InDeV: In-Depth understanding of accident causation for vulnerable road users

HORIZON 2020 - the Framework Programme for Research and Innovation

Review of current study methods for VRU safety

Appendix 7 – Systematic literature review: Self-reported accidents

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VRU - Vulnerable road user
TRID - Transport Research International Documentation
1. Introduction

The main idea behind the self-reporting of accidents is to ask people about their traffic accidents and gain knowledge on these accidents as a supplement to the official records kept by police and/or hospitals. The ways of getting information from people can vary; people may be asked to fill out written questionnaires (either online or paper-based), interviews may be performed (either face-to-face or via telephone) and people may be asked to report their accident via an app on their mobile device. The method for gaining self-reported information thus varies greatly – and so does the information that people are asked to give. In most studies, only the number of accidents in which the respondent was involved is relevant for the researcher. In other studies, respondents are asked about possible accident causation factors, and some studies deal with respondents’ recall of the accident details. In other words, self-reporting can have many different aims depending on the research question that is being investigated.

1.1. Objective and scope of the literature study

A large systematic literature review is carried out in order to map the current practice when collecting self-reported traffic accidents. The purpose of the review is to identify studies where traffic accidents are reported by the involved road users.

Research questions for the literature study are:

- What is the purpose of collecting self-reported accidents?
- What are these data used for?
- How are data on accidents collected?
- How are respondents recruited, how many are they and what is the response rate?
- How far back are respondents asked to remember their accidents and are they asked more than once over a period of time?
- Are self-reported traffic accident data compared to data from other types of records on traffic accidents?

The methodology behind the literature review is presented in the following pages followed by the results from the review.
2. Method

2.1. Search strategy

Three databases were used in the search for publications: ScienceDirect, Scopus and Transport Research International Documentation (TRID).

The systematic literature review aimed at locating publications related to traffic accidents. Self-reporting of accidents is used in different fields of research including medicine and social science. Searching only using self-report and accident will therefore return a very high number of publications, where the majority are related to other kinds of accidents than traffic accidents. Therefore a combination of traffic related keywords were included. Search terms and combinations of keywords are shown in Table 1.

Table 1: Search terms and keywords used in the literature search.

<table>
<thead>
<tr>
<th>First keyword</th>
<th>Second keyword</th>
<th>Third keyword</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accident OR Crash AND</td>
<td>self-report OR selfreport AND</td>
<td>Traffic OR Car OR Pedestrian OR Bus OR Truck OR Lorry OR Moped OR scooter OR motorcycle OR Taxi OR Bicyclist OR Vulnerable Road User</td>
</tr>
</tbody>
</table>

2.2. Inclusion/exclusion criteria

Only publications in English were included in the review. No time restrictions were applied for ScienceDirect and Scopus databases to retrieve more relevant papers. For TRID database the search was limited to the last 10 years due to large hits’ results.

In the screening process of the search results the following inclusion criteria were used:

- The paper deals with traffic accidents, not other types of accidents
- Self-reporting means that people give information on at least the number of accidents but perhaps also more details either via face-to-face-interview,
telephone interview or questionnaire (paper or electronic). Notice that self-reports are not about comparing hospital data with police data unless the researcher has asked the patients about something related to their accident.

The abstract is written in English

2.3. Screening process

The screening process is shown in Błąd! Nie można odnaleźć źródła odwołania.. The initial search in the three databases resulted in 1379 publications. Hereof 208 were duplicates. From screening of the title and abstract 988 publications were excluded leaving 183 publications to be screened in full text. Thirty eight of those were excluded based on full text screened. Unfortunately, there are 13 papers we are unable to review due to access not granted. This leaves a total of 136 publications to be included in the review. A few of the publications describe more than one study of self-reported accidents which in total leaves 144 studies to be coded.
2.4. Codebook

For the thorough review of the final publications a codebook was established. The codebook holds information on:

- Publication ID
- Full reference
- Link to publication
- Year of publication
- Non-inclusion criteria in case a paper was not included after all
- Whether or not the focus of the study was methodological or practical applied
- Language of the publication
- How data was collected in the study
- The period of which the respondent was asked to recall accidents
- How many times the respondent was asked to self-report and by which interval
- How were the respondents selected for the study
- Number of respondents
- Response rate
- Road user type included in the study
- Age group of the respondents
- In which country was the study conducted
- Whether the self-reported data compared to other types of accident data
- What the self-reported accidents were used for in the study
- General comments to the study

This review has a focus on mapping the current practice in the field of self-reporting of traffic accidents. However in the future there is also a need to review the methodology behind self-reporting studies. Therefore the codebook also includes a possibility to mark publications as interesting for such a review.
3. Characteristics of the reviewed studies

In this review the interest is to map the current practice in self-reporting studies. In the longer term however it will be interesting to map best practice; therefore it is important that the methodology behind self-reporting of accidents is developed. In the review it is mapped whether or not there is a focus on methodology or the focus mainly is on getting results in the form of accident data and using these data for analyses.

Of the 144 studies reviewed 109 mainly had a practical focus meaning the main focus is on the results – getting accident data, see Table 2. Eight studies had a strong methodological focus, for instance papers that discuss the validity of self-reported data in depth, or how memory works or which types of biases there were present in self-reported data (Arthur Jr et al., 2005; Bajaj et al., 2009; Berecki-Gisolf et al., 2015; Boufous et al., 2010a; Friesen & Gangadharan, 2013; Tin Tin, Woodward, & Ameratunga, 2013; Wåhlberg, 2011b). Twenty seven studies focused on both practical and applied issues as well as the methodological aspect of self-reporting of accidents.

Table 2: Grouping of studies with regard to their focus: practical/applied or methodological.

<table>
<thead>
<tr>
<th>Applied/Practical</th>
<th>Methodological</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>8</td>
<td>27</td>
</tr>
</tbody>
</table>

There is a great variation in the type of road user involved in accidents in self-reporting studies. Figure 2 shows which types of road users are included in the studies reviewed. Some studies include both pedestrians and bicyclist and thus appear in both columns in the figure. Twenty nine studies include all kinds of road users and do not distinguish between the types of accidents they wish to get reports of. Six studies include pedestrian accidents only and pedestrian combined with bicyclists (Grembek et al., 2014; Haworth & Schramm, 2011; Herslund & Jørgensen, 2003; Ibrahim et al., 2012; Loukaitou-Sideris et al., 2014; Twisk et al., 2015). Nineteen studies include bicyclist accidents either exclusively or combined with other types of vulnerable road users. The majority of studies focus solely on car accidents (77), while twelve studies include motorcycle accidents in the study. Four studies include only accidents with buses (Mallia et al., 2015; Salminen et al., 2009; Wåhlberg, 2011b; Wåhlberg, 2011b). Lastly, four of the studies report accidents of other types of road users (Beilock, 1995; Isho, Tashiro, & Usuda, 2015; Steg & van Brussel, 2009; Teyhan et al., 2016) and for two of the studies it is not specified which types of road users are included (Arthur Jr et al., 2005; Powell et al., 2007).
Figure 2: Road user types involved in accidents reported in the studies. Note: Some studies include more than one type of road user but not all kinds.

Besides differences in included road user types, the studies also vary by the age group the respondents are recruited from, see Table 3. The majority of studies (84) find respondents among adults from the legal age of obtaining driver’s license and with no upper age limit. Besides that, there are studies with a focus on children and youngsters (13) and elderly (14). Young drivers; from the age 17/18 years until 20 – 25 years of age; are specifically studied in 14 studies. In 15 studies the age group is another; typically this covers adults with an upper limit of age ranging from 30 to 88. In three studies the age group of the respondents is not specified (Friesen & Gangadharan, 2013; Grembek et al., 2014; Herslund & Jørgensen, 2003).

Table 3: Age group for respondents in the studies reviewed

<table>
<thead>
<tr>
<th>Adults</th>
<th>Only children and youngsters</th>
<th>Only elderly</th>
<th>Not specified</th>
<th>Young drivers (17/18 – 20/25 years)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>85</td>
<td>13</td>
<td>14</td>
<td>3</td>
<td>14</td>
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Błąd! Nie można odnaleźć źródła odwołania. shows the distribution of studies on the regions of the world. Studies on self-reporting of traffic accidents are mainly conducted in Europe (47), North America (34) and Australia/New Zealand (39). One publication describes three studies in three African countries; Ghana, Tanzania and Uganda (Nordfjærn, Jørgensen, & Rundmo, 2012). Another publication reports of a study amongst taxi-drivers in South Africa (Peltzer & Renner, 2003). Thirteen studies were carried out in Asia, hereof 4 in China. In South America, six studies were accomplished, two of them reported in the same publication (Ledesma et al., 2010; Magalhães et al., 2011; Mamo et al., 2014; Poó et al., 2013; Wong et al., 2010). Only one study is conducted in the Middle East, more specifically a study of pedestrian accidents amongst student in Cairo in Egypt (Ibrahim et al., 2012). In Africa four studies were conducted.

![Self-reported accidents by region](image)

*Figure 3: Distribution of studies on regions.*

In summary, the studies reviewed focus mainly on car accidents involving adult road users. The majority of the studies were conducted in Europe, North America and Australia/New Zealand and have a practical and/or applied focus.
4. The purpose of a self-reporting study

Different incentives may initiate a self-reporting study. What are all these accident reports going to be used for? In the distribution of incentives for self-reporting studies, the distribution of incentives for self-reporting studies are shown. The majority of studies use the accident reports for evaluating the safety effect of a specific safety measure (50). Almost as many studies (46) use the reports for estimating the total number of traffic accidents within a specific group of people – for instance how many accidents elderly experience, or if the number of accidents for stroke survivors is different one year after their stroke compared to five years after their stroke.

![Figure 4: Distribution of studies in our review depending on what the information from self-reported traffic accidents are used for.](image)

Twenty nine studies use the information from self-reports to shed light on accident causations factors (e.g. finding out if listening to music affects accident involvement). Twelve studies strive to estimate the underreporting of traffic accidents by using self-reported accidents compared to official statistics. One study uses the information from self-reported traffic accidents to estimate the cost of traffic accidents (de Rome et al., 2014).
Another six studies have other objects for collecting self-reported accidents. One seeks to identify the role of personality traits and road safety attitudes to accident risk (Mallia et al., 2015). Two studies used the information for validating a method for assessment of driving style from one country to another (Poó et al., 2013). Yet another study describes accidents involving children and seeks to suggest age-specific accident prevention measures (Kahl, Dortschy, & Ellsäßer, 2007). Furthermore self-reports are used to relate accident involvement with road rage experiences (Mann et al., 2007). Lastly, one study uses self-reported accidents to determine association between alcohol intake and traffic accidents (Valencia-Martín, Galan, & Rodriguez-Artalejo, 2008).

Of the studies focussing on the methodological aspects, five have the objective to estimate underreporting (Arthur Jr et al., 2005; Bajaj et al., 2009; Boufous et al., 2010a; Friesen & Gangadharan, 2013; Tin Tin et al., 2013) and 3 studies aim at evaluating a safety measure (Berecki-Gisolf et al., 2015; Jimenez-Mejias et al., 2013; Wåhlberg, 2011a).
5. Data collection

5.1. Recruitment of respondents

Respondents to provide information in self-reported traffic accidents studies are often sought to be a representative sample of the population one wish to examine. Błąd! Nie można odnaleźć źródła odwołania. gives a picture of what the basis for recruiting respondents are in the studies reviewed. In general, some specific criteria for inclusion in a study are used quite often either with random sampling or based on volunteers. Most studies (76) use a random sample with specific criteria. These are random samples with some specific criteria under which the randomness will be applied, e.g. road users who have had a stroke within the last year. Amongst those patients, 500 are randomly chosen for the possibility to participate in the study. Other studies base their recruitment on volunteers with specific criteria (32), e.g. a newspaper add asks for all citizens above age 65 to participate in the study.

![Recruitment of respondents](image)

**Figure 5: Criteria for recruitment of respondents for studies.**

Eighteen studies use random sample to recruit respondents without any specific criteria. Five studies recruit respondents from volunteers amongst all road users (Arthur Jr et al., 2005; Bagdadi & Várhelyi, 2011; Grembek et al., 2014; Mann et al., 2007; Qu et al., 2014).
Thirteen studies use other methods for recruitment or the recruitment process is not described in the paper.

### 5.2. Sample size

The number of respondents range from 10 (Herslund & Jørgensen, 2003) to 1.750.918 (Vernon et al., 2002). For twenty five of the studies the number of respondents is not reported. For the remaining 129 studies the distribution on number of respondents is shown in Figure 6: Number of respondents per study. There are quite a few small studies with less than 1.000 respondents (57 in total).

The number of necessary respondents vary depending of the objective of the study. However when considering studies with the objective of estimating underreporting the number of respondents still ranges from fifty eight (Hoggarth et al., 2009) to 10.000 (Hunter et al., 1993).

### 5.3. Response rate

The response rate is provided in some papers and can be calculated from others. However for forty two of the studies no response rate is available. In general the response rate ranges from 10 % to 100 %.
5.4. Collecting information on traffic accidents

Information on self-reported traffic accidents are in general collected either by interview or by questionnaire. Some studies used more than one method for data collection, i.e. both paper and online questionnaire. Thirty six studies use questionnaires without elaborating on the style of the questionnaire, hereof one study combines questionnaire with interviews (Chliaoutakis et al., 2002). Twenty nine studies use online questionnaires and thirty nine paper questionnaires – hereof one study uses both (Haworth & Schramm, 2011).

![Data collection chart]

Figure 7: Way of data collection in the studies reviewed. Note: Some studies have used more than one method for data collection.

The second most common method for gathering self-reported accident data is interviews. Four studies use interviews without specifying whether or not this is face-to-face or telephone interview. One of the studies use interview combined with direct observations (Huang et al., 2011) and another study combines interviews with questionnaires (Chliaoutakis et al., 2002). The remaining two solely use interviews (Asbridge et al., 2014; Beilock, 1995).

Fourteen studies use face-to-face interviews in order to collect information on traffic accidents and seventeen use telephone interviews, hereof one study use both methods (De Rome et al., 2014a).
5.5. Recall period

Respondents in a self-reporting study have to recall their accidents for some time period back. A balance have to be between how many details the respondents are asked to recall and how far back they can remember those details. Two studies ask their respondents to remember their accidents the last month or less (Beilock, 1995; Laapotti et al., 2001). In the other end, respondents are asked to remember back further than 5 years (in 3 studies) (Anstey et al., 2009b; Magalhães et al., 2011; Wåhlberg, 2011a).

![Period of recall of accidents](image)

**Figure 8: Period of recall: How far back in time do respondents have to remember their traffic accidents?**

In between, there are four studies asking their respondents to remember their accidents under the last 1-3 months (Antonopoulos et al., 2011; Buckley & Sheehan, 2007; Dunstan et al., 2012; Qu et al., 2014); Forty studies ask the respondents to remember up till 1 year back; In forty two studies the respondents have to recall from 1 to 3 years back and in 19 studies the participants were asked to recall up till 5 years back. In thirty four studies it is not specified in the publication how far back respondents were asked to recall their accidents.

5.6. Follow-up

A few studies follow up the self-reporting by asking the respondents to report more than once. 122 studies only ask the respondent to report once. One study asks the respondents twice (Cheng & Ng, 2010). One study asks for self-report monthly over a
period of one year (Wood et al., 2009). In one study participants are asked every 1-3 months to recall their accidents (Poulos et al., 2015b).

In eight studies the participants are asked every 3 months – 1 year to recall their accidents (Hoggarth et al., 2009; Poulos et al., 2015a; Poulos et al., 2015b; Ross et al., 2012; Sakashita et al., 2014; Shaw et al., 2012; Wåhlberg, 2011a; Wåhlberg et al., 2010). Every second year respondents are asked to report their traffic accidents in 3 studies (Arthur Jr et al., 2005; Finestone et al., 2011; Owsley, McGwin Jr, Phillips, McNeal, & Stalvey, 2004). Lastly, eight studies ask the respondents with more than 2 years of interval (Alvarez & Marcos, 2010; Anstey et al., 2009; Bajaj et al., 2009; Begg & Gulliver, 2008; Begg et al., 2014; Fuller et al., 2013; Mayou & Bryant, 2003; Wundersitz, 2008).
6. Comparing self-reported data to other data sources

It is interesting to know if the information from the self-reported traffic accidents, for instance the number of accidents, the year of the accident or other details about the accident, is compared with another source of knowledge. As it is evident from Błąd! Nie można odnaleźć źródła odwołania most studies (86) do not compare information from self-reports with other types of accident reports.

Figure 9: Self-reported traffic accidents compared to other data sources.

Forty percent of the studies do compare the information with data sources of some sort. Nine studies compare the information to police records (Anstey et al., 2009; Arthur Jr et al., 2005; Boufous et al., 2010a; Boufous et al., 2010; Hoggarth et al., 2009; Hunter et al., 1993; Laapotti et al., 2001; Ross et al., 2012; Vingilis et al., 2013). Two studies compare information from self-reports to insurance records (Dalziel & Job, 1997; Salminen et al., 2009). Three compare the information to hospital records (De Rome et al., 2014; Finestone et al., 2011; Mayou & Bryant, 2003). Two studies compare information from self-reported accidents to company records of accidents (Berecki-Gisolf et al., 2015; Verschuur & Hurts, 2008).
7. Summary and Conclusions

In summary, the studies reviewed focus mainly on car accidents involving adult road users. The majority of the studies were conducted in Europe, North America and Australia/New Zealand and have a practical and/or applied focus.

There are three different main objectives for collecting self-reported accidents; 1) To evaluate the safety effect of a specific measure, 2) Estimate the total number of accidents within a specific group of people, 3) Estimate accident causations factors.

More than half of the studies reviewed have recruited their respondents from a random sample – either a random sample of the total population in a country or more often a random sample amongst a specific group of people. The sample size in self-reporting studies varies from 10 to almost 2 million respondents. Likewise the response rate varies from around 10 % to 100 %. The sample size is not specified in twenty five studies, and the response rate not specified or retrievable in forty two of the studies.

Information on self-reported traffic accidents are in general collected either by interview or by questionnaire. Most commonly questionnaires, both online and paper, are used for collecting the information.

In more than half of the studies the respondents were asked to recall their accidents within the last 3 months – 1 year. In one fourth of the studies it was not described how far back in time respondents were asked to remember. Almost all studies only ask their respondents to self-report accidents once. A small percentage (15 %) of the studies asked their respondents to self-report twice or several times within a period of time.

Self-reported accidents are in 60 % of the studies not compared to other sources of accident data. However 40 % of the studies do compare the information with data sources of some sort such as hospital records, insurance records, police records or company records.
8. Literature


Chen, Y. L. (2007). Driver personality characteristics related to self-reported accident involvement and mobile phone use while driving. Safety Science,45(8), 823-831.


Korpinen, L., & Pääkkönen, R. (2012). Accidents and close call situations connected to the use of mobile phones. Accident Analysis & Prevention, 45, 75-82.


Laapotti, S., Keskinen, E., Hatakka, M., & Katila, A. (2001). Novice drivers' accidents and violations—a failure on higher or lower hierarchical levels of driving behaviour. Accident Analysis & Prevention, 33(6), 759-769.


Poulos, R. G., Hatfield, J., Rissel, C., Flack, L. K., Murphy, S., Grzebieta, R., & McIntosh, A. S. (2015b). Characteristics, cycling patterns, and crash and injury experiences at baseline of a cohort of transport and recreational cyclists in New South Wales, Australia. Accident Analysis & Prevention, 78, 155-164.


Deliverable D2.1 “Review of current study methods for VRU safety – part 5”


