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Health burden of road traffic accidents, an analysis of clinical data on disability and mortality exposure rates in Flanders and Brussels

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ABSTRACT

Statistics on road traffic accidents (RTAs) mainly come from police records. The police reported RTA statistics however are known to have a large degree of under-registration, underestimating the true risk of being injured in traffic accidents. The use of medical based datasets can provide a more accurate estimate of the actual traffic accident health risk. Exposure-based rates of the actual burden from Flanders and Brussels were calculated, comparing differences between road user, age, gender and type of injury sustained. Minimal Clinical Data (MCD) was selected for the years 2003–2007, as well as data from the mortality statistics. Disability Adjusted Life Years (DALY) were calculated and put into perspective with the passenger kilometres travelled.

Motorcyclists followed by bicyclists and pedestrians showed a higher DALY per travelled kilometre (6365, 1724 and 1359 DALY per billion kilometres respectively), compared to 113 DALY per billion kilometres for motor vehicles. In bicyclists and to lesser extent in motorcyclists, the majority of the health burden was attributed to disability following injuries and not fatalities. Also in the other road user categories disability added substantially to the total health loss. The use of medical data and more particular the MCD may be a valuable addition of those RTAs that are missed by the police scope. Although the results are still conservative estimations, an injury-based approach can help to better understand the health problem that road traffic accidents cause.

1. Introduction

Road traffic injuries are a major health problem. Every year more than 1.2 million people are killed, and many million more are injured or disabled worldwide due to road traffic accidents (RTAs) (Peden et al., 2004). In Belgium, road traffic fatalities represent approximately one-third of all unnatural deaths below the age of 40 (ADSEI, 2008), which is above the European Union population average (European Road Safety Observatory, 2011). Numbers of people injured in RTAs are much harder to find. Most numbers are derived from police data. However, not all RTA victims are reported in police data. An accurate estimation of the true risk of being injured in road traffic is therefore unlikely and police data shall be an underestimate (Constant and Lagarde, 2010; Kormer and Smolka, 2009). The lack of accurate exposure estimates (e.g. kilometres travelled) adds to the uncertainties of estimating the true risk. More reliable data is needed for analysing the burden of RTAs and the injuries or casualties arising from them. Medical data is recently used to quantify the health burden of RTAs. These analyses usually indicate higher incidence rates (Chini et al., 2010).

In this study we explored an injury-based approach to more accurately estimate the health risk of RTAs using hospital discharge data (HDD) and mortality statistics. Both are population-based and constitute the most extensive data sources available. Exposure-based rates of the road traffic health burden are calculated by using Disability Adjusted Life Years (DALY), which is a useful health indicator for RTAs (Polinder et al., 2007a; Holtslag et al., 2008; Lapostolle et al., 2009; Chong et al., 2010). Hospital data (Minimal Clinical Data – MCD) and the mortality statistics from Flanders and Brussels, where it was previously not possible to use medical data for road traffic safety research, were combined with empirical data on injury consequences, giving a more complete view of the lasting health burden of RTAs. Exposure-based rates (per passenger kilometre) of the road traffic health burden that resulted in death

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or hospital in-patient treatment over the period 2003–2007 are compared in relation to other road users, age, gender and injuries sustained.

2. Materials and methods

2.1. Data selection

Injury data was obtained from nationwide MCD, governed by the Federal Public Service of Health. Selection was restricted to inhabitants of Flanders and Brussels for the ICD-9-CM (ICD-9-Clinical Modification) transport-related external causes E810–816, E818–819, E826–827 and E829 (RTA with at least one moving vehicle) and the years 2003–2007. External causes (E-codes) were aggregated into 14 groups according to the 4th digit of ICD9 E-coding, which identifies the type of injured person. To minimize double counting all transfers, day-patients and re-admissions were excluded (Langley et al., 2002; Lawrence et al., 2007).

Injury information was gathered from the main diagnosis. The injury diagnosis was translated into the EUROCOST injury classification (Polinder et al., 2004, 2005), which has been used in other recent burden of injury studies (Lyons, 2008; Haagsma et al., 2009). The 39 EUROCOST injury groups allowed to aggregate the original ICD-9-CM codes into fewer groups with a higher number of patients and offer a clear link with disability (Haagsma et al., 2009).

Four main road user groups were identified: motor vehicle (with four or more wheels), motorcycle (two or three wheels), pedal cycle and pedestrian. A rest-category 'other' was created, which included other specified and unspecified road users falling outside the four main groups. Next, a distinction between single RTAs and accidents in which several road users were involved was made, based on the ICD-9-CM codebook description of 'collision'. For 'motor vehicle' accidents (E810–816, E818–819) codes in which the description clearly states that there is a collision between two or more road-users were coded as 'collision'. A motor vehicle in collision with an object was classified as non-collision. Unspecified accident circumstances were categorized as 'unspecified'. Pedestrians were always classified as involved in a collision, unless where 'unspecified' was indicated, as pedestrians' falls were excluded from the original external cause selection. E826.1 (pedal cycle accident, bicyclist is victim) was kept as a separate category within the 'other road vehicle' accidents (E826–827, E829).

Mortality statistics were obtained from the regional authorities [Flemish Agency for Care and Health and the Brussels-Capital Health and Social Observatory (unpublished data)]. Road traffic-related mortality numbers were collected according to the same criteria as the hospital data. In Belgium people dying within 30 days following an RTA are counted as road traffic fatalities. In the hospital data all patients who died in hospital within 30 days were therefore excluded to prevent double counting with the mortality statistics. The mortality statistics classify the causes of death using the international classification ICD-10. We used the external ICD-10 causes that matched the used ICD-9-CM E-codes, i.e. V01–V89 (land transport accidents).

2.2. DALY calculation

To calculate DALY for a particular cause of disease or injury in a population Years of Life Lost (YLL) are added to the Years Lived with Disability (YLD). In our study, YLL due to mortality from RTAs were calculated by multiplying number of deaths in an age and gender class with the respective life expectancy for that age and gender class. Life expectancy was obtained from the Belgian standard life tables for the year 2005. For YLD, a distinction was made between lifelong and temporary disability. The YLD calculation was based on the disability information determined by a literature review on the associations between hospital data characteristics of injury patients and functional consequences at longer term (Haagsma et al., 2009). From the review, it was recommended using proportions of residual disability and disability weights derived from the Dutch follow-up study by Polinder et al. (2007b), since these disability weights are based on EQ-5D data of a large number of injury patients. By using the Dutch disability information we assume that the disability risk after an injury between the two neighbouring countries is comparable. For spinal cord injury and injury of nerves of arm/hand disability weights from the Global Burden of Disease were used, as these could not be provided by Haagsma et al. (2009). For temporary disability, the injury count was multiplied with a one-year disability weight for temporary consequences. For lifelong disability the number of injuries was multiplied with the residual life expectancy and the lifelong disability weight (Haagsma et al., 2009). No age weighting or time discounting was applied.

The rates of YLD (per 10,000 inhabitants) were calculated by dividing the annual average number of YLD according to gender and age by the population of 2005 (i.e. the middle of the period in question 2003–2007) and multiplying by 10,000. The rates of YLL and DALY were calculated in the same way.

The exposure-based DALY rates were based on the exposure data taken from the third Flemish travel behaviour investigation (Moons, 2009), which was conducted in the period 2007–2008, and thus overlaps with the timeframe of the MCD. The exposure data was available as the average amount of kilometres travelled per person per day for both gender and age. To estimate the total amount of kilometres, the exposure kilometres were multiplied with the respective populations and the numbers of days in 2005. Rates of DALY per billion (10^9) kilometres travelled were calculated by dividing the annual average number of DALY according to gender and age, by the total amount of kilometres travelled by age and gender.

2.3. Statistical analysis

Frequency distributions between age group (0–14, 15–34, 35–64, >64) and injury class and between injury class and collision type was calculated using the Chi^2 test. When comparing injury distributions of hospitalized patients over road user category and collision types, patients with no injury after examination were excluded from the selection. For statistical and clarity reasons the original injury classification was aggregated into six body regions which enabled to set up a contingency table to calculate the Chi^2 test. Statistical analyses were performed using SPSS version 19 (IBM, Somers, NY).

3. Results

3.1. Statistics of hospitalized patients

A total of 48,374 reported road traffic injured people were identified to be hospitalized over the period 2003–2007. In absolute numbers, bicyclists were most hospitalized, followed by motor vehicle accidents and 'other' road users. Overall the number of hospitalizations was twice as high in males compared to females. Motorcycle accidents were the most frequent in males, while females had a higher proportion of pedal cycle and pedestrian accidents. The number of in-patients for motor vehicle accidents was equal for both genders (Table 1). The distribution of both gender ($p < 0.001$) and age ($p < 0.001$) differs between road user and collision types, with the age group 15–35 having the highest number of inpatients in the motorized vehicles. In bicyclist and pedestrian,