How can we assess the role of driver distraction in crashes? Feasibility of using the Australian National Crash In-depth Study (ANCIS) for collecting distraction data

Kristie L. Young, Michael G. Lenné, Christina M. Rudin-Brown & Michael Fitzharris

Monash University Accident Research Centre, Melbourne, Victoria
Email: kristie.young@monash.edu

Abstract

This study examined the feasibility of collecting distraction-related crash data through the Australian National Crash In-depth Study (ANCIS). Specifically, the amount and type of self-report data that can be collected regarding the role of distraction in crashes was investigated through the ANCIS driver interview process, and conclusions were drawn regarding the feasibility of this method to collect accurate data on the issue. A total of 21 Victorian ANCIS case drivers participated in the pilot study. Of these, seven completed the distraction survey. The remaining participants did not complete the survey due to their stated inability to recall the circumstances leading up to their crash. This paper presents the findings of the study with respect to the type of distractions involved and the immediate circumstances pre-crash. While pilot study data suggest that the completeness and accuracy of the distraction data collected through the ANCIS interviews is likely to be limited for seriously injured vehicle occupants, the method nonetheless represents a highly cost-effective option for collecting distraction-related crash information for a subset of those, more severe, crash types captured through the ANCIS study protocol.

Keywords
Driver distraction; road crashes; ANCIS.

Introduction

Data on the role of driver distraction in road crashes is lacking in Australia and other countries. A range of methods have been used to collect data on the role of distraction in road crashes overseas. Historically, these methods rely on the use of data from police crash reports and/or crash investigations. More recently, however, advances in vehicle instrumentation and data storage technology have made the 'naturalistic' driving method a popular and accurate means to collect data on the causal role of distraction in crashes and near crashes [1]. The proportion of crashes that are determined to be attributable to a driver being distracted by a competing activity, however, typically differs depending on the methodology used.

Only a handful of studies have reported detailed data on the frequency of crashes in which driver distraction is a contributing factor. The majority of these report results derived from a retrospective examination of police reports and crash databases, and estimate that distraction from a range of sources is a contributing factor in between 8 and 12 percent of crashes [2-5]. It is difficult, however, to accurately quantify the frequency of crashes in which driver distraction is a contributing factor using traditional crash report measures. The main problem in doing so is that crash report forms rarely provide an opportunity for police officers to record information on whether or not a driver was engaged in a distracting activity at the time of a crash – and even where provision is made to do so, drivers may not admit that they were distracted for a host of reasons such as fear of

incrimination or lack of recall. It is likely, therefore, that this method underestimates the contribution of distraction to crash causation.

Naturalistic driving studies are a relatively recent research method that collects data on drivers' exposure to a range of distracting activities. Through instrumentation of vehicles with a range of sensors and cameras, researchers can obtain accurate data on a range of variables. These include driver exposure to distracting activities in everyday driving conditions, the conditions under which drivers engage in distracting activities, and the effect these activities have on driving behaviour, performance and safety outcomes.

To date, only a handful of naturalistic driving studies have been conducted that examine driver involvement in distracting activities. All have been conducted in the United States, and include the 100-car study [6-7], a naturalistic study of commercial heavy vehicle drivers [8], and smaller scale studies by Stutts et al. [9] and Mazzae et al. [10]. These naturalistic studies estimate the proportion of crashes in which distraction is a contributory factor to be much higher than the police crash report-based estimates. The findings of the 100-car naturalistic driving study, for example, suggest that driver distraction contributes to 23 percent of crashes and near crashes combined [6-7].

While naturalistic driving studies are currently acknowledged as the 'best practice' method to collect detailed and accurate real-world data on the contribution of driver distraction to adverse safety outcomes such as crashes, the method does have a number of limitations. First, it yields vast amounts of data, which can be very expensive and time consuming to code and analyse. Second, the highly varied and uncontrolled driving conditions experienced by drivers in naturalistic settings can make analysis of the data complicated. Third, no matter how unobtrusive the data collection equipment is, drivers' everyday driving behaviour can be altered in response to being monitored, and this may include reduced engagement in distracting activities. Fourth, the naturalistic studies conducted to date have used relatively small sample sizes, which reduce the likelihood that the results are representative of the wider driving population. Finally, while conventional video sensors used in naturalistic studies are capable of recording driver engagement in a wide range of potentially distracting activities, they cannot accurately record all instances in which distraction contributes to crashes or incidents (e.g., cognitive distraction where there is often no observable trace).

It is clear that the collection of distraction-related crash data presents a number of challenges, and often involves a trade-off between the accuracy of the data collected and the cost of collecting these data. Given these limitations, the Australian National Crash In-depth Study (ANCIS) program offers a potentially promising alternative to investigate the role of distraction in crashes. The incorporation of a driver distraction module into the ANCIS study protocol was deemed the most cost and time efficient compared to alternative data collection methods (e.g., police reports and naturalistic studies), because it can make use of the well-established crash investigation and interview procedures already used in the ANCIS project. A further advantage would be the ability of this method to overcome some of the challenges associated with drivers' unwillingness to report engagement in certain activities prior to a crash by employing a research nurse as the interviewer rather than the police.

The ANCIS program involves the interview, where medically fit, of occupants injured and transported to hospital as a consequence of involvement in crashes. Eligibility into the study has two principle criteria, these being that the occupant was in a passenger and light goods vehicles manufactured since 1989 and that the occupant was hospitalised at least overnight due to injuries

sustained during the crash. ANCIS is presently undertaken in a number of hospitals in NSW and Victoria.

The ANCIS project has traditionally focused on the assessment of injury risk and the assessment of the effectiveness of vehicle safety countermeasures, however with the emergence of crash avoidance technology the uses of ANCIS is being expanded. It is well recognised that interviewing drivers involved in serious injury crashes may present its own issues, including limited or inaccurate recall of the circumstances surrounding the crash. The aim of this pilot study was therefore to identify any such issues and determine if ANCIS is a feasible means by which to collect distraction-related crash data. Additionally, the study sought to collect preliminary data on the role of driver distraction in road crashes in Victoria.

Method

Participants

A total of 21 Victorian ANCIS cases were recruited for the distraction survey pilot study from The Alfred hospital, which is a mandated State Trauma Centre. Data from these cases was collected from March to May 2009. With one exception (32 days), all interviews were carried out within one month of the crash (Mean = 5 days; SD = 6.9). Seven of the 21 were able to complete the distraction module. The mean time to interview for those completing the distraction module was 1.6 days (SD = 1.1; Median = 1; Range = 1-4 days) compared to a mean time to interview of 6.5 days (SD = 7.9; Median = 4; Range = 1-32 days) for those cases that did not complete the distraction module. Details of these cases are displayed in Table 1.

Table 1 Demographic details of ANCIS cases that did and did not complete the distraction survey

	Completed	Not Completed
No. Cases	7	14
Gender		
Male	3	10
Female	4	4
Mean Age	42.29 (12.59)*	30.21 (10.98)
Crash Type		
Single vehicle	0	9
Multi vehicle	7	5
BAC > .05	0	5

*Standard Deviation in parentheses

The severity of injuries sustained is an important outcome to consider for a number of reasons. First, the time for the patient to be medically competent to participate in the study depends to a large extent on the injuries sustained. Second, injuries to the head in particular affect recall, and third, the requirement for post-operative analgesia or pain relief medications can also influence recall. The Injury Severity Score (ISS) provides an index of injury severity and ranges from zero (no injury) to 75 (deceased), with scores above 15 being indicative of major trauma [11]. Among

the seven cases completing the distraction module, the mean ISS was 8.4 (SD = 6.7; Median = 6; 1 of 7 (14%) ISS > 15) while for those that did not complete the module the mean ISS was 13.4 (SD = 11.0; Median = 11; 5 of 14 (35%) ISS > 15). The total length of stay was shorter for those that completed the distraction module (M = 5.6, SD = 6.7, Median = 6) than for those that did not (M = 10.3, SD = 11.6; Median = 6), although this was not statistically significant. Finally, none of the cases that completed the distraction module sustained an injury to the head, while 9 of the 14 (64%) that did not complete the distraction module sustained an injury to the head.

Survey Materials

The distraction survey questions included a combination of free-recall and forced-choice questions relating to a range of potentially distracting activities performed by the driver immediately prior to the crash. Drivers were first asked to describe if they were distracted by anything immediately prior to the crash (free-recall). They were then asked a series of closed questions about their engagement in a range of non-driving related activities (e.g., use of in-vehicle and portable devices and non-technology based activities). These questions were designed to prompt the driver's memory in instances where free-recall was not successful, as using this method has demonstrated that people are better able to recognise information rather than to recall it [12]. Finally, for those drivers who reported engaging in one or more distracting activities, they were asked if and how they believed this activity(ies) had contributed to the crash.

Prior to conducting the trial, feedback on the content and structure of the survey was obtained from road safety experts at MUARC, the Transport Accident Commission (TAC) and the Ministry of Transport in New Zealand. In addition to the expert feedback, the survey was piloted on six Victorian drivers to ensure the interview was not too long, that the questions were clear and understandable, and that the structure of the interview was logical.

Procedure

The pilot distraction data were collected as part of the existing ANCIS driver interview. Data were collected in Victoria only from drivers who had been admitted to The Alfred hospital as a consequence of a motor vehicle crash. Drivers who met the criteria for inclusion in the ANCIS were administered the distraction survey after Section 3 (events leading up to the crash) of the existing ANCIS driver interview. Consent to collect the distraction-related information was obtained as part of the normal ANCIS driver consent process. The distraction survey component took up to 15 minutes to administer depending on the extent of driver recall of the crash. If drivers stated or demonstrated up front that they had no recollection of any circumstances surrounding the crash, the distraction survey was not administered beyond the first few questions. A trained nurse collected all survey data. Prior to completing the survey, drivers were informed of the definition of driver distraction [13] and any questions they had regarding the study were answered.

After the case had been processed, the distraction survey data were combined with other data collected from the ANCIS study, including demographic and crash typology details.

Results

Of the 21 pilot cases, seven completed the distraction survey. The remaining 14 cases did not complete the survey due to the drivers' lack of recall about the circumstances leading up to the

crash and the crash itself. The lack of recall in these cases was due to a combination of: loss of consciousness, being asleep at the time of the crash, or high blood alcohol content (BAC) levels. None of the cases refused to take part in the distraction survey. Those cases that completed the survey were an average of 12 years older than those who did not complete the survey, were all involved in multiple vehicle crashes, and did not have a BAC reading of .05 or above. Information relating to injury severity information was presented above.

Due to the small number of cases that completed the survey, statistical analysis of the pilot survey data was not possible. As such, the results are reported descriptively.

Of the seven cases that completed the survey, only one driver reported that they were distracted immediately prior to the crash. This case had limited recall regarding the specific details of the distracting activity in which they were reportedly engaged. In response to the free-recall question, the driver reported *"doing something on the dash"* just before the crash, and that they believed that this activity contributed to the crash because it *"took my mind off driving"*. When questioned further using the forced-choice format, the driver indicated that the activity in which they had been engaged in was associated with the music system in the vehicle, claiming that they were "listening to music/radio" as well as "operating the stereo system". In addition, this driver reported being unsure if they were also "inserting or ejecting a CD or tape", "reaching for an object", "smoking" or "daydreaming/lost in thought" at the time of the crash.

Three other completed cases also reported that they were listening to music/radio at the time of the crash, but stated that they did not believe this activity contributed to their crash in any way.

Discussion and Conclusions

This pilot study aimed to determine whether ANCIS is a feasible means by which to collect distraction-related crash data, as well as to collect preliminary data on the role of driver distraction in road crashes.

Given the limited number of drivers who completed the survey, it is clearly not possible to draw conclusions about the role of distraction in crashes in Victoria based on the results of this pilot study alone. Conclusions can, however, be drawn regarding the feasibility of using this method to collect information about distraction-related crashes.

Relative to other methods, the ANCIS is a cost-effective means of collecting in-depth information on the role of distraction in crashes, because its recruitment and crash investigation mechanisms are already in place. However, the pilot study has revealed limitations with this method. Two-thirds of the cases recruited for the pilot study were not able to complete the distraction survey due to a lack of recall about the circumstances surrounding their crash. As well as stemming from any head injuries sustained in the crash as well as high levels of injury severity more generally, this lack of recall could stem from driver fatigue before the crash or a high BAC, both of which were also likely contributors to the crash. It is important to note that this lack of recall, when it occurred, typically related to all aspects of the crash, not just those related to the activities drivers were performing prior to the crash. This suggests that the issue may relate more to an inability to recall crash details in general, rather than an unwillingness to report particular aspects related to the crash. It is instructive to note that while there were no statistically significant differences in this small number

of participants in time until interview, length of stay and injury severity, those that completed the driver distraction module as a group were less severely injured.

Even the one case who reported being distracted at the time of the crash appeared to have limited recall of the specific details of their activities. These issues indicate that a potential limitation with using ANCIS to collect distraction-related data could be the high number of drivers participating in the study who would have limited or no memory of the crash event. As ANCIS collects data on those admitted to hospital, it is the case that patients at the more severe end of the recruitment spectrum would be less likely to remember the details of the crash or their actions immediately preceding it. Indeed, a large number of the pilot cases had sustained some form of head injury in the crash or were highly intoxicated, both of which were likely contributors to the lack of recall. It must be noted that all of the cases enrolled in this pilot study were recruited at a single hospital - The Alfred. It must be considered that The Alfred is the principal State Trauma Centre in the State of Victoria and that the large number of high acuity patients admitted represents a small proportion of the overall crash problem. As ANCIS presently recruits patients in multiple hospitals in NSW and Victoria, the use of the driver distraction module could be a valuable tool in understanding crash risk if employed more broadly across the entire ANCIS study.

Following from above, a consequence of collecting data based only on a sample of admitted patients is that only data from a small portion of total distraction-related crashes will be captured. Distraction also contributes to a high number of less severe, non-injury or minor-injury crashes [2,4]. It is therefore important to consider a means of collecting these data to ensure that the role of distraction in crashes is not underestimated. Such an approach would also increase the chance of drivers having better recall of the circumstances surrounding their crash.

The pilot study findings suggest that the completeness and accuracy of the driver-reported distraction data collected through the ANCIS interviews is likely to be limited for those cases at the more serious end of the spectrum. Nonetheless, compared to other methods, such as naturalistic driving studies, the ANCIS represents a low cost option for collecting distraction-related crash data for those crash types covered by the study method.

There are a number of options for potentially improving the amount and accuracy of the distraction data collected as part of the ANCIS. The issue of driver recall limiting the completeness and accuracy of data could be overcome by also interviewing passengers and/or other witnesses, where available, about the driver's activities leading up to the crash. The feasibility of checking mobile phone records in cases where phone activity is suspected could also be investigated as a means of verifying the driver or witness accounts of the crash. A number of epidemiological studies have used this method to verify driver mobile phone use in the period immediately before, and after, a collision [14-15]. Additionally, the use of ANCIS study protocols among a broader range of crash types, including property damage and minor injury crashes, would reduce the risk of underestimating the role of distraction as a causal factor in crashes as well as provide valuable data on the types and severity of crashes that are most commonly associated with driver distraction. Finally, future studies would be well served to use well established inclusion and exclusion criteria where recall is important, including the exclusion of those with post-traumatic amnesia for a period greater than 24 hours, moderate and severe head injuries, and currently prescribed post-operative analgesia. While the implementation of such criteria might reduce the number of study participants, it would also reduce the risk of any potential recall bias and confabulation.

While the ANCIS program can provide more detailed information about the factors associated with distraction-related crashes, the conduct of this pilot study revealed a number of challenges in collecting distraction data. The ANCIS focus on serious injury cases indicates that it is not a suitable method at present to collect population level data on the frequency of distraction-related crashes in Victoria, but rather could provide valuable insights for a sub-set of road crashes.

Acknowledgements

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