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Hoe ernstig zijn de verwondingen van verkeersslachtoffers? Analyse van de MAIS-ernstscore van verkeersslachtoffers opgenomen in de Belgische ziekenhuizen in de periode 2004-2011.

La gravité des blessures des victimes de la route. Analyse des scores MAIS des victimes de la route hospitalisées en Belgique entre 2004 et 2011

The MAIS severity scale for injuries suffered by victims of road traffic accidents

In recent years, there has been growing international conviction that a sound road safety policy not only requires **objectives** related to reducing the number of road traffic fatalities but also to the number of **(seriously) injured victims of road traffic accidents**. The European Commission considers the current definition of 'seriously injured' to be an inadequate basis for such an objective, however. Up to now 'seriously injured' in official accident statistics in Belgium and most other European Member States has been defined as road traffic victims that must remain in hospital at least twenty-four hours following the accident. In most Member States (including Belgium) the police usually judge whether a road traffic victim has suffered serious or minor injuries. This often involves a subjective assessment by the police officer that is not based on any medical criteria. For this reason, and due to the serious underreporting of the number of seriously injured victims recorded by the police, the European Commission proposes a **new definition of 'seriously injured'**, namely **'MAIS 3+ injured'**.

The Abbreviated Injury Scale (AIS) is the scale used in the medical world to express the severity of injuries. According to this scale 'serious' is interpreted as involving the possibility of death. This scale includes six levels of severity, ranging from one ('minor injuries') up to and including six ('unsurvivable injuries'). The Maximum Abbreviated Injury Scale (MAIS) score for a road traffic victim is nothing more than the maximum AIS severity score for a road traffic victim with one or multiple injuries. *MAIS 3+ injuries* therefore includes all road traffic victims with a MAIS score of at least three (i.e. a MAIS score of three, four, five or six).

The European Commission has asked EU Member States to report the number of seriously injured road traffic victims for 2014 using the new '*MAIS 3+*' definition as of 2015. The main advantage of using the MAIS 3+ description for seriously injured road traffic victims compared with the current definition is that it is **less susceptible to underreporting and is also based on medical criteria**.

Belgian hospitals are not obliged to record AIS severity scores. On the other hand, standard **ICD-9-CM diagnosis codes** are recorded in hospitals for all injuries and illnesses for all hospitalised patients, for example code 850.0 = concussion without loss of consciousness (hospitalised patients are persons that stay in hospital for at least one night). It is possible to convert ICD-9-CM diagnosis codes into an AIS severity score using a conversion program.

Objectives and methodology

The **main objective of this study** was to determine, for the first time in Belgium, the number and the distribution of the number of *MAIS 3+ injured*. In addition, it was necessary to examine how the number of seriously injured road traffic victims would change when the existing definition of 'seriously injured' is replaced by the *MAIS 3+ injuries* definition. Another objective was to provide an overview of the distribution of the nature of the injuries suffered by road traffic victims.

Two study populations were used for the analysis, based on police and hospital data respectively. For the **study population based on police data**, all seriously injured and fatally injured road traffic victims (people who did not die at the scene of the accident or on the way to hospital) from the period 2004-2011 were selected from the police data. The total number of road traffic victims amounted to 48,528.

A selection was made from hospitalised patients from 2004 to 2011 to determine the **study population based on hospital data**. These hospital patients had to satisfy two selection criteria: (1) the ICD-9-CM *main diagnosis* of the patient had to be between 800.00 and 959.9, and (2) the patient had to have one of the following *E codes*: E810 through E819, E826, E827 and E829.¹ The E code indicates the external cause of the injury. In the case of road traffic victims the E code describes the type of accident (e.g. E814.7 'An accident between a pedestrian and a motorised vehicle in which the patient is the pedestrian').

¹ However, just 90% of the patients with codes E826, E827 and E829 were selected in a random manner. This is because approximately 10% of the victims with codes E826, E827 and E829 were involved in an accident that did not occur on a public road. According to the definition used in official accident statistics they are not classified as road traffic victims.

The study population only includes road traffic victims that were hospitalised for at least one night, since recording an ICD-9-CM main diagnosis and an E code is only compulsory for these patients. In total 117.044 hospitalised road traffic victims were selected from the hospital data and included in the study population. Although this data is more complete than that recorded by the police, to a certain extent it also underestimates the total number of road traffic victims.

To establish a patient's MAIS score the patient's ICD-9-CM main diagnosis was converted to the corresponding AIS severity score using the ICDPIC conversion program. Since in some cases the AIS severity score of the main diagnosis can be lower than the road traffic victim's MAIS severity score, there is probably a slight underestimation of the road traffic victims' MAIS severity level.

Comparison of the numbers of seriously injured road traffic victims according to the different definitions

The percentage of persons with a MAIS severity score of at least three among hospitalised road traffic victims during the period 2004-2011 remained extremely stable over the period considered: **between 21% and 23%**. Of the 77% of hospitalised patients with a severity score lower than MAIS 3 (in 2011), 60% had a MAIS 2 severity score and 17% a MAIS 1 severity score.

The annual number of hospitalised road traffic victims or '*injury ≥ 1 night*' fluctuated between 14.000 and 15.500 throughout the entire 2004-2011 period and peaked in 2007 and 2008. In turn, the number of '*MAIS 3+ injured*' fluctuated between 3.000 and 3.600 patients, and also peaked during 2007-2008. The police data reveals a different pattern. The highest number of 'police seriously injured' was recorded in the first year, 2004. The number of registered 'police seriously injured' declined steadily from approximately 6.386 in 2004 to 5.630 in 2011. Therefore, the **trends** related to the numbers of seriously injured road traffic victims clearly **differ** depending on the data source consulted, either police data or hospital data.

Not only the trends differ but the measured numbers also differ considerably. Although the number of '*police seriously injured*' (based on police data) and the number of '*seriously injured ≥ 1 night*' (based on hospital data) are two descriptions that should roughly cover the same group of seriously injured road traffic victims, **2,5** times as many seriously injured road traffic victims are recorded in the second group than in the first group. This indicates serious **underreporting** of the number of seriously injured road traffic victims in the official accident statistics. This 2,5 ratio was also established in an earlier study (Nuytens, 2013) for the period 2004-2007.

It is also useful to compare the number of 'police seriously injured' with the number of '*MAIS 3+ injuries*', the new definition for seriously injured road traffic victims. The ratio between the number of '*MAIS 3+ injuries*' and the number of 'police seriously injured' is **0,58**. This means that there are markedly less '*MAIS 3+ injuries*' than severely injured road traffic victims recorded by the police. **Consequently, a switch from the current definition to the new definition of seriously injured would lead to a significant decrease in the number of seriously injured road traffic victims reported.**

Moreover, the ratios between the numbers of seriously injured road traffic victims based on the different definitions differ according to the type of road user and age category. Comparing the number of '*police seriously injured*' (based on police data) with the number of '*injured ≥ 1 night*' (based on hospital data) reveals that certain types of road users and age categories are 'underreported' to an even greater extent than others. These specifically concern cyclists² (the '*injured ≥ 1 night*'/ '*police seriously injured*' ratio is 5,4), 0-15 year-olds (the ratio is 4,7) and people aged 60 and over (3,4). Passengers of motor vehicles are barely underestimated based on the official accident statistics (1,0).

Compared to the number of '*police seriously injured*', the number of '*MAIS 3+ injured*' is consistently lower, with the exception of cyclists and people aged 60 and over. This means that switching from the previous

² Based on the hospital data, in the period 2004-2011, cyclists appear to represent the largest group in every age category for 'injuries ≥ 1 night', with the exception of the 30 to 59 years age category. Based on the official statistics seriously injured cyclists do not represent the largest group in any age category in the period 2004-2011.

to the new definition of seriously injured would lead to a decrease in the number of seriously injured road traffic victims reported, **except for the number of cyclists and people aged 60 and over**. Consequently, switching to the new definition of seriously injured would also mean that the *proportion* of cyclists and people aged 60 and over would increase considerably. (For example, in 2011 the proportion of cyclists would rise from 16% to 36%, and the proportion of people aged 60 and over would rise from 18% to 29%). Furthermore, the proportion of occupants of motor vehicles would decrease considerably (from 52% to 31% in 2011).

The injuries suffered by road traffic victims

This report also includes the first study of the injuries suffered by road traffic victims performed using the ICD-9-CM main diagnoses recorded.

The main diagnosis of road traffic victims most frequently involves the following **parts of the body**: head (26%), lower limbs (21%), upper limbs (19%) and the chest (17%). With regard to the **nature** of the main diagnoses a great many fractures (55%) and internal injuries (27%) are observed.

Information related to the nature and location of the injuries was consolidated into '**injury groups**'. The most frequent injury groups are: internal injuries to the skull/brain (22%), fractures to the lower limbs (17%) and fractures to the upper limbs (16%). Trailing far behind, we observe chest fractures (9%), fractures to the spine/spinal cord (6%), internal chest injuries (6%), and fractures to the skull/brain injuries (4.5%). All other injury groups constitute proportions of less than 4%. The seven cited injury groups all feature in the top ten most frequent injury groups of all types of road users and age categories.

Fractures to the skull/brain are the most serious of the aforementioned injury groups. 86% of all hospitalised road traffic victims with a head injury have a MAIS severity score of at least three. Internal chest injuries are also above average in terms of severity (68% of patients score a MAIS 3+).

The **frequency of certain injury groups varies in relation to the victims' transport mode**. Internal injuries to the skull/brain are most common among all road traffic victims but fractures to the lower limbs are most common among pedestrians, moped riders and motorcyclists. Pedestrians suffer from an above average number of basal skull fractures. These may be caused by the head colliding with a moving vehicle and/or the ground. Relatively high numbers of fractures and internal injuries to the chest and spine are observed among occupants of motor vehicles. This can be explained by the impact exerted during an accident caused by the seatbelt/airbag/steering wheel/dashboard to the upper body of these victims. Lastly, of all types of road users, cyclists are most likely to suffer from internal injuries to the brain (including a great many cases of concussion). From our analyses, we can conclude that the location and nature of the injuries suffered by road users are largely determined by the parts of the body that have to absorb the impact of the collision.

The frequency of injury groups also differs according to age category. Fractures to the lower limbs are most frequent among people aged 60 and over, whereas internal injuries to the skull/brain are most common in other age categories.

Recommendations

This study is an important first step in researching the injuries suffered by road traffic victims in Belgium.

Several recommendations can be formulated. We advocate, for instance, for the continuation of the current police reporting method regarding accidents that result in injury partly because the police data provides more detailed information about the nature of the road traffic accident than hospital data. We also propose that in the future, objectives related to the number of seriously injured road traffic victims are expressed using the 'MAIS 3+' definition at the federal and regional levels.

We note that, to a certain extent, underreporting in official accident statistics has led to an underestimation of the road safety issue in general and of several specific target groups in particular (cyclists and senior citizens). Therefore, policy priorities related to road safety may have to be partly reviewed.

To avoid confusion between the old and new definitions the BIVV/IBSR resolves to consistently include the number of seriously injured road traffic victims and victims that suffered minor injuries in reports based on police data related to accidents. As of 2015, the BIVV/IBSR's road safety barometer will include an estimate of the number of *MAIS 3+ injured*. In future research, we will explore the nature of injuries suffered by road traffic victims in more depth. We will also take into account other diagnoses in addition to the main diagnosis and examine other severity scales besides the MAIS severity scale.



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