



<http://researchspace.auckland.ac.nz>

ResearchSpace@Auckland

Copyright Statement

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand).

This thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- Any use you make of these documents or images must be for research or private study purposes only, and you may not make them available to any other person.
- Authors control the copyright of their thesis. You will recognise the author's right to be identified as the author of this thesis, and due acknowledgement will be made to the author where appropriate.
- You will obtain the author's permission before publishing any material from their thesis.

To request permissions please use the Feedback form on our webpage.

<http://researchspace.auckland.ac.nz/feedback>

General copyright and disclaimer

In addition to the above conditions, authors give their consent for the digital copy of their work to be used subject to the conditions specified on the Library Thesis Consent Form.

**Unintentional falls at home among
young and middle-aged adults: the
influence of alcohol**

Bridget Kool

**A thesis submitted for the degree of Doctor of
Philosophy,
The University of Auckland, 2009**

Abstract

Aim

To investigate the epidemiology of unintentional fall-related injuries at home among young and middle-aged adults (25 to 59 years) and to investigate the contribution of alcohol to these injuries.

Methods

Routinely collected national fall injury data were analysed to describe the incidence and characteristics of falls at home resulting in death or hospital inpatient treatment among this age group in New Zealand.

A systematic review of the published literature evaluated the epidemiological evidence quantifying the risk of falls associated with acute and usual alcohol consumption in this age group.

A population-based case-control study was conducted in Auckland, New Zealand over a 12-month period. Cases were 335 people aged 25 to 59 years who were admitted to hospital or died as a result of unintentional non-occupational falls at home. Controls were 352 people randomly selected from the electoral roll from the same age group as the cases. The participants or next-of-kin completed a structured interview to ascertain data on personal and lifestyle factors including alcohol consumption.

Findings

The review of national injury data found that almost a third of unintentional falls resulting in an in-patient admission among working-age people were recorded as occurring at home. For every death there were about 150 in-patient hospital admissions.

The systematic review identified only a small number of studies but showed an increased risk of unintentional falls in this age group with increasing exposure to alcohol use. The magnitude of this risk varied considerably across studies with most estimates being relatively imprecise. There was modest evidence of a dose-response relationship with acute alcohol use. The association between usual alcohol use and fall risk was inconclusive.

The case-control study revealed that after controlling for confounding, the consumption of two or more standard alcoholic drinks in the preceding six hours relative to none is associated with a significantly increased risk of fall-related injury. Approximately 21% of unintentional non-occupational falls at home in this population was attributed to this risk.

No association between hazardous drinking as a usual pattern and falls was found when the analyses were adjusted for confounders.

Conclusion

A significant proportion of unintentional fall-related injuries among the working-aged New Zealanders occur at home. Consuming two or more drinks in the previous six hours was strongly associated with unintentional non-occupational falls at home that result in admission to hospital or death in this age group. This largely unrecognised problem should be addressed in further research and in falls prevention programmes.

Acknowledgements

Firstly I would like to thank my supervisors Associate Professor Shanthi Ameratunga, and Professor Rod Jackson. I am extremely grateful for their support, encouragement, mentoring and guidance throughout my PhD journey.

The research presented in this thesis was the main component of the Auckland Falls Study, funded by the Accident Compensation Corporation (ACC). Associate Professor Shanthi Ameratunga (Principal Investigator) and Elizabeth Robinson (co-investigator) from the Section of Epidemiology and Biostatistics gave critical input to the design and development of the Auckland Falls Study. I would like to acknowledge the contribution of the other co-investigators: Professor Rod Jackson, Mr Alex Ng, Mr John Cullen, Dr Wayne Hazell, and Dr Sue Crengle; and the Study Advisory Group: Paula Eden, Marilyn Jones, Catherine Gilhooly, Jane Sherard, Kerri Hiini, Malakai Ofanoa, Dr Michael Baker, Associate Professor Ngaire Kerse, Vili Nosa, and Graham Liggins. I am grateful to the study personnel who contributed to the implementation of the study: Cherie Lovell, Mildred Lee, and Katrina Lawson. I would like to thank the participants who agreed to take part in the Auckland Falls Study and who have contributed to the findings and recommendations. I greatly appreciate the assistance provided by the Trauma Services staff who assisted with the identification of cases at the three recruiting hospitals: Rangitikei (Auckland City Hospital), Rhonda Paice (Auckland City Hospital), Helen Naylor (Middlemore Hospital), and Jodie Orchard (North Shore Hospital)

I am most grateful for the financial support provided to me through my ACC Career Development Award.

Finally, I would like to thank my husband Tom and our four children Charlotte, George, Rosie, and Phoebe for helping to make this all possible through their unwavering support and belief in me.

Table of Contents

<i>Abstract</i>	<i>ii</i>
<i>Acknowledgements</i>	<i>iv</i>
<i>Table of Contents</i>	<i>v</i>
<i>List of Figures</i>	<i>x</i>
<i>List of Tables</i>	<i>x</i>
<i>List of Abbreviations</i>	<i>xi</i>
CHAPTER ONE: INTRODUCTION	12
1.1 Fall-related injury is an important public health issue	12
1.2 Unintentional falls among young and middle-aged adults at home.....	12
1.3 Addressing the burden of falls	14
1.4 Alcohol use and falls	16
1.5 Context and aims of the thesis	19
1.6 Roles of the study investigators.....	20
1.7 Structure of the thesis	21
CHAPTER TWO: A REVIEW OF NATIONAL ROUTINELY COLLECTED DATA ON UNINTENTIONAL FALLS AT HOME AMONG YOUNG AND MIDDLE-AGED ADULTS...	22
2.1 Introduction	22
2.2 Sources of routinely collected injury data in New Zealand.....	22
2.3 Rationale for a review of unintentional falls data.....	23
2.4 Methods	24
2.5 Results	24
2.5.1 Fatalities.....	24
2.5.2 Hospitalisations.....	25
2.6 Discussion	26
2.7 Summary.....	28

CHAPTER THREE: SYSTEMATIC REVIEW OF EPIDEMIOLOGICAL STUDIES OF THE ROLE OF ALCOHOL IN UNINTENTIONAL FALLS AMONG YOUNG AND MIDDLE-AGED ADULTS	29
3 Introduction	29
3.1 Systematic review of epidemiological studies of the role of alcohol in unintentional falls among young and middle-aged adults	29
3.1.1 <i>Aim and objectives</i>	29
3.1.2 <i>Methods</i>	30
3.1.2.1 Inclusion criteria.....	30
3.1.2.2 Data sources and search terms	30
3.1.2.3 Quality assessment	31
3.1.3 <i>Results</i>	31
3.1.3.1 Study characteristics	31
3.1.3.2 Selection biases	36
3.1.3.3 Information biases	36
3.1.3.4 Confounding	37
3.1.3.5 Effect estimates	37
3.1.4 <i>Discussion</i>	39
3.2 Other factors which may influence the relationship between alcohol and falls among young and middle-aged adults	42
3.2.1 <i>Introduction</i>	42
3.2.2 <i>General health</i>	43
3.2.3 <i>Physical activity</i>	44
3.2.4 <i>Fatigue</i>	44
3.2.5 <i>Living alone</i>	44
3.3 Summary	44
CHAPTER FOUR: AIMS AND METHODS OF CASE-CONTROL STUDY	46
4.1 Introduction	46
4.2 Research objectives and hypotheses	46
4.3 Rationale for undertaking a case-control study.....	46
4.4 Study design.....	48
4.4.1 <i>Study base</i>	48
4.4.2 <i>Selection and recruitment of controls</i>	48
4.4.3 <i>Identification and recruitment of cases</i>	50
4.4.4 <i>Study size and potential recruitment rate</i>	51

4.5	Study procedures, recruitment and data collection	52
4.5.1	<i>Study personnel</i>	52
4.5.2	<i>Data collection</i>	52
4.5.2.1	Data collection process	52
4.5.2.2	Questionnaire	53
4.5.2.3	Alcohol exposure measurement.....	53
4.5.2.4	Measurement of potential confounders.....	56
4.5.2.5	Information collected on non-participants	58
4.5.3	<i>Data management and analysis</i>	58
4.5.3.1	Data editing, entry, and quality checks	58
4.5.3.2	Data analysis	58
4.6	Ethical considerations	59
CHAPTER FIVE: RESULTS.....		61
5.1	Introduction	61
5.2	Study numbers and response rates	62
5.2.1	<i>Unintentional falls at home resulting in hospitalisation or death (Cases)</i>	62
5.2.2	<i>Sample of the study base (Controls)</i>	62
5.3	Characteristics of the fall events	64
5.3.1	<i>Type and location of fall</i>	64
5.3.2	<i>Temporal factors</i>	64
5.3.3	<i>Outcome of falls</i>	65
5.4	Characteristics of the study base.....	65
5.4.1	<i>Demographic profile</i>	65
5.4.1.1	Gender and age.....	65
5.4.1.2	Ethnicity and socioeconomic status	66
5.4.2	<i>Prevalence of alcohol-related characteristics in the study base</i>	67
5.4.2.1	Measures of acute alcohol use.....	67
5.4.2.2	Measures of usual alcohol use.....	67
5.4.3	<i>Prevalence of other characteristics in the study base</i>	68
5.4.3.1	Risk and protective factors for falls	68
5.4.3.2	General housing design issues	69
5.5	Is alcohol use an independent risk factor for unintentional falls at home resulting in serious injury among young and middle-aged adults?	70
5.5.1	<i>Introduction</i>	70
5.5.2	<i>Univariate analysis of effect of alcohol use and other factors on risk of fall injury</i>	70
5.5.2.1	Alcohol use	70
5.5.2.2	Physical and emotional wellbeing	71

5.5.2.3	Sleepiness	72
5.5.2.4	Lifestyle factors	73
5.5.3	<i>Potential confounders</i>	74
5.6	Multivariable models	76
5.6.1	<i>Alcohol use</i>	76
5.6.2	<i>Other factors associated with an increase in fall risk</i>	77
5.6.3	<i>Population-attributable risks and interactions</i>	78
5.7	Summary	79
	CHAPTER SIX: DISCUSSION	80
6.1	Introduction	80
6.2	Unintentional falls at home among young and middle-aged adults	80
6.3	What is already known about the role of alcohol in unintentional falls?	81
6.4	What role does alcohol play in nonoccupational unintentional falls at home among young and middle-aged New Zealanders?	82
6.4.1	<i>Acute alcohol use and risk of fall injury</i>	82
6.4.2	<i>Usual alcohol use and risk of fall injury</i>	84
6.4.3	<i>The prevalence of alcohol use among young and middle-aged adults</i>	84
6.5	Other factors associated with increased risk of fall injury	85
6.6	Strength and weaknesses of this case-control study	85
6.6.1	<i>Study design</i>	85
6.6.2	<i>Selection issues</i>	86
6.6.2.1	Cases	86
6.6.2.2	Controls	86
6.6.3	<i>Information biases</i>	88
6.6.4	<i>Confounding</i>	89
6.6.5	<i>Precision</i>	89
6.6.6	<i>External validity</i>	90
6.7	Meaning of the study and implications	90
6.7.1	<i>Future research</i>	90
6.7.1.1	Acute alcohol use	90
6.7.1.2	Falls surveillance	91
6.7.1.3	Contextual issues	91
6.7.1.4	The longer-term burden of falls in this age group	91
6.7.2	<i>Injury prevention activities</i>	92
	REFERENCES	96

APPENDICES.....	114
Appendix One: Injury paper.....	114
Appendix Two: Falls NZHIS data fact sheet	115
Appendix Three: Injury Control Bulletin Item	116
Appendix Four: Systematic review paper	117
Appendix Five: Summary of fall-related systematic reviews	118
Appendix Six: Methods Paper Appendix Seven: Prevalence paper	120
Appendix Seven: Prevalence paper	121
Appendix Eight: Results paper.....	122
Appendix Nine: Falls results fact sheet.....	123
Appendix Ten: Study Manual.....	124

List of Figures

Figure 1: Framework for action to reduce alcohol-related harm	18
Figure 2: Frequency and rate (per 100,000) of unintentional fatal falls at home, by age band: New Zealand, 25 to 59 year olds, 1993 – 2002 (n= 73).....	25
Figure 3: Number and overall average rate of hospitalisations for unintentional falls at home by age group: among 25 to 59 year olds, New Zealand, 1993 – 2004 (n= 11,236).....	26
Figure 4: Inclusion and exclusion flow chart for risk factor studies	31
Figure 5: Control recruitment process.....	49
Figure 6: Control selection and recruitment	63
Figure 7: Distribution of case falls by time of day of fall occurrence, by gender, n=333 (males n=153, females n=180).....	65

List of Tables

Table 1: Alcohol consumption and the risk of fall injury among young and middle-aged adults: summary of epidemiological evidence	32
Table 2: Factors found to be associated with falls in community dwelling older aged adults.....	42
Table 3: Case-control study sample size calculations	51
Table 4: Characteristics of case responders, refusals, and total eligible	62
Table 5: Characteristics of control responders and refusals.....	63
Table 6: Baseline distribution of demographic characteristics of controls in the Auckland Falls Study compared to census data for the region.....	66
Table 7: Distribution of acute measures of alcohol use in the study base, by gender	67
Table 8: Distribution of usual frequency of alcohol use in the study base, by gender	67
Table 9: Selected fall risks and protective devices in a study sample by NZ individual deprivation characteristics	69
Table 10: Self-reported alcohol use and risk of fall injury: Univariate analysis	71
Table 11: Self-reported physical and emotional wellbeing and risk of fall injury: Univariate analysis.....	72
Table 12: Self-reported measures of sleepiness and risk of fall injury: Univariate analysis ..	73
Table 13: Self-reported lifestyle factors and risk of fall injury: Univariate analysis.....	74
Table 14: Unadjusted odds ratios and 95% confidence intervals for socio-economic variables.....	75
Table 15: Risk factors significant in multivariable adjusted model	77
Table 16: Population-Attributable Risks for risk factors for falls.....	79

List of Abbreviations

ACC	Accident Compensation Corporation
ACCIS	Auckland Car Crash Injury Study
AUDIT	Alcohol Use Disorders Identification Test
BAC	Blood Alcohol Concentration
BMI	Body Mass Index
CI	Confidence Interval
DALY	Disability Adjusted Life Year
ED	Emergency Department
ICD	International Classification of Diseases
IPRU	Injury Prevention Research Unit
ISS	Injury Severity Score
MeSH	Medical Subject Headings
NICE	National Institute for Clinical Excellence
NIQS	National Injury Query System
NMDS	National Minimum Dataset
NZHIS	New Zealand Health Information Service
NZIPS	New Zealand Injury Prevention Strategy
OR	Odds Ratio
PAR	Population-Attributable Risk
ProFaNE	Prevention of Falls Network Europe
RR	Relative Risk
SD	Standard Deviation
TLA	Territorial Local Authority
UK	United Kingdom
US	United States
Vs.	Versus
WHO	World Health Organisation