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Patterns of health care use of injured adults: A population-based matched cohort study

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ABSTRACT

Background: Healthcare use by traumatically injured individuals prior to and subsequent to their injury are not often explored for different types of injuries. This study aims to describe health care use 12 months preceding and 12 months following a traumatic injury by injury type and injury severity.
Method: Hospital and mortality data from three Australian states were linked in a population-based matched cohort study. Individuals ≥18 years who had an injury-related hospital admission in 2009 were identified as the injured cohort. A comparison cohort of non-injured people, matched 1:1 on age, gender and postcode of residence, was randomly selected from the electoral roll. Twelve-month pre- and post-index injury health service use was examined. Rates, adjusted rate ratios and attributable risk proportions were calculated by injury type and severity.
Results: The injury cohort experienced higher 12-month pre- and post-injury hospital admissions than the non-injured group. By 6 to 7 months post-injury, the injury cohort had largely returned to their pre-injury health service use levels, except for injuries involving dislocations, sprains and strains and injury to nerves and spinal cord. Hip fracture (17.69 per 100 person-months) and poisoning (16.09 per 100 person-months) had the highest rates of post-injury hospitalisation in the injured cohort. The adjusted rate ratios (ARR) for post-injury hospitalisation were highest for poisoning (ARR: 3.77; 95% CI: 3.38–4.21) and injury to nerves and spinal cord (ARR: 2.73; 95% CI: 2.27–3.28). Poisoning also had the highest ARR for post-injury LOS (ARR: 5.31; 95% CI: 4.51–6.27).
Conclusions: After sustaining a traumatic injury, many individuals are readmitted to hospital and require ongoing care up to 12 months post-injury. That injured individuals post-injury largely return to their pre-index injury hospital use by 6 to 7 months could imply a return to pre-injury function and/or that other measures of health service use should be explored. Trauma services should consider long-term follow-up and support services for seriously injured patients post-hospital discharge.

Introduction

Sustaining a traumatic injury can result in changes in an individual's physical functioning and leave many individuals with ongoing impairment, pain and disability that can affect their health-related quality of life, impact their ability to perform activities of daily living (ADLs), and require ongoing health care [1,2]. Injured individuals may require subsequent hospital treatment and can sometimes experience complications, necessitating readmission to hospital [3]. In some cases, particularly for older individuals, there is also an additional effect of co-existing chronic health conditions that can impact on recovery from injury [4]. Comorbid health conditions are associated with worse health outcomes, more complex clinical management, and increased health care use [5,6].

In some instances, injured individuals never fully recover following their injury and require lifelong management of their condition [3,7]. Ongoing health care and treatment has an impact on both the health and injury compensation systems [8]. It also has implications for the design of the length of trauma patient follow-up studies, on post-injury information provided to injured individuals and their families [9], and on the design and resourcing of support services for trauma patients post-hospital discharge [10]. Understanding patterns of health service use and complex comorbidity following different types of injury is critical to jurisdictional service planning and cost projections. Despite this,

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there is limited data on the distribution of health service use for different types of injury and for different levels of severity, preceding and also after discharge from initial acute care.

The few previous studies that have examined traumatic injury and health service utilisation using a matched-cohort design with a non-injured comparison group have largely examined health service use post-injury [1,11], with one study also examining long-term health care use preceding the injury [12]. These studies identified that individuals who sustained particular types of injuries, including spinal cord injury or traumatic brain injury (TBI), experienced increased use of health services up to ten-years after their initial injury hospitalisation compared to a non-injured group [1,11–13]. Two of these studies only examined individuals to the end of the traditional working age (i.e. 65 years) [1,12] and one only considered the impact of spinal cord injuries [11]. No previous studies have examined health service utilisation at a population-level preceding and post an injury-related hospitalisation for different types of injuries for ages ≥ 18 years to determine what injury types may have increased (or decreased) prior and subsequent health care use following the injury. This study aims to describe patterns of health care use in the 12 months preceding and 12 months following a traumatic injury, by injury type and injury severity, using a population-based matched cohort study.

Method

A population-based matched cohort study of individuals aged ≥18 years using linked hospital separation and mortality records from three Australian states during 1 January 2008 to 31 December 2010. The research was undertaken with the approval of Human Research Ethics Committee associated with each of the involved State Health Departments. The method for this study has been described elsewhere [14] and an overview is provided here.

Data collections and person-time at-risk calculation

Information on all inpatient separations from all public and private hospitals in New South Wales (NSW) and Queensland (QLD) and for public hospitals in South Australia (SA), were obtained from the hospital separation records These records included information on patient demographics, source of referral, diagnoses, external cause(s), hospital separation type and clinical procedures. Diagnoses and external cause codes were classified using the International Classification of Diseases, 10th Revision, Australian Modification (ICD-10-AM) [15].

Mortality data were obtained from the Registry of Births, Deaths and Marriages in the three Australian states. Where an individual died within 12 months of the index injury hospitalisation, survival time post the index injury was calculated by subtracting the date of the index injury hospital admission from the date of death for the injured and their matched non-injured comparison. Person-time at risk was calculated for each month by injury type and also by injury severity for 12 months post the date of the index injury hospitalisation for both the injury and non-injured comparison cohorts.

Injured population

The injured population was identified using a principal diagnosis of injury (ICD-10-AM: S00-T75 or T79) in the hospital admission records in 2009. The index injury admission was defined as first injury-related hospital admission in that year

Non-injured comparison population

A population-based, non-injured comparison cohort of individuals aged ≥18 years who were not hospitalised for an injury in 2009 was randomly selected from the three state electoral rolls. It is compulsory to vote in Australia, and so all individuals aged ≥18 years should be registered on the electoral roll as it is A non-injured cohort was established by each state data linkage centre, which matched randomly selected cases1:1 on age, gender and postcode of residence at the date of the index injury admission of their matched counterpart. In Australia, socio-economic disadvantage is estimated using the Socio-Economic Indexes for Areas (SEIFA) [16]. SEIFA is a multicomponent area level measure of the socioeconomic status of the community defined by an individual’s postcode of residence. Matching by postcode ensured that the injured and non-injured cohorts were as alike as possible in terms of socio-economic disadvantage. All hospital admission and mortality records for the non-injured cohort were identified during 1 January 2008 to 31 December 2010.

Data linkage

Data custodians in each state identified all index injury-related hospitalisations in 2009 in hospital admission records. Each state-based data linkage centre probabilistically linked all hospitalisation and mortality records of the index injury hospital admissions for individuals with a valid postcode of residence in their state, and randomly identified matched counterparts for the index injury cases. All records from NSW and SA were provided to the Centre for Data Linkage and records for these two states were probabilistically linked to identify any cross-border health care use by either injury cases or their matched counterparts. A unique identifier for each person was created by the linkage centres used identifying information (e.g. name, address, date of birth, gender).

Identification of comorbidities

The Charlson Comorbidity Index (CCI) was used to identify comorbidities based on diagnosis classifications from hospitalisation records [17]. A 12-month look back period from the admission date of the index injury admission was used for the identification of comorbidities for both the injury cases and their matched counterparts. The CCI was treated as a categorical variable and categorised as severe comorbidity (CCI ≥ 3), mild-moderate comorbidity (CC1 = 1 or 2) and no reported comorbidity (CCI = 0). Specific health conditions associated with injury risk and poor recovery [18,19], including mental health conditions (ICD-10-AM: F20-F50), alcohol misuse and dependence (ICD-10-AM: F10, Y90, Y91, Z50.2, Z71.4, Z72.1) and drug-related dependence (ICD-10-AM: F11-F16, F19, Z50.3, Z71.5, Z72.2) were also identified using hospitalisation records.

Injury severity

Injury severity was allocated using the International Classification of Disease Injury Severity Score (ICISS). This score is generated by applying survival risk ratios (SRR) derived from the published literature to each individual's injury diagnosis classification [20]. For individuals with multiple injuries the ICISS is the product of the probability of survival for each injury diagnosis using SRRs calculated for each injury diagnosis [20]. Three severity levels were used to define minor (≥0.99), moderate (0.941–0.99) and serious (≤0.941) injury [21].

Identification of urban and rural location of residence

The Australian Statistical Geographical Standard Remoteness Area was used to identify rural and urban residents. This measure of rural/urban status assigns residents to one of five categories on the basis of distance to service centres [22]. The five categories