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Epidemiology of traumatic hand injuries

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Abstract
Epidemiology is a dynamic field that takes into account several aspects related to human diseases, including infections, human social or travel patterns, as well as climate, environmental conditions, and occupational factors. Hand trauma somehow constructs a practical image of society and the nature of its broad activities, not only but also it reflects safety measures in various aspects. Hand and wrist injuries not just account for a significant portion of all injuries observed in emergency departments, but also impose a huge financial burden on community.

Keywords: Traumatic hand, financial burden on community, injuries

Introduction
Epidemiology is a dynamic field that takes into account several aspects related to human diseases, including infections, human social or travel patterns, climate, as well as environmental factors. This implies that the findings acquired for a particular disease or outbreak may not necessarily be able to be replicated for the same illness in an alternative environment [1].
Hand trauma refers to a variety of injuries that affect both the soft tissues and bones of the hand. These conditions are managed in the emergency departments and by plastic and orthopaedic surgeons in specialized hand clinics. The hand plays a crucial role in both occupational and social functions, and because hand injuries are generally complicated, they typically require specialized care in hand units [2].
While hand trauma is often not fatal, hand injuries often result in significant morbidity. Hand trauma frequently leads to a reduced quality of life, impairing a patient's capacity to work and contribute to their communities. In extreme situations of bilateral hand injuries, it may even end in the incapacity of caring for oneself [3].

Impact of hand injuries on patient's life
The main scale of hand trauma problem lies in two main aspects. First is that hand trauma mainly affects the working population mostly leading them to terminate their work at least temporarily non the less, hand trauma mainly causes permanent disability and victims rarely return to same work again. Secondly, despite major advances in hand surgery and reparative and reconstructive procedures, there is no escape from disability even to a minor degree. Thus, from the moment of trauma the sequel is already determined considering best- and worst-case scenarios. That necessitates directing the national spending to prevention programs considering that the main context of hand injury which is work related injury is considered preventable to a remarkable degree.
Dexterity impairment is a common consequence of various musculoskeletal disorders affecting the hand and upper limb. According to a recent census in Canada, around 1 in 28 persons had a dexterity-related handicap [4]. Internationally, numerous research from various nations have found a significant occurrence of dexterity impairment, which leads to a reduced capacity to maintain paid employment and participate in daily activities [5].
Dexterity encompasses the extent to which a task is executed with regard to all measures of achievement, such as task effectiveness, precision of movement, and adaptability to changing circumstances. Hence, Yong *et al.* [5], suggest that the dexterity of the hand should not be confined to finger or fine motor skills, but should also encompass the overall ability to do meaningful daily activities with the hand. He holds the view that the concept of dexterity is

applicable to the evaluation of everyday tasks and aligns with how task performance is assessed in real-world situations.

Given the profound significance attributed to hands, it is comprehensible that individuals who experience hand trauma may encounter changes in their perception of their own bodies [6] and experience psychological discomfort. Hands have a crucial role in defining our identity, granting us autonomy in tasks, recreation, self-care, social engagements, and communication. The prevailing societal stigma around disability results in feelings of insecurity, ineptitude, and dependency when one has a nonfunctional hand, leading to obvious negative psychological responses. The memory of the injuries and the physical condition of the hand can elicit an emotional response and lead to psychological anguish [7].

Acute and persistent pain had been more strongly linked to hand and digital amputations compared to other types of injuries. [8] This association was not modified by whether the amputated body parts were reimplanted or not [9] Damage to the hand that is used more frequently also resulted in higher levels of pain, as indicated by pain ratings [10].

The majority of individuals who have experienced trauma exhibit a variety of symptoms associated with post-traumatic stress disorder (PTSD) but are able to adjust well within a period of three months. However, a subset of individuals experiences persistent issues over a prolonged period of time. Approximately 30% of these individuals experience recovery after one year, whereas one-third continue to exhibit symptoms even after a decade [7].

Hand trauma patients showed notable anxiety symptoms [9], with reported prevalence of acute affective symptoms ranging from 24% [7] to 72% [11]. Depression and anxiety coexisted with feelings of disgust, anger, aggressiveness, and concerns related to physical appearance [12]. The decline occurred over a period of 18 months [11], consistent with a reaction to adjusting after an injury, with the most significant decrease happening in the initial 3 months.

Approximately 50% of patients who experience upper-extremity injuries and have psychiatric symptoms may not have undergone psychiatric therapy before. Pointing out self-inflected hand injury which can be a preventable cause of hand and upper extremity trauma [13].

General epidemiological aspects of hand trauma

Hand trauma somehow constructs a practical image of society and the nature of its broad activities, not only but also it reflects safety measures in various aspects.

Upper limp injury is almost one third of all trauma presentations at emergency departments across the US according to the National trauma data bank in its last update in 2016, and although it's only associated with fatality in 2.72% of cases but it remains a major etiology of disability and impaired quality of life.

Hand trauma reflects the industrial culture in China. In the last decade, studies conducted in China have revealed that occupational hand trauma patients make up 50%–80% of the overall cases of hand trauma, which is greater than the global average. Furthermore, it is the most prevalent type of occupational injury treated in emergency departments, with male predominance 81% against 19% in females [12].

In a 17-year period study from 1998 to 2015 in England, 845,890 episodes of hand injuries had been documented in hospital episode statistics (HES) data, about 76% of injuries occurred in men compared to 24% in females. The population in England experienced an overall growth of 11%. Correlated to a 76% increase in the absolute number of hand injuries per year and a 57% growth in the incidence of hand injuries per 100,000 population [2].

There is a controversy whether soft tissue injury or fractures is a more common type of injury. Angermann *et al*. [14], recorded the most frequent traumas are wounds, followed by contusions and fractures. Manley *et al*. [2], recorded the most common form of hand injury was Fractures 51% followed by muscle and tendon lesion 22%, nerve lesion 9%, nail bed laceration 9%, amputation 8%, vessel lesion 1%, and finally nail bed contusion respectively. Its observable that there is no universality in the most common type of injury. On the contrary, it's unique to every society and shapes by the shape of traditions and major working activities.

The fingers accounted for the majority of fractures (46%), followed by the metacarpals (36%). Extensor injuries constituted 54% of the total injuries, while flexor injuries comprised 28%. Most of the nerve injuries observed were digital nerve injuries, with 55% occurring in the finger and 14% in the thumb. The incidence of traumatic amputations at the wrist level in England is rare, with a frequency of 1-12 cases per year. Although The finger was the most frequent location for amputation, either partially or completely. Replantation procedures were significantly less frequent than documented amputations. The reimplantation procedure was performed on around 3% of the fingers that were amputated, and on approximately 8% of the thumbs that were amputated [2].

Incidents of nail bed injuries are on the rise, particularly among children aged 0-14. Crush injuries that occur indoors are the most common cause of these injuries. Repairing these injuries in children generally necessitates the use of general anaesthesia, which entails risks and potential long-term consequences. The frequency of nail bed repairs increased proportionally with the number of nail bed injuries, indicating that there is no evidence of a diminishing threshold for surgical treatment in these patients [2].

Costs and economic burden of hand trauma

Hand and wrist injuries are not only a significant portion of all injuries observed in emergency departments, but they also impose a huge financial burden on society. The injuries cost significant healthcare expenses (Direct costs) as well as productivity losses (Indirect costs), with the latter being the primary factor [15].

According to De Putter *et al*. [15], there are only a limited number of research conducted at single centres that have assessed the expenses associated with hand and wrist injuries. Additionally, there is a lack of population-based studies on this subject. Based on prior research, it has been established that the expenses spent due to work absenteeism are typically greater than the costs associated with healthcare [16].

The overall expenses associated with injuries in The Netherlands amounted to $4.4 billion, comprising $2.5 billion in direct healthcare expenses and $1.9 billion in productivity losses. In 2007, hand and wrist injuries incurred a cost of $740 million, making them the most expensive type of injury. They surpassed knee and lower limb fractures, hip fractures, and skull-brain injuries in terms of cost. Approximately 56% of the expenses attributed to hand and wrist injuries were specifically associated with productivity expenditures. The age distribution data reveals that individuals between the ages of 20 and 64 accounted for nearly 75% of the total costs associated with hand and wrist injuries, indicating a significant impact on productivity expenses [15].

The primary responsibility was attributed to hand fractures. Over 50% of those with hand and wrist injuries exhibit open wounds or superficial injuries, however these cases contribute to less than 10% of the total economic burden. This group exhibits comparatively modest healthcare expenditures per individual case and minimal reduction in output. The prevalence of patients with intricate soft-tissue injuries, such as crush injuries or traumatic amputations, was minimal. However, on an individual patient basis, these injuries result in substantial healthcare expenses and a decrease in productivity [15].

A comprehensive analysis conducted in 2016 on the direct and indirect expenses associated with hand injuries revealed that these types of injuries impose a significant financial strain, irrespective of the specific injury received, the cost elements considered, or the location of the study. It is important to mention that occupational therapy and physiotherapy services have been shown to make up only 0.01% of the total cost. However, they have the potential to significantly reduce indirect costs associated with lost productivity and missed work days [16].

Table saw injuries in the United States, regardless of whether they occur at work or not, lead to significant expenses for patients, their families, and insurance providers. According to the U.S. Consumer Product Safety Commission Injury Cost Model, approximately $2.13 billion is annually allocated towards the medical treatment of blade-contact injuries caused by table saws [17].

A different investigation assessed the economic impact of hand injuries and identified the primary factors that contribute to the expenses of hospitalization in Vietnam. The majority of medical expenses were paid directly by individuals, and the primary factors driving hospitalization costs were surgical procedures, diagnostic testing, and pharmaceuticals. Even among patients who had health insurance, there was no notable reduction in hospitalization expenses in Vietnam. Conclusion: the huge expenses associated with hospitalizations due to injury, along with the rising healthcare expenditures, impose a substantial financial strain on patients and their families, particularly in LMICs [18].

Impact of hand injury on low and moderate-income countries (LMICs)

The process of economic growth is expected to lead to an increase in hand injuries in LMICs. There is typically a deficiency in the workforce and urgent medical systems when it comes to managing hand injuries. A significant number of trauma centres in LMICs lack adequately educated hand surgeons, nursing personnel, and the necessary equipment to effectively treat hand trauma, such as a shortage of internal fixation devices. Given that several LMICs have a scarcity of surgical physicians, with a density of fewer than 1 per 100,000 population, the exact number of surgeons with the necessary training to handle hand injuries remains uncertain [19].

The Lancet Commission on Global Surgery has shown that 90% of those who require surgery in LMICs are unable to get essential surgical treatment. Approximately 5 billion individuals globally are impacted by limited availability of surgical treatment [3].

Hand injuries frequently occur in LMICs. The patient's dominant hand is often the one that is more frequently afflicted, which negatively impacts the prognosis for the patient's ability to return to work. Hand trauma is often caused by several factors such as traffic accidents (Including injuries to both pedestrians and vehicle occupants), occupational accidents, falls, burns, weapons (Such as firearms, landmines, machetes, and explosives), interpersonal confrontations, ethnoreligious clashes, and acts of terrorism [20].

Motorcycles are often utilized for transportation and frequently suffer from inadequate maintenance. Additionally, road infrastructure is weak, traffic regulations are poorly implemented, and the absence of protective gear leads to a high number of daily accidents and hand injuries. Occupational accidents are prevalent in LMICs, where there is often a lack of protective equipment, machine safeguards, and return to work programmes [3].

In 2010, a prospective research was conducted in Ethiopia to assess the clinical consequences of acute injury to the hands in 253 individuals. Most of the injuries took place in the workplace, accounting for 75% of all injuries. Out of these workplace injuries, 75% were caused by machinery. Most patients (198, 78.3%) were treated without surgery due to the absence of a surgical facility. Overall, the ultimate results were unsatisfactory. According to the evaluation of the participants' range of motion at the last follow-up test, 62% of them had unfavourable end results. Ultimately, a total of 63 patients, accounting for 17% of the sample, were unable of resuming their prior employment [20].

In 2010, prospective research was undertaken in Nigeria to investigate the causes of hand injury. The study included 74 individuals. The predominant causes of injury were road accidents and accidents related to equipment operation. Engineers had the greatest percentage of hand injuries, with the palm (zone three) being the most often affected area [21].

A different study examined hand injuries in Poland between 1987 and 2000, at a period when Poland was classified as a middle-income nation. The researchers provided a description of 1199 individuals who had treatment for intricate hand injuries. The majority of injuries occurred in home settings using mechanical equipment, which not only constituted the most frequent source of injury but also accounted for the most serious injuries. Persistent impairment was shown to be connected with more severe injuries and older age. The average cost of therapy per case was $6162.76. Direct expenditures, which amounted to $246.96, made up just 4% of the overall costs, whereas indirect costs, totaling $5915.8, represented 96% of the total costs [22].

Research done in 2010 aimed to evaluate the risk variables associated with work-related hand injuries (WRHI) in China [23]. The majority of injuries took place in factories, accounting for 85.4% of all incidents. The index finger was the finger most often wounded, whereas the right thumb sustained the most serious injury. There was a shown correlation between injury incidence and both gender and organisation size. Gender and usage of powered machines were also shown to be correlated with severity. The researchers determined that the industrial sector and the use of mechanised equipment are the main causes of significant hand injuries.

A cross-sectional research was conducted in Malaysia in 2012 to analyse the prevalence and variables linked to WRHI. According to the data, WRHIs accounted for 24.9% of all occupational injuries documented [24].

In 2004, a retrospective analysis of fingertip injuries specifically in Kuwait in the year 2000 was published [25]. The predominant cause of harm was the falling of a heavy weight. The yearly treatment cost for fingertip injuries was anticipated to be more than US $2 million, with an average sick leave duration of 30 days. Injuries affecting just the fingertip impose a substantial medical and economic impact on the person, employer, and society.

The known research on hand injury in LMICs have a poor

quality. The scarcity of data on hand injuries and their related impact may be due to many causes, including the low prioritization of hand injuries on the worldwide health plan and the limited focus on injury prevention activities in LMICs. The limited financial resources and shortage of skilled researchers in LMICs may account for the absence of thorough population-based studies. These studies are crucial in informing more effective resource allocation for both the prevention and management of hand injuries [19].

Tanta as a city at central delta region

Tanta city is the capital of the El-Gharbia governorate which occupies a central position in the delta region of the river Nile. El-Gharbia governorate has a population exceeding 5,000,000 habituating a surface area of about 1900 square kilometers [26]. El-Gharbia governorate is divided into 8 major provinces. Which is Tanta, El-mahalla, El-Santa, Basyoun, Kafr El-zayat, Kotor, Zefta and Samannoud. Each of the major provinces includes a central hospital from which Tanta University Hospital receives different patient referrals. In addition to cases presented from Kafr El-sheikh, El-behera and other governorates.

Tanta university hospitals are located at the center of the city providing a tertiary level health service. This Includes the emergency hospital that provide critical and emergency care twenty-four seven, in a multi-disciplinary manner. Each of Neurosurgery, general surgery, GIT surgery, vascular surgery, pediatric surgery, plastic reconstructive surgery & burn unit, cardiothoracic surgery & orthopedic surgery include emergency sectors all are integrating through complex and polytrauma patients at the Emergency hospital. In addition to internal medicine & endoscopy, toxicology, intensive care units, lab, blood bank & radiology are all available specialty services at Tanta university emergency hospital.

The Plastic and reconstructive surgery department operates a burn unit with a total capacity of 19 beds at the emergency hospital. And together with vascular and cardiothoracic surgery, operate a common pool of 3 operating rooms and 1 recovery room as well as 6 surgical wards of total 32 beds.

Conflict of Interest

Not available

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Not available

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