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Road crash risk after Whiplash Associated Disorder

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ABSTRACT

The future on-road safety of drivers affected by Whiplash Associated Disorder (WAD), the most common soft-tissue injury suffered in a traffic crash, has not been extensively explored. We obtained an anonymised file of 4280 insurance claimants with WAD and, as controls, 1116 claimants with comparably severe soft-tissue injuries who are considered to be at no increased risk than the general population. Their demographic information, road user type and traffic crash records both prior and subsequent to the traffic incident in which the injury occurred, the index crash, were obtained. Rates of subsequent crash involvement in these two groups were then compared, adjusting for age, sex, road user type and prior crash experience. The risk of a subsequent crash in the WAD group relative to controls was 1.14 (95% confidence interval, 0.87–1.48). To allow for differentially altered driving exposure after index crash we distributed a brief survey asking about changes in driving habits after a traffic crash involving injury via physiotherapy clinics and online through the electronic newsletter of a local motoring organisation. The survey yielded responses from 113 drivers who had experienced WAD in a traffic crash and 53 with other soft tissue injuries. There were no differences on average between the groups in their prior driving levels or their percentage change therein at one, three or six months after injury. There was thus no evidence that drivers with WAD are at any higher safety risk than drivers with other types of relatively minor post-crash soft tissue injury.

1. Introduction

There is a growing international research literature concerning the effects of medical conditions on driving and traffic safety (National Highway Traffic Safety Administration, 2009; Vaa, 2003; Charlton et al., 2010; Rizzo, 2011). These are used in the development of medical indices for advice to patients and licensing authorities. Musculoskeletal conditions are a class of medical condition considered in most such reviews. To date, however, there do not appear to be any reported studies that have examined Whiplash Associated Disorder (WAD). This is surprising as litigation and insurance data consistently indicate that WAD is prevalent, being the most common injury outcome of motor vehicle collision by a substantial margin (Walsh et al., 2007; Carroll et al., 2011; Casey et al., 2011; Picelli et al., 2011; Van der Velde et al., 2011).

The annual incidence of WAD is likely to be at least 300 per 100,000 population in many Western countries and shows a consistent rising trend (Söderlund, 2011; Holm et al., 2008; Casey et al., 2011).

Whiplash is typically induced by a rear impact motor vehicle collision. The resulting injuries to soft-tissue associated with the cervical spine together with a range of related sequelae are termed Whiplash Associated Disorder (WAD) (Spitzer et al., 1995). Symptoms can include pain, restriction of movement, poor balance and coordination, reduced concentration, and visual disturbance (Van Oosterwijck et al., 2011; Treleaven et al., 2011; Verhagen et al., 2011; Picelli et al., 2011). For about half of those suffering a whiplash injury, symptoms will resolve within the first three months. For the remainder, however, the course is likely to be chronic, with little if any symptom improvement for a number of years or indefinitely (Jull et al., 2011a,b; Carroll et al., 2008; Sterling, 2012; Jull et al., 2011a,b; Casey et al. 2011; Verhagen et al., 2011; Findling et al., 2011).

Chronic WAD has been associated with self reports of particular difficulties when driving. Two recent studies, one employing a semi-structured interview and the other employing a range of well known measures, have found that checking blind spots, reversing/reverse parking and prolonged driving were reported as being particularly troublesome (Pereira et al., 2008; Takasaki et al., 2011). Perceived driving difficulty was strongly related to reported pain and psychological distress but not objective measures of neck function. These studies also reported that drivers with WAD did not reduce their self reported driving exposure, in spite of being more anxious and cautious whilst driving.

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While there are a number of studies examining the effectiveness of various therapies, little primary research has investigated the impact of WAD on driving skills (for exceptions see Pereira et al., 2008; Takasaki et al., 2011; Gimse et al., 1997). To our knowledge no reported research has directly investigated whether WAD increases crash risk. If there is an increase in the frequency of crashes involving drivers with previous WAD, the extent of the problem needs to be ascertained.

This study attempts to address this issue by comparing the crash experiences of drivers subsequent to a crash resulting in a WAD with those of drivers subsequent to a crash in which other soft tissue injuries matched to level 1 of severity (AAAM, 2005) were sustained. The groups were from a routine database held by a governmental insurance regulator; both had made successful claims for third party compensation and were comparable in this respect. A comparison series of uninjured drivers could not be obtained due to government privacy restrictions but there is relevant research evidence available on the driving safety of the matched injury group.

In Vaa's 2003 meta-analysis of relative risks of accident involvement, the relative risk of crash for people with arthritis or other locomotor disability was reported as 1.17 (95% confidence interval, 1.00–1.36) not much above the average crash risk for the population (Vaa, 2003). Vernon and colleagues (Vernon et al., 2002) reported a relative crash risk of 1.11, (95% confidence interval, 0.70–1.74) for drivers with an unrestricted license who reported functional motor impairment, that is symptoms for which no physical cause can be found, in comparison to drivers matched on a range of variables with no medical conditions. Henriksson (2001) investigated crash risk for 793 people in Sweden who drove a car adapted for a disability. Three quarters of these drivers used a wheelchair for mobility when not driving, with 7% also driving from the wheelchair. Despite this being a well-powered study, there was no significant difference between crash risk for these drivers with a disability and the general population, the number of crashes experienced by these drivers being less than the number expected on the basis of police statistics for the general Swedish driving population. This suggests that a control group with this composition would have no increased risk of crash and that drivers with a soft-tissue injury other than WAD can act as a control surrogate for the general driving population.

At the same time the possibility existed that these two groups of drivers might have different driving exposures before and in particular after the crash in which their injuries occurred and might have differentially altered the amount they drove subsequent to that crash. If there were such differences it would impact on the interpretations of results from the crash rate comparison. In order to control for this potential exposure effect we devised a brief questionnaire to elicit relevant information on this matter from a different and independent volunteer sample of drivers who had been injured in a road crash within the previous three years. This part of the study is described as Phase 2, with the analysis of the secondary data from traffic records being Phase 1.

2. Phase 1: Methods

We requested and received a file generated by the Queensland Motor Accident Insurance Commission (MAIC). These files contained anonymised records of all persons who had made claims to MAIC in 2003 for a Whiplash Associated Disorder (WAD) or for another level 1 soft tissue injury incurred in a traffic crash (the "index" crash) as driver, motorcyclist, pedal cyclist, passenger or pedestrian. Each record consisted of the month and year of the crash for which a claim was made; the nature of the injury (whiplash, other soft tissue injury); gender and age of claimant; road user type (driver, passenger, etc.) of claimant in the incident resulting in the injury. These data were then linked with information, supplied by the Queensland Transport Crash Database QTCD, on crashes of any severity within the 5 years prior to the index crash, the index crash where identified and all crashes, again of any severity, subsequent to the index crash. This crash information referred only to vehicle controllers, even if they had been injured as pedestrians, passengers or pedal cyclists at the index crash. It included month, year, nature and severity of crash (property damage only, minor injury, hospitalization, fatality), but not the type of vehicle being driven at the time. Since in 2003 over 90% of eligible Queensland residents had valid driver's licenses (Queensland Department of Transport and Main Roads 2011), it is reasonable to assume that the great majority of those injured as non-drivers would also be driving a motor vehicle at some other time, possibly to a lesser extent than those injured while driving.

Claimants with WAD are referred to as "cases", those with other soft tissue injuries as "controls". For brevity, motor vehicle controllers will be termed in what follows as drivers, unless motorcycling is specifically considered. Since driving licences were not available to persons under 17 years of age in Queensland, the analyses have been confined to persons who were aged at least 17 years at the date of the index crash.

2.1. Data analysis

All analyses made use of failure-time models; the outcome variable was the number of months between the date of the index crash and the date of the first subsequent crash, if any, or to the end of follow-up otherwise. Univariate analyses used Kaplan–Meier curves to estimate three-year crash incidences and log-rank chi square statistics to test difference in incidence between study factors. Multivariate analyses used conventional Cox proportional hazards modeling. Analytic models included WAD status and factors found to have a significant univariate association with time to first subsequent crash, which is a proxy for likelihood of having a subsequent reported crash within the observation period. When the analysis is confined to claimants who were motor vehicle controllers at index crash, motorcycle riding at index crash is included since it is strongly associated with WAD status at claim: only 1.6% of case drivers were motorcyclists compared to 16.2% of control drivers. The outcome measure for this analysis is the hazard ratio (HR) which is an estimate of the rate ratio, that is the ratio of the crash rate among the WAD sufferers to that among claimants with other soft tissue injuries.

All multivariate models included the variables, WAD status, the reference category being other soft tissue injury at claim; prior crashes within the past 5 years (coded as none – the reference category; one; more than one); and age in three broad categories (<35 years – the reference category; 35–54 years; $\geqslant$55 years). Six models were examined:

(1) Males and (2) females who were drivers at the index crash, separately; the variable, motorcycle use at index crash, was included in these models.
All males and (4) all females separately; the variable, driver at index crash, which encompassed also motorcyclist at index crash, was included.
(5) All drivers at index crash; here the additional variables were motorcycle use at index crash and gender, the reference categories being car or truck drivers at index crash and males respectively.
(6) Entire sample, i.e. including those who were not vehicle controllers at the index crash; the additional variables here were driver at index crash and gender.