Alcohol and risk of injuries from unintentional cutting, piercing and falls at home

Results from the Home Safety Study

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COMMISSIONING CONTACT'S COMMENTS

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DISCLAIMER

This research was carried out in 2008-2009 by an independent party under contract to the Alcohol Advisory Council of New Zealand (ALAC), the predecessor organisation to HPA. The views, observations and analysis expressed in this report are those of the authors and are not to be attributed to HPA.

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Alcohol and risk of injuries from cutting, piercing and unintentional falls at home

Results from the Home Safety Study

A Report for the Alcohol Advisory Council of New Zealand

May 2011

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- ACC personnel: John Wren and Justine Ropata
- ALAC personnel: Margaret Geddes Chartres.

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Abbreviations/Acronyms

ACC	Accident Compensation Corporation
ALAC	Alcohol Advisory Council of New Zealand
AUDIT	Alcohol Use Disorders Identification Test
BMI	Body Mass Index
CI	Confidence interval
ICD	International Classification of Diseases
ISS	Injury Severity Score
NZiDep	New Zealand Index of Deprivation
NZIPS	New Zealand Injury Prevention Strategy
OR	Odds ratio
RTD	Ready to drink pre-mixed alcoholic drinks
SBI	Screening and Brief Intervention

Executive summary

Background

Unintentional injuries in the home account for a significant burden of injury among all age groups in New Zealand. Falls are the leading cause of injury-related admissions to hospital and one of the three leading causes of injury death in New Zealand. Cutting and piercing injuries are the second leading cause of injury hospitalisation in New Zealand. Home is the most common location for injuries resulting in hospitalisation. The impacts of injuries at home among young and middle-aged adults may have significant implications for both work productivity and family life.

A multi-regional, population-based, case-control study (the Home Safety Study) was designed to explore the role of risk factors, in particular alcohol use, for unintentional falls and cutting and piercing injuries at home resulting in admission to hospital among young and middle-aged adults (aged 20 to 64 years). The cases in the study were people aged 20 to 64 years who had sustained fall-related, cutting and piercing injuries at home in one of three study regions (Auckland, Waikato, Otago), resulting in admission to hospital in a 16-month study period commencing in August 2008. Controls (the comparison group) were randomly selected via telephone using a Computer Assisted Telephone Interviewing system. An interview-administered questionnaire collected data on a range of known and postulated risk factors for injuries from unintentional cutting, piercing and falls. Information on acute alcohol use was obtained by asking subjects how many drinks (converted to 12 gram alcohol units) they had consumed in the six hours before the injury (cases) or index time (controls). The standardised Alcohol Use Disorders Identification Test (AUDIT) scale was used to determine hazardous alcohol use.[1]

Main findings

The Home Safety Study in 2008-2009 recruited 356 people aged 20 to 64 years with cutting and piercing injuries (79.8% response rate) and 690 people with fall injuries (90% response rate) as cases for the study. These people were admitted to hospital in one of the three regions of New Zealand that formed the study base: Auckland, Waikato and Otago. 839 people were recruited as controls (45% response rate among those who were eligible and contactable). There was a strong and consistent relationship between alcohol use risk factors and the risk of unintentional injuries at home resulting in admission among young and middle-aged adults, even after controlling for potential confounders including hazardous drinking (Table 1).

However, although alcohol use is an important risk factor for these injuries, for the majority of participants in our study, alcohol was not a contributing factor.

[1] A score of eight or more on the AUDIT test indicates a hazardous pattern of drinking.

Table 1: Alcohol use risk factors for unintentional home injuries among 20- to 64-year-olds resulting in admission to hospital

Cutting or piercing injury		
Acute alcohol use: Drinking in the previous 6 hours compared with no drinking	≥ 3 drinks increases your risk by almost 4 times	OR* 3.93 (95% CI 1.61, 9.57)
Hazardous drinking: AUDIT score (≥8) compared with low risk score (0-7)	Almost doubles your risk	OR* 1.67 (95% CI 1.00 , 2.80)
Drinking behaviours: • 16.7% (n=49) people had consumed alcohol in the 6 hours before injury • 85.5% of this drinking had taken place at home (theirs or another's)		
Fall injury		
Acute alcohol use: Drinking in the previous 6 hours compared with no drinking	2 drinks doubles your risk	OR* 2.04 (95% CI 1.05, 3.99)
	≥ 3 drinks increases your risk by almost 12 times	OR* 11.95 (95% CI 5.33, 26.8)
Hazardous drinking: AUDIT score (≥8) compared with low risk score (0-7)	Doubles your risk	OR* 2.16 (95% CI 1.40, 3.35)
Drinking behaviours: • 27.2% (n=158) of people had consumed alcohol in the 6 hours before injury • 91.1% of this drinking took place at home (theirs or another's)		

* OR = odds ratio, controlled for confounders; CI = confidence interval

Conclusions

The relationships and interactions between acute alcohol use, hazardous drinking and risk of injury are complex. This research has confirmed that both acute alcohol use and hazardous drinking are associated with an increase in the risk of cutting and piercing injuries and fall-related injuries at home among young and middle-aged adults. For fall-related injuries, there is evidence of a dose-response relationship with regard to acute alcohol use prior to injury (a larger number of drinks increases the risk of injury from a fall). Therefore, the potential injury risks associated with drinking at home require greater attention.

Policy solutions that have the potential to reduce the burden of injuries associated with alcohol in a range of settings include increasing the price of alcohol, increasing the purchase age of alcohol, decreasing accessibility of alcohol, decreasing marketing and advertising of alcohol, and increased drink-driving measures. In addition, there is a need to consider improvements or modifications in product design and environmental strategies that would address the particular contexts in which these injuries occur.

Introduction

Globally, unintentional injury is a leading source of morbidity and a significant contributor to mortality. Several reports have identified the home as the commonest location for injuries resulting in hospitalisation and second to road as the location for injury deaths.[1-4 15 16] In the United States (US), it is estimated that 44% of injuries requiring medical treatment occur in and around the home.[5] In Sweden, 36% of all unintentional home injuries occur among people aged 25 to 64 years.[6] An Australian analysis of 29,649 emergency department injury presentations among the same age group found that cutting and piercing injuries were the leading cause of presentation, accounting for 27% of cases.[7] A US study estimating the societal costs of unintentional injuries at home identified cutting and piercing as accounting for the second highest costs following falls.[8]

Young and middle-aged adults constitute the majority of the workforce, therefore any reductions in injuries will have significant economic and social benefits.[9] However, there is little published information on the epidemiology of unintentional falls and cutting and piercing injuries at home among young and middle-aged New Zealanders.

A key aim of this study (the Home Safety Study, undertaken in 2008-2009) was to examine and identify the role of alcohol in unintentional falls and cutting and piercing injuries occurring among young and middle-aged adults at home. These findings will provide valuable information for the development of injury prevention initiatives to reduce the incidence, morbidity and mortality associated with these mechanisms of injury. This work builds on a previous case-control study of unintentional falls at home among 25- to 59-year-olds conducted by the lead researchers of this study in Auckland and funded by the Accident Compensation Corporation (ACC).[10-14]

The main objective of the study in relation to the role of alcohol was to:

> *Undertake an in-depth investigation of the role, contribution, and context of alcohol consumption (expanding on current quantity and frequency studies)*.

For the purposes of the case-control and case-crossover components of this project, the International Classification of Diseases (ICD) external cause codes (E codes) have been used to operationalise falls and cutting and piercing injuries. Categories of mechanisms of injury are consistent with those outlined in the International Collaborative Effort on Injury Statistics' External Cause of Injury Mortality Matrix for ICD-10 (www.cdc.gov/nchs/data/ice/icd10_transcode.pdf). In the case-control study, cases who were injured as a result of cutting by a *specified sharp object not elsewhere classified* (W49), such as broken plates and sharp metal, were also included in the study. A home injury was defined as an unintentional injury that occurred either inside or outside the home environment or its premises (e.g. driveway, garage, outhouse, garden).[15]

Study administration

Investigators

Professor Shanthi Ameratunga and Dr Bridget Kool made up the principal investigator team for the project. Co-investigators included: Mrs Elizabeth Robinson (statistician), Dr Lorna Dyall (senior lecturer), Mr Dudley Gentles (research fellow), Mr Alex Ng (trauma surgeon), Mr John Cullen (orthopaedic surgeon), Dr Wayne Hazell (emergency care physician), Mr Grant Christey (trauma surgeon) and Mr Mike Hunter (intensivist).

Elizabeth Robinson, a co-investigator and a biostatistician in the School of Population Health, provided input on the biostatistical elements and the methodology of the project. Four research fellows assisted with the project.

Advisory group

An advisory group for the study was established to ensure that findings could usefully inform end-users and the stakeholders in the field. Advisory group members included representation from ACC and Māori and Pacific groups, a lay representative, a senior researcher with expertise in falls in the elderly, and a city council representative. Advisory group members were kept up to date with the study progress through regular email updates.

Ethical and research approval

Ethical approval for the study was obtained from the multi-regional ethics committee (MEC/08/13/EXP). In addition, ethical approval was obtained from ACC (# 137). Research approval was obtained from the hospitals where recruitment took place. In some instances Māori research committee approval was also obtained in hospitals where these committees were in place.

Report structure

This report comprises four sections:

- Section 1: Describes the methodology of the Home Safety Study
- Section 2: Presents the results in relation to unintentional cutting and piercing injuries
- Section 3: Presents the results in relation to unintentional fall injuries
- Section 4: Discusses implications and provides recommendations.

The Home Safety Study methodology

Decisions regarding the scope, study population and methodology for the Home Safety Study were based on a review of the literature, and previous research conducted by the research team (the Auckland Falls Study).[10 13 14] This process helped to ensure that robust and meaningful data

was obtained that can be used to inform injury prevention initiatives. A case-control design was used because this is most suited to investigating the causes of rare diseases.[16]

Six public hospitals from four regions were initially selected to capture participants from a range of socio-economic and geographic areas. The regions were: Auckland (Auckland City, North Shore and Middlemore Hospitals), Waikato (Waikato Hospital), Eastern Bay of Plenty (Whakatane Hospital) and Otago (Dunedin Hospital). Due to recruitment issues in the Eastern Bay of Plenty region a decision was made by the research team, in consultation with ACC and the Alcohol Advisory Council of New Zealand (ALAC), to cease recruitment from the region.

Source population

The study base was defined as all persons aged 20 to 64 years, who were New Zealand residents and residing in the Auckland, Waikato or Otago regions during the 16-month period between 4 August 2008 and 13 December 2009. The three regions were selected to ensure adequate representation of Māori, Pacific, urban and rural participants, and a wide geographical scope for this project. These three regions have a total population of approximately 1.8 million (estimated resident population June 2009), of whom approximately 60.8% are aged 20 to 64 years.[17]

Selection and recruitment of controls for the case-control analysis

The aim of the control selection was to obtain a sample of the study base (people aged 20 to 64 years residing in the three study regions) to ensure that an estimate could be obtained of the exposure distribution in the population from which the cases came (the "study base"). No matching of cases was undertaken as this would have precluded an analysis of any matched factors. Controls were excluded if they could not speak English, no proxy was available, they were in residential care, or they were non-New Zealand residents. Controls were sampled at a steady rate throughout the study period and exposures and history were measured at the time of sampling. Verbal consent was obtained from participating controls.

Population-based controls were identified by randomly selecting Telecom landline residential numbers from the study regions, in proportion to the number of cases residing in each study region. People aged 20 to 64 years who normally resided in the households were invited to participate in the study. They were interviewed using a questionnaire by qualified telephone interviewers using Computer Assisted Telephone Interviewing (CATI). Up to five call-backs were made in an attempt to make contact with people; if unsuccessful they were allocated as "missed" status.

Based on the distribution of unintentional home injury admission data, an index day of the week and time of day was randomly assigned as a reference point for control interviews. This enabled analyses of exposures specifically related to the time of the falls, cutting and piercing injuries.

Identification and recruitment of cases

Cases were defined as people aged 20 to 64 years, resident in one of three study regions (Auckland, Waikato and Otago), who were admitted to public hospitals within 48 hours of an unintentional non-occupational cutting or piercing injury or fall injury sustained at home (theirs or another's). Hospitalisation was defined as primary admission to a service other than the emergency department. Recruiting hospitals serve a total population of approximately 1.8 million (estimated resident population June 2009), of whom approximately 60.8% are aged 20 to 64 years.[18] Full case ascertainment was achievable because only the five hospitals where recruitment took place (Auckland City, North Shore, Middlemore, Waikato, and Dunedin) admit adult trauma cases in these regions.

Cases were included if they were capable of giving informed consent, or had acceptable surrogates (proxies) capable of giving consent on their behalf.

Admission registers of the five recruiting hospitals were reviewed by the study research nurse at least three times per week during the study period to identify potential cases who met the study inclusion criteria. Daily admission reports of people aged 20 to 64 years admitted to the respective hospitals with an identified cutting, piercing or fall injury were provided to the study research nurse as a quality assurance measure to ensure that all potential cases were assessed for study entry requirements.

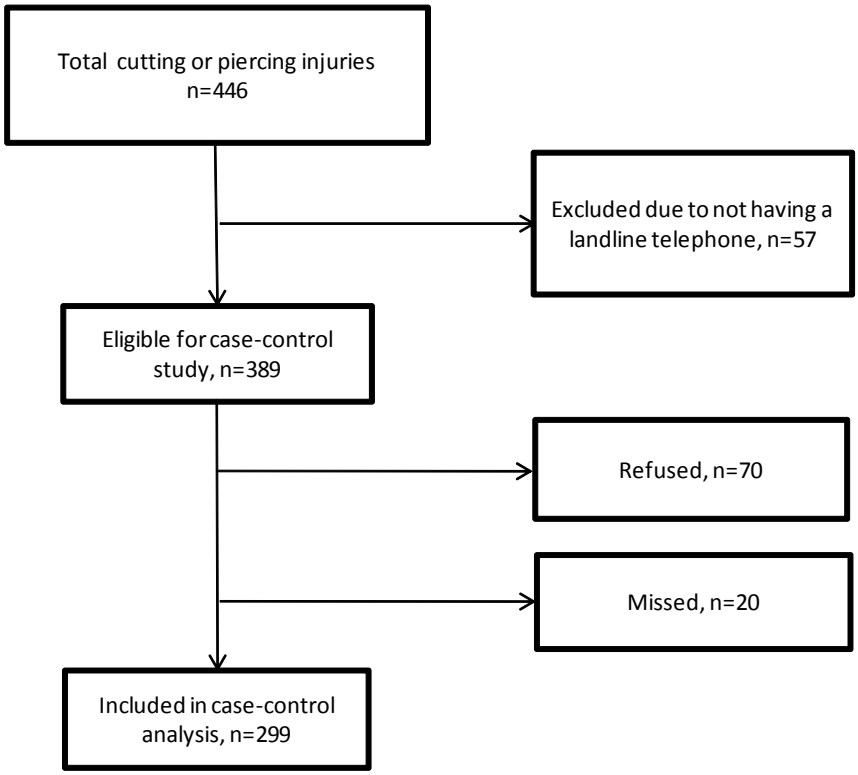
The study nurse ideally made initial contact with prospective cases during their hospital stay. At this point eligibility was confirmed, a detailed explanation of the study (including written material) provided, informed consent obtained, and a convenient time to come back and interview the case arranged. If this was not possible or practical, face-to-face contact took place with the case following discharge. For non-survivors, contact with family was made around six weeks after the injury event by letter, inviting the next-of-kin to consider taking part in the study as a proxy respondent. If the next-of-kin agreed, proxy interviews took place face-to-face at a convenient time.

Unintentional cutting and piercing case-control study

During the 16-month recruitment period for the cutting and piercing case-control study, 446 cases met the study eligibility criteria (Figure 1). As members of the control group were recruited by landline home telephone, cases without landline home telephones were excluded (n=57). Of the eligible cases (389), 299 (76.9%) were interviewed, 70 (18.0%) declined to participate and 20

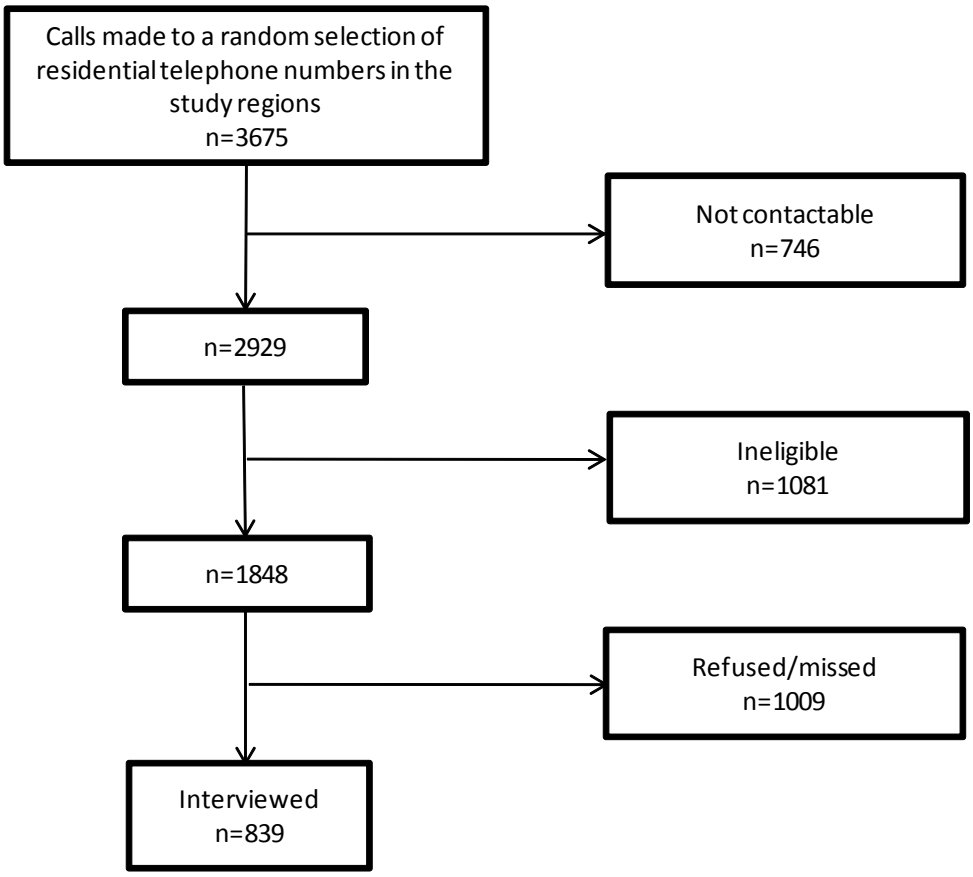
(5.1%) were missed. The home telephone status of the declined and missed cases was not known. Based on the proportion of interviewed cases excluded owing to the absence of a home telephone (16%), we estimate that 14 declined or missed cases did not have home telephones, resulting in an adjusted response rate of 79.7%. One interview was conducted with a proxy respondent. 203 cases (67.9%) were recruited from the Auckland region, 60 from Waikato (20.1%) and 36 (12.0%) from Otago.

Figure 1: Selection and numbers of cutting and piercing cases



Of 3,675 potential controls contacted by telephone, 746 (20.3%) could not be contacted and 1081 (29.4%) were found to be ineligible when contacted (Figure 2). Of the 1848 who were eligible and contactable, 839 (45.4%) were interviewed, 924 (50.0%) declined to participate, and 85 (4.6%) were missed despite five scheduled call-backs. We could not determine whether there were any differences between those who took part and those who declined to participate or were missed, as there was no information available about the latter individuals. A large number of controls (n=588) were recruited from the Auckland region (70.1%), 190 from Waikato (22.6) and 61 from Otago (7.8%).

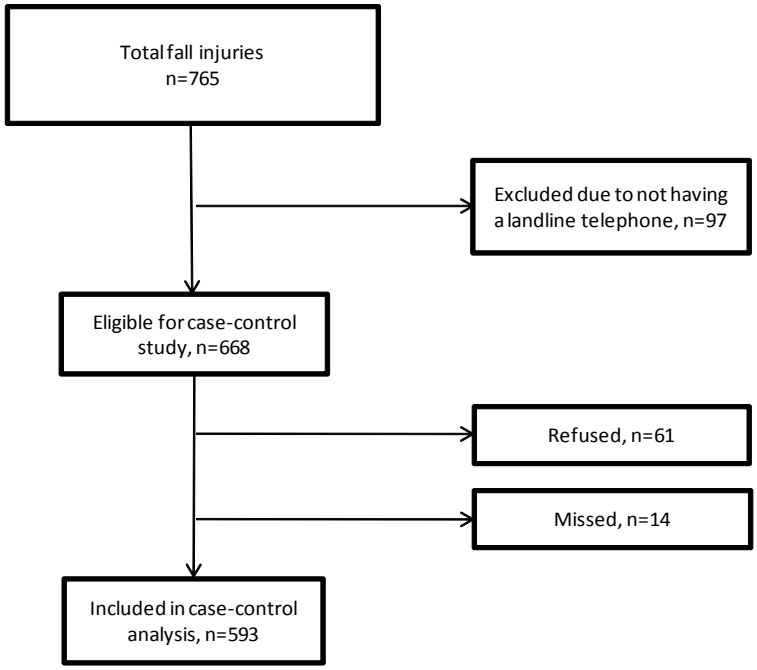
Figure 2: Selection and numbers of controls



Unintentional falls case-control study

During the 16-month recruitment period for the unintentional falls case-control, 765 people aged 20 to 64 years were admitted to hospital in the three study regions as a result of an unintentional fall at home (Figure 3). As members of the control group were recruited by landline home telephone, cases without a landline home telephone were excluded (n=97). Of the eligible cases (n=668), 593 (88.8%) were interviewed, 61 (9.1%) declined to participate, and 14 (2.1%) were missed. Home telephone status of the declined and missed cases was not known. Based on the proportion of interviewed cases excluded due to the absence of a landline home telephone (14%), we estimate 10 declined or missed cases did not have a landline home telephone, resulting in an adjusted response rate of 90.1%. Seven interviews were conducted with proxy respondents. 462 cases (77.9%) were recruited from the Auckland region, 67 (11.3%) from Waikato, and 64 from Otago (10.8%).

Figure 3: Selection and numbers of unintentional falls cases



The control group used in this study was the same as that described above in the section on the cutting and piercing case-control study (Figure 2).

Data collection

The study questionnaires were developed in consultation with the Study Advisory Group. The questionnaire for both cases and controls covered a range of factors, including socio-demographic information, general health and medical conditions, smoking status, prescription medication use, environmental factors, sleep patterns, alcohol and recreational drug use, and hours spent at home (awake and asleep). Where possible, question items were drawn or adapted from previous home injury research and validated self-report measures. Home surveys were not undertaken, therefore all information relating to the identification of hazards and protective factors was obtained by self-report.

Ethnicity information was collected using the standard ethnicity question for the New Zealand health and disability sector.[19] Responses were analysed using the prioritised output method, in which each individual was allocated to a single ethnic group using a priority system (Māori, Pacific peoples, Asian, other groups, and then New Zealand European).[19] The New Zealand Index of Deprivation (NZiDep) was used to measure the individual-level socio-economic status of subjects.[20]

Information on acute alcohol use was obtained by asking subjects how many drinks (converted to 12 gram alcohol units) they had consumed in the six hours before the cutting or piercing injuries (cases) or index time (controls). The standardised Alcohol Use Disorders Identification Test

(AUDIT) scale was used to determine hazardous alcohol use.[21] A score of eight or more indicates a hazardous pattern of drinking. Cases were also asked about the circumstances of their injuries. Breath and blood alcohol levels were not routinely collected (some cases had blood alcohol levels obtained by hospital staff).

The trained research nurses administered the questionnaire to cases. Two trained CATI staff interviewed the controls. Case interviews took between 25 and 40 minutes, whilst control interviews took 15 to 20 minutes. The majority of case interviews were conducted face to face in hospital, the remainder occurring face to face at home. All control interviews were conducted via phone.

In this study, hospitalisation was used as a proxy for moderate to severe injuries among cases. Admission to hospital can be influenced by numerous factors aside from severity of injury, including access to services, admission policies and patient age. A key outcome for the study was to identify modifiable risk factors to help reduce the incidence and severity of injuries associated with cutting and piercing and falls. Therefore in order to capture more accurately the severity of the injuries of cases, injuries were categorised according to the Injury Severity Score (ISS) (a measure reflecting the threat to life[22]) by a trained ISS coder using data abstracted by the study research nurse from case medical records. Additional information concerning hospital admissions was collected using the *Medical Record Abstract Form.* The mechanisms of injury were coded using the ICD-10-AM external cause of injury codes.[23]

Data analysis

Odds ratios (ORs) and confidence intervals (CIs) were calculated using unconditional logistic regression models. Variables were selected for inclusion in the multivariable model based on prior knowledge of possible risk factors, and using Greenland's change in estimate model with a cut point of 10%.[24]

Risk factors for unintentional cutting and piercing injuries at home among young and middle-aged adults

This section reports the results of the case-control study of unintentional cutting and piercing injuries at home in people aged 20 to 64 years, undertaken in 2008-2009. The aim of the study was to identify and quantify modifiable risk factors for cutting and piercing injuries at home. For the purposes of this report, the exposure of particular interest was alcohol use.

Socio-demographic characteristics (cutting and piercing injuries)

The distribution of a range of socio-demographic characteristics is displayed in Table 2. Of the cases, 70% were males and 45% were aged 20 to 39 years. The male-to-female ratio for cutting and piercing injury hospitalisations was 2.4:1.

In the control group, gender imbalance (71% females) and an underrepresentation of Māori and Pacific peoples (7.5% and 4.3% respectively, compared with the expected proportions, 9.7% and 9.0% respectively, based on 2006 Census figures for those aged 20 to 64 years resident in the study regions[17]) were evident, calling into question the representativeness of the control group.

The proportion of controls with no deprivation characteristics (47.6%) was similar to that estimated by Salmond and colleagues for New Zealand adults (50.7%, 95% CI 45.4-56.0).[20] The proportion of controls who reported owning their homes (76.7%) was higher than the 2006 Census finding that 66.9% of households owned the dwellings in which they lived or held the dwellings in family trusts.[17]

Of cases who reported drinking alcohol prior to their cutting or piercing injury, the majority (85.5%) reported the home (theirs or another's) to be the location where the majority of their drinking took place and where they had their last drink. The most common type of drink consumed prior to their injury was beer, followed by wine, spirits, and ready-to-drink (RTD) alcoholic drinks. There was a statistically significant relationship (p=0.039) between type of alcoholic drink and gender, with males more commonly reporting consuming beer immediately prior to their cutting or piercing injury, while females were more likely to have consumed wine.

Table 2: Socio-demographic characteristics of cases and controls (unintentional cutting and piercing injuries)

Characteristics	Cases (n=299)	Controls (n=839) n (%)

	n (%)	
Gender		
Female	89 (29.8)	596 (71.0)
Male	210 (70.2)	243 (29.0)
Age group		
20-29 years	70 (23.4)	89 (10.7)
30-39 years	66 (22.1)	167 (20.1)
40-49 years	67 (22.4)	236 (28.4)
50-59 years	69 (23.1)	230 (27.6)
60-64 years	27 (9.0)	110 (13.2)
Ethnicity		
New Zealand European	176 (58.9)	566 (67.5)
Māori	37 (12.4)	63 (7.5)
Pacific	32 (10.7)	36 (4.3)
Other	54 (18.1)	173 (20.6)
Socioeconomic status (NZiDep)*		
1: No deprivation characteristics	171 (58.2)	395 (47.6)
2: 1 deprivation characteristic	45 (15.3)	194 (23.4)
3: 2 deprivation characteristics	27 (9.2)	112 (13.5)
4: 3-4 deprivation characteristics	35 (11.9)	95 (11.5)
5: 5 or more deprivation characteristics	16 (5.4)	34 (4.1)
In paid employment		
Yes	218 (73.6)	609 (73.4)
No	78 (26.4)	221 (26.6)
Qualifications		
Post-secondary school education	142 (48.1)	472 (56.7)
Secondary school qualification	72 (24.4)	259 (31.1)
No school qualification	81 (27.5)	102 (12.2)
Home ownership		
Own	183 (64.0)	636 (76.7)
Rent	103 (36.0)	193 (23.3)

*NZiDep: New Zealand Deprivation Index
Column totals could differ as a result of missing data.

Results for cutting and piercing injuries

Adjusted ORs for potential risk factors for cutting and piercing injury are presented in Table 3. Logistic regression modelling included important confounding factors (age group, gender, ethnicity, NZiDep, day of event and time of event) and co-variables (sleep in the previous 24 hours, sleep in the previous week, alcohol use in the previous six hours, hazardous drinking, marijuana use during the previous year, other recreational drug use during the previous year and current smoking status). Variables were selected for inclusion in the logistic regression models based on existing evidence about factors that may be important in the aetiology of cutting and piercing injuries, and Greenland's change in estimate approach.[24] With regard to the latter approach, variables were included if they changed the β coefficients for the exposures of interest by more than 10%.

The variables 'difficulty reading small print' (a plausible potential risk factor for injury) and 'prescription medication use' (an indicator of co-morbidity) were considered but not included in the logistic regression models. Modelling showed that these variables made hardly any change to the effect estimates for the alcohol, fatigue and drug exposures.

Model 1 (Table 3) represents the adjusted ORs for the factors included in the model, without the effect of hazardous drinking. This model shows a positive relationship between subjects who had drunk three or more alcoholic drinks in the previous six hours and the risk of cutting and piercing injuries. Those who had drunk three or more alcoholic drinks were four and a half times more at risk of cutting or piercing injuries than those who had had no drinks (OR 4.46; 95% CI 1.88-10.55, p=0.001). Overall, the relationship between acute alcohol use and the risk of cutting or piercing injuries was statistically significant (p-value 0.0003).

In Model 2 (Table 3), following an adjustment for hazardous drinking, the positive relationships remained between acute alcohol use (overall p value 0.0010) and the risk of cutting or piercing injuries. The relationship between hazardous drinking (AUDIT score ≥8) and the risk of cutting or piercing injuries bordered on statistical significance (OR 1.67; 95% CI 1.00-2.80, p=0.050).

Table 3: Results from multivariable models for unintentional cutting and piercing injuries

Factors	Cases (n=299) n (%)	Controls (n=839) n (%)	Crude OR (95% CI)	Multivariable Model 1 Adjusted OR* (95% CI)	Model 2: Hazardous drinking added to model Adjusted OR† (95% CI)
Alcohol use in previous 6 hours (12 g drinks)					
0	245 (83.3)	737 (89.1)	1	1	1
1-2	16 (5.4)	71 (8.6)	0.68 (0.39-1.19)	0.51 (0.26-1.01)	0.50 (0.25-0.99)
≥3	33 (11.2)	19 (2.3)	5.22 (2.92-9.36)	4.46 (1.88-10.55)	3.93 (1.61-9.57)
Hazardous drinking (AUDIT)					
Low risk (score 0-7)	216 (75.8)	756 (91.5)	1	Not included	1
Hazardous (score ≥8)	69 (14.2)	70 (8.5)	3.45 (2.39-4.97)		1.67 (1.00-2.80)
Sleep in previous 24 hours					
≥6 hours	257 (95.5)	773 (93.2)	1	1	1
<6 hours	12 (4.5)	56 (6.8)	0.64 (0.34-1.22)	0.36 (0.16-0.81)	0.39 (0.18-0.86)
Sleep in previous week					
At least one sleep ≥7 hours	248 (86.1)	757 (91.5)	1	1	1
No sleeps ≥7 hours	40 (13.9)	70 (8.5)	1.74 (1.15-2.64)	2.02 (1.21-3.36)	1.87 (1.11-3.14)
Marijuana use during the previous year					
No	251 (84.8)	798 (96.7)	1	1	1
Yes	45 (15.2)	27 (3.3)	5.30 (3.22-8.72)	2.65 (1.35-5.18)	2.37 (1.18-4.77)
Other recreational drug use during the previous year	275 (94.2)	661 (99.1)	1	1	1
No	17(5.8)	6 (0.9)	6.81 (2.66-17.46)	3.12 (0.98-9.92)	2.94 (0.90-9.55)
Yes					
Current smoking status					
Non-smoker	222 (74.8)	727 (87.4)	1	1	1
Smoker	75 (25.3)	105 (12.6)	2.34 (1.68-3.26)	1.65 (1.03-2.63)	1.47 (0.90-2.39)
Difficulty reading small print, even with glasses					
No	260 (87.0)	652 (78.4)	1	Not included	Not included
Yes	39 (13.0)	180 (21.6)	0.54 (0.37-0.79)		
Prescription medication use					
0 to 1 medication	255 (85.3)	700 (83.4)	1	Not included	Not included
2 or more medications	44 (14.7)	139 (16.6)	0.87 (0.60-1.26)		

* OR adjusted for gender, age group, ethnicity, NZiDep, day of event, time of event, and includes sleep in last 24 hours, sleep in last week, alcohol in previous 6-hours, marijuana use during the past year, other recreational drug use during the past year, and current smoking status

† OR adjusted for the factors in Model 1 and hazardous drinking

Discussion on alcohol and unintentional cutting and piercing injuries at home

This study suggests that drinking three or more alcoholic drinks in the previous six hours has a strong relationship with the risk of unintentional cutting and piercing injuries at home among young and middle-aged adults.

The findings of this study are consistent with previous research looking at the association between acute alcohol use and unintentional injury.[28-30] Links between alcohol use and fall-related home injuries among working-age adults have been established.[13] There has been less focus on cutting and piercing injuries, despite these being the second most common cause of injury (after falls) resulting in hospitalisation.[31] We are not aware of any case-control studies that have specifically investigated modifiable risk factors contributing to unintentional cutting and piercing injuries at home among adults aged 20 to 64 years.

Our study provides support for policies and interventions aimed at reducing the harmful use of alcohol in the home setting. Measures to prevent cutting and piercing injuries at home are likely to require a mix of strategies, including improving product design and raising awareness about personal protective measures and the safe use of equipment. Future aetiological studies should also focus on factors related to the home environment and tools/machinery contributing to cutting and piercing injuries.

Although alcohol use is an important risk factor for cutting and piercing injuries, it must be acknowledged that for the majority of participants in our study, alcohol was not a contributing factor to their cutting and piercing injuries. It is likely that fatigue and drug use also contribute to the burden of cutting and piercing injuries. Future research should address these factors and ensure an adequate study size in order to examine the effects of acute drug exposures.

Strengths and weaknesses of the study

This population-based case-control study was designed in a way that attempted to minimise biases relating to selection, recall and confounding. The method of case ascertainment, which involved a prospective case-finding system, obviated relying on ICD place of injury and diagnostic codes to identify cases. Controls were selected from a sample of the study population base (people aged 20 to 64 years resident in households randomly selected from residential landline telephone numbers in the study regions). Recall bias was minimised in this study by using a detailed, standardised questionnaire administered by trained study research nurses. Differences in recall between cases and controls were minimised by asking both groups identical exposure questions and using an index reference time when asking controls about acute exposures.

Interviews with cases were carried out as soon as possible after admission to hospital. Missing data (e.g. subjects refusing to answer questions or being unable to remember) were minimal and therefore unlikely to have affected the study results. In order to reduce confounding, the effect estimates calculated in this study were adjusted for a range of demographic factors and other co-variables.

The control group may not have been representative of the study population as females were overrepresented and the group had lower proportions of Māori and Pacific peoples (7.5% and 4.3% respectively), than would be expected for the source population (9.7% and 9.0% respectively, based on 2006 Census figures for those aged 20 to 64 years resident in the study regions).[17] Because the control group could have been at less risk of cutting and piercing injuries than the study population, our modelling may have resulted in an overestimation of the effects of the exposures of interest.

Despite efforts to minimise recall bias, residual bias may have occurred due to problems with recall of injury circumstances by respondents. For example, respondents might have intentionally or unintentionally not recalled details about alcohol and/or drug use. Details about alcohol exposure requested from people who were intoxicated at the time of interest are likely to be inaccurate. Systematic differences in recall between cases and control may have occurred if cases, due to their being injured and hospitalised, had been made more aware of certain exposures. Another threat to internal validity of the study is residual confounding, which may have occurred due to misclassification of confounders or missing important confounders from the analysis.

Study efficiency may have been affected by differences between the cases and controls with respect to the time and day of injury (for cases) or index point (for controls). The index time for controls was randomly allocated based on the profile of time and day of occurrence for fall-related injuries in the home, as there was no available information on these factors for cutting and piercing injuries in the home. Our models included time of day and day of week variables to correct for possible confounding resulting from these factors.

Risk factors for unintentional fall injuries at home among young and middle-aged adults

This section reports the results of a case-control study of unintentional falls at home in people aged 20 to 64 years, undertaken in 2008-2009. The aim of the study was to identify and quantify modifiable risk factors for unintentional fall injuries at home. For the purposes of this report, the exposure of particular interest was alcohol use.

Sociodemographic characteristics (unintentional fall injuries)

The distributions of a range of sociodemographic characteristics among the cases and controls are displayed in Table 4. Of the cases, 56.8% were females and nearly three-quarters were aged 40 to 64 years. The majority of cases were New Zealand Europeans (67.5%), over half (56.2%) had no deprivation characteristics (as measured by NZiDep) and 65.9% reported that they owned their homes.

Issues related to the extent to which the control group was representative of the study population have been highlighted in the previous section. Females were overrepresented (71.0%) and Māori and Pacific peoples were underrepresented (7.5% and 4.3% respectively), compared with 2006 Census figures (9.7% and 9.0% respectively) for those aged 20 to 54 years resident in the study regions.[17] The proportion of controls with no deprivation characteristics (47.6%) was similar to that estimated by Salmond and colleagues for New Zealand adults (50.7%, 95% CI 45.4-56.0). The proportion of controls who reported owning their homes (76.7%) was higher than the 2006 Census finding that 66.9% of households owned the dwellings in which they lived or held the dwellings in family trusts.[17]

Of the cases who reported drinking alcohol prior to their falls, the majority (91.1%) reported the home (theirs or others') to be the location where the majority of their drinking had taken place. Similarly, 89.8% reported home to be the place where they had had their last drink. The most common types of drink consumed were wine (36.5%) and beer (35.9%), followed by spirits (17.7%) and RTD alcoholic drinks (5.9%). There was a statistically significant relationship ($p<0.001$) between the type of alcoholic drink and gender, with males more commonly reporting consuming beer immediately prior to their falls, and females more likely to have consumed wine.

Table 4: Socio-demographic characteristics of cases and controls (unintentional fall injuries)

Characteristics	Cases (n=593) n (%)	Controls (n=839) n (%)

Gender		
Male	256 (43.2)	243 (29.0)
Female	337 (56.8)	596 (71.0)
Age group		
20-29 years	71 (12.0)	89 (10.7)
30-39 years	86 (14.6)	167 (20.1)
40-49 years	151 (25.6)	236 (28.4)
50-59 years	161 (27.3)	230 (27.6)
60-64 years	121 (20.5)	110 (13.2)
Ethnicity		
New Zealand European	400 (67.5)	566 (67.5)
Māori	47 (7.9)	63 (7.5)
Pacific	41 (6.9)	36 (4.3)
Other	105 (17.7)	173 (20.6)
Socio-economic status (NZiDep)*		
Group 1: No deprivation characteristics	328 (56.2)	395 (47.6)
Groups 2-4: 1-4 deprivation characteristics	216 (37.0)	401 (48.3)
Group 5: 5 or more deprivation characteristics	40 (6.9)	34 (4.1)
In paid employment		
Yes	388 (65.7)	609 (73.4)
No	203 (34.4)	221 (26.6)
Qualifications		
Post-secondary school education	272 (46.3)	472 (56.7)
Secondary school qualification	133 (22.6)	259 (31.1)
No school qualification	183 (31.1)	102 (12.2)
Home ownership		
Own	386 (65.9)	636 (76.7)
Rent	200 (34.1)	193 (23.3)

* NZiDep: New Zealand Deprivation Index
Column totals may differ as a result of missing data.

Results for unintentional fall injuries

Logistic regression modelling included important confounding factors (age group, gender, ethnicity, NZiDep, day of event and time of event) and co-variables (Body Mass Index [BMI], physical activity, prescription medication use, sleep in the previous 24 hours, sleep in the previous week, alcohol use in the previous six hours, hazardous drinking, marijuana use during the previous year, other recreational drug use during the previous year and current smoking status). Variables were selected for inclusion in the logistic regression models based on existing evidence about factors that may be important in the aetiology of falls, and Greenland's change in estimate approach.[24]

The variables 'general health status', 'need help because of a disability' and 'difficulty reading small print' were considered but not included in the logistic regression models. Modelling showed that these variables made very little change to the effect estimates for the remaining exposures.
Model 1 (Table 5) represents the adjusted ORs for the factors included in the model, without the effect of hazardous drinking. This model shows a positive relationship between drinking alcohol in the previous six hours (acute alcohol use) and the risk of fall-related injuries ($p < 0.0001$). Having two alcoholic drinks compared with none more than doubled the risk of fall injuries (OR 2.29; 95%

CI 1.19-4.41), and having three or more alcoholic drinks compared with none increased the fall risk by more than 15 times (OR 15.49; 95% CI 7.04-34.09).

The statistically significant association with acute alcohol use identified in Model 1 remained evident following an adjustment for hazardous drinking (Model 2) ($p < 0.0001$). This model also showed a relationship between hazardous drinking (AUDIT score ≥8), with a more-than-double increase in the risk of fall-related injuries (OR 2.16; 95% CI 1.40-3.35, $p=0.001$).

Table 5: Results from multivariable models for unintentional fall injuries

Factors	Cases (n=593) n (%)	Controls (n=839) n (%)	Crude OR (95% CI)	Multivariable model 1 Adjusted OR* (95% CI)	Model 2: Hazardous drinking added to model Adjusted OR† (95% CI)
Alcohol use in previous 6 hours (12 g drinks)					
0	422 (72.8)	737 (89.1)	1	1	1
1	29 (5.0)	43 (5.2)	1.18 (0.72-1.91)	1.44 (0.80-2.61)	1.25 (0.68-2.30)
2	36 (6.2)	28 (3.4)	2.25 (1.35-3.73)	2.29 (1.19-4.41)	2.04 (1.05-3.99)
≥3	93 (16.0)	19 (2.3)	8.55 (5.14-14.20)	15.49 (7.04-34.09)	11.95 (5.33-26.80)
Alcohol screen (AUDIT)					
Low risk (score 0-7)	428 (73.4)	756 (91.5)	1	Not included	1
Hazardous (score ≥8)	155 (26.6)	70 (8.5)	3.91 (2.88-5.31)		2.16 (1.40-3.35)
Sleep in previous 24 hours					
≥6 hours	510 (95.5)	773 (93.2)	1	1	1
<6 hours	24 (4.5)	56 (6.8)	0.65 (0.40-1.06)	0.44 (0.22-0.86)	0.43 (0.22-0.84)
Sleep in previous week					
At least 1 sleep ≥7 hours	443 (79.4)	757 (91.5)	1	1	1
No sleeps ≥7 hours	115 (20.6)	70 (8.5)	2.81 (2.04-3.86)	2.73 (1.80-4.16)	2.68 (1.76-4.10)
Marijuana use during the past year					
No	517 (88.1)	798 (96.7)	1	1	1
Yes	70 (11.9)	27 (3.3)	4.00 (2.53-6.32)	1.85 (0.98-3.50)	1.50 (0.78-2.88)
Other recreational drug use during the past year					
No	566 (96.6)	661 (99.1)	1	1	1
Yes	20 (3.4)	6 (0.9)	3.89 (2.66-17.46)	1.33 (0.40-4.43)	1.22 (0.36-4.16)
Current smoking status					
Non-smoker	436 (73.7)	727 (87.4)	1	1	1
Smoker	156 (26.4)	105 (12.6)	2.48 (1.88-3.26)	2.55 (1.73-3.75)	2.46 (1.67-3.64)
Prescription medication use					
0 to 1 medication	425 (71.7)	700 (83.4)	1	1	1
2 or more medications	168 (28.3)	139 (16.6)	1.99 (1.54-2.57)	1.50 (1.06-2.10)	1.45 (1.03-2.05)
Physical activity: met standard of ≥30 minutes moderate or ≥15 minutes vigorous exercise 5 days/week					
Yes	167 (28.8)	438 (52.7)	1	1	1
No	413 (71.2)	393 (47.3)	2.76 (2.20-3.45)	2.49 (1.88-3.32)	2.46 (1.85-3.28)
BMI					
BMI <25	192 (33.1)	365 (45.8)	1	1	1
Overweight	215 (37.0)	251 (31.5)	1.63 (1.27-2.10)	1.69 (1.20-2.37)	1.67 (1.19-2.35)

Obese	174 (30.0)	181 (22.7)	1.83 (1.39-2.40)	1.94 (1.35-2.79)	1.89 (1.31-2.72)
General health status					
Excellent, very good, or good	532 (89.7)	759 (91.2)	1	Not included	Not included
Fair or poor	61 (10.3)	73 (8.8)	1.19 (0.83-1.70)		
Need help because of a disability					
No	555 (94.2)	789 (94.8)	1	Not included	Not included
Yes	34 (5.8)	43 (5.2)	1.12 (0.71-1.79)		
Difficulty reading small print, even with glasses					
No	477 (80.6)	652 (78.4)	1	Not included	Not included
Yes	115 (19.4)	180 (21.6)	0.87 (0.67-1.13)		

* OR adjusted for gender, age group, ethnicity, NZiDep, day of event, time of event, and includes sleep in last 24 hours, sleep in last week, alcohol in previous 6-hours, marijuana use during the past year, other recreational drug use during the past year, and current smoking status

† OR adjusted for the factors in Model 1 and hazardous drinking

Discussion on alcohol and unintentional falls at home

The findings of the case-control study suggest that drinking alcohol in the previous six hours has a strong relationship with the risk of unintentional falls at home resulting in hospitalisation among young and middle-aged adults. In our analyses, the association between acute alcohol use and falls remained following an adjustment for hazardous drinking, which itself was associated with a doubling of the risk of fall-related injuries.

The number of subjects reporting the consumption of three or more drinks was relatively small, limiting the precision of the crude and adjusted effect estimates for drinking three or more alcoholic drinks in the previous six hours, compared with no drinks. However, the effect estimates are large, even at the lower limit of the 95% confidence interval.

The findings of this study are consistent with previous research looking at the association between acute alcohol use and unintentional fall-related injuries.[13 28] The Auckland Falls Study[13] found that drinking alcohol was strongly associated with unintentional falls at home among people aged 25 to 60 years. This study noted a dose-response relationship between alcohol use and the risk of fall-related injuries. The OR for two standard drinks, compared with none, was 3.7 (95% CI 1.2-10.9) and the OR for three or more drinks was 12.9 (95% CI 5.2-31.9). These estimates were adjusted for the effects of confounding by age, gender, ethnicity, paid employment, socio-economic deprivation, hazardous drinking, prescription medication use, physical activity, sleep in the previous 24 hours, tobacco smoking, and marijuana use in the previous three hours.

Our study has added to evidence from the Auckland Falls Study by expanding the study population to a wider age range (i.e. 20 to 64 years). By undertaking a much larger study, we have been able to provide more precise estimates and address other potential risk factors. In addition to prescription medication use and physical exercise, our study suggests that other factors (BMI, chronic fatigue, current tobacco smoking status and hazardous drinking) have important associations with the risk of fall-related injury.

The relationships and interactions between acute alcohol use, hazardous drinking and risk of injury are complex. Our study suggests that, although both exposures are related to the risk of fall-related injury, the acute consumption of three or more drinks prior to injury has a much stronger association with injury risk than hazardous drinking. A study by Vinson and colleagues also found that the associations between measures of long-term alcohol exposure and injury were less than the association with recent consumption.[32] They postulated that the association between alcohol use disorders and injury may be indirect, mediated largely through short-term exposure. Vinson and colleagues also suggested that the risk associated with chronic exposure to alcohol may be more substantial than it appears due to its persistent effect on injury risk, in comparison with the transient effect of short-term exposure.

It is clear that alcohol use is an important risk factor for fall-related injury and should be a focus of injury prevention policy and interventions. However, further research is required to investigate the effects of chronic alcohol exposure and its relationship with acute alcohol exposure and the risk of fall-related injury. Future studies should also explore the confounding effects of acute drug exposures and risk-taking behaviours (such as impulsivity) on the risk of fall-related injury.

The strengths and weaknesses of the study design have been discussed on p 23, including potential study weaknesses due to a non-representative control group, residual bias from problems with recall (e.g. incorrect recall of alcohol exposure by respondents) and confounding (e.g. misclassifications of confounders or important confounders not being included in the analysis). A higher response rate (approximately 90%) was achieved for the falls cases compared with the cases in the cutting and piercing injury arm of the study (approximately 80%).

Recommendations and implications

The final section of this report summarises the information discussed in the previous sections in terms of recommendations for policy and practice, and future research, for the prevention of unintentional cutting, piercing and fall injuries at home.

Policy and practice

The following recommendations relate to future policy and practice to prevent unintentional cutting, piercing and fall injuries at home.

Recommendation 1:
Measures to prevent cutting and piercing injuries at home among young and middle-aged adults are likely to require a mix of strategies, including improving product design and raising awareness about personal protective measures and the safe use of equipment.

Recommendation 2:
In addition to alcohol use, other factors worthy of consideration in future multifaceted approaches to reduce the incidence and severity of injurious falls at home include addressing obesity, chronic fatigue, inadequate physical activity, and lifestyle factors, such as smoking.

The New Zealand Injury Prevention Strategy (NZIPS) was released in 2003, signalling the commitment of the government and other agencies to reduce the rate and impacts of injury in the community.[33] Priority settings for the strategy include home, and one of the six priority areas is falls. A report on the five-year evaluation of NZIPS was released in 2010.[34] The evaluation found that overall injury-related deaths in New Zealand had decreased; however, the overall serious non-fatal injury rate had increased from 212 per 100,000 in 2005 to 224 per 100,000 in 2008. The report suggested that these findings could have been due to a variety of factors, including effective injury prevention interventions that reduced the severity of injuries from fatal to serious, and improvements in medical care that led to an increased survivability of previously fatal injuries. The report recommended that the original six priority areas (road crashes, workplace injuries, suicide and self-harm, assault, falls and drowning) be maintained, and that additional areas of child injury, alcohol, Māori and community engagement receive an increased focus. Alcohol-related injury has subsequently been included as a focus area across the six injury prevention priority areas.

Given the findings of this project it would seem appropriate that the home environment remain a focus for injury prevention efforts in New Zealand, and that activities targeting reducing alcohol-related harm will result in a significant reduction in injury in New Zealand.

While the risks associated with drink driving are well recognised, the potential injury risks associated with hazardous drinking at home require greater attention. A range of interventions are needed to address alcohol-related harms, including injuries. The World Health Organization in its 2010 publication *Global Strategy to Reduce the Harmful Use of Alcohol* recommends that a wide range of policy options and interventions are required to reduce the harmful use of alcohol. These include the availability of alcohol, pricing policies, marketing of alcoholic beverages, drink-driving policies and reducing the consequences of drinking and alcohol intoxication.

In New Zealand, the 5+ Solution advocated by Alcohol Action New Zealand (www.alcoholaction.co.nz) is an example of general policy directives that have the potential to reduce the burden of injuries associated with alcohol in a range of settings including the home environment. The 5+ Solution includes: increasing the price of alcohol and the purchase age of alcohol; decreasing accessibility of alcohol and marketing and advertising of alcohol; and increasing drink-driving measures; coupled with increasing treatment opportunities for heavy drinkers.

Nationally available resources include:

- ACC's website has information about staying safe from trips and falls in the home (www.acc.co.nz/preventing-injury/trips-falls/).

- ALAC's website (now the Health Promotion Agency's website www.alcohol.org.nz) has a range of alcohol-related information, resources and online tools available to view, download or order.

- the Alcohol Drug Helpline - 800 787 797 www.alcoholdrughelp.org.nz/ which offers free confidential information, help and support for people who have any issues or concerns about their, or someone else's, alcohol or drug use.

Future research

The following recommendations relate to future research to prevent unintentional cutting, piercing and fall injuries at home.

Recommendation 3:

Future adequately powered aetiological studies are needed to investigate the role of other factors involved in cutting and piercing injuries at home among young and middle-aged adults, such as fatigue and recreational drug use.

Recommendation 4:

Further research is required to investigate the effects of chronic alcohol exposure and its relationship with acute alcohol exposure and the risk of fall-related injury, and the confounding effects of acute drug exposures and risk-taking behaviours (such as impulsivity).

This research did not investigate the consequences of injuries in the home, including immediate and ongoing healthcare costs and quality of life, disability and financial implications. These are important aspects to consider among the working-aged given the potential for adverse impacts on economic productivity. Opportunities exist for a prospective study that includes a linkage of Ministry of Health and ACC data to investigate issues surrounding serious injuries resulting from cutting and piercing and falls at home.

References

1. Driscoll TR, Mitchell RJ, Hendrie AL, Healey SH, Mandryk JA, Hull BP. Unintentional fatal injuries arising from unpaid work at home. *Injury Prevention* 2003;9(1):15-19.
2. Langley JD, McLoughlin E. Injury mortality and morbidity in New Zealand. *Accident Analysis Prevention* 1989;21(3):243-254.
3. Runyan CW, Casteel C, Perkis D, Black C, Marshall SW, Johnson R, et al. Unintentional injuries in the home in the United States. Part 1: Mortality. *Am J Prev Med* 2005;28(1):73-79.
4. Keall MD, Baker M, Howden-Chapman P, Cunningham M. Association between the number of home injury hazards and home injury. *Accident Analysis & Prevention* 2008;40(3):887-893.
5. Chen LH, Warner M, Fingerhut LA, Makuc D. Injury episodes and circumstances: National Health Interview Survey, 1997-2007. *Vital and Health Statistics. Series 10, Number 241*: US Department of Health and Human Services, 2009.
6. Lindqvist K. Epidemiology of accidents in a Swedish municipality. *Accident Analysis & Prevention* 1989;21(1):33-43.
7. Sherrard J, Day LM. Injury morbidity in Victoria among adults 25 to 64 years of age: implications for prevention. *Aust J Public Health* 1995;19(5):470-476.
8. Zaloshnja E, Miller TR, Lawrence BA, Romano E. The costs of unintentional home injuries. *American Journal of Preventive Medicine* 2005;28(1):88-94.
9. Talbot LA, Musiol RJ, Witham EK, Metter EJ. Falls in young, middle-aged and older community dwelling adults: perceived cause, environmental factors and injury. *BMC Public Health* 2005;5:86.
10. Kool B, Ameratunga S, Hazell W, Ng A. Unintentional falls at home among young and middle-aged New Zealanders resulting in hospital admission or death: context and characteristics. *New Zealand Medical Journal* 2010;123(1316):75-84.
11. Kool B, Ameratunga S, Jackson R. The role of alcohol in unintentional falls among young and middle-aged adults: a systematic review of epidemiological studies. *Injury Prevention* 2009;15:341-347.
12. Kool B, Ameratunga S, Jackson R, Robinson E. Hospitalisations and deaths due to unintentional falls at home among working-aged New Zealanders. *Injury* 2007;38:570-575.
13. Kool B, Ameratunga S, Robinson E, Crengle S, Jackson R. The contribution of alcohol to falls at home among working-aged adults. *Alcohol* 2008;42:383-388.
14. Kool B, Ameratunga S, Robinson E, Crengle S, Jackson R. Unintentional falls at home among working-aged adults: methodology and population control selection for a case-control study. *Australasian Epidemiologist* 2008;15(1):14-17.
15. Runyan C, Casteel C. The state of home safety in America: Facts about unintentional injury in the home. 2nd ed. Washington DC: Home Safety Council, 2004.

16. Beaglehole R, Bonita R, Kjellstrom T. *Basic Epidemiology*. Geneva: World Health Organization, 1993.
17. Statistics New Zealand. 2006 Census population and dwellings tables. Available from: www.stats.govt.nz/tools_and_services/tools/TableBuilder/2006-census-pop-dwellings-tables.aspx [cited 1 September 2010].
18. Statistics New Zealand. Population Estimates at 30 June 2006-09. Available from: www.stats.govt.nz/tools_and_services/tools/TableBuilder/intercensal-population-estimates-tables.aspx [cited 1 September 2010].
19. Ministry of Health. *Ethnicity Data Protocols for the Health and Disability Sector*. Wellington: Ministry of Health, 2004.
20. Salmond C, Crampton P, King P, Waldegrave C. NZiDep: A New Zealand index of socioeconomic deprivation for individuals. *Social Science & Medicine* 2006;62(6):1474-1485.
21. Babor TF, Higgins-Biddle JC, Saunders JB, Monteiro MG. *The Alcohol Use Disorders Identification Test. Guidelines for use in primary care.* Geneva: World Health Organization, 2001.
22. Baker SP, O'Neill B, Haddon W, Jr., Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *Journal of Trauma* 1974;14(3):187-196.
23. National Centre for Classification in Health. *The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification.* 2nd ed. Sydney: National Centre for Classification in Health, 1998.
24. Greenland S. Modelling and variable selection in epidemiologic analysis. *American Journal of Public Health* 1989;79(3):340-349.
25. Hartge P. Participation in population studies. *Epidemiology* 2006;17(3):252-254.
26. Olson SH. Reported participation in case-control studies: Changes over time. *American Journal of Epidemiology* 2001;154(6):574-581.
27. Cardis E, Richardson L, Deltour I, Armstrong B, Feychting M, Johansen C, et al. The INTERPHONE study: design, epidemiological methods, and description of the study population. *European Journal of Epidemiology* 2007;22(9):647-664.
28. Taylor B, Irving HM, Kanteres F, Room R, Borges G, Cherpitel C, et al. The more you drink, the harder you fall: A systematic review and meta-analysis of how acute alcohol consumption and injury or collision risk increase together. *Drug and Alcohol Dependence* 2010;110(1-2):108-116.
29. Vinson DC, Mabe N, Leonard LL, Alexander J, Becker J, Boyer J, et al. Alcohol and injury. A case-crossover study. *Archives of Family Medicine* 1995;4:505-511.
30. Borges G, Cherpitel CJ, Mondragon L, Poznyak V, Peden M, Gutierrez I. Episodic alcohol use and risk of nonfatal injury. *American Journal of Epidemiology* 2004;159(6):565-571.

31. Injury Prevention Research Unit, University of Otago. Fact sheet number 39: Causes of injury by age. In: Gulliver PJ, Simpson JC, editors, 2007.
32. Vinson DC, Borges G, Cherpitel C. The risk of intentional injury with acute and chronic alcohol exposures: A case-control and case-crossover study. *Journal of Studies on Alcohol* 2003;64:350-357.
33. Accident Compensation Corporation. *New Zealand Injury Prevention Strategy*. Wellington: Accident Compensation Corporation, 2003.
34. New Zealand Injury Prevention Secretariat. *New Zealand Injury Prevention Strategy, Five-year Evaluation – Final Report*. Wellington: New Zealand Government, 2010.