Disability following car crashes: an epidemiological investigation

Shanthi Neranjana Ameratunga

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy,

The University of Auckland, 2005

Abstract

Background

Road traffic injury is projected to rank as the third largest contributor to the global burden of disease by 2020. Disability is a significant component of the burden of disease ranking. Most published data on traffic crash outcomes, however, focus primarily on deaths and hospitalisations. Reliable estimates of post-crash disability and information on factors that modify the disabling process are essential to prioritise and allocate appropriate resources for road traffic injury prevention and interventions that reduce the risk of secondary disability.

Aims

To quantify the risk of disability associated with serious injury crashes in car drivers in a defined population; to explore the extent to which this risk is modified by chronic alcohol abuse; and to critically review methodological approaches that can redress the inadequate epidemiological attention to injury-related disability.

Methods

Systematic reviews were conducted to examine the available epidemiological evidence quantifying the association of car crashes with disability and the effect of alcohol on the risk of post-injury disability. Studies published or presented between January 1980 and April 2003 were reviewed. No language restriction was imposed.

A population-based prospective cohort study conducted in the Auckland region of New Zealand recruited drivers exposed to serious injury crashes (identified through a surveillance system monitoring hospital admissions of injured car occupants). A representative sample of car drivers in the region was identified through roadside surveys (controls). The participants were interviewed at recruitment (to obtain pre-crash information from crash drivers and baseline data from controls) and re-interviewed at five and eighteen-months follow-up. Structured interviews on all three occasions included the Short Form-36, a global health change indicator, and the Alcohol Use Disorders Identification Test. Information on a range of potential confounders was sought at baseline through the interview, alcohol measurements and clinical records.

Results

Studies identified in the systematic reviews revealed that published estimates of the risk of post-crash disability ranged from 2% to 57%. The evidence regarding the effect of alcohol on post-injury disability is inconclusive largely because none examined this association directly. Most studies identified in the reviews were limited by several methodological problems including the absence of appropriate comparison groups, inadequate or no adjustment for confounding, significant potential for selection bias due to the study setting, high levels of loss to follow-up, and missing data.

In the prospective cohort study, 215 crash drivers (75% follow-up) and 254 controls (69%) completed the 18-month interview. Overall, 40% of the drivers who were hospitalised, 20% of the crash drivers not hospitalised, and 7% of the controls reported deteriorated health at 18 months relative to their baseline health. This represents a ten-fold excess risk of disability among hospitalised drivers and a three-fold excess risk among non-hospitalised crash drivers, relative to drivers in the general population.

Among crash drivers reporting an overall decline in health, clinically important reductions in general and mental health were apparent over the follow-up period despite improving physical health and function. This trend was more evident among non-hospitalised than hospitalised crash drivers.

Compared with drivers who were neither involved in a crash nor defined as hazardous drinkers, crash drivers who were hazardous drinkers had a seven-fold excess risk of a clinically significant ($\geq$ 10%) decline in the SF-36 general health score (OR 6.85; 95% CI: 1.84-25.43). Crash drivers who were not hazardous drinkers had a three-fold risk (OR: 3.00; 95% CI: 1.14-7.89). The results indicated an important interaction between crash involvement and chronic alcohol abuse in potentiating the risk of disability.

Conclusion

Serious traffic crashes are associated with significant longer-term disability in a substantial proportion of survivors with an apparent worsening of mental health over time. Definitions of disability and estimates of the burden of disability following traffic injury remain highly variable in the published literature and it is timely for the international research community to develop a more systematic and consistent approach to this major and increasing component of the global burden of disease. By addressing the main methodological limitations of previous studies, this study revealed that chronic alcohol abuse potentiates the risk of post-crash disability. The findings suggest that measures for preventing road traffic crashes as well as efforts to identify problem drinkers among crash survivors should be intensified. The thesis highlights the need for robust indicators of non-fatal injury to monitor the impact of road safety programs and large-scale epidemiological studies to investigate the spectrum and determinants of post-injury disability.

To my grandparents

Rose and Anselm Fernando and Pearl and Cecil de Mel

Acknowledgments

First, I wish to thank Professors Rod Jackson and Robyn Norton whose support was critical to this work and my enjoyment of it. I am indebted to Robyn for encouraging my interest in this field, her guidance with the project and her mentorship throughout my career in injury research. In Rod, I found a supervisor whose boundless enthusiasm to discuss, debate and critically review all aspects of my work greatly enhanced the experience and inspired my teaching and learning.

I would also like to acknowledge the other co-investigators of the project. Jennie Connor coordinated the case-control study that was integrally linked to this research and Elizabeth Robinson provided valued statistical advice. Ian Civil (Director of Trauma Services, Auckland Hospital) and John Coverdale (Associate Professor of Psychiatry) provided thoughtful guidance in developing the research concept and addressing its application to practice. Derrick Bennett's advice while he was in Auckland is also appreciated.

I am indebted to the study participants whose contribution made this work possible. I also gratefully acknowledge the Health Research Council of New Zealand and the Alcohol & Liquor Advisory Council of New Zealand (ALAC) for funding this project.

The quality of the data collected owes much to the commitment of a small but enthusiastic team of research interviewers (particularly Cherie Lovell, Desiree Lloydd, Kerry Turnpenny and Lynne Hutchison) and the trauma coordinators who facilitated the process including Rhondda Paice, Rangi Dansey and Barbara Amadeo.

I had the privilege of working with Gordon Smith and Ellen Mackenzie at the Johns Hopkins School of Public Health during the tenure of an overseas research fellowship awarded by the Accident Compensation Corporation of New Zealand. This experience and discussions with Ian Cameron, Adnan Hyder, Jerry Jurkovich, John Langley, Rod McClure, Keith McLea, Barry Pless and Maria Segui-Gomez enriched my appreciation of this research field and proved invaluable during the conduct of the project.

The helpful suggestions of the Burden of Alcohol Research Group, Andrew Jull, Maree Hackett and Rod Watts are gratefully acknowledged. I particularly appreciate the collegial support provided by Sally Abel, Carol Everard, Sue Crengle, Lorna Dyall, Raina Elley, Tim Kenealy, Jo Broad and Ekramul Hoque.

Finally, I thank my family, particularly Rohan and Anouska Ameratunga and my parents Thakshan and Sushila Fernando, for their love and support in countless ways.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ACC	Accident Compensation Corporation of New Zealand
ACCIS	Auckland Car Crash Injury Study (baseline case-control study)
ACCORD	Auckland Car Crash Outcomes Recovery & Disability Study
ADL	Activities of Daily Living
AIS	Abbreviated Injury Score
AUDIT	Alcohol Use Disorders Identification Test
BAC	Blood Alcohol Concentration
CI	Confidence Interval
DALY	Disabilty Adjusted Life Year
ED	Emergency Department
GCS	Glasgow Coma Score
ICF	International Classification of Functioning, Disability and Health
ISS	Injury Severity Score
LTSA	Land Transport Safety Authority
mg %	milligrams per 100 decilitres of blood
MVC	Motor Vehicle Crash
NZHIS	New Zealand Health Information Service
OECD	Organisation for Economic Cooperation and Development
OR	Odds Ratio
RR	Relative Risk
SF-36	Short Form-36 (original source: Medical Outcomes Study)
WHO	World Health Organisation