



Drivers' psychiatric disorders and fatal motor vehicle accidents in Finland



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ABSTRACT

Relatively little is known about fatal motor vehicle accidents (FMVA) involving drivers with psychiatric disorders. In this study of all drivers killed in FMVAs in Finland between 1990 and 2011, we aimed to study drivers' death rate trends in FMVAs, with special focus on drivers with a history of psychiatric disorders. Prevalence of drivers' hospital treated psychiatric disorders, and characteristics of drivers with psychiatric disorders were also studied. For the purpose of this study, three national registers were accessed. Drivers' hospital treated psychiatric disorders were screened in a five-year period prior to death. Drivers with ($n = 425$) and without ($n = 3856$) psychiatric disorders were compared, female and male drivers separately. The main outcome measure was any psychiatric disorder in drivers within the five-year timescale. Socio-demographic factors, use of intoxicants and medication at the time of death, recent adverse life events, and drivers' physical and emotional states were used as covariates in the statistical analyses. During the study period, death rates increased for females with psychiatric disorders, and decreased for females without psychiatric disorders. Death rates for males with psychiatric disorders decreased between the years 1990–2000 and 2007–2011, and increased between the years 2000–2007. Death rates decreased over the whole study period in males without psychiatric disorders. Alcohol related disorders and affective disorders were the most prevalent hospital treated psychiatric disorders among drivers involved in FMVAs. Use of medications at the time of death, and committing suicide in traffic both associated with being a driver with psychiatric disorders involved in FMVAs for both genders. As FMVAs involving drivers with psychiatric disorders have increased, a more focused and detailed evaluation of the driving performance of drivers with psychiatric disorders is recommended. These evaluations should also be extended to drivers with non-psychotic disorders.

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1. Introduction

Although some effort has been made to study the effect of psychiatric disorders on driving performance, relatively little is still known about the subject. Previous literature suggests that an association may exist between psychiatric disorders (e.g. schizophrenia and depression) and impaired driving performance (Bulmash et al., 2006; De Las Cuevas and Sanz, 2008; De Las Cuevas et al., 2010; St Germain et al., 2005; Wickens et al., 2014). However,

it remains unclear to what extent psychiatric disorders impact on driving performance given that psychiatric medication can also have a deleterious effect on driving. For an example, in many studies anxiolytics such as benzodiazepines, and tricyclic antidepressants are found to associate with higher risk for traffic accidents (Chang et al., 2013; Hetland and Carr, 2014; Orriols et al., 2009; Ravera et al., 2011). A recent study also found evidence that selective serotonin re-uptake inhibitors (SSRI) increases the risk for traffic accidents (Chang et al., 2013). However, as contradictory evidence exists (see reviews: Hetland and Carr, 2014; Orriols et al., 2009), the impact of SSRIs on traffic accident risk is not yet clearly established. In addition to having an effect on driving performance, psychiatric disorders *per se* may increase the risk of death in motor vehicle accidents (Crump et al., 2013; Dumais et al.,

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2005).

Studies have found that comorbidity between substance use disorders and psychiatric disorders, such as anxiety and mood disorders, is common (European Monitoring Centre for Drugs and Drug Addiction, 2013; Jané-Llopis and Matysina, 2006). It has also been found that psychiatric disorders, such as anxiety disorder, bipolar disorder and depression, associate with driving under the influence (DUI) of alcohol and/or drugs (Karjalainen et al., 2013; Lapham et al., 2001). Alcohol and drug use disorders have been shown to increase the risk for fatal motor vehicle accidents (FMVA) by over twofold (Callaghan et al., 2013).

In this study we aim to analyze the trends in death rates of drivers killed in FMVAs in Finland, with a special focus on drivers with a history of psychiatric disorders. Additionally, the prevalence of drivers' hospital treated psychiatric disorders in a five-year period prior to their death, and driving related risk factors including alcohol, illicit drugs and medications, and their association with being a driver with history of psychiatric disorder, are studied.

2. Methods

2.1. Study population

The initial study population ($n = 4930$) consisted all drivers killed in motor vehicle accidents in Finland between the years 1990 and 2011, and whose deaths were investigated by Finnish road accident investigation teams. From the initial study population we selected a sample population which included only Finnish citizens. This was in order to ensure the availability of drivers' health related information. We studied drivers aged 16 years and above at their time of death because 16 is the minimum age to obtain a driver's license for a small motorcycle in Finland. Only fatal motor vehicle accidents (FMVA) involving small (engine size between 50 cm³ and 125 cm³) or regular sized motorcycles, cars and vans (including combination with trailers) were studied. A final total of 4281 drivers (3552 (83%) male and 729 (17%) female), fulfilled all of our inclusion criteria and were included in this study.

2.2. Data

2.2.1. The investigation of FMVAs and the database of road and cross-country traffic accidents

We had access to data from three national registers which we combined using personal identity codes (Population Register Centre, n.d). The main data in this study was obtained from the Finnish database of road and cross-country traffic accidents, which is maintained by The Finnish Motor Insurers' Centre (LVK). This database contains results from investigations conducted by twenty independent road accident investigation teams (RAIT). In Finland, special RAITs have been responsible for investigating road and cross-country traffic accidents involving fatalities since 1968. This work has been statutory since 2001 ("Act on the investigation of road and cross-country traffic accidents No. 24/2001," 2001, "Council of State decree on the investigation of road and cross-country traffic accidents No. 740/2001," 2001) and these investigations are steered and supervised by the Road Accident Investigation Delegation set up by the Ministry of Transport and Communications. The intention of the RAITs are to conduct comprehensive and method based investigations of FMVAs (The Finnish Motor Insurers' Centre, 2004). This is done primarily for traffic safety purposes. The teams consist of specialists from various disciplines, including police, medicine, vehicle technology, road maintenance and behavioral sciences, thus ensuring that the various factors that could explain the course and the cause of the

FMVA are acquired. RAITs also aim to interview the people involved, eyewitnesses and next-of-kin of the parties involved. Additionally, members of the RAITs are entitled to acquire information from various registers to complement their investigations. The Finnish Motor Insurers' Centre provided the main data in this study and approved its use (10/16/2013).

A detailed description of the investigation method of FMVAs in Finland has been published elsewhere (Salo et al., 2006; The Finnish Motor Insurers' Centre, 2004). A summary of the investigation is also provided at the Finnish Motor Insurers' Centre's website (The Finnish Motor Insurers' Centre, 2015).

2.2.2. Health care register data

We obtained drivers' health records from the Care Register for Health Care (CRFHC, previously Hospital Discharge Register), which has existed since 1969. CRFHC is a national health care register maintained by the National Institute of Health and Welfare in Finland (THL) and contains information on patients treated in hospitals, health centers and other inpatient care institutions (National Institute for Health and Welfare, 2014). Information gathered in the register includes treatment diagnoses (main and subsidiary diagnoses) and the length of hospital treatment. The Finnish Classifications of Diseases, which is based on the International Classification of Diseases (ICD) versions 8, 9 and 10, has been used since 1969, 1987 and 1996, respectively (Tautiluokitus, 1969, 1987, Tautiluokitus ICD-10, 1995).

Using CRFHC data, we screened for drivers' psychiatric inpatient hospital diagnoses within a five-year time-period prior to the driver's death. Table 1 presents the psychiatric diagnoses and their categorization. THL approved our access of the CRFHC and provided the health care data (THL/1270/5.05.00/2013, 3/12/2014).

2.2.3. Cause of death data

Cause of death information was obtained from the official death certificates of drivers killed in FMVAs. In Finland, all suicides and unintentional injuries leading to death are examined by forensic medicine specialist physicians ("Act on the Inquest into the Cause of Death No. 459/1973," 2011). Official death certificates are completed after the examination and eventually archived by Statistics Finland (Statistics Finland, n.d). Statistics Finland provided the official death certificates for this study and approved their use (TK53-1422-13, 11/20/2013).

2.3. Outcome

The outcome variable in this study was any driver's hospital treated psychiatric disorder within the five-year time-period prior to their FMVA (yes/no). Psychiatric disorders were either main or subsidiary diagnoses in the CRFHC data. After initial analyses, we made a follow-up analysis while excluding drivers with alcohol related disorder or drug use disorders from the outcome variable.

2.4. Covariates

2.4.1. Socio-demographics

Using the database of road and cross-country traffic accidents, we studied the following socio-demographic variables: driver's age, marital status, education, and employment status at the time of death. Driver's marital status was categorized as: unmarried, married or cohabiting, divorced or separated, widowed, other/unknown. Education, either completed or ongoing, was categorized as: basic (elementary/junior high), intermediate (vocational/upper secondary education), high (university/university of applied sciences education), and other/unknown. Employment status was categorized as: employed (any job), unemployed, and other/

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