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Distraction and driving: Results from a case–control responsibility study of traffic crash injured drivers interviewed at the emergency room

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ABSTRACT

Background: Use of cellular phones has been shown to be associated with crashes but many external distractions remain to be studied.
Objective: To assess the risk associated with diversion of attention due to unexpected events or secondary tasks at the wheel.
Design: Responsibility case–control study.
Setting: Adult emergency department of the Bordeaux University Hospital (France) from April 2010 to August 2011.
Participants: 955 injured drivers presenting as a result of motor vehicle crash.
Main outcome measures: The main outcome variable was responsibility for the crash. Exposures were external distraction, alcohol use, psychotropic medicine use, and sleep deprivation. Potential confounders were sociodemographic and crash characteristics.
Results: Beyond classical risk factor found to be associated with responsibility, results showed that distracting events inside the vehicle (picking up an object), distraction due to driver activity (smoking) and distracting events occurring outside were associated with an increased probability of being at fault. These distraction-related factors accounted for 8% of injurious road crashes.
Limitations: Retrospective responsibility self-assessment.
Conclusions: Diverted attention may carry more risk than expected. Our results are supporting recent research efforts to detect periods of driving vulnerability related to inattention.

1. Introduction

In high-income countries since the 1970s there has been an overall downward trend in road-crash injuries, despite rising motorization. This trend is the result of successive traffic safety policies targeting human risk factors, the development of safer vehicles and the improvement of road design (Peden et al., 2004). Yet, in recent years, the number of lives saved has plateaued. New frontiers must be explored to achieve further progress.

Studies based on expert assessment of crash reports noted that driver distraction may be a major cause of road traffic crashes (Wang et al., 1996; Wilson and Stimpson, 2010). Distraction can be defined as the diversion of attention away from activities critical for safe driving, toward a competing activity, which may result in insufficient or no attention to these critical activities (Lee et al., 2008). This excludes inattention due to driver states that may affect performance (bored, sleepy, fatigued, drunk, under the influence of illegal or medicinal drugs, emotionally upset) or due to cognitive

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workload induced by internal activities (e.g. daydreaming) (Regan et al., 2011).

Experimental studies observing participants' behaviors when driving an instrumented vehicle with induced distracting tasks showed poorer driving performance (Young et al., 2012a,b; Horberry et al., 2006). In actual driving conditions, an unprecedented study that observed, in an unobtrusive way, 100 drivers' behaviors in naturalistic settings, concluded that secondary-task distraction was a contributing factor in over 22% of all crashes and near crashes (Klauer et al., 2006). These results were, however, mainly based on the analysis of the risk of near crashes and so far there are no available data on the role of these activities in the risk of actual road traffic crashes.

Among these secondary tasks, the impact of cell phone use while driving has been extensively investigated in the past few years, showing that it plays a role in about one in ten crashes (Collet et al., 2010; Strayer and Drews, 2007; Strayer et al., 2011), but other sources of distraction have received much less consideration.

To assess the risk associated with diversion of attention due to unexpected events or secondary tasks at the wheel, we performed a responsibility case–control study of traffic crash responsibility in drivers involved in injury crashes interviewed at the adult emergency department of Bordeaux University Hospital, France.

2. Materials and methods

2.1. Study design and setting

We performed a comparative study of responsibility in a population of patients involved in injurious road traffic crashes. Its basic principle was to compare the frequency of exposures (distracting activities and confounders) between drivers responsible for the crash (cases) and drivers not responsible for the crash (controls), with cases and controls coming from the same source (same period and location of recruitment). The study was conducted in the adult emergency department of the Bordeaux University Hospital (France) which attends urban and rural populations of an area comprising more than 1.4 million people. Patients were recruited from April 2010 to August 2011. Data were collected by trained interviewers (research assistants) through direct interviews conducted with the patient to obtain information about the crash, patient characteristics and potentially distracting tasks at the time of the crash. Informed consent was obtained from all subjects. This study was approved by the French Data Protection Authority (Commission Nationale Informatique et Libertés).

2.2. Participants

Patients were eligible for study inclusion if they had been admitted to the emergency department in the previous 72 h for injury linked to a road traffic crash, were aged 18 years or older, drivers in the crash, and able to answer the interviewer (Glasgow Coma Score = 15 at the time of interview, as determined by the attending physician). 1436 patients were assessed for eligibility. Of these, 368 were excluded for ineligibility (not driver $n = 93$; admission for more than 72 h $n = 29$; unable to answer $n = 246$). This led to a total number of eligible patients of 1068. Of these, 57 refused to participate and a further 56 were excluded from the analysis because of incomplete data. The final sample for analysis comprised 955 patients (89% of the 1068 eligible drivers). Mean time between the accident and the interview was: 4 h 34 min (SD = 12 h 58 min).

2.3. Outcome variable: responsibility for the crash

Responsibility levels in the crash were determined by a standardized method adapted from the quantitative Robertson and Drummer crash responsibility instrument (Robertson and Drummer). The Robertson and Drummer's method was validated in several studies assessing the association between responsibility and exposure to drugs (Robertson and Drummer, 1994; Laumon et al., 2005; Orriols et al., 2010; Lowenstein and Koziol-McLain, 2001). The adaptation of the method to the French context has been validated and presented in previous research (Laumon et al., 2005; Orriols et al., 2010). Notably, this method of determining the driver's crash responsibility was compared with an independent expert responsibility evaluation, achieving fair agreement with a kappa of 0.71 (Laumon et al., 2005). The method takes into consideration for 6 different mitigating factors considered to reduce driver responsibility: road environment, vehicle-related factors, traffic conditions, type of accident, traffic rule obedience and difficulty of the driving task. Compared to the initial method proposed by Drummer, the adapted method does not use 2 items: witness observations and level of fatigue which are inconsistently available in crash police reports in France. For each factor, a score is assigned from 1 (not mitigating, i.e. favorable to driving) to 3 or 4 (mitigating, i.e. not favorable to driving). All 6 scores are subsequently summated into a summary responsibility score. This summary score was then multiplied by 8/6 to be comparable to the 8 factors score proposed by Robertson and Drummer. Higher scores correspond to lower level of responsibility. The allocation of summary scores was: 8–12, responsible; 13–15, contributory; more than 15, not responsible. Drivers who were assigned any degree of crash responsibility were considered to be cases; drivers who were judged not responsible (score of more than 15) served as controls. Sensitivity analyses were performed to assess the robustness of association estimates to the responsibility determination procedure. The responsibility score was modified by eliminating one by one each of 6 mitigating factors that constitute this score, leading to 6 further responsibility scores based on the remaining 5 mitigating factors. Responsibility cut-points were set using the median. The interviewer was blind to the participant responsibility status when using questionnaire sections related to potential distraction because: (1) responsibility score was computed during the analysis step; (2) traffic rule obedience was reported after the distraction section. All information was obtained from participants.

2.4. Exposure to distractors

When interviewed, patients were asked to describe distracting events and activities that occurred just before the crash (the event had to be going on at the time of the driving mistake [inappropriate maneuver, failure to detect a threat, etc.] that led to the crash), from a list of potential distracting events and activities including: listening to the radio or music, watching television, cell phone use (specifying whether hand-held or hand-free), conversation, dialing, text messaging, Internet, navigation system use, reading a road map, having a conversation with or listening to passengers, scolding children, arguing, eating, drinking, smoking, picking up an object, putting on make-up, reading, writing, singing, kissing or hugging, and being distracted by an event outside the vehicle.

Potential confounders included patient characteristics (age, gender, socio-economic category), crash characteristics (season, time of the day, vehicle type) and self-reported psychotropic medicine use in the preceding week (for anxiety, depression, other nervous disease, sleep, epilepsy). Patients were also asked how many hours they had slept during the last 24 h. They were considered as sleep-deprived if they reported sleeping less than 6 h. Finally, the participants were questioned about alcohol consumption (within the six preceding hours).