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Burden of injury of serious road injuries in six EU countries

Wendy Weijermars[a,*], Niels Bos[a], Ashleigh Filtness[b], Laurie Brown[b], Robert Bauer[c], Emmanuelle Dupont[d], Jean Louis Martin[e], Katherine Perez[f,g,h], Pete Thomas[b]

[a] SWOV Institute for Road Safety Research, PO Box 93113, 2509 AC Den Haag, The Netherlands
[b] Loughborough Design School, Loughborough University, LE11 3TU, UK
[c] Austrian Road Safety Board(KFV), Austria
[d] VIAS Institute, Belgium
[e] IFSTTAR, Institut Français des Sciences et Technologies des transports, de l'aménagement et des réseaux, France
[f] Agència de Salut Pública de Barcelona (ASPB), Spain
[g] Institut Investigació Biomèdica Sant Pau (IIB Sant Pau), Spain
[h] CIBER Epidemiología y Salud Pública (CIBERESP), Spain

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ABSTRACT

Background: Information about the burden of (non-fatal) road traffic injury is very useful to further improve road safety policy. Previous studies calculated the burden of injury in individual countries. This paper estimates and compares the burden of non-fatal serious road traffic injuries in six EU countries/regions: Austria, Belgium, England, The Netherlands, the Rhône region in France and Spain.
Methods: It is a cross-sectional study based on hospital discharge databases.
Population: of study are patients hospitalized with MAIS3+ due to road traffic injuries. The burden of injury (expressed in years lived with disability (YLD)) is calculated applying a method that is developed within the INTEGRIS study. The method assigns estimated disability information to the casualties using the EUROCOST injury classification.
Results: The average burden per MAIS3+ casualty varies between 2.4 YLD and 3.2 YLD per casualty. About 90% of the total burden of injury of MAIS3+ casualties is due to lifelong consequences that are experienced by 19% to 33% of the MAIS3+ casualties. Head injuries, spinal cord injuries and injuries to the lower extremities are responsible for more than 90% of the total burden of MAIS3+ road traffic injuries. Results per transport mode differ between the countries. Differences between countries are mainly due to differences in age distribution and in the distribution over EUROCOST injury groups of the casualties.
Conclusion: The analyses presented in this paper can support further improvement of road safety policy. Countermeasures could for example be focused at reducing skull and brain injuries, spinal cord injuries and injuries to the lower extremities, as these injuries are responsible for more than 90% of the total burden of injury of MAIS3+ casualties.

1. Introduction

Traditionally, road safety policy has been primarily aimed at reducing the number of fatalities. However, road traffic crashes also cause a large number of non-fatal (serious) road traffic injuries, resulting in considerable economic and human costs (Weijermars et al., 2016b). Moreover, the number of serious road traffic injuries has not been decreasing as fast as the number of fatalities in some countries, and has even been increasing in other countries (Berecki-Gisolf et al., 2013; OECD/ITF, 2011). Therefore, serious road traffic injuries are increasingly being adopted as an additional indicator for road safety (e.g. EC, 2010).

Non-fatal injuries can have a major impact on the quality of life of a crash survivor and their relatives. On a more aggregated level, they also pose a burden to society. The health burden of injuries can be expressed in Disability Adjusted Life Years (DALYs) (Murray and Acharya, 1997).

* Corresponding author.
E-mail address: wendy.weijermars@swov.nl (W. Weijermars).

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This measure integrates premature mortality – expressed in Years of Life Lost (YLL) – and loss of quality of life due to disability. The latter is expressed in Years Lived with Disability (YLD) and is estimated by multiplying the prevalence of a disorder by the loss of health associated with the disability (disability weight). Information on the burden of non-fatal injury enables policy makers to compare 1) the burden of non-fatal injuries with the burden of fatal injuries (expressed in YLL), and 2) the burden of road traffic injuries with the burden of other types of injuries and the burden of diseases (Bhalla et al., 2014; Haagsma et al., 2016; Murray et al., 2013). Furthermore, information about the burden of (non-fatal) injury for different groups of road traffic casualties is very useful to further improve road safety policy. In cases where a group of casualties (e.g. a certain transport mode or type of injury) experience relatively large health impacts from their injuries, it might be advisable to develop measures targeting them specifically. Additionally, measures might also aim at reducing health impacts.

Previous studies calculated the burden of road injury in individual countries like Belgium (Dhondt, Macharis, Terryn, Van Malderen, and Putman, 2013), France (Lapostolle et al., 2009), The Netherlands (Weijermars et al., 2016a) or Sweden (Tainio, Olkowicz, Teresiński, De Nazelle, and Nieuwenhuijsen, 2014). As previous studies have applied different methods and different definitions of (serious) road injuries, between country results cannot easily be compared on the basis of these individual studies. In the present paper, the burden of non-fatal, serious road injuries is estimated for a number of EU countries and regions – Austria, Belgium, England, The Netherlands, the Rhône region in France and Spain – based on one and the same method. The country results can therefore be compared

2. Method

2.1. Study design and population

This is a cross-sectional study based on Hospital Discharge Databases. The population of study is patients hospitalized due to road traffic injuries. For this study, only patients with serious road traffic injuries were considered. A patient with a serious road injury is thereby defined as a hospitalized non-fatal road traffic casualty with an injury score of MAIS3+ (MAIS = Maximum Abbreviated Injury Scale, see Gennarelli and Wodzin, 2005). This definition was proposed as a result of the EU funded SafetyNet project (Thomas et al., 2009) and the IRTAD working group on serious injuries (OECD/ITF, 2011) and accepted by the High Level Group on Road Safety representing all EU Member States (EC, 2013).

For all countries, MAIS3+ casualties were selected using hospital discharge data, applying the guidelines that were developed within the SafetyCube project (Pérez et al., 2016). This means that all patients with an injury diagnosis (ICD9CM:800-999; ICD10: S00-T88), with external causes for road traffic injuries (ICD9CM: E810-E819, E826, E827, E829, E988.5; ICD10: V01-89) and an injury severity of MAIS3+ are selected. Moreover, fatalities within 30 days and readmissions are excluded as far as possible.

As a consequence of differences in available data, there are some differences in selection of MAIS3+ road injuries between the countries. Table 1 provides an overview of these differences. Differences in methodology mainly affect the total estimated number of serious road injuries and therefore the total burden of injury (see Weijermars et al., 2016a,b for more detailed information). Effects on the estimated average burden of injury per casualty are assumed to be relatively small.

2.2. Calculation and analysis of the burden of injury

The burden of injury, expressed in YLD, is calculated using a method that was developed within the European INTEGRIS study (Haagsma et al., 2012). The method combines data on the incidence of injuries with disability information for these injuries using the EUROCOST injury classification. The EUROCOST injury classification distinguishes 39 injury groups defined in such a

way, that they are more or less homogeneous in terms of healthcare use (Polinder et al., 2004).

The INTEGRIS study provides disability weights (DWs) and proportions of casualties with lifelong consequences (Pls) for each of the 39 EUROCOST injury groups (see Appendix A). A disability weight reflects the impact of a health condition and has a value between 0 (full health), and 1 (entirely disabled or dead). A patient was assumed to encountered lifelong consequences if, at the two year follow up, he or she still claimed to be experiencing injury-related health problems and reported symptoms compatible with the injury suffered. The DWs and Pls are mainly based on a study of functional outcomes in injury patients in the Netherlands (Polinder et al., 2007), supplemented for some injuries with disability weights from a different study (Haagsma et al., 2008). Separate DWs and Pls are available for casualties that were admitted to the hospital and for casualties that were only treated at the Emergency Department. Since our study focuses on serious road injuries, we applied the DWs and Pls for hospital admitted casualties. Moreover, the INTEGRIS study provides separate DWs for the first year after the crash (acute) and for the remainder of a casualty's life (lifelong).

The application of the INTEGRIS method consists of the following steps:

Step 1: Assign each road traffic casualty to one of the 39 EUROCOST groups

For all selected MAIS3+ casualties, ICD or AIS (Rhône region of France) injury codes are translated into EUROCOST injury groups. In case of multiple injuries, the hierarchical scheme proposed by Polinder et al. (2008) is applied.

Step 2: Calculate the burden of injury for each road traffic casualty by applying equation 1

For each MAIS3+ casualty, the burden of injury is estimated by means of equation 1.

$$B_i = DWa_{j(i)} + Pl_{j(i)} * DWl_{j(i)} * (LE_i - 1) \quad (1)$$

With:

B_i = Burden of injury [YLD] of MAIS3 + casualty $i = 1...N$, with N = number of MAIS3 + casualties

$j(i)$ = EUROCOST injury group, $j = 1\ldots39$ of casualty i

$DWa_{j(i)}$ = Disability Weight for disability during first year, provided by Haagsma et al. (2012)

$DWl_{j(i)}$ = Disability Weight for lifelong disability, provided by Haagsma et al. (2012)

$Plj_{(i)}$ = Proportion [%] of cases with lifelong consequences, provided by Haagsma et al. (2012)

LE_i = remaining Life Expectancy [years] of casualty i given its age and gender.

Information about the remaining Life Expectancy is taken from the Global Burden of Disease study 2013. The mean life expectancy of the region R10 Western Europe is used, as it appeared to best suit the countries analysed here.[1]

Step 3: Sum the burden of injury of individual road traffic casualties and analyse results

The burden of injury for a group of road traffic casualties (e.g., cyclists) was estimated by summing up the burden of injury of individual road traffic casualties within that group. Moreover, the average burden per casualty was estimated by dividing the burden of

[1] http://ghdx.healthdata.org/global-burden-disease-study-2013-gbd-2013-data-downloads.

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