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## Mini-Review

## Global road traffic injury statistics: Challenges, mechanisms and solutions

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## ABSTRACT

High-quality data are the foundation to monitor the progress and evaluate the effects of road traffic injury prevention measures. Unfortunately, official road traffic injury statistics delivered by governments worldwide, are often believed somewhat unreliable and invalid. We summarized the reported problems concerning the road traffic injury statistics through systematically searching and reviewing the literature. The problems include absence of regular data, under-reporting, low specificity, distorted cause spectrum of road traffic injury, inconsistency, inaccessibility, and delay of data release. We also explored the mechanisms behind the problematic data and proposed the solutions to the addressed challenges for road traffic statistics.

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## Introduction

Road traffic injuries are a global health challenge. The number of road traffic deaths continues to rise steadily, from 1.15 million in 2000 to 1.35 million in 2018. Of the 56.9 million deaths worldwide, road traffic injuries account for about 2.37% and are the eighth cause of global death.<sup>1</sup> In response, the United Nations released the Global Plan for the Decade of Action for Road Safety 2011–2020 in 2011<sup>2</sup> and included road traffic injury prevention as Target 3.6 of the Sustainable Development Goals (SDG) in 2015.<sup>3</sup>

Road traffic injury statistic is the foundation to monitor the progress and evaluate the effectiveness of road traffic injury prevention efforts nationally and globally. Official road traffic injury data which were delivered by governments worldwide are often believed reliable and valid, and are used for a variety of official and unofficial purposes. Unfortunately, it has been demonstrated that the data deviate from reality in several countries. In fact, the quality of official data has even been suggested to deteriorate recently in a few countries.<sup>4</sup>

Road traffic data with problems may mislead resource allocation and strategic decision-making, ultimately create unwanted risk for evaluating the effectiveness of road traffic injury

prevention. They may also bias the research findings. This paper summarized the documented problems in government statistic on road traffic injury, discussed the potential mechanisms behind the invalid and unreliable data, and suggested solutions to the challenges.

## Problems and mechanisms

In most countries, multiple government departments or agencies collect and release road traffic injury data. These often include road traffic police departments, health departments, transportation departments, and administration departments for work and labor safety.<sup>5</sup> Data collection standards vary across countries,<sup>1</sup> but typically, road traffic departments gathered the most complete data concerning traffic-related injuries and death from the scene of the crash. The data include the information about the type of road users involved, motor vehicle's characteristics, road conditions, traffic control measures, weather conditions, and so on.

Other government departments collect the data at other points. Health departments typically collect data from hospitals where the victims treated or other medical facilities. Transportation and labor officials are most likely to summarize the data based on reports from traffic police and/or health professionals. We summarize seven of the most commonly reported data problems below.

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### *Absence of regular data*

The World Health Organization (WHO) reports that there are 4 countries (Central African Republic, Equatorial Guinea, Liberia, Rwanda) in the world without regular statistical reports concerning road traffic injuries.<sup>1</sup> The absence of raw data requires researchers to use statistical models with limited available covariates to estimate road traffic morbidity and mortality in these countries.<sup>1,6</sup> Such estimates generate unwanted and substantial uncertainties in calculating global, regional, and national statistics because the statistical models are often imperfectly fitted and the estimates and inevitably yield biases.<sup>6,7</sup>

### *Under-reporting*

Evidence suggests that serious under-reporting of road traffic injuries may exist in many locations. Under-reporting of injuries and deaths will obviously underestimate the severity of the public health problem, and also may distort the road traffic mortality trends significantly when the under-reporting changes over time.<sup>4</sup> Several factors lead to under-reporting of road traffic injury.

First, road traffic injuries will be undercounted in some cases. For example, road traffic crashes are not reported to relevant departments at the local level. They may also be undercounted if injured road users are not taken to a hospital or medical facility for treatment. This could occur if the injured person dies at the scene or on the way to hospital, as well as in cases where the injured person suffers minor injuries or refuse to receive treatment due to the inability to pay for medical costs.<sup>8</sup> Such situations are particularly common in remote areas, where crash-related costs may be resolved through negotiation between the parties involved.<sup>9</sup>

Second, under-reporting may emerge through operational definitions used to classify road-traffic fatalities.<sup>5</sup> Some countries use a seven-day definition, meaning a fatality within 7 days of the crash is considered to be a result of the crash. The WHO recommends use of a 30-day definition instead.<sup>5</sup> Use of a 7-day definition creates a substantial under-reporting of traffic-related fatalities.<sup>5</sup>

Last, performance-based administration policies may motivate road traffic police officers to improperly report fewer deaths and serious injuries than actually occur. If local police departments are rewarded for reducing injuries and fatalities, they may under-report the number of injuries and deaths to avoid criticism or penalties and obtain financial rewards from superior offices or governmental bodies. Such patterns have been documented in some jurisdictions.<sup>9,10</sup>

### *Low data specificity*

To achieve maximal benefit, comprehensive information about the crash should be included in the data on road traffic injury, such as the data on victims and road users, the traffic environment, and the weather conditions. Without data specificity – or specific information concerning relevant variables – researchers and decision-makers are unable to quantify the severity of the problems accurately and to take appropriate interventions. According to The Global Status Report on Road Safety 2018,<sup>4</sup> 45 out of 175 countries (26%) failed to specify some or all road traffic deaths by road user. In health data from the US, for example, the number of motor vehicle traffic deaths with an unspecified road user ranged from 13,476 to 17,584 per year between 1999 and 2017, accounting for 31% and 45% of total motor vehicle traffic deaths each year, respectively.<sup>11</sup> Despite the lack of specificity in health data, specific information about nearly all crashes in the US are available in police data.<sup>12</sup> While in other countries, even police data lack of specificity. For

example, in India, the type of collision and the type of road were unspecified in 22% and 45% of the crashes in 2017, respectively.<sup>13</sup>

### *Distorted cause spectrum of road traffic injury*

Cause spectrum refers to the distribution of factors that affect the risk of road traffic crash. Accurate description of the cause spectrum is essential to define road traffic injury prevention priorities. Cause spectrum can be seriously distorted when a single-cause model, which only requires identification of one single cause for the crash, is used instead of a multiple or shared cause model. In particular, use of a single-cause model could lead to arbitrary decisions or inappropriate evaluation when other causes coexist. In China, for example, adoption of a single-cause method to report the cause of road traffic crashes led to a situation where 99% of the reported fatal crashes were caused by illegal or risky behaviors of road users for many years.<sup>14</sup> Such classification may be affected by pressure from local departmental leaders, who sought to avoid critics or penalties.

### *Inconsistency*

Because multiple departments in each country collect and release road traffic injury data simultaneously, it is common to see differences, which are often minor but occasionally more significant, across data sources. When the differences are moderate or large, and vary across time, it confuses researchers and decision-makers. In 2017, a study of traffic injury data from both health and non-health data sources in 71 countries found that 13 (30%) of the countries had a difference over 30% between the two kinds of data sources.<sup>4</sup> A few countries, such as Mexico, China, and Jamaica had differences that exceed 170%. Disparities between the two data sources also changed over time. In some cases (e.g. Azerbaijan, China), it became worse over the study time of 1985 to 2013 despite economic development of the countries.<sup>4</sup>

### *Inaccessibility*

Data accessibility is critical for the data translation and application. Many countries routinely collect road traffic injury data but do not release the data to the public, furthermore the use of data to serve decision-making and research was seriously limited, and therefore the opportunity to improve road traffic safety was missed. According to a study assessing the availability and consistency of road traffic mortality data from 195 countries, only 77 (39%) had publicly available data from both health and non-health departments for at least one year from 1985 to 2013.<sup>4</sup>

### *Delay of data release*

The release of official road traffic injury statistic is delayed in many countries for one or two years as the data are summarized and validated. Although some time is inevitably needed to prepare accurate data, these delays postpone identification of new patterns and trends in road traffic injury, thus delaying response to newly emerging road traffic injuries. Such delays can result in failure to save lives. As an example, a 2010 publication reported an unexpected 145% mortality increase and 86% morbidity increase among the Americans aged 65 years and older from motorcycle crashes between 2000 and 2006.<sup>15</sup> Four years passed between injury incidents and publication of the increases.

## Solutions

The challenges listed above can be addressed. We propose the following strategies.

*Establish a multidisciplinary and independent road crash investigation team to be responsible for data collection in each country*

Collection of road traffic injury data requires adequate professional personnel who are competent to investigate crash causes on the spot, from a “bottom-to-up” perspective. Such teams must be free of external governmental or industry (e.g. insurance companies) pressure and able to collect complete and valid road traffic injury data and release the data independently.

*Adopt standard data collection methods*

All countries should adopt a unique and standard operational definition of cases and a classification of their causes. According to WHO's report released in 2018, the 24-h and 7-day time periods to define road traffic deaths after a crash that are currently adopted in 9 and 13 countries,<sup>1</sup> respectively. It should be revised to a 30-day period that was recommended by the WHO. To improve international data comparisons, a standard classification and cause taxonomy should be adopted to classify road traffic injury causes, paralleling the International Classification of Disease (ICD). In addition, multiple cause classifications are recommended to replace the single-primary cause classification.

*Integrate multi-department data*

Multiple-department data sources are valuable to validate data quality against each other and provide comprehensive information concerning road traffic injuries, including information about the crash circumstances (commonly available in police reports) as well as pre-hospital aid and medical treatments (commonly available in health reports).

*Make the data be freely accessed by researchers and the public in an efficient manner*

Data are valueless until they were used. Therefore, it is essential to publicize road traffic injury data to the public, researchers and other stakeholders in a comprehensive and timely manner. Of course, data should only be released after preserving the privacy of victims and ensuring the data are reliable and valid. Data from the US (e.g. Web-based Injury Statistics Query and Reporting System, Fatality Analysis Reporting System) and global data from the Global Burden of Disease project offer examples of publicly-available road traffic data.

*Use technology to reduce delays in data release*

The use of modern information technologies, such as publicly-available internet portals to share data, artificial intelligence strategies to examine and clean data, big-data collection and storage, and sophisticated quantitative modeling to impute missing values can significantly reduce time to process and transfer data from collection to cleaning, and then to release.

In support of the implementation of SDGs, the problems and challenges of global road traffic injury data must be solved. The solutions we propose offer hope to improve the quality of global road traffic injury data.

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## Ethical Statement

Not applicable.

## Declaration of Competing Interest

The authors declare no conflicts of interest.

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