing care structures, establishing a hand trauma registry so to provide more detailed data. Good examples for such a network in Europe are "FESUM" in French, Belgium and Switzerland as well as the pilot project "Hand Trauma Alliance" in Germany [24, 25]

With the analysis of data from a large sample like the S-IDB we obtained a clear picture of the ED diagnoses per age-gender specific population groups. This study contributes to assess the health impact of upper extremity injuries on the Italian population and health system in terms of morbidity indicators such as the incidence rates of ED attendances and hospitalized cases. These data will lead to assess the cost of injuries and evaluate the benefit of preventive interventions and planning of the health care organization.

Developing population-based knowledge of the injuries by anatomic site is essential for health care re-

sources allocation, the organization of health care services, preventive measures optimization and research purposes.

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### Conflict of interest statement

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