



What can the drivers' own description from combined sources provide in an analysis of driver distraction and low vigilance in accident situations?

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ABSTRACT

Accident data play an important role in vehicle safety development. Accident data sources are generally limited in terms of how much information is provided on driver states and behaviour prior to an accident. However, the precise limitations vary between databases, due to differences in analysis focus and data collection procedures between organisations. If information about a specific accident can be retrieved from more than one data source it should be possible to combine the available information sets to facilitate data from one source to compensate for limitations in the other(s). To investigate the viability of such compensation, this study identified a set of accidents recorded in two different data sources. The first data source investigated was an accident mail survey and the second data source insurance claims documents consisting predominantly of insurance claims completed by the involved road users. An analysis of survey variables was compared to a case analysis including word data derived from the same survey and filed insurance claims documents. For each accident, the added value of having access to more than one source of information was assessed. To limit the scope of this study, three particular topics were investigated: available information on low vigilance (e.g., being drowsy, ill); secondary task distraction (e.g., talking with passengers, mobile phone use); and distraction related to the driving task (e.g., looking for approaching vehicles). Results suggest that for low vigilance and secondary task distraction, a combination of the mail survey and insurance claims documents provide more reliable and detailed pre-crash information than survey variables alone. However, driving related distraction appears to be more difficult to capture. In order to gain a better understanding of the above issues and how frequently they occur in accidents, the data sources and analysis methods suggested here may be combined with other investigation methods such as in-depth accident investigations and pre-crash data recordings.

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1. Introduction

Every year, approximately 1.3 million people die and between 20 and 50 million are injured in road traffic accidents across the world (WHO, 2009). Moreover, accidents have a major negative impact on costs and transport efficiency. A host of initiatives aiming to address this situation by encouraging safety development within all parts of the road transportation system on a global, national and regional level already exists (Johansson, 2009; Corben et al., 2010; UN, 2010). However, while these initiatives historically have targeted injury prevention, the need to extend the initiatives to include accident prevention as well, is becoming increasingly evident.

Two main issues need to be investigated in order to lay a basic foundation for accident preventive safety development. Firstly, establishing which types of accidents are most common by studying accident data of a substantial number of cases sampled for statistical representation for a region or country. Secondly, establishing why accidents occur, i.e., identifying the underlying causation mechanisms. Extensive additional information explaining why accidents occur is required for accident preventive safety development.

Several databases, useful in terms of addressing the first issue above already exists while how to resolve the second issue is less clear. The most common data sources used for setting up statistical accident databases, e.g., police reports, insurance claims, hospital data, and mail surveys, are often limited when describing why accidents occur. Police reported data are also known for underreporting of accidents, especially for less severe accidents (Amoros et al., 2006; Aptel et al., 1999; Maas and Harris, 1984). Furthermore, the information provided in police reports usually contains limited information on the driver's pre-crash behaviour (Shinar et al., 1983). The validity of self-report methods such as mail

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surveys and interviews have been questioned due to the effects of social desirability responses and the role of the driver's memory (af Wåhlberg, 2009; Clarke et al., 1998). Lastly, insurance companies collect accident data representative of a broad range of accidents, including damage only accidents. Insurance data, however, may only contain limited or inaccurate information explaining why the accident occurred, since the insurance claims process focus on insurance liability settlements (Hutchingson, 1987).

Nonetheless, since each statistical data set is collected by different means and with a different focus, it is possible that any limitation in terms of accident causation information is not identical. This raises the question of whether it would be beneficial to combine data from different sources, i.e., whether data from one source can compensate for limitations in the other(s). Previous studies into injury causation mechanisms have indeed recognised this possibility. For instance, Wilson et al. (2012) provide several examples of researchers who have combined police and hospital data to achieve a more accurate classification of injuries in combination with a description of the accident circumstances. However, to the authors' knowledge, this method has not yet been tried for accident causation mechanisms and the primary data source used in this study, i.e., mail survey data.

The overall aim of this study is to examine to what extent combining word data from an accident mail survey and insurance claims documents can overcome limitations found in accident causation information when using mail survey variables alone. The mail survey was completed by the driver involved in the accident and contained both multiple choice questions and the driver's own description of the accident. The insurance claims documents included insurance claims completed by the involved road users as well as witness statements and/or police reports in a few cases.

To limit its scope, the study focused on two particular issues. The first issue was the extent to which data on well known factors contributing to accidents were captured in the different data sets. Three targeted factors were addressed in the analysis, namely low vigilance (e.g., being drowsy, ill, or under the influence of alcohol/drugs), secondary task distraction (e.g., talking with passenger, texting), and driving related distraction (e.g., looking in mirrors). The second issue was whether combining the data sets results in a better overall understanding of the role of low vigilance and distraction play in accidents. The specific research questions were:

- A. In what proportion of cases can low vigilance, secondary task distraction and driving related distraction be identified by combining word data from a mail survey and insurance claims documents, compared to using mail survey variables alone, and to what level of certainty?
- B. What is the level of agreement in accident descriptions between the survey and other documents for:
 - (1) the responding driver?
 - (2) between the responding driver and other involved road users?
- C. Does information from the other sources provide further insight into how survey responses should be interpreted?
- D. What type of additional information, if any, may be obtained from the word data in either source, and how will this information contribute to the understanding of the role of low vigilance and driver distraction in accident situations?

2. Materials and methods

This section contains information about the sources of data used, and the analysis performed.

2.1. Data collection

Two main sources of accident data were used in this study: responses to a mail survey distributed by an accident research team and insurance claims documents available from an insurance company.

2.1.1. Survey data collected by an accident research team

The accident research team continuously collects accident data by distributing a mail survey, as well as, performing in-depth accident investigations. The data collection exclusively target cars of one particular brand. Mail survey questionnaires are sent to owners of a car that has been involved in a traffic accident in Sweden resulting in vehicle repair costs above a specified level (approx. €4500). The mail survey includes vehicles from model year 1990 insured by an insurance company currently covering 100% of the targeted cars in Sweden up to 3 years after production, and approximately 40% of the targeted cars older than 3 years. Injuries were not sustained in the majority of the surveyed accidents and accidents that had occurred abroad were also excluded from the survey. In total, survey questionnaire responses from 977 accidents that occurred between April 2007 and March 2008 were included in the study. Mail surveys were completed by 969 car drivers/owners, and 8 accidents were targeted for in-depth investigation by the accident research team. In such cases, the accident investigator completed the same survey questionnaire based on interviews with the driver. The mail survey had a 40% response rate in this time period. For more information on distribution (e.g., consent letters, reminders) and non-response analysis for this survey, see Tivesten et al. (2012).

The mail survey contains questions related to the actual collision, as well as, the circumstances prior to the collision. The most important survey questions for this study are presented in Table 1.

Questions regarding background information about the driver and other occupants in the car were also posed. Two questions were open-ended questions, requiring a descriptive answer in words and/or sketches. The driver was asked to explain what happened at the time of the accident, and to provide any additional information that could explain why the accident occurred. The remaining questions were either multiple choice questions, or questions that required short written answers. The descriptive answers, along with optional text after response alternatives labelled *other* as well as other notes written by the respondent, are hereby referred to as survey word data. Answers that were coded into variables are hereby referred to as survey variables.

Two key questions from the mail survey resulted in variables called *Feel* and *Attention*. The first question "How did you feel?" had response alternatives on a five point scale ranging from very tired (*Feel* = 1) to very alert (*Feel* = 5). The second question was "Did anything divert your attention?". Answers to this question resulted in the variable called *Attention*. Both the *Feel* and the *Attention* variable are shown in Table 2.

2.1.2. Documents collected by the insurance company

The insurance company collects different accident documents during the insurance claim process. An overview of these documents is presented in Table 3. The registered owner of the vehicle involved in the accident submits an insurance claim to the insurance company. If another vehicle is involved, the claim adjuster requests a copy of the opponent driver's insurance claim from their insurance company. This part of the insurance claim process is to determine which driver and insurance company is liable for payment. Information regarding the accident location, sketches of the accident situation, descriptions of the event, and whom the driver considered to be responsible is generally available in the insurance claim. In some cases, witness accounts and/or police reports were also available. The witness statements are

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