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Attributable health care costs of traffic victims until 1 year after hospitalisation

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ABSTRACT

We investigated the attributable health care costs of patients who were hospitalised after a traffic injury in Belgium between 2009 and 2011. Clinical and demographic information from a national hospital dataset and health care costs from sickness funds were linked at the individual level. A total of 61,232 traffic victims were identified in the hospital dataset and included in the study. Weekly average health care costs, as well as average attributable health care costs, were calculated until one year after the initial traffic injury hospitalisation. These weekly costs were analysed and compared to the average weekly costs prior to the injury hospitalisation using Generalized Estimation Equations within a case-crossover design. Different costs patterns were estimated for mild, moderate, and severe injury according to ICD-derived Injury Severity Score (ICISS) categorisation. The overall total average attributable health care cost for the first year after the traffic crash was €9977 (€ 2015 prices). The highest attributable health care cost is directly after the injury hospitalisation (3608% higher in the first week compared to average weekly costs before the injury hospitalisation). Compared to the one year period prior to the hospitalisation, the health care expenditures are at least twice as high until week 17. The costs were still significantly higher up to one year after traffic injury onset (32%). These results are based on the analyses of the total population, but similar patterns in the cost trajectories were found for the different ICISS categories. Long term health care expenditures, rather than health care expenditures related to acute care episode only, should be considered in budget planning or priority setting in, for example, traffic injury prevention programs.

1. Introduction

Traffic crashes impose a large health and economic burden on society (WHO, 2015). Various national and international studies have described the costs associated with (traffic) injuries, whereby most focused on acute inpatient treatment using hospital data. For example, in the United States, the median hospitalisation charge was estimated at $25,590 (dollar 2007 price level) for injured teenage (15–18 years old) traffic victims (Peek-Asa et al., 2011) and at $17,571 (dollar 2003 price level) for children (20 years and younger) (Gardner et al., 2007). Devos et al. (2015) described that an inpatient's median hospital cost after a traffic injury was €3273 (IQR €1733–€8891, euro 2011 price level) in Belgium. Yet, many severe injuries result in

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long term physical consequences requiring ongoing care (Mayou and Bryant, 2003; Tournier et al., 2014). Polinder et al. (2016) recently published a study on the average lifetime costs of minor and severe injuries. These authors calculated that minor and severe traffic injuries were responsible for an average lifetime health care cost of €2995 (€ 2012 price level) in the Netherlands. It is less clear how increased health care costs attributable to a traffic injury are distributed over the longer time span. Are costs only higher immediately after the injury or do they persist throughout the following years (Bohl et al., 2010)? To examine this more into detail, studies need to focus on longitudinal costs trajectories investigating the trend in health care expenditures after a traffic injury. To capture the attributable medical burden of traffic injuries, these studies should include information on costs related to hospital stays, rehabilitation, long term care, drugs, outpatient care, etc. These kinds of studies concerning traffic injuries are scarce. Some longitudinal cost studies have been conducted on fall-related injuries in the elderly. Bohl et al. (2010) reported that fall-related injuries resulted in higher medical costs up to 12 months after the fall experience, with the largest increase in costs in the first quarter following the fall. Carter and Porell (2011) described that costs remained higher than would be expected for 27 interrupted months following injury. These studies described the health care costs associated with long-term care, but were restricted to fall-related injuries in the elderly and were limited in sample size.

In the current study, we estimate the average attributable health care cost at one year post-traffic injury hospitalisation. Furthermore, we evaluate inpatients' post-traffic injury hospitalisation expenditures for health care relative to their expenditures prior to the injury hospitalisation. It was hypothesised that health care expenditures increase sharply directly after the injury hospitalisation, then decrease again, but remain at a higher level than the average health care expenditure before the traffic injury.

2. Methods

2.1. Study design

The cost trajectories of hospitalised traffic victims were modelled within a case-crossover design. This design is popular in studies on for example acute outcome of air pollution exposure, in which risks are compared in a single cohort before and after a certain exposure (Maclure, 1991). The case-crossover design can be applied to estimate the cost of illnesses as well, as long as there is a clearly defined starting point (Finkelstein et al., 2005). Previous research demonstrated that for injury cost analyses the use of such a case-crossover design resulted in more accurate cost estimates compared to the case-control design (Finkelstein et al., 2005). Within a case-crossover design each traffic victim acts as his own control. Consequently, all known variation in a traffic victim's expenditures not associated with the injury (age at the time of traffic injury, gender, comorbidities, socio-economic status, etc.) is expected to be controlled for. Controlling for this confounding is the main advantage of the case-crossover design compared to the traditionally used case-control design. The case-control design compares the costs of traffic victims (cases) with their matched pairs (controls). A regression analysis is then applied to control observable differences between cases and controls. However, it is not possible to control for all differences between cases and controls. Therefore, case-control studies are often biased by unobservable variables. An additional advantage of the case-crossover design compared to the case-control design is the elimination of selection bias when selecting control subjects. For each traffic victim we calculated the individual weekly average health care expenditure calculated over the year prior to the traffic crash. This weekly average functioned as reference category for the health care expenditures in the 51 weeks after the traffic crash. Week 0 started on the admission date of the traffic injury hospitalisation. The time horizon was set at one year. All expenditures were considered from a combined sickness funds and victim perspective, i.e. expenditures paid by the government (sickness funds) and by the traffic victim were included.

As secondary analyses, we modelled three different cost trajectories, i.e. the cost trajectories of hospitalised traffic victims with mild, moderate, and severe injuries according to the ICD-derived Injury Severity Score (ICISS) (Tohira et al., 2012). In addition, cost trajectories were also modelled by roadway user category (pedestrian, cyclist, motor vehicle driver and passenger, and motor cyclist). The results of the analyses according roadway user category can be found in supplementary material.

2.2. Data sources

We used two administrative databases. The database from the Belgian Federal Public Service Health (FPS Health) in which the traffic victims were identified was linked at individual level to the database from the sickness funds (provided by the InterMutualistic Agency, IMA) containing all reimbursed health care costs. Traffic victims were identified based on either relevant E-codes (E810–E819, E826, E827, E829) registered in Minimal Hospital Discharge Data (MHDD), or by the code 'type of roadway user'. The latter is mandatory to be registered in the emergency department files for those patients with a visit at the emergency department after involvement in a traffic crash. Data on health care expenditures of the included traffic victims was provided by IMA, which is an aggregation of all Belgian sickness funds databases. Almost 100% of the Belgian population is covered since it is legally required to register for a health insurance at one of the Belgian sickness funds. These databases contain detailed information on all medical and allied health treatment procedures and services reimbursed by the Belgian government as well as the reimbursed costs and out of pocket costs. For example all costs associated with

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