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Factors influencing hospital admission and associated hospital costs of traffic victims admitted to an emergency department

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ABSTRACT

Objective: Use of health care services and hospitalisation associated with traffic accidents impose an economic burden on society. This study analyses the determinants of hospitalisation and hospital costs associated with road traffic accidents in Belgium, using an emergency and hospital care dataset.
Participants: Traffic victims ($N=4645$) admitted to the emergency department of the university hospital Brussels.
Methods: A logistic regression analysis and a generalised linear model (GLM) were used to analyse the probability of hospitalisation and costs respectively, controlling for roadway user categories, demographic (gender, age, and individual socioeconomic status (SES)) and clinical (nature, location, and severity of injury) characteristics.
Results: 20.3% of the traffic victims who went to the emergency department were hospitalised. The probability of hospitalisation, controlled for confounding factors, was significantly higher in victims aged 0–16 years (OR 2.46 (95% CI 1.74–3.49)) and ≥60 years (OR 1.52 (95% CI 1.06–2.17)) compared to those in age category 30–44 years. Motorcyclists, controlled for demographic and clinical factors, were significantly less likely to be hospitalised compared to pedestrians (OR 0.61 (95% CI 0.39–0.94)). Fractures and internal injuries were associated with the highest probability to be hospitalised. The GLM-analyses revealed that, controlled for confounding factors, men, older age and low SES patients were associated with higher hospital costs. The median hospital cost was €3273 (IQR €1733–€8891, 2011 euro price level) for inpatients.
Conclusion: In general, most of injury literature report 'unit costs' for fatally, severely and slightly injured traffic victims. This study demonstrates that other criteria such as traffic victim characteristics (gender, age, SES) and injury characteristics (nature, location, severity) need to be considered in order to give a more accurate picture of the probability of hospitalisation and associated medical costs.

1. Introduction

Being a prime cause of death and disability worldwide, road traffic accidents place a high burden on public health (World Health Organization, 2014). Despite many efforts to reduce them, they remain the leading cause of injury requiring hospitalisation in Europe (Segui-Gomez et al., 2008). The financial and emotional burden of a traffic accident can be devastating for the persons involved. Furthermore, use of health care services and productivity losses associated with traffic accidents impose an economic burden on society (Connelly and Supangan, 2006), (Garcia-Altes and Perez, 2007).

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With a high burden of traffic injuries and rising hospital costs, more accurate knowledge on the economic impact of road traffic accidents is desirable. At policy level, this knowledge is fundamental for monitoring the (cost-)effectiveness of existing road safety policies and readdressing new policies. Improved knowledge on the association between type of roadway user, type of injuries and likelihood of hospitalisation and hospital costs could lead to improvements of current transport models and therefore optimise evaluations of (new) policies. Additionally, information on the injuries with the highest financial burden should stimulate and encourage the transport industry to identify the type of collisions associated with these injuries. This information can then be used in the development of innovative safety technologies. Furthermore, at micro-level, more profound knowledge in hospital admission likelihood and associated costs might assist the hospital management in their trauma care organisation.

Although the prevalence, severity, and type of injury sustained by traffic victims have been examined in many studies (Amoros et al., 2008), (Mayou and Bryant, 2003), (Markogiannakis et al., 2006), only few studies documented the associated use of hospital resources in terms of hospital admissions, length of stay (LOS), and/or associated costs. Peek-Asa et al. (2011) and Gardner et al. (2007) investigated the factors affecting hospital costs and LOS among, respectively, hospitalised teenage (age 15–18 years old) and young (age 0–20 years old) traffic victims in the United States. Santolino et al. (2012) examined factors affecting LOS among Spanish motor victims. In these three studies it was reported that hospital costs and LOS varied by age (Peek-Asa et al., 2011), (Gardner et al., 2007), (Santolino et al., 2012), injury characteristics (Peek-Asa et al., 2011), (Santolino et al., 2012), type of roadway user (Santolino et al., 2012), injury severity (Gardner et al., 2007), and gender (Peek-Asa et al., 2011), (Gardner et al., 2007). These authors stated for example that young and old traffic victims are more likely to be admitted to the hospital than middle-aged victims. Males injured in collisions are also found to be more likely to be hospitalised than women. Another person variable of interest in traffic research is the socio-economic status (SES) of traffic victims. Previous research has shown that SES is an important determinant for traffic accident involvement. However, little is known about the impact of SES on hospitalisation risk and hospital costs (Factor et al., 2008). Haghparast-Bidgoli et al. (2013) found an association between socio-economic status and hospital charges in Iran. To the best of our knowledge, this is the only study examining the association between low SES and traffic victims' hospital costs. No study in high or middle income countries examined factors influencing hospitalisation and associated costs for all types of roadway users without age limitations controlling for individual socioeconomic status.

In the present study, hospitalisation and emergency records are included in the analyses, which enable us to take a more detailed look at the road traffic accident victims with minor injuries as well. The objectives of the present study are to examine the impact of individual and injury characteristics on the risk for hospitalisation and the associated hospital costs. As hospitalisation has a detrimental influence on associated costs, we examined first the factors influencing the likelihood of hospital admission using a logistic regression analysis. Secondly, we analysed the factors influencing hospital costs for inpatients with a generalised linear model.

2. Materials and methods

2.1. Data sources

We performed a retrospective analysis with data from 2008 until 2011 from UZ Brussels (university hospital Brussels). The ethics committee of UZ Brussels approved the use of de-identified data from traffic victims at patient level (B.U.N.143201215726).

Traffic victims were identified in both the emergency database (outpatients) and in the Minimal Clinical Dataset (MCD, inpatients). In this study, the terms inpatients and outpatients are frequently used. Inpatients are defined as persons who are admitted to the hospital with at least one overnight stay after the initial emergency department (ED) visit. Outpatients are defined as persons discharged after the ED visit without any hospitalisation. Data were used from three different datasets which were linked at patient level: (1) Traffic victims could be retrieved from the emergency database by the variable 'type of roadway user'. The registration of this variable is mandatory for each traffic victim that enters the emergency department. (2) In the Minimal Clinical Dataset (MCD), persons were identified as inpatient traffic victims based on road traffic E-codes (E810–E816, E818, E826, E827, E829). (3) In the Minimal Financial Dataset, claims data are registered both for in- and outpatients.

2.2. Description of variables

The primary outcomes for this study were likelihood of hospitalisation and hospital costs (emergency claims included) per stay. Type of roadway user was defined as: pedestrian, cyclist, motor vehicle driver, motor vehicle passenger, and motorcycle driver/passenger. Age was categorised into five groups: 0–16 years, 17–29 years, 30–44 years, 45–59 years, and 60 years and more. Individual SES was characterised by the official social insurance category that entitles certain groups of people to reduced co-payment (e.g. persons whose deductible household gross income does not exceed €14057 (2008) to €15345 (2011)). All patients were categorised into low (reduced co-payment) or high SES. Additionally, inpatients benefitting from a hospital insurance or eligible for accident insurance coverage are categorised in the 'additional insurance' group. Belgium has a compulsory health insurance system with a broad coverage. A supplementary hospital insurance covers the additional costs of a single room and co-payments.

The main medical diagnoses and injuries were classified in nine 'nature of injury' categories according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM): (1) fractures (ICD 800-829), (2) dislocations (ICD 830-839), (3) sprains and strains (ICD 840-848), (4) intracranial injuries excluding skull fractures (ICD 850-854), (5) internal injuries (ICD 860-869), (6) open wounds (ICD 870-897), (7) superficial injuries including contusions (ICD 910-924), (8) injuries to nerves and spinal cord (ICD 950-957), and (9) unspecified injuries (ICD 959). A tenth category was the 'no injury category', including traffic victims suffering pain (e.g. headache, abdominal pain) but for whom no injury was diagnosed. Patients with main diagnoses such as fear complaints, pregnant women without an injury, or alcohol abuse were also categorised as 'no injury'. Up to six ICD-9-CM diagnoses per traffic victim were registered in the MCD and/or emergency database. For inpatients, the main diagnosis was extracted from the MCD. For outpatients, the injury with the highest AIS (Abbreviated Injury Scale) score was selected as main diagnosis from the emergency database (AAAM, 2008). We used the Stata user-written ICDPIC programme to convert each patient's registered ICD-9-CM codes to AIS scores. ICDPIC was developed using National Trauma Data Bank (NTDB) data to assign approximate injury severity scores by classifying injuries into general