Increases in consumption and harms among young people in the context of alcohol policy liberalisation

A thesis presented in partial fulfilment of the requirements for the degree of Doctor of

Philosophy in Public Health at Massey University, Albany,

New Zealand.

Taisia Huckle

2011

Abstract

Objective: To assess drinking patterns and alcohol-related harms among young people in the context of substantial liberalising alcohol policy change in New Zealand. Five studies were developed to address this objective which assessed: (i) trends in drinking patterns, alcohol-related problems and harms during the time of the liberalising policy change and (ii) specific policy changes relevant to young people in New Zealand: the lowering of the minimum purchase age, the introduction of ready to drinks and alcohol outlet density (alcohol outlets had proliferated due to the relaxation of the liquor licensing system).

Methods: General population alcohol surveys and routinely collected harms datasets were utilised. Survey measures were: typical occasion quantity, drinking frequency, heavier drinking, self-reported drunkenness, alcohol-related problems and individual demographic measures. Harms measures included: prosecutions for disorder offending, prosecutions for driving with excess breath alcohol, alcohol-involved crashes (all and fatal) and individual demographic measures. Analysis techniques utilised in Studies One through Five were as follows: quantile regression, general linear models, broken stick Poisson regression, logistic regression (and analysis of variance) and multi-level modelling. When possible the wider New Zealand population was considered in relation to young people. Young people were defined as those up to 24 years of age (inclusive).

Results: In the context of alcohol policy liberalisation young people, and in particular teenagers, were observed to experience the greatest increases in typical occasion quantities, alcohol-related problems and harms relative to other groups in the New Zealand population. Specific liberalising policy contexts relevant to young people, including the lowering of the minimum purchase age, ready to drinks and alcohol outlet

density were also associated with increased quantities consumed or increased harms among teenagers.

Conclusion: The public health problem of increased alcohol consumption and related harms among young people in New Zealand can be reduced. It will, however, take effective restrictive alcohol policy controls to achieve this.

Forward

This thesis is based on five individual, but related, published research studies undertaken during my PhD candidature. Two manuscripts are published in Addiction, one is *in press* at Journal of Studies on Alcohol and Drugs and two are published in Drug and Alcohol Review. These manuscripts are drawn together to form a PhD thesis fulfilling Massey University requirements.

A sixth study was undertaken as part of this thesis however, in the end, it did not fit cohesively into the theme. This study is included in Appendix 1 (published in Addiction).

I gratefully acknowledge the above journals for allowing these publications to be included in this thesis.

I am first author on all studies and the work I present is my own. My primary supervisor helped me to structure my arguments and statisticians undertook the SAS analysis; therefore Professor Sally Casswell and various statisticians are co-authors on the manuscripts. In one study a Geographical Information Systems analyst was also included as a co-author. Statements of the candidate's contribution to each publication are in Appendix Five.

Results from these studies were presented at scientific conferences, including several Kettil Bruun Society meetings. A presentation was also given at the Alcohol Advisory Council (ALAC) Working Together conference.

Acknowledgements

Table of Contents

List of Tables

List of Figures

Introduction

Market liberalisation and alcohol industry lobbying fuelled the systematic erosion of effective alcohol policy controls in New Zealand. The year 1990 signalled the start of a decade in which liberalising policy change transformed the alcohol environment and from which alcohol emerged as more visible and available than ever before. Increases in the physical availability of alcohol occurred via proliferating alcohol outlets, extended trading hours, changes to the beverage distribution system and days of sale. Increases in the promotion of alcohol occurred due to the deregulation of alcohol advertising in the broadcast media and later the introduction of more sophisticated marketing techniques, including the introduction of ready to drinks (alcopops). The minimum legal purchase age was also lowered from 20 to 18 years.

A direct way of studying alcohol policy interventions, such as those above, is to study alcohol measures when there is a policy change (Room, 2004). In New Zealand, several research studies were implemented investigating alcohol measures during the time of liberalising alcohol policy changes and it was within the framing of these studies that the majority of this thesis was written.

The aim of this research is to assess drinking patterns and alcohol-related harms among young people in the context of substantial liberalising policy change. The focus is placed on young people as many of the policy changes that transformed New Zealand's alcohol environment, from restrictive to liberal, were particularly relevant to young people (Babor, Caetano, Casswell, Edwards, Giesbrecht, Graham et al., 2010). Elsewhere, young people have experienced heavier consumption in similar liberalising policy contexts such as the United Kingdom (UK) (Measham & Brain, 2005). In the UK heavier

consumption among young people has been linked to a wider choice of drinks, drinking establishments, longer trading hours and sophisticated and targeted alcohol marketing (Measham & Brain, 2005). These are many of the same influences that young people in New Zealand have been exposed to, although here with the addition of the lowering of the minimum purchase age.

Young people may also be more vulnerable to the effects of liberalising alcohol policy changes. Measham and Brain argue that as traditional norms and values disappear so do those that may limit heavier drinking. As young people have lost traditional sources of identity including the nuclear family, identities are formed in the market and this is particularly so in relation to consumption (Measham & Brain, 2005).

There are several concerns from a public health perspective. Adolescence is a time of substantial neuromaturation that is disrupted by alcohol. Binge drinking can damage the forebrain, particularly the prefrontal cortex, which drives impulse inhibition, paying attention, making decisions and goal setting (Monti, Miranda, Nixon, Sher, Swartzwelder, Tapert et al., 2005). Binge drinking is also related to impairment of working memory processes in young adults aged 18-25 years (Crego, Holguin, Parada, Mota, Corral, & Cadaveira, 2009). Furthermore, in New Zealand, the burden of alcohol-related mortality and morbidity is disproportionately experienced by younger people aged 15-29 years (Connor, Broad, Rehm, Vander Hoorn, & Jackson, 2005).

A further reason for the focus on young people up to the age of 24 years at the initiation of this thesis was the limited published evidence about young people's alcohol-related behaviour in New Zealand from which to inform alcohol policy (Casswell & Zhang, 1998; Everitt & Jones, 2002; Guria, Jones, Leung, & Mara, 2003).

The legislative framework for alcohol sales in New Zealand

The New Zealand policy environment in the 1980s and 1990s was characterised by considerable neo-liberal economic reforms (Evans, Grimes, Wilkinson, & Teece, 1996). The reforms promoted market liberalisation and free trade, limited government and a deregulated labour market (Evans et al., 1996; Kelsey, 1995). While many countries have engaged in deregulatory reforms, 'the New Zealand experiment' (Kelsey, 1995) has been described as the most noticeable example of policy liberalisations in the economically developed world (Evans et al., 1996). Many Governmental Acts were liberalised as part of these reforms including the main legislative document controlling the sale and supply of alcohol; the Sale of Liquor Act 1962.

Sale of Liquor Act 1989 (implemented 1ˢᵗ April 1990)

The new Sale of Liquor Act in 1989 was "to establish a reasonable system of control over the sale and supply of liquor to the public with the aim of contributing to the reduction in liquor abuse, so far as that can be achieved by legislative means" (Sale of Liquor Act, 1989). A "reasonable system of control" reflected the underlying philosophy of market liberalisation while "contributing to the reduction in liquor abuse" reflected the social goal of the Act (Hill & Stewart, 1996). The 1989 Act was not to restrict the sale and supply of liquor, as in the past, but to promote safe and legal drinking (Ministry of Justice, 1996).

The 1989 Act introduced substantial changes to the availability of alcohol by relaxing the liquor licensing system and several key amendments were made in this respect (Hill & Stewart, 1996). Prior to 1989, under the 1962 Sale of Liquor Act, requirements for obtaining a liquor licence were stringent and the numbers of alcohol outlets were restricted by the criteria for granting a licence. A prospective licensee had to provide

evidence that a new liquor outlet was "necessary or desirable" to meet the needs of the public (Hill, 2004a). The new licensing system removed this requirement under the philosophy that liquor licences would be 'easy to get but easy to lose' (Hill, 2004a).

Under the new licensing system liquor licences were easy to get as there were few means under which they could be refused. A new liquor licence application could only be refused on the grounds of the 'suitability' of the applicant determined by a police check. If a history of criminal record, drug convictions, drink driving or recent loss of liquor licence in another location was uncovered this would deem an applicant unsuitable (Hill, 2004a, 2004b).

Liquor licences were also meant to be easy to lose however as time progressed it became clear that they were not. Licence cancellations were difficult to obtain and prosecutions uncommon (Hill, 2004a; Hill & Stewart, 1996). The wider impacts of liquor outlets on the community or public health evidence could not be considered in decisions to grant, review or cancel licences as each licence had to be considered on its own merits against narrow criteria in the legislation (Hill, 2004b). Criteria for loss of licence included evidence of infringements of the Sale of Liquor Act laws, selling to minors or poor management. Poor management could lead to loss of licence more easily than any infringements of the Act as it reflected on the suitability of the licensee (Hill, 2004a).

Prior to 1989 there were provisions for controls on the locations in which alcohol outlets could open. Licence applications near hospitals, schools or churches could be declined (Hill, 2004a). It was felt however that the previous legislation had encroached on local government town planning (Hill, 2004a). So from 1989 matters related to the location of

alcohol outlets were left to the Resource Management Act 1991 which, in practice led to a significant gap in jurisdiction (Hill, 2004a).

With the control of locations of liquor licences now under the Resource Management Act effectively a licence application could not be refused on the basis of location. The Resource Management Act was used by local governments (city councils) to zone land for residential, business or other purposes (as part of Local District Plans). However the broad zonings used in Local District Plans did not address the suitability of locations for alcohol outlets (Hill, 2004a). This meant there was a considerable gap between planning and licensing. Once resource consent for a liquor outlet had been granted under the Resource Management Act it was not possible, under the 1989 Sale of Liquor Act, for the licence to be refused on the basis of location (or for communities to effectively object to an application on the basis of location). If a new applicant was judged suitable to hold a licence and had resource consent they were granted a licence (Hill, 2004a). As such liquor outlets were able to open in undesirable locations such as near schools.

Some devolution of the administration of licences occurred under the 1989 Act. Seventy-four District Licensing Agencies were introduced; one agency for each local government area. District Licensing Agencies administered, monitored and reported on licences and renewals to the national-level Liquor Licensing Authority but could themselves only grant special licenses for a specific event (Hill & Stewart, 1996). Later in the decade they could grant and renew uncontested liquor licenses within their jurisdiction (Hill, 1998). Contested applications, renewals and applications for cancellation, suspension or variation went to the Liquor Licensing Authority. The Authority's decisions were made against criteria and conditions in the 1989 Act. Compared with similar Acts in Australia

and the UK the Liquor Licensing Authority had little discretion or flexibility in its decision-making (Hill, 2004b).

The licence criteria and conditions in the 1989 Act did include new host responsibility requirements. Food had to be available in on-licensed premises, as well as non-alcoholic beverages. More focus was placed on host responsibility around food and intoxication (Hill, 2004a). However prohibitions in the Act against the serving of intoxicated patrons were not clear-cut, inhibiting enforcement (Hill & Stewart, 1996).

The availability of alcohol was also increased under the 1989 Sale of Liquor Act by the liberalisation of trading hours. On and off-licensed premise hours were made a condition of each individual licence and applicants could apply for very late closing times or licences to operate 24 hours a day. Hours could be determined by the type and location of an outlet (based only on land use), licensee, clientele and style of operation (New Zealand Law Commission, 2010). However hours were mainly based on what the applicant asked for unless a local government policy on acceptable hours of trading was in operation which had occurred in some areas (Hill pers com 2011. Hill, 2004b). Hours were however a discretionary condition, meaning that the national body, the Liquor Licensing Authority, could cut back the closing times of premises associated with late night problems such as intoxication (Hill & Stewart, 1996).

Motivations for relaxing trading hours were "to be convenient to the public". Large increases in the number of premises trading later were not expected due to constraints such as "the already high level of availability of alcohol, the cost of labour at late hours and lack of sufficient patronage to support large numbers of late night or early morning outlets" (New Zealand Law Commission, 2010).

Following the 1989 Act, alcohol outlets traded considerably later than before. On-premise outlets, with residential neighbours, operated until 11pm on weeknights and midnight or 1pm on weekends. Bars and nightclubs in cities traded to 3am or 5am (Hill, 1998). Off-licensed premises did not trade after 10 or 11pm. Prior to 1989, on-licensed premises would trade between 9am and 10pm or 11pm with off-licensed premises hours normally restricted to between 8am and 7pm (New Zealand Law Commission, 2010).

Further increases to the availability of alcohol were introduced under the 1989 Act. Wine, of around 11% alcohol content, was permitted for sale in supermarkets and grocery outlets. Grocery outlets that met a minimum size requirement, typically larger than small corner shops, were permitted to sell wine (Sale of Liquor Act, 1989). This aspect of the Act was to encourage a more Mediterranean style of drinking pattern by positioning wine alongside food.

Alcohol taxation 1989

Amendments to the Sale of Liquor Act were not the only way that alcohol policy changed in New Zealand. In 1989 a budget reform led to changes in alcohol taxation (Easton, 2002). Until the mid-1980s taxation on alcohol was ad hoc with excise duties and wholesale taxes on beer and spirits, and a sales tax on wine. The 1989 Budget established an excise duty on alcohol that was broadly based on absolute alcohol content rather than the type of drink, although it discriminated by absolute alcohol by volume (Easton, 2002). This meant that as absolute alcohol content rose, the tax payment rose in proportion.

Very low levels, under 3%, were not excised and the rate was higher for absolute alcohol by volume above 24.0 percent (i.e. spirits). The excise duty was increased automatically in line with changes in the consumer price index although the spirits excise rate was not linked to inflation until 2002/03 (Easton, 2002).

Alcohol advertising deregulation 1992

Substantial deregulation of alcohol advertising occurred in 1992. Prior to 1992, during the 1980's, all broadcasting was controlled by the state and no alcohol ads were permitted. From 1981 off-licensed premises were allowed to advertise the availability of alcohol on television and radio without mention of prices or alcohol brand names. In 1987 sponsorship and corporate alcohol advertising were permitted on television and radio. Brand names could only be mentioned if the brand name was part of, or identical to, the name of the advertiser (New Zealand Drug Foundation, 2006).

In the context of the economic reforms, in part due to the free market philosophy and privatisations and with considerable pressure on the media and advertising industries to increase revenue, brand advertising of alcohol was permitted in the broadcast media in 1992. Advertising on television was permitted from 9pm to 6am. Brand advertising of alcohol was also permitted on the radio (New Zealand Drug Foundation, 2006).

No regulation or restriction was introduced at this time apart from an ineffective system of industry self-regulation of a Liquor Advertising Code. Although originally it was planned that an independent Crown entity, the Broadcasting Standards Authority, would oversee controls on alcohol advertising this then passed to industry proponents and the focus was now placed on 'reviewing the advertising code' as opposed to reviewing the policy (New Zealand Drug Foundation, 2006).

Random compulsory breath testing 1993

There was one policy area in which restrictions had consistently been increased: the law against drink-driving. On the 1ˢᵗ of April 1993 Compulsory Random Breath Testing was introduced under the Land Transport Act. Police now set up check points at which all drivers were to be breath tested. At the same time the legal limit for drivers under 20 years was reduced: 0.03mg/ml compared to 0.08mg/ml for those over 20 years. A substantial enforcement and advertising effort occurred from late 1995 (Guria et al., 2003).

Introduction of ready to drinks 1995

A relaxation of customs policy in the early 1990s contributed to the introduction of spirit-based ready to drinks known internationally as alcopops. Previously there were two licences to import spirits in New Zealand and these were held by the two major breweries. The relaxation meant that cheap spirits could be parallel imported and were subsequently used to make spirit-based ready to drinks. Initially, these beverages were brightly coloured and with an alcohol content of around 5%. From around 1995 the availability and range of ready to drinks expanded rapidly to include many brands, types and flavours. In 2000s stronger bourbon and colas aimed more at males were introduced, some with around 8% alcohol content (Huckle et al 2008b).

Amendments to the 1989 Sale of Liquor Act

On the 1ˢᵗ of December 1999 more changes to the Sale of Liquor Act were implemented. The most disputed of these was the lowering of the minimum purchase age from 20 to 18 years. There is one exception to the minimum age of 18: in designated areas of on-licensed premises, persons aged under 18 years may consume alcohol if supplied and supervised by their parent or legal guardian (Sale of Liquor Act, 1989).

Several arguments were put forward in support of lowering the purchase age. A perception existed that the exemptions in legislation before 1999 created difficulties in enforcing the law. Prior to 1999 18-19 year olds could drink in on-licensed premises if an parent guardian or adult spouse or relative was present or if the alcohol was accompanied by a meal or entertainment (Ministry of Justice, 1996). An election was near and the votes of those aged 18-19 years were wanted. The hospitality industry argued there was already a de-facto age of 18 years. The 1999 amendments were intended to simplify the law and improve its enforceability, thereby creating "a hard 18, No ID, no sale culture" (Alcohol Health Watch 2004).

It was in the above context, that the purchase age was lowered to 18 years. Photo age ID was introduced as proof of age at licensed premises (if requested). The three recognised evidence of age documents, as now defined in the Act, were a passport, a photo driver licence, or a Hospitality Association of New Zealand 18+ card with a photo (Lash, 2005). However no extra resources to monitor or enforce these amendments were provided (Hill, 2000).

At the same time, offences by those under the purchase age could now be handled with infringement fines. Offenders could still be prosecuted in court, but now an infringement notice of $200 could also be given by Police. Prosecutable offences as cited in Lash (2005) were: purchase liquor on or from licensed premises; are found in a restricted area on-licensed premises; are found in any supervised area on-licensed premises unless accompanied by a parent or guardian; drink alcohol in a public place while not accompanied by a parent or guardian; or possess alcoholic drink for consumption in a public place while not accompanied by a parent or guardian (Lash, 2005 pp15). Fines

were doubled for licensees convicted of selling alcohol to minors (Hill, 2000), although licence suspension or cancellation was the preferred enforcement route (Hill pers com 2011).

The 1999 amendments further increased the availability of alcohol with the introduction of Sunday trading for all licensed premises. Previously Sunday trading was not permitted in premises for which the primary business was selling alcohol or drinking. It was however permitted for restaurants while serving meals. Nightclubs could also open on Sundays on condition that food or entertainment was provided, indicating that drinking was not the primary business (Hill, 2000). The 1999 Act removed this restriction under the philosophy that "partial prohibition on Sundays was unfair to pubs, inconvenient to shoppers and considered silly by tourists" (Hill, 2000, p.7).

Also substantially increasing the availability of alcohol was the introduction of beer for sale in supermarkets and grocery outlets in 1999. This was a compromise to a proposal that all alcohol retailers should be permitted to sell all beverages, including spirits and ready to drinks. (Hill, 2000).

Other changes in 1999 included a new requirement that managers of on and off-licensed premises complete a training course and that a manager had be present at all times during trading hours. It also became an offence for licensees or managers to promote on-licensed premises in any way that encouraged fast or excessive drinking (Hill, 2000). This is the only legislative restriction on the promotion of alcohol.

Liquor bans 2002

At the local government level liquor bans were introduced in 2002. Although the Local Government Act was amended in 2001 to allow local government to implement liquor bans for longer than 24 hours which had not been possible under the 1974 Act. Due to an error in the 2001 amendment it was not until 2002 that the new liquor bans were implemented. By 2004 some 30 local governments had year round liquor bans (alcohol free zones) often at beaches, parks and city centres. A further 15 had seasonal bans at beaches or for events such as New Year's Eve. By 2004 liquor bans were in operation on the weekend in at least four large cities (Webb, Marriot-Lloyd, & Grenfell, 2004).

Light spirits tax change 2003

Light spirits were cheap and popular among young people. These beverages were sold in 1125 litre bottles with strength of 23% alcohol content. The New Zealand tax scale had only a few broad categories and light spirits content slipped under the tax band of 14-23% intended for products such as fortified wines (SHORE, 2006a). This meant that light spirits were taxed at a low rate relative to alcohol content. From 2003 the highest tax rate i.e. the spirits tax rate was applied to beverages with an absolute alcohol by volume above 14.0 percent, thereby covering light spirits (Easton, 2002).

Conclusion

The majority of alcohol policy changes in New Zealand were liberalising. The Sale of Liquor Act moved away from controls on the physical availability of alcohol to a focus on responsible host management, although this has low levels of effectiveness in preventing or reducing heavier consumption and related harms (Babor et al., 2010). Policy change also substantially affected the way alcohol was promoted and contributed to the introduction of a new product, ready to drinks.

What was known of the effects of policy change in New Zealand 1990-2004?

Effects of the Sale of Liquor Act 1989

As a result of the relaxation of the licensing system liquor outlets proliferated in New Zealand during the 1990s. Between 1990 and 1995 an increase of 4,600 liquor licences occurred (Hill & Stewart, 1996). By 2002 this figure had further increased by 3,200 licences, making a total increase of over 7,800 liquor licences between 1990 and 2002. Between 1990 and 2006 the number of liquor licences increased from 18 per 10,000 New Zealanders to 35 per 10,000 people including on, off and club licences (i.e. sports clubs). (Data obtained from the Liquor Licensing Authority 2006). The introduction of wine into supermarkets and grocery outlets contributed to this increase in licences, however, bottle shops also proliferated as did a range of on-premise drinking opportunities.

The proliferation of bars and nightclubs with longer trading hours facilitated a burgeoning youth focussed night time economy that promoted consumer excess (McEwan, Campbell, & Swain, 2010). By 1995, around a third of 16-17 year olds and three quarters of 18-19 year olds had consumed alcohol at bars in the previous 12 months. Around one fifth of 16-17 year olds and two thirds of 18-19 year olds had consumed alcohol in nightclubs (Habgood, Casswell, Pledger, & Bhatta, 2001). Between 1990 and 1994 the average typical occasion quantity consumed at nightclubs by 14-19 year olds was around 3 drinks (a drink here is defined a 15ml pure alcohol). By 1997 this amount had increased to almost 6 drinks per typical occasion.

Problems related to the longer trading hours introduced under the 1989 Act were reported by local police. High levels of intoxication were linked with later closing times as some patrons were drinking heavily for longer. Disorderly behaviour was usually

associated with premises open later or premises open last. When outlets closed at different times migrating drinkers, often intoxicated, would be attracted to the latest open outlet to continue drinking (Hill & Stewart, 1996). Also in city centres, with longer trading hours or 24 hour trading, drunk drivers were caught on the road at 7 am and 8 am when people were travelling to work and school (Hill & Stewart, 1996).

The introduction of wine for sale into supermarkets and grocery outlets was associated with a 17% increase in estimates of wine available for consumption (Wagenaar & Langley, 1995; Zhang & Casswell, 1999). The real price of wine declined following its introduction into grocery outlets which was reported to have, in part, contributed to the increase in wine consumption. A decrease in spirits consumption was also found suggesting some beverage substitution (Zhang & Casswell, 1999). Women, in particular, felt more comfortable purchasing wine from the supermarket and were able to avoid the stigma associated with visiting a specialised alcohol outlet (Wyllie, Holibar, Jakob-Hoff, & Casswell, 1993).

Effects of Alcohol Advertising Deregulation 1992

Alcohol advertising substantially increased following the introduction of the brand advertising in the broadcast media in 1992. Expenditure on alcohol advertising in the broadcast media increased from around $8 million dollars in 1991 to around $27 million by 1993 (inflation adjusted dollars) (Huckle & Huakau, 2007). Shortly after the introduction of brand advertising young people were exposed to a fourfold increase in televised alcohol advertising (Wyllie, Waa, & Zhang, 1996).

Casswell and Zhang (1998) found a measurable impact of the new alcohol advertising in the broadcast media in New Zealand. Casswell & Zhang collected responses to the new

televised brand alcohol advertisements among the same respondents at age 18 years and, then again, at 21 years. Results showed that those who exhibited positive liking of alcohol advertising and brand allegiance at age 18 drank larger volumes of beer at age 21. This result was found independently of volumes consumed at age 18 years. It was also found that liking and allegiance influenced volume but that this relationship was not reciprocal (Casswell & Zhang, 1998).

Effects of Random Compulsory Breath Testing 1993

Random compulsory breath testing was initially effective in reducing alcohol-involved traffic crashes. A reduction in the proportion of alcohol-involved traffic crashes including fatal crashes was reported for the New Zealand population between 1995 to 1999 (Guria et al., 2003). It was apparent however that the effectiveness of this policy change had plateaued following the 1999 Sale of Liquor Act amendments that had increased the availability of alcohol and lowered the minimum purchase age.

Effects of the introduction of ready to drinks 1995

Following their introduction in 1995, ready to drinks became the most rapidly growing beverage type (although currently they still lag behind beer, wine and spirits respectively in terms of volume of pure alcohol consumed at the total population level) (Statistics New Zealand, 2011). Between 1995 and 1999 ready to drinks, by volume had increased by 18 million litres compared to wine that increased by 13 million litres. Both beer and spirits declined during this time (although beer is still New Zealand's most popular beverage). By 2005, around 40 million litres of ready to drinks were available for consumption (Statistics New Zealand, 2009a).

Effects of the Sale of Liquor Act amendments 1999

Research that was undertaken in New Zealand in relation to the 1999 Act amendments had focused on the lowering of the purchase age, from 20 to 18 years. An increase in presentations for intoxication at an emergency department was reported among 18-19 year olds (Everitt & Jones, 2002). An increase in alcohol-involved crashes was found for 15-17 year olds nationally (Guria et al., 2003). Pseudo-patron purchase surveys found that it was very easy for 18 year olds to purchase alcohol without age ID in Auckland, New Zealand's largest region, following the lowering of the purchase age (Huckle, Conway, Casswell, & Pledger, 2005a).

Effects of the 2003 light spirits tax change

The tax increase on light spirits in 2003 dramatically decreased the popularity of this beverage type (SHORE, 2006a). However, prior to the tax increase, light spirits were consumed considerably less, at the total population level, than ready to drinks or any other beverages in New Zealand (Data supplied by Statistics New Zealand).

Trends in alcohol consumption

Unpublished national survey data had documented increases in consumption between 1995 and 2000. In 1995 42% of the total volume of absolute alcohol consumed by the sample, aged 14-65 years, was consumed in heavier drinking occasions (defined as 6 or more drinks on a typical occasion for females and 8 or more for males). In 2000 this proportion had increased to 50%. Between 1995 and 2000 increases in alcohol consumed on a typical occasion in the last 12 months were found for males aged 14-15, 16-17 years and among the males in the age groups 30 years and over. Among females increases were found among all age groups including those aged 16-17, 18-19 and 20-24 years (Habgood et al., 2001). Males aged 14-15 years increased their drinking frequency in the last 12

months between 1995 and 2000; for females increases were found for those 14-15, 16-17 and 30-39 years.

Unpublished survey data from Auckland, New Zealand's largest region, between 1990 and 1999 found an increase in typical occasion quantity in the last 12 months among the sample aged 14-65 years, with 14-19 year olds increasing at a higher rate. There was no increase in frequency of drinking in the last 12 months over the time of the surveys although a drop occurred between 1990 and 1992 (Casswell & Bhatta, 2001).

With respect to total population consumption (alcohol available for consumption) – according to Statistics New Zealand long term data series, a decline occurred between 1990 and 1997 despite the proliferation of liquor outlets, longer trading hours, the introduction of wine for sale in grocery outlets, the introduction of alcohol brand advertising in the broadcast media and the introduction of ready to drinks. It was likely that total population consumption was underestimated during the 1990's due to a failure to account for the increasing alcohol content in wine along with the increasing market share of wine (informed by Chikritzhs, Allsop, Moodie, & Hall, 2011, Statistics New Zealand data during the 1990s, and Alston, Fuller, Lapsley, Soleas, & Tumber, 2011). It was also possible that total population consumption was not reflecting behaviour in population subgroups[a].

Conclusion

There was some evidence to suggest that several policy changes were associated with changes in behaviour at the population level in New Zealand, including the introduction

---

[a] Total population consumption increased after 1997. Further discussion of total population consumption can be found in Appendix 2 (also contextualised with the thesis findings).

of wine into grocery outlets and the introduction of Random Compulsory Breath Testing. However prior to this thesis commencing there had been very few published empirical studies examining consumption or related harms related to policy changes among young people. Those that existed had focussed on effects of alcohol marketing deregulation (Casswell & Zhang, 1998) and the lowering of the minimum purchase age (Everitt & Jones, 2002; Guria et al., 2003). These studies had focussed on a specific policy change and no published data were available documenting trends over time in consumption or harms for young people. There were also several other areas where no research existed even though data showed, for example, that there had been an increase in the number of alcohol outlets and an increase in the consumption of ready to drinks, both of which, were likely relevant to young people.

How alcohol policies affect young people (theoretical framing)

Alcohol control policies influence the physical availability of alcohol, alcohol advertising and other marketing approaches, such as the introduction of new products, the enforcement of alcohol laws and the price of alcohol (Babor, Caetano, Casswell, Edwards, Giesbrecht, Graham et al., 2003). Alcohol control policies that liberalise the alcohol environment can increase levels of consumption and harms (Babor et al., 2010).

Alcohol policy that is relevant to all population groups may have differential effects on different parts of the drinking population (Room, Romelsjo, & Makela, 2002). A policy may affect demographic groups differently; have different effects depending on people's drinking patterns; may affect alcohol-related problems differently and trends in problems may not match those observed in total population consumption. As such, total population consumption, although often used to assess policy change, may not be a good proxy measure (Room et al., 2002).

Differential effects of policy

Liberalising alcohol policy is likely to have more effect on individuals and sub groups of the population constrained by the old policy (Room et al., 2002). People whose consumption is lower than their desires, because of the restriction, will be more affected by liberalising policy change. For example, "a price reduction would affect those people most who, before the reduction, would have drunk more alcohol if only it weren't for the money". Those who are satisfied with their level of consumption will be less affected by liberalising policy change (Room et al., 2002, p.33).

The social and cultural context of a policy may contribute to differential policy effects. Policy effects may vary because of, for example, the level of social acceptance of drinking among a population group when a policy is introduced (Room et al 2002).

However it is also feasible that a policy implemented at a wider population level but particularly effective with a particular population group may be related to a differential effect. For example the images and communication technologies used in alcohol advertising have significant appeal to young people (Babor et al., 2010). The advent of new marketing strategies, including the development of new products such as ready to drinks have been specifically aimed at a new generation of young alcohol consumers and designed to meet the needs of particular groups of young people (Brain, Parker, & Carnwath, 2000; Casswell, 2004).

Differential impacts may also occur across population groups depending on how changes in the availability of alcohol affect drinking patterns and routine drinking activities such as drinking in bars vs home; socially vs alone. Greater alcohol-related health and social problems are focused in the groups most exposed to drinking in bars and/or socially

(Stockwell & Gruenewald, 2004) i.e. exposed to the effects of others drinking and those who expose themselves to heavier drinking (Pers com. Gruenewald 2011).

It could also be possible that when many liberalising policy changes are introduced, as has been the case in New Zealand, that differential impacts may occur among the groups for whom the most liberalising policy changes were relevant.

Focus of this research

Alcohol use and related problems among young people are predicted by environmental and individual factors (Birckmayer, Holder, Yacoubian, & Friend, 2004). Such factors were utilised in the conceptualisation of this research and are described below:

Physical availability: defined as "the availability of alcohol in one's physical environment mediated by the likelihood that one will come into contact with these sources of drink" (Stockwell & Gruenewald, 2004, p.217). The physical availability of alcohol includes the regulations surrounding the sale of alcohol; including days of sale and trading hours, restrictions on locations and numbers of alcohol outlets, legal availability or age limits on buying, selling and consuming alcohol. Beverage distribution systems are included as are the range, types and strengths of beverages sold (Babor et al., 2010; Measham & Brain, 2005; Pacific Institute for Research and Evaluation (PIRE), no date; Stockwell & Gruenewald, 2004). Increases in the physical availability of alcohol leads to greater ease or convenience in obtaining alcohol. It may also stimulate demand. Supply influences demand just as demand influences supply (Edwards & Holder, 2000).

Social availability: the social availability of alcohol or the social supply of alcohol is relevant for those under a legal purchasing age. Social supply refers to access to alcohol via social

sources, for example friends, parents and others (Pacific Institute for Research and Evaluation (PIRE), no date).

Alcohol Promotion: aims to increase the demand for alcohol through the advertising and promotion of alcohol. The purpose is to increase the attractiveness of drinking, recruit new users and retain current users (Pacific Institute for Research and Evaluation (PIRE), no date).

Related to the promotion of alcohol are new marketing approaches. More recently this has included the development of new products including ready to drinks. These beverages are aimed at a new generation of young alcohol consumers and compete in the market as they are pleasant tasting and already pre-mixed (more convenient compared to spirits) and often have higher alcohol content than beer (Brain et al., 2000; Casswell, 2004).

Individual factors: such as age and gender can affect the distributions of drinking patterns (quantity per occasion and frequency) (Babor et al., 2003).

Objective

The overarching objective and the specific aims of the studies carried out for this thesis were developed to address the lack of policy relevant research among young people in New Zealand.

Objective: To assess drinking patterns and alcohol-related harms among young people in the context of substantial liberalising alcohol policy change in New Zealand. When possible the wider New Zealand population was considered in relation to young people.

The specific aims of the studies were:

1) To assess trends in drinking patterns and alcohol-related problems among age and gender groups in the context of a liberalised alcohol policy environment 1990- 2000.

2) To examine trends in drinking patterns over three national general population samples in New Zealand from 1995 to 2004.

3) To assess alcohol-related harms and offences from 1990 to 2003, a period of alcohol policy liberalisation, that included the lowering of the purchase age from 20 to 18 years in 1999.

4) To report patterns of use of ready to drinks and to assess if ready to drink consumers have heavier drinking patterns.

5) To examine the relationship between physical, socio-economic and social environments and alcohol consumption and drunkenness among a general population sample of drinkers aged 12–17 years.

Data sources utilised in the studies

Several sources of data were utilised in this research and are described below:

Study One utilised the Auckland Annual Alcohol Surveys 1990 -2000. These surveys were developed and implemented by researchers at the Alcohol and Public Health Research Unit (APHRU), University of Auckland. The surveys were funded by the Health Research Council of New Zealand (HRC) and the Alcohol Advisory Council of New Zealand (ALAC). These data were provided to the candidate for secondary analysis.

Study Two utilised the National New Zealand Alcohol Surveys 1995 & 2000 and the 2004 Health Behaviours Survey (Alcohol Use). The 1995 & 2000 surveys were developed and implemented by researchers at the Alcohol and Public Health Research Unit (APHRU), University of Auckland. They were funded by the HRC and ALAC. The 2004 survey was implemented by researchers at the Centre for Social & Health Outcomes Research and Evaluation (SHORE), Massey University. This survey was funded by Public Health Intelligence (PHI). For the 2004 survey the candidate worked on the design of the questionnaire with Professor Casswell, data preparation and documentation. These data were provided to the candidate for secondary analysis.

Studies Three and Five utilised data, obtained by the candidate, from the New Zealand Transport Agency, New Zealand Police, Ministry of Justice (Study Three) and the Liquor Licensing Authority (Study Five).

Study Four utilised the 2004 Health Behaviours Survey funded by PHI.

Study Five utilised data from the Alcogenic Environments Study 2005. This study was developed and implemented by researchers at SHORE, Massey University (funded by HRC). The candidate undertook questionnaire design with Professor Casswell and collected the data for the project. A telephone survey was undertaken and the candidate worked on sampling, running the survey software and data quality assurance. Two pseudo-patron purchase surveys were conducted for on and off-licensed outlets and the candidate managed the data collection for these surveys. The candidate also contributed to the design of the alcohol outlet density measure used in this research (Study Five). It was the candidate's idea to include survey measures to capture respondent reports of access to alcohol and then to use these measures to calculate alcohol outlet density.

Thesis structure

This thesis is comprised of five published studies that work together to form a thesis contributing to understanding about alcohol-related behaviour among young people in the context of liberalising policy changes. Each study addresses one of the specific aims outlined previously and studies are presented as separate chapters in the same order as the aims (One through Five).

The structure means that relevant literature is included in the introduction to each chapter, providing the context for the arguments that follow. Only studies published at that time are included in the literature reviews. Some paragraphs are similar throughout the thesis due to the format of the thesis (5 related papers). The links serve to connect the chapters.

The final chapter returns to the research objective and specific aims to summarise the major themes that have arisen from this research and to discuss the contribution this

thesis has made to the alcohol policy research literature. Theoretical support for the research is discussed as well as the limitations and strengths of the research, future work, implications for alcohol policy and finally the conclusion is drawn.

Link

The purpose of Study One was to understand young people's drinking patterns and related problems in the context of substantial liberalising policy change. The data utilised in Study One were from a series of annual alcohol surveys. These surveys were implemented at the beginning of the 1990's to monitor trends following the relaxation of the liquor licensing system and the introduction of wine for sale in supermarkets and grocery outlets (Sale of Liquor Act, 1989). It was not known at the time that additional liberalising policy changes would further modify aspects of the alcohol environment; but as it happened these annual surveys would go on to capture trends in alcohol-related behaviour in the context of substantial liberalising policy change.

Study One: Increases in typical quantities consumed and alcohol-related problems during a decade of liberalising alcohol policy

Huckle, T., Pledger, M & Casswell, S. Increases in typical quantities consumed and alcohol-related problems during a decade of liberalising alcohol policy, *Journal of Studies on Alcohol and Drugs* (2011).[b]

Objective: To assess trends in drinking patterns and alcohol-related problems among age and gender groups in the context of a liberalised alcohol policy environment.

Method: Eleven comparable general population alcohol surveys were conducted in Auckland, New Zealand between 1990 and 2000; a time in which a substantial number of liberalising alcohol policy changes occurred. Measurements included: typical occasion quantity and frequency of drinking in the last 12 months. Self-reported alcohol-related problems in the last 12 months were divided into two groups based on risk curve analysis: threshold problems (experienced only once a high level of consumption is reached such as 'had hands shake in the morning') and non-threshold problems (those exhibiting a dose-response relationship). Age groups were 14-19, 20-24, 25-39 and 40-65 years.

Results: Significant increases in typical occasion quantity were found for males and females aged 14-19 years and for females 20-24 and 40-65 years. The increase was most marked among those 14-19 years. Only females aged 25-39 years increased how often they drank**.** The prevalence of threshold problems significantly increased among male

---

---

drinkers aged 14-19 and 40-65 years. The proportion of 14-19 year old males experiencing threshold problems was observed to be higher in each year compared to males 40-65 years and the 14-19 year olds experienced a greater year on year increase. Increases in non-threshold alcohol-related problems occurred for the youngest and oldest males and for most female age groups (14-19, 25-39 and 40-65 years). The increase was most marked among females 14-19 years.

Conclusion: Increases in quantities consumed and alcohol-related problems were found predominantly among young people and females. The youngest age group, those 14-19 years, experienced the most marked increases in quantity consumed and problems including, for males, the experience of more serious problems such as 'had hands shake in the morning' (experienced only once a high level of consumption is reached).

Introduction

Research suggests that liberalising alcohol policies, such as those experienced in New Zealand will generally increase alcohol consumption (Babor et al., 2010). The introduction of alcohol into grocery outlets has been shown to increase consumption both at the population level and among specific population groups (Valli, 1998; Wagenaar & Langley, 1995; Zhang & Casswell, 1999). The lowering of the minimum purchase age is associated with increases in consumption among young people (Wagenaar & Toomey, 2002) and longitudinal analysis has linked increased alcohol advertising, due to policy liberalisation, to increases in consumption among young people (Casswell & Zhang, 1998).

Liberal policy changes are also associated with increases in alcohol-related harms (Bloomfield, Rossow, & Norström, 2009; Chikritzhs & Stockwell, 2002, 2006; Chikritzhs & Stockwell, 2007; Herttua, Makela, & Martikainen, 2008, 2009; Smith, 1986) . Most studies have used routinely collected measures to assess specific policy changes such as price. There have been few studies using general population survey data to assess self-reported harms when liberal alcohol policy changes have occurred. Recent exceptions include Bloomfield et al. (2010) and Gustafsson (2010). Bloomfield et al. (2010) assessed self-reported problems in Denmark, South Sweden and Finland following the liberalising of travellers allowances and tax reductions and found that self-reported alcohol problems did not increase following the policy changes (Gustafsson found similar results).

While substantial research has assessed consumption and harms following a specific policy change there are fewer studies that have assessed trends when a series or package

of liberalising alcohol policy change has occurred. One example from Sweden used surveys of young people from 1971-1999. This research linked liberal alcohol periods characterised by increases in outlet numbers and the introduction of alcopops and cider into restaurants/retail stores to increasing consumption (Andersson, Hansagi, Thakker, & Hibell, 2002). A New Zealand study, comparing two national data points between 1995 and 2000, found that, in the context of several liberalising policy changes increases in quantities consumed occurred among most age groups (particularly young people) (Huckle, You, & Casswell, 2011).

Alcohol consumption and related harm are significant public health issues in New Zealand. In 2002, estimates using the global burden of disease (GBoDI) methodology estimated alcohol to contribute 5.7% of disability adjusted years of life lost (DALYs), close to the global average (Connor et al., 2005). Weekend heavy drinking is common place and this is similar to many other established market economies including the UK, some Nordic countries and Australia. In New Zealand drinkers intentionally drink to become intoxicated and this behaviour is widely viewed as socially acceptable (McEwan et al., 2010).

During the 1980s New Zealand engaged in "aggressive neo-liberal supply-side reforms" that promoted wider market liberalization and free trade (Evans et al., 1996; Kelsey, 1997). In this context substantial alcohol policy liberalisations occurred. In April 1990 conditions for obtaining a liquor licence were relaxed; supermarkets and grocery outlets were permitted to sell wine and trading hours were extended (with 24 hour trading permitted). Prior to 1990 requirements for obtaining a liquor licence were stringent (Hill & Stewart, 1996). Nationally this policy change resulted in substantial increases in the numbers of alcohol-outlets from around 18 licences per 10,000 people in 1990 to 35 per

10,000 people by 2006 and a similar pattern occurred in Auckland (Data obtained from the Liquor Licensing Authority). Some of this increase was due to supermarkets and grocery outlets becoming alcohol outlets but there was also a substantial increase in on premise drinking opportunities, mainly in bars and nightclubs frequented by younger people.

In 1992 brand advertising of alcohol, mainly aimed at young people, was permitted in the broadcast media with very little in the way of regulation or restriction (Alcohol & Public Health Research Unit, 1998). Prior to 1992, alcohol advertising was very limited. Following this policy change there was a fourfold increase in televised alcohol advertising seen by young people (Wyllie et al., 1996) and alcohol advertising became widespread very quickly and became part of young people's everyday social lives (Casswell, 2004).

A relaxation to customs policy led to the introduction of ready to drinks (RTD's) in 1995 (more widely known as alcopops). These beverages were popular among young people, in particular young females (Huckle, Sweetsur, Moyes, & Casswell, 2008b). Approximately 2 million litres, by volume, were available for consumption in 1995 and in 2000 this amount had increased to around 24.5 million litres, the largest increase compared to any other beverage at that time (Statistics New Zealand, 2001). However the volume of ready to drinks consumed still remained considerably lower than beer and wine at the national level (Statistics New Zealand, 2004a).

On December the 1st 1999 the minimum legal purchase age was lowered from 20 to 18 years, beer was introduced for sale in grocery outlets and supermarkets and Sunday trading was introduced (with extended hours for bars on the other days of the weeks) (Huckle, Pledger, & Casswell, 2006). Several studies have documented significant

increases in alcohol-related harms including traffic crashes and injuries among young people following the lowering of the minimum purchase age in New Zealand (Everitt & Jones, 2002; Guria et al., 2003; Huckle et al., 2006; Kypri, Voas, Langley, Stephenson, Begg, Tippets et al., 2006). However the effects of the introduction of beer for sale in grocery outlets and Sunday trading have not yet been evaluated.

Although most of the policy changes that occurred during the 1990's were liberalising there were some restrictions introduced. The earliest of these, in 1989, was a policy linking alcohol taxation to inflation so as to maintain the real price (Zhang & Casswell, 1999); a policy that very few Western countries have in place (Babor et al., 2010). The real price of wine did decrease however during the 1990's (Wagenaar & Langley, 1995; Zhang & Casswell, 1999).

The most restrictive policy change was the introduction of Compulsory Random Breath Testing (CBT) in 1993. At the same time the legal limit for drivers under 20 years was reduced, (Land Transport Safety Authority, 2004) and a substantial enforcement and advertising effort occurred from late 1995 (Guria et al., 2003; Lash, 2005). CBT decreased alcohol-involved traffic crashes by 10% between 1993 and 2000 (Land Transport Safety Authority, 2001).

There have been relatively few studies conducted that have assessed trends in alcohol-related behaviour when a package of policy change such as New Zealand has experienced has occurred. This aim of this study therefore is to use eleven years of comparable survey data (1990-2000) to assess trends in drinking patterns and self-reported alcohol-related problems in the context of a package of alcohol policy change and among various age groups and by gender.

It was hypothesised that: (i) greater increases in young people's consumption and problems would occur (including among young women) as all policy changes were relevant to young people; and (ii) some increases in consumption and problems among older age groups but to a lesser extent as not all policy changes were directly relevant to the older age groups.

Method

Data Collection

The surveys document drinking behaviour in the Auckland region (an urban drinking environment). The surveys began in 1990 and the first policy changes, relating to licensing (beginning in April 1990), were implemented gradually as individual applications went through the licensing process and it was not until 1991 that supermarkets & grocery outlets had any substantial market share of wine sales (Wagenaar & Langley, 1995). The survey data in 1990 may therefore be viewed as a baseline.

Interviews were conducted with respondents aged 14-65 years between November and December in each year from 1990 to 2000. The average sample size for these surveys was 1208 (range 1063-1443). The surveys used the same interview schedule, interviewing techniques and sampling designs which are essential to collecting comparable data. Contact and interviewing were undertaken using an in house Computer Assisted Telephone Interviewing (CATI) system. A high level of quality control, essential for the collection of comparative data, was achieved using this CATI system (for further explanation see Casswell, Huckle, & Pledger, 2002) (included in Appendix 3). The average response rate for the surveys was 67% (range 60%-73%). Response rates did not diminish over time.

Sampling Methods

Around one third of New Zealand's population lives in Auckland (over a million people). It includes a slightly different population mix to the rest of New Zealand and immigration saw increases, in particular, among Asian peoples from 5.1% of the population in 1991 to 13.1% in 2001 (Auckland Regional Council, 2007) over the time of the surveys.

Within the Auckland region random digit dialling was used to select the household. This had the advantage of including households with unpublished phone numbers. A further random selection was then made to determine which individuals in the household would be interviewed. Respondents were independently and randomly selected by the computer based on the number of eligible individuals living in the household.

People without landline telephones were excluded from the sample. Landline telephone coverage in New Zealand was high – 93.5% to 96.0% between 1990 and 2001. Certain groups are under-represented amongst those with access to a landline telephone however this did not affect population level estimates (Wyllie, Black, Zhang, & Casswell, 1994). Cell phone usage was not widespread among the residential population over the time span of the surveys (Pers comm. Telecom).

Since the number of persons randomly selected per household was proportional to household size the survey was self-weighting with respect to household size.

Measures

Typical occasion quantity and frequency of drinking: Drinkers in the past 12 months were asked how often they drank and how much they would drink on a typical occasion at a number of mutually exclusive specified locations, plus any additional locations, they had had a drink. For further description see Casswell et al. (2002). This approach to collecting consumption data in general population interviews has been found to give a very good approximation to the alcohol available for consumption (Casswell et al., 2002). In the 2000 survey two new locations were added which accounted for a very small amount of increase in volume (Habgood et al., 2001).

Respondents reported the quantities of alcohol they consumed in their own terms and these were coded by interviewers using the wide range of containers commonly used to serve and sell alcoholic beverages in New Zealand. Numerous container coding options were available specific to different beverage types (Casswell et al., 2002). Beverage conversions were based on container sizes and standard alcohol content beverages as documented by Statistics New Zealand.

Alcohol-related problems: Drinkers who reported experiencing at least one problem from their drinking in the last 12 months had their responses categorised into two groups corresponding to the distinctions found in previous analysis of risk curves for the same alcohol-related problems (data collected in these same surveys) (for further explanation see Wyllie, Zhang, & Casswell, 2000). This grouped the problems for analysis. The specific measures used are outlined below.

Alcohol-related problems were grouped as

1) Threshold problems, which were those that occurred only once a higher level of alcohol had been consumed: 20+ litres of pure alcohol per annum (as perWyllie et al., 2000) (a threshold effect). These were: 'stayed intoxicated for several days', 'had hands shake a lot in the morning after drinking' and 'taken an alcoholic drink first thing in the morning'.

2) Non-threshold alcohol-related problems were those that showed a more linear relationship (dose-response) with volume of alcohol consumed. These were: 'told to leave a place because of drinking', 'physical fight because of drinking', 'away from work because of drinking', 'involved in a serious argument after drinking', 'got drunk when there was an important reason to stay sober', 'awakened the next day unable to remember things done while drinking', 'felt ashamed of something done while drinking', 'felt the effect of alcohol after drinking the night before' and 'felt the effects of alcohol while at work/study/household duties'.

Ethnicity: Respondents could report more than one ethnicity. These were prioritised for analysis as per Census New Zealand (Statistics New Zealand, 2009b).

Analysis

The point of interest was whether there had been an increasing or decreasing trend in the measures over the 11 year period. Therefore analyses were wanted on the original scale of the data. For typical occasion quantity and annual frequency of drinking the data are highly skewed and regression on the mean tends to reflect the behaviour of the heaviest

drinkers. Often the way to accommodate this is to investigate the trend on the log scale but this has the consequence that the trend is non-linear on the original scale. Therefore quantile regression was used to investigate median typical occasion quantity and median yearly frequency of drinking.

For threshold problems and non-threshold problems, where the responses are binary, the typical method of analysis is to use logistic regression. However, this means that the trend isn't linear on the probability scale but on the logistic scale. For this case, we analysed the data using least squares regression but used bootstrapping to derive the errors. Bootstrapping involves taking multiple samples from the observed data. With a large enough sample, the sample looks like the distribution it is sampled from.

For each response of interest two models were fitted. The first had time as the sole explanatory variable and the second model had time as the explanatory variable with ethnicity as a confounder. Models were run for males and females separately.

Analysis included drinkers aged 14-19, 20-24, 25-39 and 40-65 years. The 14-19 year group represented those under the minimum legal purchase age over the time of the surveys (excluding the year 2000 where 18-19 year olds became legal purchasers; sample numbers prevented this group being assessed specifically), the 20-24 year group were the heaviest drinkers in the population; the 25-39 year olds were homogenous in terms of drinking patterns and volume of consumption and this was true for the 40-65 year olds also.

Results

Results presented in Tables 1 & 2 include both the unadjusted (Model 1) and adjusted models (Model 2) however the text only reports results for the adjusted models. Changes are reported if the significance level is less than 0.05.

Table 1.1: Model specifications

	n	Model 1			Model 2[1]		
		trend	se	p-value	trend	se	p-value
Typical occasion quantity							
Male							
14-19	688	2.48	0.89	0.0055	1.95	0.88	0.0270
20-24	680	0.87	0.87	0.3220	0.78	0.87	0.3728
25-39	1866	0.09	0.30	0.7702	0.12	0.28	0.6733
40-65	2078	0.15	0.17	0.3817	0.26	0.19	0.1727
Female							
14-19	634	1.52	0.56	0.0069	2.17	0.56	0.0001
20-24	613	1.39	0.46	0.0029	1.63	0.32	0.0000
25-39	2158	0.21	0.11	0.0616	0.13	0.10	0.2030
40-65	2241	0.36	0.20	0.0743	0.52	0.18	0.0040
Year frequency of consumption							
Male							
14-19	699	2.00	1.44	0.1652	2.67	1.42	0.0601
20-24	691	-2.86	3.59	0.4265	-0.50	3.32	0.8802
25-39	1887	-2.06	1.64	0.2101	-0.81	1.62	0.6153
40-65	2099	-1.33	2.20	0.5445	2.17	1.75	0.2169
Female							
14-19	645	-0.33	1.55	0.8294	0.64	1.36	0.6362
20-24	619	-0.50	1.81	0.7821	0.33	2.10	0.8737
25-39	2183	2.33	1.23	0.0572	3.00	0.93	0.0012
40-65	2273	1.00	1.74	0.5645	1.21	1.29	0.3482
Probability of non-threshold problems							
Male							
14-19	693	0.0138	0.0051	0.0040	0.0171	0.0053	0.0020
20-24	690	-0.0039	0.0044	0.3880	0.0013	0.0044	0.7780
25-39	1875	-0.0021	0.0036	0.5900	0.0019	0.0035	0.5860
40-65	2080	0.0040	0.0033	0.2200	0.0061	0.0033	0.0680
Female							
14-19	643	0.0067	0.0057	0.2400	0.0134	0.0057	0.0120
20-24	617	0.0043	0.0055	0.4220	0.0084	0.0057	0.1240
25-39	2174	0.0115	0.0034	0.0020	0.0140	0.0034	0.0000
40-65	2259	0.0068	0.0030	0.0240	0.0073	0.0030	0.0200
Probability of threshold problems							
Male							
14-19	693	0.0142	0.0048	0.0020	0.0144	0.0049	0.0000
20-24	689	0.0010	0.0050	0.8060	0.0039	0.0053	0.4640
25-39	1874	0.0024	0.0024	0.2840	0.0026	0.0024	0.2400
40-65	2077	0.0025	0.0011	0.0120	0.0023	0.0011	0.0320
Female							
14-19	642	0.0056	0.0041	0.1800	0.0062	0.0043	0.1680
20-24	617	0.0074	0.0047	0.1400	0.0082	0.0048	0.1140
25-39	2174	0.0021	0.0014	0.1340	0.0019	0.0014	0.1760
40-65	2256	0.0012	0.0007	0.1080	0.0011	0.0007	0.1280

Notes:

1: Adjusted for ethnicity

Drinking measures

Significant increases in typical occasion quantity were found for males aged 14-19 and females aged 14-19, 20-24 and 40-65 years (Table 1.1). The increase was greatest among males and females 14-19 years (Figure 1.1). The only significant change in frequency of drinking was among females 25-39 years who increased (see Table 1.1). (Figure not provided as only one significant change occurred).

Figure 1.1: Typical occasion quantity
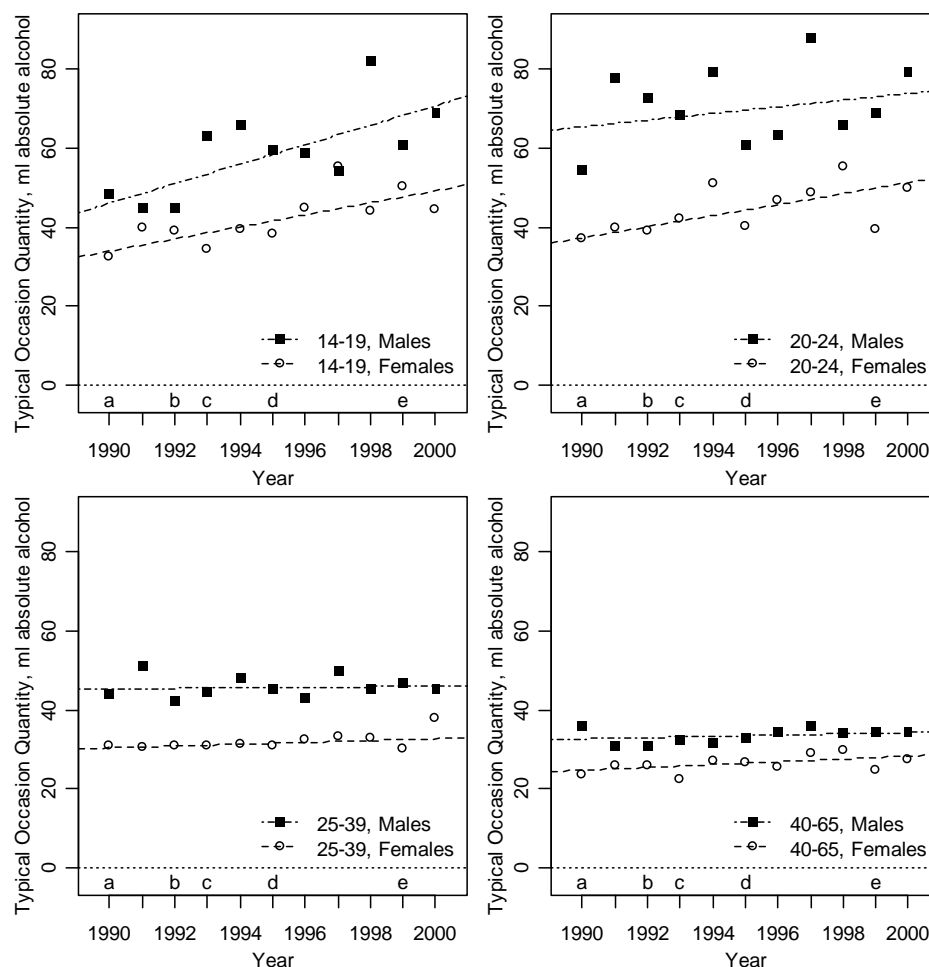
A – Licensing system relaxed & wine introduced into supermarkets and grocery outlets
B – Alcohol advertising permitted in the broadcast media
C – Compulsory Breath Testing introduced and lower legal limits for drivers under 20 years
D – Ready to drinks introduced
E – The minimum purchase age lowered from 20 to 18 years; Sunday trading and beer introduced into supermarkets and grocery outlets

Alcohol-related problems

Significant increases in threshold problems were found for males aged 14-19 and 40-65 years (Table 1.1). The proportions of 14-19 year old males experiencing these problems was observed to be higher in each year compared to the 40-65 year group (Figure 1.2) and the increase over time was more marked in the youngest age group (Table 1.1). No significant changes were found among females of any age (Table 1.1).

The only significant change among males with regard to non-threshold problems was among those 14-19 years, who significantly increased. However among females those 14-19, 25-39 and 40-65 experienced significant increases with the increase more marked among the 14-19 year age group (Table 1.1 & Figure 1.3).

Figure 1.2: Threshold problems
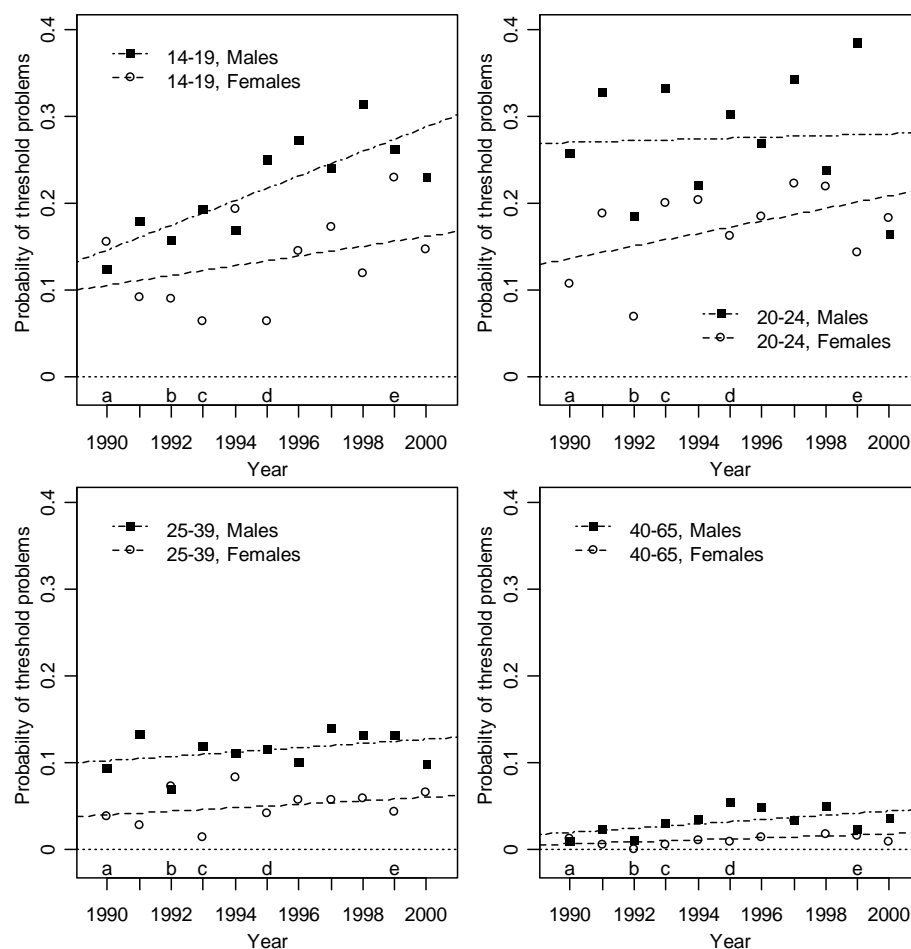
Figure 1.3: Non-threshold problems
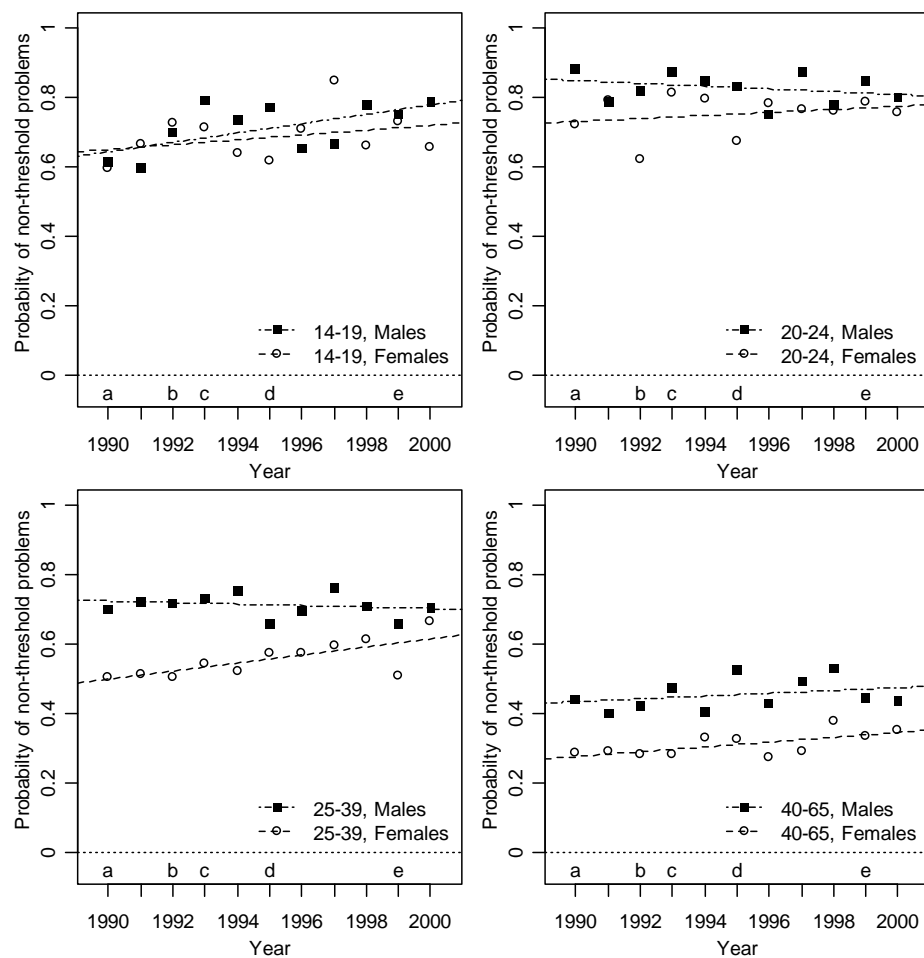
Discussion

A key finding was that the youngest age group, the 14-19 year olds, experienced marked increases in typical occasion quantity and alcohol-related problems including, for males, relatively serious problems (such as had hands shake in the morning or took a drink first thing in the morning). The public health significance of this result lies in the current evidence suggesting that heavier alcohol consumption can impair brain development in the teenage years and contribute to the experience of injury among young people resulting in years of life lost (Connor et al., 2005; Hart, 2007).

Assessing the local context we find that young people were subject to many policy changes. Alcohol outlet density more than doubled in Auckland and outlets such as bars and nightclubs, with extended trading hours, proliferated. By 1995 around a third of 16-17 year olds and three quarters of 18-19 year olds had consumed alcohol at bars in the last 12 months (Habgood et al., 2001). In Auckland, higher outlet density (including on-licensed premises) has previously been associated with higher quantities of alcohol consumed among teenagers (Huckle, Huakau, Sweetsur, Huisman, & Casswell, 2008a).

Other policy changes were directly relevant to young people including the introduction of alcohol marketing in the broadcast media in 1992. A New Zealand longitudinal study has linked this new advertising to increased consumption among young people (Casswell & Zhang, 1998). RTD's (alcopops) were introduced in 1995 and have been found to be associated with heavier drinking among teenagers in New Zealand (Huckle et al., 2008b). The MPA was also lowered in 1999 which meant that some school children could now buy alcohol. Previous New Zealand studies have found increases in harms among younger people following this policy change (Everitt & Jones, 2002; Guria et al., 2003; Huckle et al., 2006; Kypri et al., 2006).

Some of these increases in consumption among young people here reflect trends seen in other countries that have experienced liberalisations (or that have particularly liberal alcohol policies). In regard to average weekly quantities, a survey from the UK found an increase for 16 to 24 year olds between 1992 and 2000 (Goddard, 2006). Increases in young females' consumption occurred in the UK and Denmark during the 1990's (Measham & Ostergaard, 2009). In Europe between 1995 and 1999 proportions of 15 to 16 year olds consuming at least five drinks in a row 3 times or more in the last 30 days increased in countries surveyed, including quite markedly in heavier drinking and liberal

countries such as Denmark and the UK (Hibell, Andersson, Ahlstrom, Balakireva, Bjarnason, Kokkevi et al., 2000). In Australia, where licensing liberalisations have occurred, the proportion of risky drinkers (among drinkers) has significantly increased from the mid-eighties to 2005 (White & Hayman 2006).

In this study we found increases in quantities consumed and problems among young females (14-19 and 20-24 years). Young females were subject to many of the same policy changes as young males and some policy changes were particularly relevant to women including the introduction of RTD's (Huckle et al., 2008b). More young females are now delaying child bearing, working in non-traditional occupations and have more disposable income. Some studies have suggested that women's changing roles in society may have led to gender convergence in drinking (Bloomfield, Gmel, Neve, & Mustonen, 2001; McPherson, Casswell, & Pledger, 2004; Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000). While there is some evidence to support the notion of a gender gap decrease as a driver of drinking this idea has been challenged more recently by Measham and Ostergaard (2009). Measham and Ostergaard (2009) attributed young women's increasing consumption from Denmark and the UK during the 1990's to the expansion in the night time economy (including low cost of alcohol), economic regeneration, national deregulation of licensing and developments in the international alcohol industry.

We also found increases in older women's quantities and problems. The introduction of wine into supermarkets was likely relevant. The introduction of wine into grocery outlets allowed women to feel more comfortable about purchasing wine as it became another grocery item; wine could also be purchased less visibly thereby avoiding the stigma of visiting an 'alcohol outlet' (Wyllie et al., 1993). Sixty percent of wine sales now occur through grocery outlets (McEwan et al., 2010).

For older males we expected some increases in consumption and problems but to a lesser extent than younger people. Apart from males aged 14-19 years no other age groups increased their quantity or frequency of consumption. The oldest male age group (40-65 years) did experience a significant increase in threshold problems, however this was not a large increase comparatively speaking.

While we have included important contextual information on the policy changes that have occurred in the alcohol environment over the time of the study, this study design cannot determine whether these changes were responsible for the increases in consumption. Data are self-reported. Alcohol surveys are known to underestimate consumption. However the surveys reported here have been found to provide good coverage (Casswell & Bhatta, 2001). Some survey years had lower response rates than others but none below 60% (and response rates did not diminish systematically over time).

Conclusion

In the context of a liberalising alcohol policy environment increases in quantities consumed and alcohol-related problems were found among young people and females. It can be argued that these groups are those affected by more policy changes. The youngest age group, those 14-19 years, experienced the most marked increases in these measures including, for males, the experience of more serious problems.

Link

Study One provided evidence that young people experienced marked increases in typical occasion quantity and related problems in the context of liberalising policy change during the 1990s. Study Two built and extended on Study One by focusing on trends in drinking patterns and heavier drinking during a later time period, following 1999, when further liberalisations to the Sale of Liquor Act were made: the minimum purchase age was lowered from 20 to 18 years; Sunday trading was permitted as was beer for sale in supermarkets and grocery outlets. National alcohol surveys had been implemented in 1995, 2000 and 2004, allowing for contextualization of drinking patterns, including heavier drinking, before and after the 1999 Act amendments.

Study Two: Increases in quantities consumed in drinking occasions in New Zealand 1995–2004

Introduction and Aims Significant changes have occurred in the alcohol environment in New Zealand recently and there has been debate about how trends in alcohol consumption may currently look. This paper reports trends in drinking over three general population samples in New Zealand.

Design and Methods Three nationally representative comparable surveys were analysed for trends in: prevalence of drinking, typical occasion quantity, annual frequency and heavier drinking (5+ drinks). Analyses assessed the mean difference of the measures at each year point. Adjustments for multiple comparisons were made. Analysis was undertaken for age and separately for gender

Results Increases in quantities consumed on a typical occasion occurred for the majority of age groups between 1995 and 2000. Women were as likely as men to increase the quantities they consumed. Observing differences between age groups found that young people showed the greatest increases in quantity (including heavier drinking) and frequency of consumption between 1995 and 2000. Drinking levels remained relatively stable between 2000 and 2004 with the exception of increases in abstention for some of the younger groups and increases in quantities consumed and heavier drinking among some of the older men.

Discussion and Conclusions Increases in quantities consumed per occasion have occurred almost across the board between 1995 and 2000 in New Zealand. Women were as likely as men to increase the quantities they consumed. However young people were observed to have the greatest increases in quantity (including heavier drinking) and frequency of consumption between 1995 and 2000. Drinking remained relatively stable between 2000 and 2004.

Introduction

Alcohol consumption and related harm are significant public health issues. Recent estimates of alcohol's contribution to the Global Burden of Disease (GBD) are of a 5.3% contribution to premature mortality and of 4.6% to disability adjusted years of life lost (DALYs). In New Zealand, 2002 estimates using the GBoDI methodology estimated alcohol to contribute 5.7% of DALYs, close to the global average (Connor et al., 2005).

Undertaking alcohol surveys among populations is necessary to document drinking patterns for a number of reasons: (i) the distributions of frequency of drinking and quantity per occasion can determine the levels and dispersion of acute and chronic harm within a population (Babor et al., 2003) (ii) knowledge of drinking patterns are necessary to inform policies and (iii) they are essential for estimating proportions of deaths and hospital episodes caused using the Aetiologic Fraction method (World Health Organization, 2000).

While there is survey data available for many countries there is not a wealth of published survey trend data available for adult populations. This is usually due to one of two factors: (i) that there is lack of consistency across data collection procedures making comparability over time unreliable and (ii) sometimes measures are not comparable over time or are limited (for example where general health surveys include only some alcohol measures). There is however some alcohol survey data available for adults over time in larger established market economies such as in the U.S., the UK and Australia (Australian Institute of Health and Welfare, 2005; Chikritzhs, Catalano, Stockwell, Donath, Ngo, Young et al., 2003; Kerr, Greenfield, Bond, Ye, & Rehm, 2009; Smith & Foxcroft, 2009).

New Zealand is an established market economy in which alcohol use is widespread. Changes in the alcohol environment have occurred more recently and there has been debate about how trends in alcohol consumption may currently look. Changes have included the introduction of spirits based mixed drinks Ready to Drinks (RTD's) or alcopops in 1995, the minimum purchase age was lowered from 20 to 18 years in December 1999, Sunday trading was permitted and the introduction of beer for sale in supermarkets and grocery outlets also occurred. In the restrictive direction a tax was introduced in 2003 to make a type of spirits more expensive (called light spirits 23% abv.).(Easton, 2005; Habgood et al., 2001).

To the best of our knowledge there have been no publications of trends in drinking patterns among the New Zealand population. The aim of this paper therefore is to report trends in key drinking measures for the general population over three nationally representative comparable household surveys in 1995, 2000 and 2004.

Methods

A stratified sample design was used for each survey (1995, 2000 and 2004). Within each stratum random digit dialling was used to select a household (including listed and unlisted phone numbers). The strata, when combined, covered the whole of New Zealand. A list of all people usually resident in the household was made. All potential respondents had an equal probability of being selected. The sample sizes were 4232 in 1995, 5113 in 2000 and 7201 in 2004. An oversample of 12-19 year olds was obtained in 2000 (500) and 2004 (1522). In 1995 and 2000 the surveys were conducted between September and December each year. In 2004 the survey was conducted between September 2003 and October 2004.

As some of the months of data collection in the third survey differed from the previous two effects of seasonality were checked. Two measures, typical occasion quantity and frequency, were analysed for each month in the 2004 survey and no significant effect caused by the month of interview was found (using a 12 month reference period for data collection may have helped to minimise effects of seasonality).

Contact and interviewing were undertaken using an in-house Computer Assisted Telephone Interviewing (CATI) system. Extensively trained interviewers coded respondents' answers directly into the computer. A high level of quality control, essential for the collection of comparative data, was achieved using this CATI system (for further description see Casswell et al., 2002) (included in Appendix 3).

Telephone coverage in New Zealand was high in 1995 (96%), 2000 (97%) and 2004 (93%) compared to international figures however certain sectors of the population are under-represented among telephone surveys (Statistics New Zealand, 2004b; Wyllie et al., 1994).

Since the number of persons randomly selected per household was proportional to household size the survey was self-weighting with respect to household size. In 2000 and 2004 the oversamples of 12-19 year olds were weighted to match the corresponding population estimates obtained from Statistics New Zealand (Statistics New Zealand, 2002).

The three surveys matched the national Census data fairly well for gender, age, socio-economic status (i.e. education, employment and income), ethnicity and geographic region).

Response rates were: 76% in 1995, 73% in 2000 and 59% in 2004.

Measures

Measures were identical in each of the three surveys. Respondents who had consumed alcohol in the past 12 months reported at which of a number of mutually exclusive locations, plus any additional locations, they had had a drink. For each place respondents drank at they were asked how often they drank there and how much they would drink on a typical occasion at that location. Two new places were added to the survey interview schedule in 2000; these were Marae and Special events. Prevalence of alcohol use was collected in a separate question. Further information on the locations asked about in the survey or how the alcohol consumption measures were collected can be found in Casswell et al. (2002).

There were several measures derived from the interview questions; all measures used a 12 month reference period. Prevalence of drinking was those who had consumed alcohol in the last 12 months; typical occasion quantity was the weighted average of all the typical occasion quantities reported by a respondent at each location, taking into account how often the respondent drank at the location. Annual frequency was the sum of all frequencies at all of the locations.

A measure of heavier drinking was also derived and this was 5+ drinks on a typical occasion quantity. This measure was utilised as it allowed some comparison with international data, particularly for young people.

Analysis

GLM (general linear model) and Student-t statistic was used to assess the (least squared) mean difference of the respondent variables at each year point. The Tukey-Kramer method was used for multiple comparison adjustments between years. Variables included for analysis were prevalence of drinking in the last 12 months, annual frequency, typical occasion quantity and heavier drinking (5+ drinks on a typical occasion). Analyses were conducted on the age groups 14-15, 16-17, 18-19, 20-24, 25-29, 30-39, 40-49, and 50-65 years. These age groups were chosen to reflect different developmental stages over the life course. Analysis was done for males and females separately to reflect the different drinking patterns between the genders.

To ensure that the introduction of two new locations to the survey interview in 2000 had not inflated the alcohol consumption estimates in 2000 & 2004 analyses were run including and excluding the new locations. This made no significant difference to results.

Typical occasion quantity and frequency responses were continuous and skewed so these variables were logarithmically transformed to reduce the influence of more extreme values. Significant differences are reported at the 5% level.

Results

Table 2.1 presents descriptive results and p values from statistical testing of the drinking measures over the surveys. Units of measurement are specified in the table. In this analysis a drink is defined as 15mls pure alcohol.

Table 2.1: Drinking measures by age and gender and significance testing over time

	Men					Women				
	1995	2000	2004	1995 vs. 2000 (P)	2000 vs. 2004 (P)	1995	2000	2004	1995 vs. 2000 (P)	2000 vs. 2004 (P)
Drinkers in last 12 months (%)										
14–15	69	72.2	58.2	.	0.0016	55.8	69.2	54.6	0.128	0.0027
16–17	89.1	83.5	81.5	.	0.032	89.9	83.8	74.3	.	0.0044
18–19	89.9	91.7	89.3	.	.	78.5	89.1	87.5	0.0064	.
20–24	94.6	94.4	89.3	.	0.0273	90.2	87	89.4	.	.
25–29	91.6	89.5	87.8	.	.	85.6	82.1	84.9	.	.
30–39	90.7	89.3	89.7	.	.	87.5	85.4	86.3	.	.
40–49	88.8	87.4	87.7	.	.	87.8	81.9	83.5	0.0121	.
50–65	85.7	88.8	85.2	.	.	81.5	81	81.3	.	.
Typical occasion quantity (number of drinks)										
14–15	1.9	2.8	3.0	0.0048	.	1.8	2.2	2.8	.	.
16–17	3.8	5.6	4.7	<0.0001	0.0499	2.7	3.6	4.0	0.0074	.
18–19	5.2	6.1	6.0	.	.	3.1	4.4	4.4	0.0003	.
20–24	5.5	5.4	6.3	.	.	2.9	4.0	3.8	<0.0001	.
25–29	4.2	4.1	5.2	.	.	2.6	3.2	3.1	0.0005	.
30–39	3.1	3.5	3.9	0.0418	0.0189	2.0	2.7	2.5	<0.0001	.
40–49	2.6	3.1	3.4	0.0039	0.046	1.7	2.1	2.1	<0.0001	.
50–65	2.2	2.6	2.8	0.0005	.	1.4	1.8	1.8	<0.0001	.
Annual frequency (count)										
14–15	12.5	26.3	24.8	0.0003	.	14.3	25.8	22.8	0.0022	.
16–17	46.3	64.3	55.1	0.0287	.	26.9	39.3	38.2	0.0181	.
18–19	118.2	126.7	119.2	.	.	68.8	80.4	81.1	.	.
20–24	160.0	136.7	135.5	.	.	74.5	74.0	78.2	.	.
25–29	127.3	106.3	115.0	.	.	56.5	61.8	57.7	.	.
30–39	121.7	121.0	112.1	.	.	52.9	65.0	72.7	0.0255	.
40–49	124.0	110.6	118.3	.	.	61.9	75.0	68.7	.	.
50–65	121.2	118.6	130.3	.	.	59.1	70.8	67.9	.	.
5+ drinks or more on a typical occasion (%)										
14–15	18.8	31.5	32.5	.	.	22.0	31.0	29.0	.	.
16–17	40.4	58.9	49.4	0.0034	.	26.4	37.9	42.9	.	.
18–19	51.1	60.9	58.9	.	.	30.0	40.1	40.0	.	.
20–24	57.0	55.5	63.0	.	.	24.1	36.0	33.1	0.0474	.
25–29	37.6	44.3	50.3	.	.	17.2	26.9	23.5	.	.
30–39	25.7	34.0	36.9	0.0406	.	8.1	15.2	14.7	0.0043	.
40–49	17.3	21.1	29.2	.	0.011	4.7	7.5	8.6	.	.
50–65	10.9	14.6	20.5	.	0.0417	3.0	2.6	3.3	.	.

., non-significant; P, P-value.

Drinkers in the last 12 months

There were no changes in the proportion of drinkers in the last 12 months among males between 1995 and 2000. However increases for females aged 14-15[c] and 18-19 years were found and a decrease was found for females aged 40-49 years over the same time period (Table 2.1).

Decreases in the proportion of drinkers in the last 12 months between 2000 and 2004 were found for females aged 14-15 and 16-17 years. Decreases were found for males of the same ages and males aged 20-24 years. The largest decreases were found for males and females aged 14-15 years (where a decline of around 14% occurred for both groups) (Table 2.1).

Typical occasion quantity

Among males most age groups significantly increased their typical occasion quantity between 1995 and 2000 (Table 2.1). Exceptions were those aged 18-19, 20-24 and 25-29 years (who were already the heaviest consumers in the population). Observing the mean number of drinks between 1995 and 2000 we can see that, relative to other groups, the greatest increases in quantity occurred for ages 14-15, 16-17 and 18-19 years although the increase was not significant for this last group (variability in this measure for the 18-19 year group between each survey was high, likely making it more difficult to detect significance) (Table 2.1).

For females, who were starting from a lower consumption level, almost all ages increased their typical occasion quantity between 1995 and 2000. The only exception was the 14-15

---

[c] P value for 14-15 year females in table 2.1 should be 0.0128 not .128

year old group where no change was found (Table 2.1). Observing the mean number of drinks we see that the greatest increases were among the 18-19 and 20-24 year groups (followed by the 16-17, 30-39 and 25-29 year groups).

Between 2000 and 2004 few changes occurred. Males aged 30-39 and 40-49 increased their typical occasion quantity (while those 16-17 years decreased theirs) (Table 2.1).

Annual frequency

When annual frequency of drinking was analysed between 1995 and 2000 increases were found for males and females aged 14-15 and 16-17 and for females aged 30-39 years (Table 2.1). Most female age groups had observed increases in occasions per year - however only 3 of these age groups reached the level of significance. There were no changes between 2000 and 2004.

Heavier drinkers

Increases in the proportion of heavier drinkers were found for males 16-17 and 30-39 years and for females 20-24 and 30-39 years between 1995 and 2000 (Table 2.1). Observing the proportions in Table 2.1 we also see relatively large increases in the younger age groups between 1995 and 2000 that were not significant.

For older males increases in the proportion of those aged 40-49 and 50-65 years consuming 5+ drinks on a typical occasion significantly increased between 2000 and 2004. There were no changes for females between these years (Table 2.1).

Discussion

In this study three comparable cross-sectional surveys designed to monitor drinking patterns over time were analysed to identify trends in key drinking measures in the New Zealand population.

A finding of this study was that between 1995 and 2000 most age groups significantly increased the quantity they consumed on an occasion. Changes were almost across the board for males and females. Looking broadly at the New Zealand context we found that the environment changed in a mainly liberal direction between 1995 and 2000. Beer was introduced for sale in supermarkets and grocery outlets and Sunday trading was permitted in 1999 (Habgood et al., 2001). Aggressive beer marketing was also occurring at this time. These changes combined with the lowering of the purchase age in 1999 and the millennium in 2000 meant that there was a very liberal atmosphere[d].

In our study females were just as likely to increase the quantities they consumed as males (although their levels of consumption were lower). More females are now delaying child bearing, becoming highly educated and have their own money. Some studies have suggested that women's changing roles in society may have led to gender convergence in drinking (Bloomfield et al., 2001; McPherson et al., 2004; Wilsnack et al., 2000); and gender convergence in drinking has been found previously in New Zealand (McPherson et al., 2004). Also some policy changes may have been of more relevance to females, e.g. the introduction of ready to drinks that became more popular among females (Huckle et al., 2008b).

---

[d] Consumption, for the most part, did not decline in the 2004 survey suggesting that the increases in quantities consumed between 1995 and 2000 were not solely due to the millennium celebrations.

Observing differences between age groups found that between 1995 and 2000 it was the younger age groups that had the greatest increases in quantity and frequency of drinking (and heavier drinking for males aged 16-17 years). Some of these increases reflect trends seen internationally. In regard to average weekly quantities consumed a survey from the UK found an increase for 16-24 year olds between 1992 and 2000 (Goddard, 2006). In Europe between 1995 and 1999 proportions of 15-16 year olds consuming at least five drinks in a row increased in many countries surveyed including the United Kingdom (Hibell et al., 2000). In Australia, the proportion of risky drinkers (among drinkers) has significantly increased from the mid-eighties to 2005 (White & Hayman 2006).

Assessing the data within a local context finds that young people were subject to policy changes over the time of the surveys in New Zealand. The minimum purchase age was lowered in December 1999 from 20 to 18 years (which meant that some school children could now buy alcohol). Also the introduction of spirits based mixed drinks (ready to drinks/alcopops) had occurred in 1995 and these drinks became very popular very quickly among young people (Huckle et al., 2008b).

Between 2000 and 2004 however there was a decrease in typical occasion quantity among males aged 16-17 years (which was just significant). There was also a reduction in the proportion of 14-15 and 16-17 year olds drinking in the last 12 months. For the females aged 14-15 years the proportion of drinkers increased quite dramatically between 1995 and 2000 by around 14% (and dropped again by 2004). We could hypothesise that due to millennium celebrations this group was more likely to try alcohol in 2000; however we have no way to test this. The pattern for the males aged 14-15 and 16-17 and females aged 16-17 however was different here it appears true declines have occurred (and we are

not sure why). However, similar trends have been found in the U.K. and Australia, where the proportion of drinkers among young people has declined (even though risky drinking has increased among the drinkers) (White & Hayman 2006, Measham 2008).

The only other noteworthy changes between 2000 and 2004 were the increases in quantity for males 30-39 and 40-49 years and increases in proportion of heavier drinkers among males aged 40-49 and 50-65 years.

While we have included important contextual information on the changes that have occurred in the alcohol environment in New Zealand over the time of the study; this study design cannot determine if these changes were responsible for the increases in consumption. There are other factors that influence consumption such as economic conditions and price which may have also had a role to play and which this study cannot directly account for.

The response rate in 2004 was lower than anticipated and it is possible that the data are biased. Limited studies looking at the effects of survey non-response on alcohol consumption estimates have tended to find that lighter drinkers and abstainers are missed (Gmel, 2000; Lahaut, Jansen, van de Mheen, & Garretsen, 2002; Lemmens, Tan, & Knibbe, 1988).

Conclusion

Increases in quantities per occasion have occurred almost across the board in New Zealand between 1995 and 2000. Females were as likely as males to increase the quantities they consumed. However young people were observed to have the greatest

increases in quantity (including heavier drinking) and frequency of consumption between 1995 and 2000. Drinking levels remained stable in 2004 for most age and gender groups with the exception of increases in abstention for some of the younger groups and increases in quantity and heavier drinking among some of the older males.

Link

Based on the evidence presented in both Study One and Two young people's consumption, heavier drinking and alcohol-related problems were observed to increase more markedly than other population groups in the context of the liberalising policy change. Study Three built on these previous two studies by considering trends in routinely collected alcohol-related harms data during the 1990's and 2000's. Study Three also allowed for trends in alcohol-related harm to be assessed before and after the lowering of the minimum purchase age in 1999 from 20 to 18 years. This complemented the studies assessing the lowering of the purchase age in New Zealand at that time.

Study Three: Trends in alcohol-related harms and offences in a liberalized alcohol environment

Aim: To assess alcohol-related harms and offences in New Zealand from 1990 to 2003, a period of alcohol policy liberalization, that included the lowering of the purchase age from 20 to 18 years in 1999.

Design, setting and participants: Time trend analyses were carried out on routinely collected data for prosecutions for driving with excess alcohol; alcohol-involved vehicle crashes (all and fatal) and prosecutions for disorder offences. These were carried out separately for those aged 14-15, 16-17, 18-19, 20-24 and 25 years and over.

Measurements: Rates of: prosecutions for driving with excess alcohol (1990–2003); rates of alcohol- involved vehicle crashes (all and fatal) (1990– 2003); and rates of prosecutions for disorder offences (1994–2003).

Findings: Effects of alcohol policy liberalization: positive trends were found in the rates of prosecutions for disorder in the 16-17, 18-19, 20-24 and 25+ age groups, with 18-19 year olds and 16-17 year olds having the largest rates and largest positive trend in rates. For 16-17 year olds, there was a positive trend in the rates of prosecutions for excess breath alcohol. Negative trends in rates were found for alcohol-related crashes (all and fatal) among all age groups. Negative trends for those over 16-17 years were found for prosecutions for driving with excess breath alcohol (this was prior to the lowering of the

purchase age). Effects of lowering the minimum purchase age: the lowering of minimum purchase age coincided with an increase in the trend of alcohol-related crashes for 18-19 year olds; the next largest increase was among the 20-24 year olds (all other age groups also increased but at a much lower rate). A similar result was found for driving with excess alcohol for those aged 18-19 (and those aged 20-24 years). An increase in the rates of prosecutions for disorder offences occurred for the 14-15 year old group following the lowering of the purchase age.

Conclusion: The liberalization of alcohol throughout the 1990s may have influenced younger people more, as reflected in increases in their disorder offences and drink driving. The lowering of the minimum purchase age may have led to an increase in drink driving and alcohol-involved traffic crashes among the 18-19 year olds (those directly affected by the change in purchase age).

Introduction

In New Zealand between 1990 and 1999 there have been a series of liberalising alcohol changes including a reduction in the minimum purchase age from 20 to 18 years in 1999. Internationally, liberalised alcohol environments have been linked with increases in alcohol-related harm and heavier drinking among young people (Andersson et al., 2002; Measham, 1996; Measham & Brain, 2005; Babor et al., 2010) as has the lowering of the purchase (or drinking age) (Wagenaar & Toomey, 2002).

Changes in the alcohol environment from 1990 onwards in New Zealand has seen the number of licences to sell alcohol increase from 6,000 in 1990 to 14,000 in 2002 (Marriott-Lloyd & Webb, 2002). This increase was due to relaxed conditions for obtaining a licence to sell alcohol along with the sale of wine being allowed in supermarkets and grocery outlets.

Advertising of brands of alcohol was allowed in the broadcast media for the first time from February 1992 which led to a fourfold increase in televised alcohol advertising (Casswell, 1995). In the late 90s the alcohol marketing environment in New Zealand followed global trends, for example, marketing in ways that were attractive to young people (Casswell, 2004). New products were developed and an extensive range of ready-to-drinks (RTDs) were introduced onto the New Zealand market in 1995 (RTDs are premixed spirit based drinks that are often flavoured to suit the youth palette)[e].

---

[e] In 1995 approximately 2 million litres of RTDs were available for consumption in New Zealand; in 2000 this amount had increased to 24.5 million litres. This increase was not matched by any other type of beverage during the same time period (Statistics New Zealand, 2000)

On 1st December 1999 the legal purchase age for alcohol was lowered from 20 to 18 years. At this time beer was allowed to be sold in supermarkets and grocery outlets and Sunday trading was permitted.

Some restrictive changes occurred such as the introduction in 1989 of a policy linking alcohol taxation to inflation to maintain the real price of alcohol (Zhang & Casswell, 1999); the introduction of Compulsory Breath Testing in April 1993 and a reduced limit level for drivers under 20 years (150 micrograms of alcohol per litre of breath) (Land Transport Safety Authority, 2004). On a smaller scale and in response to perceptions of increased alcohol-related disorder, some city councils have enacted "alcohol free zones" (liquor bans) (Webb et al., 2004). By 2004 liquor bans are in operation on the weekend in at least four large cities.

There is limited research examining alcohol-related harms and offences over time in New Zealand. Studies to date include ten years of survey data from Auckland, the most populous region in New Zealand, which found a positive trend in alcohol-related self-reported problems for those aged 14-19 years (Casswell & Bhatta, 2001). National survey data (1995 and 2000) showed marked increases in self-reported problems for those aged 16-17 years (Habgood et al., 2001). A study from an Emergency Department in New Zealand found an increase in 18-19 year olds presenting with intoxication following the lowering of the purchase age in 1999 (Everitt & Jones, 2002). A study looking at alcohol-related crashes and prosecutions for drink driving over time found an increase in these measures for 15-17 year olds following the lowering of the minimum purchase age (Guria et al., 2003). This study did not however take into account changing population numbers.

This paper will report trends in rates of all and fatal alcohol-related crashes; driving with excess alcohol and disorder behaviour in New Zealand. It will do so during a period of increasing alcohol liberalisation which included the lowering of the legal purchase age. The analysis reported here is important as, to our knowledge, there is no published time trend analysis completed on these data that: (i) takes into account changing population numbers and (ii) assesses the effects of a liberalised alcohol policy environment from 1990 onwards in New Zealand.

Methods

Routinely collected data

Prosecuted cases for driving with excess alcohol were obtained from the Research and Evaluation Unit of the Ministry of Justice. Data excluded cases in which the offender was prosecuted for driving under the influence of drugs. These data are collected via a national computer system that records all prosecutions in court. If a prosecution was initiated by Police, it is in the data. If there is proof that a person has been driving while over the legal limit, they will be prosecuted. The legal breath alcohol limit for driving in New Zealand is 400mcg/l for people aged 20 years and over and in 1993 a limit of 150mcg/l was introduced for people under 20 years. In May 1999 drivers were required to produce their driver licence at the request of an officer. This meant that drivers under 20 years old, who had a lower legal limit, were more effectively identified and the testing equipment was more likely to be correctly set to the level of their legal limit. In New Zealand you must be 15 years of age to obtain a learners licence where you cannot drive unless you have a person who has had their full licence for at least 2 years in the car with you.

Alcohol involved vehicle crashes (all and fatal) where the driver had been drinking were obtained from The Land Transport Safety Authority of New Zealand. In the case of non-fatal crashes a breath test is obtained to determine the involvement of alcohol in the crash. In some cases drivers who are likely to be over the legal limits leave the scene of the crash and cannot be breath tested; they are not included in this data. There is therefore likely to be some under estimation of non-fatal alcohol involved crashes. In the case of fatal crashes a blood test is obtained at autopsy.

Apprehensions resulting in prosecutions for disorder offences came from The New Zealand Police; these data represent offences and it is possible that one or more offences may have been committed by one person or multiple persons may have been apprehended for one offence. Disorder behaviours are an indicator of alcohol-related offending. While not all of the disorder offences will be alcohol-related, in New Zealand people committing disorder offences may be more likely to have been drinking when the offence was committed (Lash, 2002). Police do not have a formal definition for 'disorder'; rather it is a label for a group of offences, each with their own definition appearing in criminal legislation (pers comm; New Zealand Police 18.05.05). Disorder offences broadly include obstructing/hindering/resisting, inciting/encouraging offences, behaviour offences, language offences, miscellaneous disorder offences and disorderly assembly offences. Further sub categorisation of these broad groups can be found at http://www.stats.govt.nz/products-and-services/table-builder/crime-statistics/default.htm. These categories of disorder have remained stable over time. Data are collected using a national computer system; if a prosecution was initiated by Police then it will be in the data. Police use the same computer systems across the entire country to manage individual cases.

Data were obtained for each year from 1990 to 2003 (year ended 31ˢᵗ December) except for disorder offences for which data were only available from 1994 onwards due to a change in data collection practice which meant data prior to 1994 was not comparable.

Statistics New Zealand data

National resident population estimates from 1991-2003 for years ended 31 December were obtained. These estimates are based on Census counts adjusted by births, deaths and migration (Statistics New Zealand, 2004c). National resident population estimates for 1990 were not available from Statistics New Zealand so the population data for this year was based on the numbers surviving to 1991 plus an estimate of attrition between 1990 and 1991. The latter was estimated using the attrition between 1991 and 1992. There are two interesting phenomena in the table, 3.1 1)the large increase in the oldest age group and 2) the decrease in population for the 16-17, 18-19 and 20-24 year olds in the mid 1990s. The latter effect means that analysing counts, without taking into effect population numbers, may be misleading.

Table 3.1: National resident population estimates from Statistics New Zealand

Age group	Year		
	1991	1997	2003
14–15	105 590	107 460	121 390
16–17	113 560	109 920	117 290
18–19	120 810	107 010	117 690
20–24	288 460	273 850	278 770
25+	2 112 280	2 368 310	2 551 870

Analysis

Routinely collected data

The model used for this data tried 1) to capture any linear trends to match the increasingly liberalised environment that occurred between 1990 and 2003 and 2) to capture any change in trend that matched the lowering of the purchase age in December 1999. This type of model is commonly called a broken stick model. There were four responses of interest: 1) the number of prosecutions with excess alcohol, 2) the number of prosecutions for disorder offences, 3) the number of all alcohol involved vehicle crashes and 4) the number of fatal alcohol involved vehicle crashes. These count data were analysed using Poisson regression with an identity link function and the model allowed for over dispersion. The explanatory variables were adjusted by a factor equal to the yearly population divided by 100,000 so that the effective response was number of events per 100,000 of the population i.e. the model, as represented to computer software, is $count_i \sim Poisson(\lambda_i)$ and $\lambda_i = \beta_0 \times p_i + \beta_1 \times (year_i - 1999.5) \times p_i + \beta_2 \times (year_i - 1999.5) \times period_i \times p_i$ where $p_i = population_i/100,000$, $year_i$ being an explanatory factor and $period_i$ a binary variable with value 1 after 1999, otherwise 0. However, the interpretation of interest, the population rate per 100, 000, is $\lambda_i/p_i = \beta_0 + \beta_1 \times (year_i - 1999.5) + \beta_2 \times (year_i - 1999.5) \times period_i$ where, in this representation, β_0 represents the break-even population rate per 100,000, β_1 is the trend or yearly increase/decrease in the population rate per 100,000 prior to the break-even point and β_2 is the change in trend after the break-even point.

The data were analysed using SAS 8.02 (SAS Institute, 2001) and graphs drawn in R 1.8.1 (CRAN, 2005).

Significance is declared for any test with a p-value of less than 0.05.

Results

Table 3.2 lists the parameter estimates and their p-values for the four responses and for each age group as well as the over dispersion parameter. For the age group 14-15 the total number of fatal crashes was 7 so this group was not analysed for this response.

Table 3.2: Model coefficients

	Age group (years)	Break-even value			Slope prior to break-even point			Slope change after break-even point			Scale
		Estimate	SE	P-value	Estimate	SE	P-value	Estimate	SE	P-value	
Disorder	14–15	755	21	<0.0001	12	6	0.0581	50	16	0.0013	1.2
	16–17	2092	50	<0.0001	84	15	<0.0001	7	37	0.8481	1.8
	18–19	2912	74	<0.0001	144	22	<0.0001	−96	54	0.0767	2.3
	20–24	1879	33	<0.0001	35	10	0.0005	33	25	0.1797	1.9
	25+	340	8	<0.0001	15	2	<0.0001	7	6	0.2392	3.3
Excess breath alcohol	14–15	20	3	<0.0001	0	1	0.9250	3	2	0.1140	1.2
	16–17	813	39	<0.0001	23	7	0.0006	38	27	0.1611	2.7
	18–19	1970	66	<0.0001	−3	12	0.8187	112	46	0.0143	2.9
	20–24	1222	56	<0.0001	−110	11	<0.0001	105	37	0.0047	4.5
	25+	591	24	<0.0001	−10	5	0.0382	−17	16	0.2702	9.0
All crashes	14–15	7.6	1.8	<0.0001	−1.2	0.4	0.0021	2.7	1.3	0.0426	1.1
	16–17	64.0	4.3	<0.0001	−7.4	0.9	<0.0001	8.8	2.9	0.0024	1.0
	18–19	102.2	6.9	<0.0001	−20.0	1.5	<0.0001	30.7	4.7	<0.0001	1.2
	20–24	86.2	7.2	<0.0001	−19.3	1.5	<0.0001	24.2	4.9	<0.0001	2.0
	25+	28.8	1.4	<0.0001	−4.4	0.3	<0.0001	4.6	0.9	<0.0001	2.1
Fatal crashes	14–15										
	16–17	2.4	1.2	0.0408	−0.5	0.2	0.0362	1.4	1.0	0.1494	1.3
	18–19	2.8	0.8	0.0008	−1.2	0.2	<0.0001	2.0	0.6	0.0013	0.8
	20–24	3.7	0.6	<0.0001	−1.6	0.1	<0.0001	1.9	0.4	<0.0001	0.8
	25+	1.8	0.2	<0.0001	−0.3	0.0	<0.0001	0.3	0.1	0.0053	1.1

Disorder offences

All age groups showed a positive trend in the rates of disorder offences before 1999 (the lowering of the purchase age and the break even point), except 14-15 year olds. Observation of the estimates show that the largest rates and the largest trends were amongst those aged 18-19 years; followed by the 16-17 year olds. Following 1999 the 14-15 year olds showed a significant increase in trend and the 18-19 year olds showed a non-significant decrease (Table 3.2; Figure 3.1).

Figure 3.1: Trends in rates of prosecutions for disorder offences
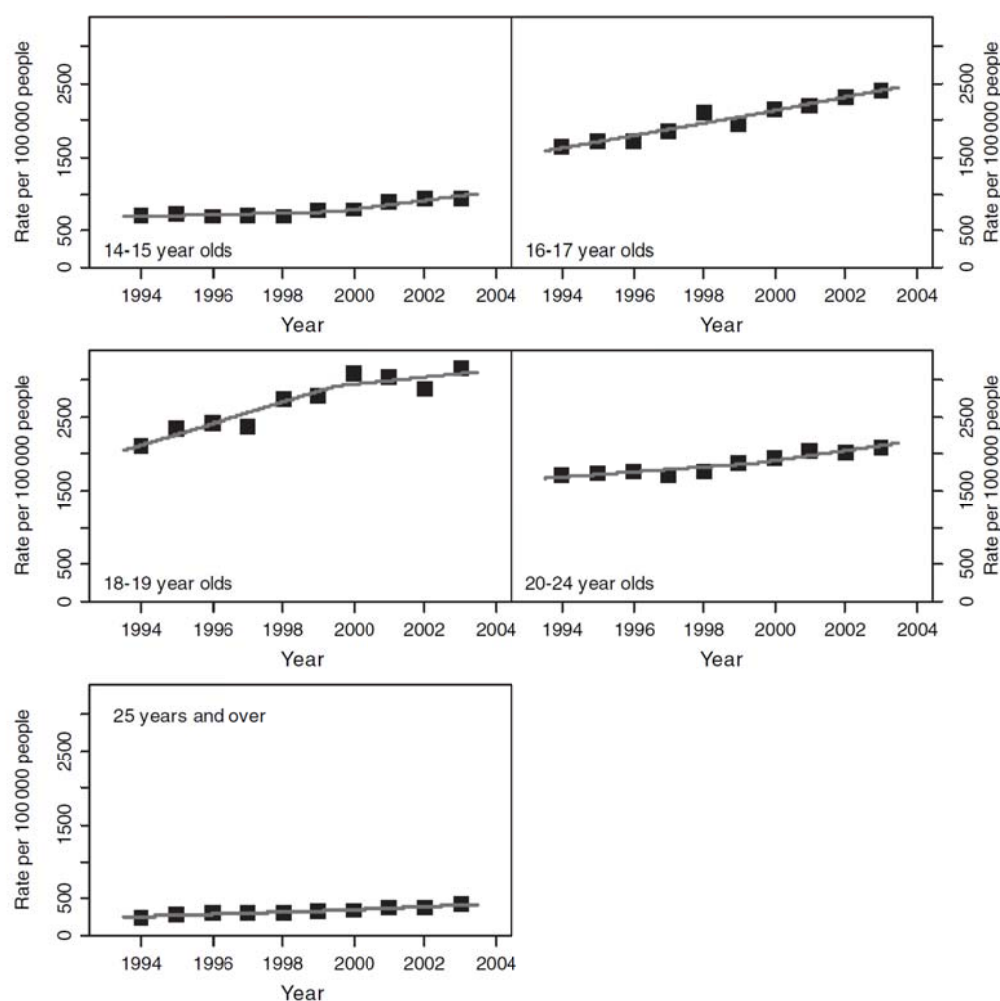
Prosecutions for driving with excess alcohol

The 16-17 year age group showed a positive trend in the rate of prosecutions which remained unchanged after 1999. The 18-19 year age group showed a flat trend in the rate of prosecutions until 1999 at which point there was an increase in the trend. The 20-24 year age group had a negative trend in the rate of prosecutions prior to 1999 but then the trend had a significant increase after 1999. The 25 plus age group had a negative trend in their rate of prosecutions that remained unchanged following 1999 (Table 3.2; Figure 3.2).

Figure 3.2: Trends in rates of prosecutions for excess breath alcohol
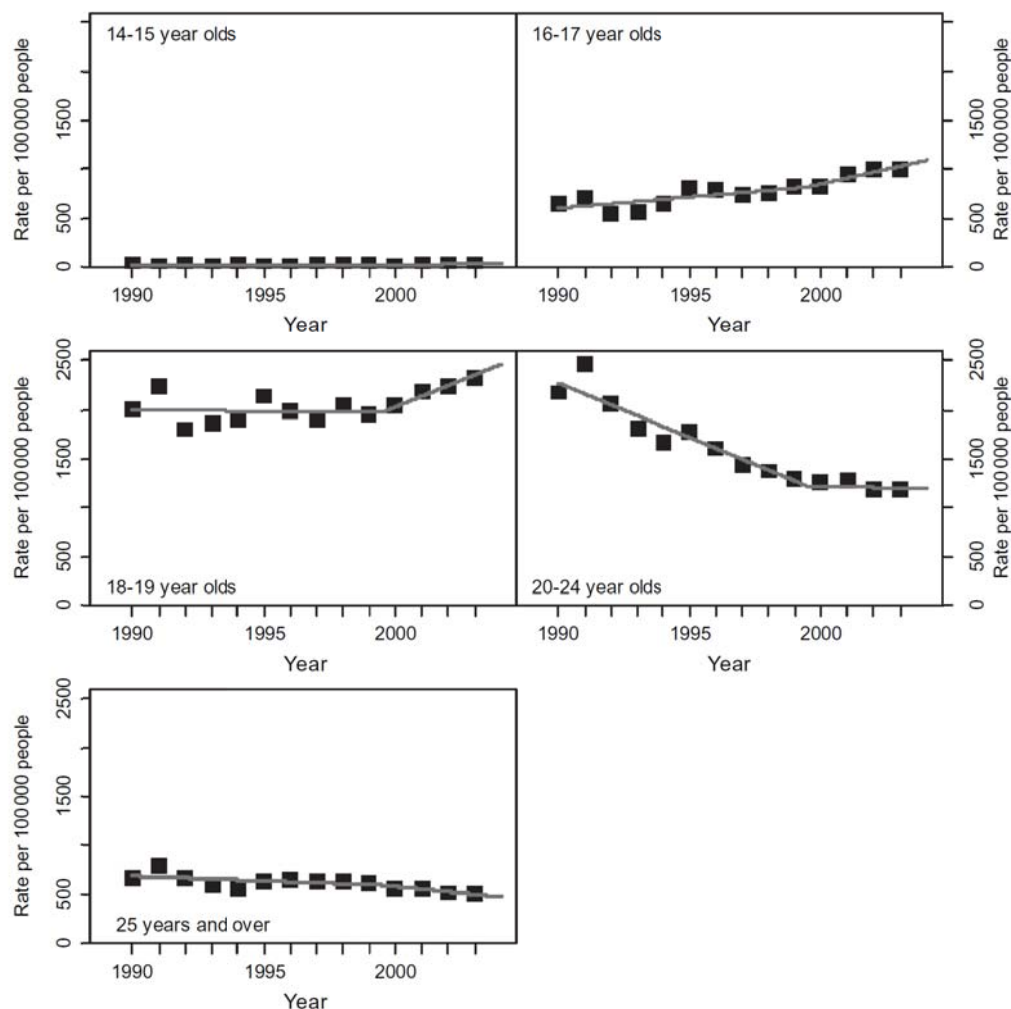
For prosecutions for driving with excess alcohol there was a large year to year variation in the numbers of people prosecuted where the age was unknown, the extremes being 13 (0.1% of total) in 1998 and 608 (2.9% of the total) in 2001 with a median of 70. To check whether the unknowns had an effect on the parameter estimates, the unknowns were split amongst the age groups according 1) to the proportion of prosecutions that age group had and 2) how large the population of that age group was. In both cases these changes had very little effect on the significant parameters, except for the break-even value for the second case for the 14-15 year age group which changed by 21%.

The scale factor measures over dispersion which can be 1) larger variation than expected or 2) excess variation due to a poor fitting model. In all cases excluding the points prior to 1995 reduces the scale factor greatly e.g. from 9.1 for the 25 plus age group to 3.1. From observation the points prior to 1995 seem to follow the general pattern of the line therefore we do not believe these large scale factors indicate a problem with the model.

All crashes involving alcohol

All age groups had negative trends in rates of alcohol involved vehicle crashes prior to 1999 and all had an increase in trends afterwards. Observing the estimates shows that the largest increases in trends were found among the 18-19 year old group; followed by the 20-24 year old group. The increases in trend for these groups were more than 2.5 times higher than the 16-17 year olds (the next highest increase).

Fatal vehicle crashes involving alcohol

All age groups showed a negative trend before 1999. After 1999 all groups showed an increase in trends (although the increase for the 16-17 year olds was non-significant). Observing the estimates shows that the largest change in trends were in the 18-19 and 20-24 year old age group.

The increases were 4.5 times higher than in the 25+ age group who had the other significant increase in trend (Table 3.2; Figure 3.3).

Figure 3.3: Trends in rates of all and fatal crashes
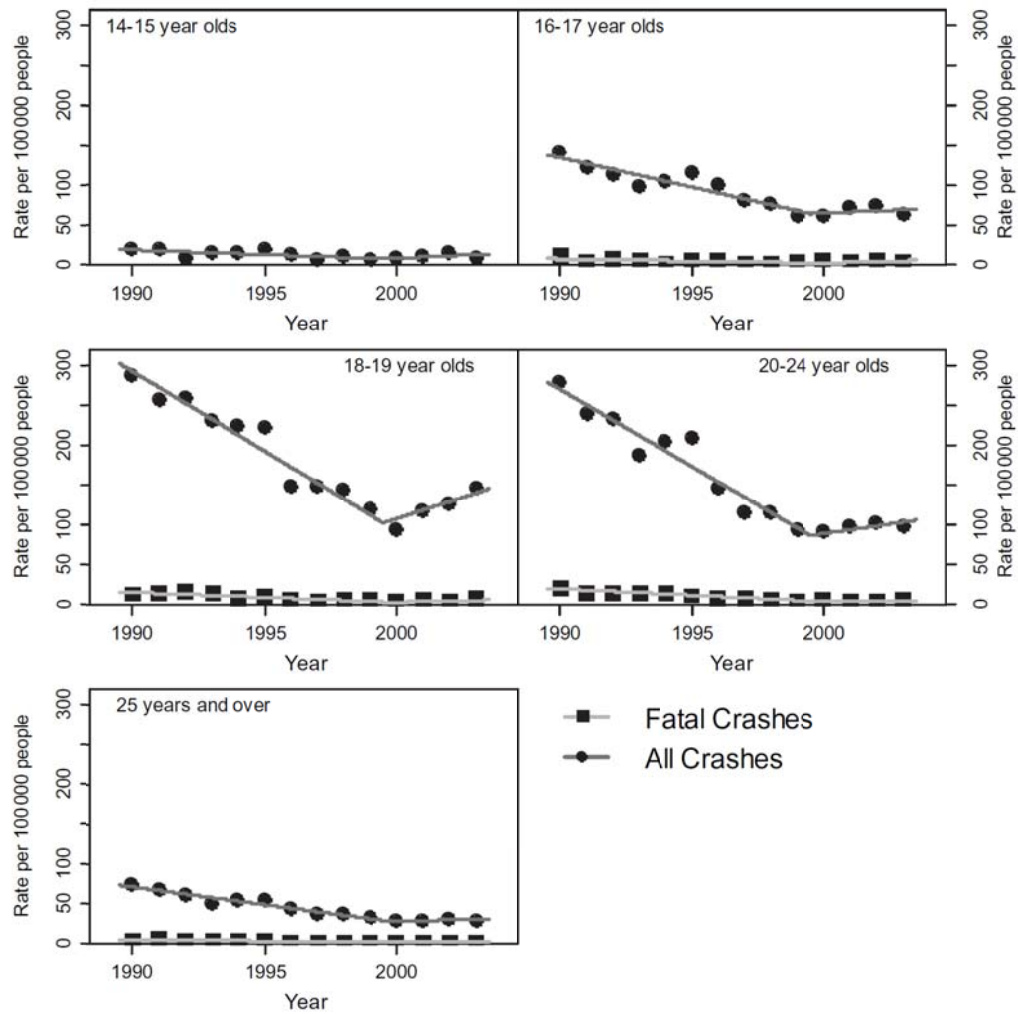
Discussion

This study cannot directly assess the effects of other external factors that are associated with drinking behaviour which may influence harm and offending, such as the real price of alcohol or economic effects in New Zealand during the period evaluated.

Disorder offence data used in this analysis may be influenced by policing effort. This may have been more variable following the lowering of the legal purchase age in 1999 due to increased publicity about alcohol-related harm for young people at this time.

Assessing effects of alcohol policy liberalisation

Positive trends were found in the rates of prosecutions for disorder in the 16-17, 18-19, 20-24 and 25+ age groups. Observation of the estimates shows that the 16-17 and 18-19 year olds had the largest rates and largest positive trend in rates. For 16-17 year olds, there was a positive trend in the rates of prosecutions for excess breath alcohol.

These results are in keeping with survey results from a series of surveys from 1990-2000 showing 1) positive trends in self-reported alcohol consumption among 14-65 year olds, but especially so among those 14-19 years and 2) increases in alcohol-related self-reported problems for those aged 14-19 years (Casswell & Bhatta, 2001).

In this analysis those aged 16-17 years were the only group to show increasing trends over time in both offence indicators: prosecutions for driving with excess alcohol and disorder offences. This is likely due to marked increases in alcohol consumption for this age group. National New Zealand alcohol surveys have shown marked increases in consumption and self-reported

problems particularly for the 16-17 year old age group compared with other age groups in the population between 1995 and 2000 (Habgood et al., 2001).

Prosecutions for driving with excess alcohol (excluding 16-17 year olds) and alcohol involved crash data (all and fatal) generally showed decreasing trends over this time (this was prior to the lowering of the purchase age in 1999). However, this is likely to be linked to the introduction of compulsory breath testing (CBT) in New Zealand in April 1993. At the same time the legal alcohol level for driving for those under 20 years was substantially lowered from 400 micrograms of alcohol per litre of breath to 150 micrograms of alcohol per litre of breath while the level for those over 20 remained at 400mcg (Land Transport Safety Authority, 2004). Alongside the compulsory breath testing operations, advertising campaigns to deter people from drinking and driving occurred, as did substantial and continual enforcement of compulsory breath testing legislation by Police. The effect of CBT on lowering drink driving offences and related crashes has previously been found in New Zealand (Guria et al., 2003). There was also a Police safety campaign (SRSP) introduced in 1995/1996 that is likely to have contributed to the reduction in alcohol-related crashes (Guria et al., 2003). This suggests that the introduction of compulsory breath testing (and SRSP) countered the effects of the alcohol policy liberalisations on traffic statistics for most groups at this time.

Assessing the lowering of the minimum purchase age

Specific changes were found following 1999 and the lowering of the minimum purchase age from 20 years to 18 years. The increases found in the drink-driving statistics do suggest an impact on those aged 18-19 years, those directly affected by the law change. This age group showed a large increase in the trend for driving with excess alcohol and all alcohol-related crashes. An increase was also found for fatal alcohol related crashes.

For prosecutions for driving with excess alcohol, a change in Police practice occurred in 1999. Drivers were required to produce their driver licence at the request of an officer. This meant that drivers under 20 years old, who had a lower legal limit, were easier to identify and the equipment was more likely to be set to the correct level for testing their legal limit. This may have resulted in more under 20's being identified as over their legal limit than were so previously. While this change in Police practice cannot be separated from the changes in the alcohol environment in 1999, it is likely that the finding of increases in 18-19 year olds prosecuted for drink driving is, for the most part, due to the lowering of the purchase age. This is supported by the corresponding increases in alcohol-related crashes after 1999 found in this analysis for this age group. It is also supported by other findings from New Zealand; a previous analysis of admissions to the emergency room of one metropolitan hospital which showed a significant increase in presentations for intoxication among 18 -19 year olds after the law change on minimum purchase age (Everitt & Jones, 2002).

The lowering of the purchase age also occurred in the context of "the millennium", at the same time beer was introduced into supermarkets and grocery outlets and there is no way to way to separate these effects. There is some evidence to suggest that the introduction of beer into grocery stores (Valli, 1998) and extended days of trading increase consumption (Norstrom & Skog, 2005) so these factors could have potentially contributed to some of the increase.

Increases were also found for 20-24 year olds in prosecutions for driving with excess alcohol and all and fatal crashes after 1999. It may be that the Sunday trading and beer in supermarkets/grocery outlets had a greater effect on this age group, or that the lowering of the purchase age or "millennium" celebrations created a generally more liberal alcohol environment which affected the consumption of this age group. The drinking-driving related statistics also suggest some impact, albeit less on the oldest age group.

After the change in the minimum purchase age the disorder trends show that the youngest age group, 14 – 15 years experienced a significant increase in trend. This result probably reflects an increase in access to alcohol due to the law change (some in this age group may look old enough to buy alcohol, or get from older friends who were now able to buy). New Zealand alcohol survey data from 2000 indicated an increase in 14-15 year old males who drank in some licensed premises including sports clubs from 1995. The same survey data has shown that 71% of those aged 14-15 years were given alcohol in the last 12 months (46% had been given alcohol by friends). Furthermore, an increase in amount consumed on a typical drinking occasion was found for males aged 14-15 years between 1995 and 2000 (Habgood et al., 2001).

For the 18-19 year olds a non-significant decrease in trend in disorder behaviour was found after 1999. This may reflect their new ability to drink in on-licensed premises where there is less risk of being arrested for disorderly behaviour compared to drinking in a public place.

Conclusion

The liberalisation of alcohol through the 1990s may have influenced younger people more as reflected in increases in their disorder offences and drink driving. The lowering of the minimum purchase age may have led to an increase in drink driving and alcohol-involved crashes among the 18-19 year olds (those directly affected by the change in purchase age).

Link

When sales of alcohol in developed countries plateau, the alcohol industry has worked to establish new markets among young people and women. One of the ways in which this has been done, both internationally and in New Zealand, has been the introduction of sweet tasting spirit-based ready to drinks (McEwan et al 2010).

In 1995 ready to drinks were introduced and became a public health concern as total population consumption estimates suggested these drinks were the fastest growing beverage type in New Zealand. A perception existed that ready to drinks were popular among young people and that their sweet and easy to drink nature was associated with heavier drinking patterns among young people.

Study Four: Ready to drinks are associated with heavier drinking patterns among young females

Abstract

Aim: To report patterns of use of ready to drinks (RTDs) and to assess if RTD consumers have heavier drinking patterns.

Method: Data from a general population sample of 7201 respondents aged 14-65 years, in New Zealand in 2004, were modelled. RTDs were introduced in 1995.

Results: Nineteen per cent of respondents consumed RTDs. Respondents aged 14-17 and 18-24 years and females were the largest consumers of RTDs. Compared to beer, wine or spirits, being an RTD consumer predicted (1) higher typical occasion quantities for respondents aged 14-17, 18-24 and 25+ years and (2) heavier drinking for those aged 14-17 and 18-24 years respectively. When amounts of beverages consumed were modelled, quantity of RTDs predicted higher typical occasion quantities among females of all ages (but a stronger relationship was observed for females 14-17 years). Among males beer was more predictive. Similar results were found for the heavier drinking measure. For 14-17-year-old females, RTDs consumption predicted higher annual frequency, but for the other females and males the amount of wine or beer consumed predicted higher frequency.

Conclusion: RTDs were most popular among young people aged 14-17 years, and females. RTDs predicted higher typical occasion alcohol consumption and heavier drinking better than any other beverage for females aged 14-17 years. For the other age and gender groups, other beverages predicted higher quantity and frequency consumption.

Introduction

Ready to drink (RTDs) refers to a range of pre-mixed spirits-based alcoholic beverages, often sweet and pleasant tasting, commonly referred to internationally as alcopops. They appeal to young and entry level drinkers and females (Brain, 2000; Jackson, Hastings, Wheeler, Eadie, & MacKintosh, 2000; Mosher & Johnsson, 2005).

In New Zealand many RTDs have an alcohol content of 5% to 8%. A four pack usually costs around New Zealand $11 (U.S $6.60) around the same price as a six pack of local beer with a usual alcohol content of 4-5%.

RTDs were introduced in New Zealand in 1995. By 2005 there were around 40 million litres of RTDs available for consumption, an increase unmatched by any other beverage during the same time period (Statistics New Zealand, 2006). Beer however remained the most popular alcoholic beverage with 315 million litres available in 2005 (Statistics New Zealand, 2006).

In Australia, New Zealand's closest neighbour, alcopops are also popular. One survey of 12-21 year olds found that 75 per cent reported drinking an alcopop at least once a week. Alcopops were most popular among the 12 to14 year-old age group and girls (ADGP, 2003).

There are a number of reasons for concern about these drinks, one being that they encourage heavier drinking. A survey of young people from the UK found that designer drinks were associated with the highest quantities of alcohol consumed on an occasion (Hughes, MacKintosh, Hastings, Wheeler, Watson, & Inglis, 1997). Similarly, a study among Scottish school children reported that those aged 12-14 years, who consumed designer drinks, consumed higher quantities of alcohol than those drinking traditional beverages. Many of these studies

however had not controlled for volume or drinking pattern which meant there was some uncertainty about whether alcopop consumers had heavier drinking patterns more generally (i.e. drink more of every beverage type) or if there was a special association between heavier drinking and alcopops.

The impact of RTDs on frequency of drinking has also been investigated. Analysis of survey data from Wales found that alcopops appeared to contribute to increases in weekly drinking for those aged 11-12, 13-14 and 15-16 years between 1994 and 1996 (Roberts et al., 1999). A study of Scottish school children found that drinkers of designer drinks aged 14 years drank more frequently than those who drank traditional beverages (McKeganey, Forsyth, Barnard, & Hay, 1996).

Some studies have found no specific risk associated with the consumption of alcopops. Brain (2000) in North-West England found that alcopop drinkers between the ages of 13-16 years consumed alcohol less frequently and engaged in less risk behaviours than those who did not drink alcopops. In a cross-sectional school-based study from Switzerland, (Wicki, Gmel, Kuntsche, Rehm, & Grichting, 2006) investigated frequency of drinking, onset of alcohol consumption, negative consequences, amount consumed, and frequency of risky single occasion drinking (while controlling for volume of consumption). This study found that although alcopops predicted heavier consumption there were similar associations for alcopops as for other beverages (Wicki et al., 2006). Alcopops did not predict heavier drinking better than any other beverage.

This analysis utilised a similar approach to that of Wicki et al. (2006). The main aims of the study were to: (i) report the patterns of use of RTDs and (ii) assess if RTD consumers have heavier

drinking patterns by age and gender groups. To the best of our knowledge there has been no published study on RTD use in New Zealand.

Methods

Interviews were conducted between September 2003 and October 2004 with 7201 respondents aged 14-65 years. The survey included oversampling 1522 14-19 year olds. The interviews were collected by an in-house computer assisted telephone interview (CATI) system. Highly trained interviewers coded respondents' answers directly into the computer. Interviews were carried out at a central location ensuring a high level of quality control (for further description see Casswell et al., 2002).

A stratified sample design was used. Within each stratum random digit dialling was used to select a household (including listed and unlisted phone numbers). A list was made of persons aged 14-65 years who were usually resident in the household and interviewees were selected independently and at random. All potential respondents had equal probability of being sampled.

Telephone ownership in New Zealand is high; 93% in 2004, (Statistics New Zealand, 2004b) however certain sectors of the population are under-represented among those with access to a landline (Krishnan et al., 2002; Wyllie et al., 1994).

Since the number of persons randomly selected per household was proportional to household size, the survey was self-weighting for household size.

The over-sample of 14-19 year olds was weighted to match population data. The surveys did however match the national census data (2001) relatively well for key demographics. Pacific people were slightly under-represented.

The response rate of 59% is comparable with international telephone surveys of health behaviours (Biener, Garrett, Gilpin, Roman, & Currivan, 2004; Redmond, Horne, Pelletier, Porter, Johnson, St. Martin et al., 2004). A conservative calculation was used: number of eligible responding / (the number of eligible responding) + (number of eligible non-responding) + (estimated numbers of eligible from the unknowns) x 100.

Measures

Respondents who had consumed alcohol in the past 12 months were asked to report the locations of drinking (for further information see Casswell et al., 2002).

For each place at which respondents drank they were asked how often they drank there and how much of every possible beverage they would drink on a typical drinking occasion. This approach to collecting consumption data in general population interviews has been found to account for almost all taxable alcohol available in New Zealand (Casswell et al., 2002). The RTD brand usually consumed was collected as part of the alcohol consumption measures and was utilised to determine the differing alcohol content of the RTDs.

Variables derived for analysis were: quantity of alcohol consumed on a typical drinking occasion (mls pure alcohol); and proportions reporting heavier drinking (four or more drinks on a typical occasion for 14-17 year olds and six or more drinks for 18-24 and 25+ years). In this analysis a drink was defined as 15mls of pure alcohol (a definition obtained by asking people in the New Zealand population about the size of their typical drinks & containers).Annual frequency of

consumption was the number of times that a respondent had consumed alcohol in the last 12 months.

Respondents who consumed any RTDs were categorised as an RTD drinker. The same was done for beer, wine and spirit drinkers. Many respondents drank more than one beverage and therefore had multiple memberships to beverage groups. Drinkers were categorised into binary variables of: (i) consumers or (ii) non-consumers.

The amount of each beverage consumed annually was also derived.

Analysis

Drinkers of each beverage were compared to non-consumers of that beverage for: typical occasion quantity, heavier drinking and annual frequency of drinking. These were called Model 1. The annual volume of all beverages was controlled for.

In the second model, the annual amount of RTDs, beer, wine and spirits (mls of pure alcohol) consumed was used to predict typical occasion quantity, heavier drinking and annual frequency. These were called Model 2. The annual volume (excluding the beverage of interest) was controlled for.

Controlling for volume separated the effect of being an RTD drinker from all other drinking, to assess if RTDs were independently related with alcohol consumption.

As more females than males consumed RTDs we ran models by gender. We had a wider sample age range of 14-65 years compared to Wicki et al. (2006) (13-16 years) therefore we could analyse the effect of being younger or older; age groups analysed were 14-17, 18-24 and 25+ years.

Logistic regression and factorial ANOVA (analysis of variance) or ANCOVA (analysis of covariance) were used. When continuous variables were skewed such as typical occasion quantity, annual frequency and volume were logged before statistical testing was undertaken. Estimates in Tables 1 and 2 are on the log scale (excluding heavier drinking which are odds ratios). Significance is declared if the p value is < 0.05. All analysis was conducted in SAS.

Results

In 2004 19% of respondents consumed RTDs. Males and females aged 14-15, 16-17, 18-19 and 20-24 years were the most common consumers. Females were significantly more likely to consume RTDs than males (Figure 4.1).

Figure 4.1: Percentage of drinkers consuming RTD's by age and gender
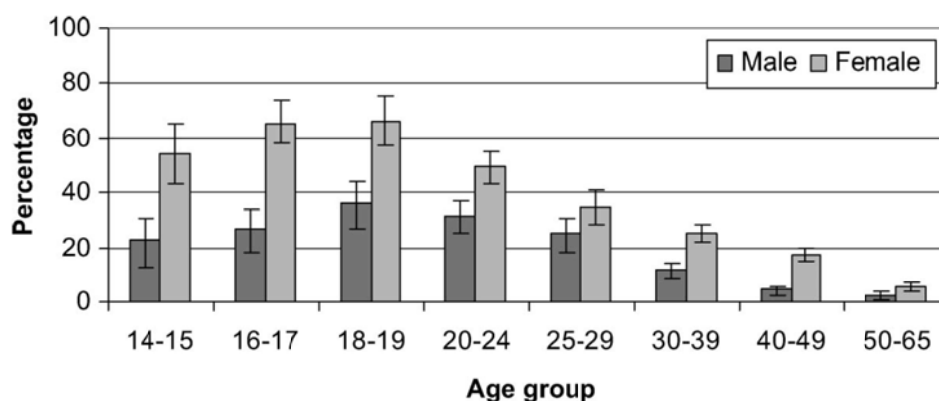
Figure 4.2 shows the proportion that RTDs, beer, wine and spirits make up of total annual volume for RTDs drinkers only. The 14-17 year old group, both males and females, consumed the highest proportion of their volume as RTDs, 60% and 70% respectively.

Figure 4.2: Volume of beverages consumed by RTD drinkers by age and gender
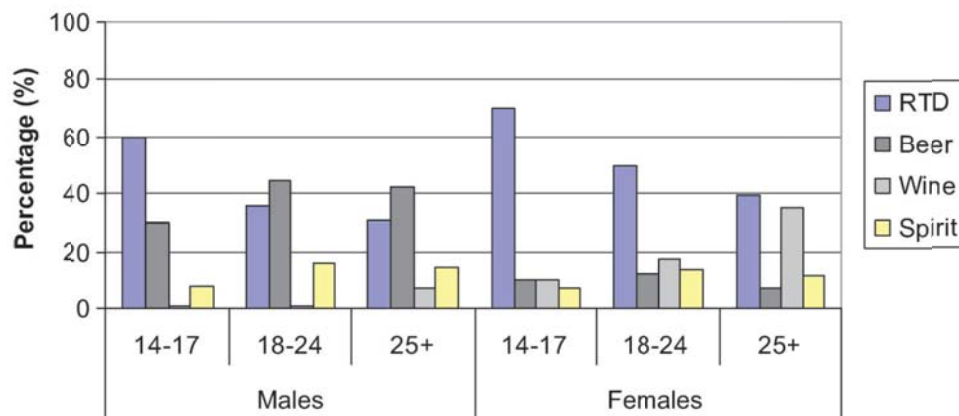
In Tables 4.1 & 4.2, estimates are odd ratios. Numbers for 14-17 and 18-24 wine drinkers and 14-17 year female spirit drinkers are low so these should be interpreted with care (less than 20 respondents in each category). Volume was controlled for in all models.

Table 4.1: Estimates for model 1: consumer vs non-consumer of beverages

| MODEL ONE	Age Group (years)	RTD vs non RTD			Beer vs non Beer			Wine vs non Wine			Spirit vs non spirit		
		Est	LCI	UCI	Est	LCI	UCI	Est	LCI	UCI	Est	LCI	UCI
Typical occasion Quantity								Males					
	14–17	0.28*	0.05	0.40	−0.28*	−0.45	−0.12	−0.37*	−0.52	−0.22	−0.04	−0.18	0.09
	18–24	0.14*	0.03	0.26	−0.30*	−0.50	−0.09	−0.12	−0.24	0.01	−0.02	−0.13	0.09
	25+	0.26*	0.14	0.38	0.18*	0.08	0.29	−0.36*	−0.43	−0.30	−0.01	−0.09	0.07
								Females					
	14–17	0.26*	0.14	0.38	−0.08	−0.20	0.03	−0.23*	−0.35	−0.12	−0.10	−0.23	0.03
	18–24	0.13*	0.03	0.22	0.08	−0.02	0.18	−0.26*	−0.36	−0.15	−0.13*	−0.22	−0.03
	25+	0.37*	0.31	0.43	0.20*	0.14	0.25	−0.46*	−0.54	−0.40	−0.01	−0.06	0.04
Heavier drinkers								Males					
	14–17	3.02*	1.28	7.17	0.30	0.09	1.03	0.24*	0.08	0.73	0.75	0.30	1.86
	18–24	2.06*	1.17	3.62	0.46	0.15	1.46	0.51*	0.28	0.95	0.87	0.52	1.47
	25+	1.52	1.00	2.32	1.51	0.88	2.60	0.28*	0.22	0.37	1.22	0.91	1.65
								Females					
	14–17	2.48*	1.17	5.26	0.64	0.31	1.30	0.58	0.29	1.19	0.55	0.25	1.22
	18–24	1.98*	1.12	3.51	1.39	0.80	2.40	0.24*	0.13	0.45	0.86	0.50	1.47
	25+	2.38*	1.67	3.40	2.74*	1.95	3.84	0.09*	0.06	0.14	1.01	0.71	1.45
Annual frequency								Males					
	14–17	−0.28*	−0.40	−0.15	0.28*	0.12	0.45	0.37*	0.22	0.52	0.04	−0.09	0.18
	18–24	−0.15*	−0.26	−0.03	0.30*	0.09	0.50	0.12	−0.01	0.24	0.02	−0.09	0.13
	25+	−0.26*	−0.38	−0.14	−0.18*	−0.29	−0.08	0.36*	0.30	0.43	0.01	−0.07	0.09
								Females					
	14–17	−0.26*	−0.39	−0.14	0.08	−0.03	0.20	0.24*	0.12	0.35	0.10	−0.03	0.23
	18–24	−0.13*	−0.23	−0.04	−0.08	−0.18	0.02	0.26*	0.16	0.36	0.13*	0.03	0.22
	25+	−0.37*	−0.44	−0.31	−0.20*	−0.25	−0.14	0.47*	0.40	0.54	0.00	−0.05	0.06

Table 4.2: Estimates for model 2: amount of beverage consumed

MODEL TWO	Age Group (years)	RTD vs non RTD			Beer vs non Beer			Wine vs non Wine			Spirit vs non spirit		
		Est	LCI	UCI	Est	LCI	UCI	Est	LCI	UCI	Est	LCI	UCI
Typical occasion Quantity								Males					
	14–17	0.22*	0.15	0.29	0.24*	0.19	0.29	−0.05	−0.12	0.01	0.16*	0.10	0.22
	18–24	0.15*	0.10	0.21	0.21*	0.18	0.25	−0.04	−0.10	0.02	0.08*	0.04	0.13
	25+	0.13*	0.05	0.21	0.23*	0.21	0.25	−0.03*	0.01	0.05	0.04*	0.00	0.08
								Females					
	14–17	0.20*	0.15	0.25	0.13*	0.07	0.19	0.02	−0.03	0.06	0.20*	0.14	0.27
	18–24	0.17*	0.12	0.21	0.16*	0.12	0.20	0.04*	0.01	0.07	0.10*	0.06	0.14
	25+	0.16*	0.12	0.19	0.14*	0.12	0.17	0.07*	0.06	0.08	0.04*	0.02	0.07
Heavier drinkers								Males					
	14–17	1.88*	1.03	3.43	1.73*	1.32	2.25	0.83	0.49	1.39	1.57*	1.02	2.40
	18–24	1.60*	1.17	2.15	1.58*	1.32	1.89	0.89	0.65	1.21	1.24*	1.01	1.53
	25+	1.58*	1.22	2.04	2.60*	2.30	2.95	0.95	0.82	1.09	1.11	0.97	1.26
								Females					
	14–17	2.08*	1.47	2.95	1.40	0.98	2.02	1.12	0.82	1.54	1.52*	1.05	2.19
	18–24	1.60*	1.25	2.05	1.63*	1.31	2.02	1.14	0.94	1.39	1.49*	1.14	1.94
	25+	1.87*	1.52	2.29	1.65*	1.42	1.93	0.94	0.82	1.08	1.31*	1.11	1.54
Annual frequency								Males					
	14–17	0.23*	0.15	0.32	0.48*	0.44	0.53	0.24*	0.16	0.32	0.13*	0.06	0.19
	18–24	0.17*	0.11	0.22	0.39*	0.35	0.43	0.18*	0.11	0.24	0.18*	0.13	0.22
	25+	0.15*	0.07	0.23	0.34*	0.32	0.37	0.32*	0.30	0.35	0.25*	0.21	0.30
								Females					
	14–17	0.36*	0.31	0.41	0.31*	0.26	0.37	0.29*	0.24	0.34	0.22*	0.13	0.30
	18–24	0.21*	0.16	0.26	0.25*	0.21	0.30	0.34*	0.30	0.37	0.26*	0.22	0.30
	25+	0.19*	0.13	0.25	0.24*	0.21	0.27	0.51*	0.49	0.53	0.27*	0.24	0.30

Model 1: Consumer versus non-consumer

Typical occasion quantity: RTD consumers of all ages drank significantly higher quantities on a typical occasion compared to non-RTD consumers. In the 25+ age group, beer drinkers drank significantly more on a typical occasion than non-beer drinkers (Table 4.1). When the estimates were observed being an RTD drinker predicted a higher typical occasion quantity compared to being a beer, wine or spirits drinker for those 14-17 years and this was the same for the other age groups (Table 4.1).

Heavier drinking: groups aged 14-17 and 18-24 years (and females aged 25+) who consumed RTDs had a significantly higher probability of being a heavier drinker than non-RTD consumers. Being a wine drinker, compared to non-wine drinkers, significantly predicted heavier drinking among almost all age groups excluding females aged 14-17 years. For females aged 25+ being a beer drinker also significantly predicted heavier drinking (Table 4.1). When the estimates were observed being an RTD consumer was the best predictor of heavier drinking for those aged 14-17 and 18-24 respectively (compared to being a beer, wine or spirits drinker). For females 25+ being a beer drinker predicted heavier drinking better than the other beverages (Table 4.1).

Frequency of drinking: when age and sex are not accommodated, drinkers who consumed wine drank significantly more often than those who did not consume wine. Respondents who drank RTDs did so significantly less often compared to non-RTD consumers (Table 4.1). Observing the estimates showed that wine or beer were better predictors of higher frequency of drinking for almost all age groups (Table 4.1).

Model 2: Amount beverage

Typical occasion quantity: when the amount of beverage consumed was modelled, observing the estimates showed that beer predicted a higher typical occasion quantity for males aged 14-17,

males 18-24 years and 25+. For female's, amount of RTD consumed was a better predictor of higher typical occasion quantity than the amount of beer, wine or spirits consumed. However for females 18-24 and 25+ beer followed closely (Table 4.2). Spirits also predicted higher typical occasion quantity for 14-17 year old females along with RTDs however numbers were small in this spirits group. Interpret with caution.

Heavier drinking: observing the estimates showed that amount of RTDs consumed predicted heavier drinking for 14-17 year olds better than the amount of other beverages consumed. This was also the case for females aged 25+. For the 18-24 year females beer predicted heavier drinking the best (closely followed by RTDs) and for males 18-24 years it was RTDs (followed closely by beer) (Table 4.2).

Frequency of drinking: RTDs predicted higher annual frequency for females aged 14-17 years compared to amount beer, wine or spirits consumed. For the other groups of female's amount of wine predicted higher frequency. For males of all ages amount of beer predicted higher frequency (Table 4.2).

Discussion

This study used a cross sectional survey to assess if RTD consumers have heavier drinking patterns.

In the younger groups RTD consumption may have been stimulated by the purchase age change in 1999. Some groups may have increased their consumption following the change and they are the same groups (young people) that are the most common RTD consumers; this may have possibly inflated RTD use in 2004. However as we are comparing the RTD consumers to non-

RTD consumers at one point in time, each of these groups had been exposed to the same level of external policy influence and we are therefore able to compare these groups.

The response rate for the survey in 2004 was lower than expected raising concern about bias within the data. Comparison of the 2004 survey data with taxable alcohol in New Zealand (calculated by Statistics New Zealand) has shown that the volume accounted for by the survey data, when scaled to a population level, accounted for 91% of the taxable alcohol (SHORE, 2006b). This is high by international standards, most other surveys account for between 40-60% of taxable alcohol (Rehm, 1998).

In this study young people and females were significantly more likely to consume RTDs, consistent with previous international studies (Brain, 2000; Jackson et al., 2000; Mosher & Johnsson, 2005; Sutherland & Willner, 1998). For females aged 14-17 years, amount of RTDs consumed predicted higher typical occasion quantity, heavier drinking and higher annual frequency better than amount of beer, wine or spirits consumed. This was not the case for any other age or gender group.

For other females, being an RTD consumer generally predicted higher typical occasion quantity and heavier drinking, but when amounts of beverages were analysed beer was as important as RTD's (and this was not the case for 14-17 year olds females). For males RTDs sometimes predicted heavier quantities and sometimes it was beer. In some groups both beer and RTDs were important. Wine and/or beer were strongly associated with higher frequency for the males and older groups. This suggests that in different age and gender groups, different beverages also predict heavier drinking patterns.

The analysis in this paper was adapted from Wicki et al. (2006) which utilised a school-based cross sectional sample of 13-16 year olds. In their study, alcopops were associated with problematic drinking patterns but these relationships were also found for all alcoholic beverages. Our results for the 14-17 females differ from Wicki et al. (2006) as RTDs in this group predicted heavier drinking patterns better than other beverages. However our results are similar for males aged 14-17 years and the other age groups for which other beverages, not only RTDs, predicted heavier drinking patterns. This study provides only a broad comparison with Switzerland, as sample frames and measures differed.

Other international studies have reported that designer drinks are associated with the heaviest quantities consumed among young people (Hughes et al., 1997; McKeganey et al., 1996). Designer drinks can contain up to 21% alcohol. Some have suggested that the higher alcohol content of these drinks accounts for heavier consumption (McKeganey et al., 1996; Wicki et al., 2006). This is not necessarily the case in New Zealand; by 2004 there were some RTDs with higher percentages of alcohol content, between 8-9%, but these beverages occupied a much smaller proportion of the market than the 5% (approx alcohol content) beverages did.

As the data are cross sectional we cannot explore in this study if the heavier drinkers are more likely to drink RTDs or if RTDs are causing heavy drinking.

Conclusion

RTDs were most popular among young people, 14-17 years, and females. RTDs predicted higher typical occasion alcohol consumption and heavier drinking better than any other beverage for females aged 14-17 years. For the other age and gender groups, other beverages predicted higher quantities and frequencies consumed.

Link

Study five addressed a further policy context likely relevant for young people; greater numbers of alcohol outlets due to the liberalisation of the liquor licensing system. Off and on-licensed premises had proliferated and a burgeoning youth focussed night time economy had emerged. There was also a perception in New Zealand that the higher density and clustering of alcohol outlets was contributing to higher levels of consumption, particularly among young people. Study Five utilised cross-sectional data to understand the relationship between drinking patterns and alcohol outlet density among other relevant predictors of drinking patterns among teenagers.

Study Five: Density of alcohol outlets and teenage drinking: living in an alcogenic environment is associated with higher consumption in a metropolitan setting

Abstract

Aim: This study examines the relationship between physical, socio-economic and social environments and alcohol consumption and drunkenness among a general population sample of drinkers aged 12-17 years.

Design, setting, participants and measures: The study was conducted in Auckland, New Zealand. The design comprised two components: (i) environmental measures including alcohol outlet density, locality-based measure of willingness to sell alcohol (derived from purchase surveys of outlets) and a locality-based neighbourhood deprivation measure calculated routinely in New Zealand (known as NZDEP); and (ii) a random telephone survey to collect individual-level information from respondents aged 12-17 years including ethnicity, frequency of alcohol supplied socially (by parents, friends and others), young person's income; frequency of exposure to alcohol advertising; recall of brands of alcohol and self-reported purchase from alcohol outlets. A multi-level model was fitted to predict typical-occasion quantity, frequency of drinking and drunkenness in drinkers aged 12–17 years.

Findings: Typical-occasion quantity was predicted by: frequency of social supply (by parents, friends and others); ethnicity and outlet density; and self-reported purchasing approached significance. NZDEP was correlated highly with outlet density so could not be analysed in the same model. In a separate model, NZDEP was associated with quantity consumed on a typical drinking occasion. Annual frequency was predicted by: frequency of social supply of alcohol, self-reported purchasing from alcohol outlets and ethnicity. Feeling drunk was predicted by frequency of social supply of alcohol, self-reported purchasing from alcohol outlets and ethnicity; outlet density approached significance. Age and gender also had effects in the models, but retailers' willingness to sell to underage patrons had no effects on consumption, nor did the advertising measures. The young person's income was influential on typical-occasion quantity once deprivation was taken into account.

Conclusion: Alcohol outlet density was associated with quantities consumed among teenage drinkers in this study, as was neighbourhood deprivation. Supply by family, friends and others also predicted quantities consumed among underage drinkers and both social supply and self-reported purchase were associated with frequency of drinking and drunkenness. The ethnic status of young people also had an effect on consumption.

Introduction

Alcohol is a key determinant of physical and mental health and is strongly related to harm among young people. Teenage drinking is a particularly important policy issue for a number of reasons: age at which people start regular drinking is predictive of consumption and alcohol-related problems in subsequent years (Chou & Pickering, 1992) higher levels of harm are associated with drinking by younger people (Jernigan, 2001) and there is also evidence of brain impairment associated with intoxication in the teenage years (Hart, 2007). In New Zealand, as in similar western countries, young people are most likely to be heavy drinkers compared to other groups in the population (Huckle & Huakau, 2005b) Survey data indicate that typical occasion quantity and frequency of drinking in New Zealand has been increasing, particularly among young people aged 14-17 years (Habgood et al., 2001).

In New Zealand there has been a number of liberalising alcohol policy changes including the 1989 Sale of Liquor Act. The Act relaxed conditions for obtaining liquor licences and allowed the sale of wine in grocery outlets and supermarkets (Hill & Stewart, 1996; Stewart, Casswell, & Thompson, 1997) following which substantial increases in alcohol outlets occurred. In 1990 there were 18 licences per 10,000 people in New Zealand (including on, off and club licences); by 2006 there were 35 per 10,000 people (Data obtained from the Liquor Licensing Authority 2006).

There is evidence that outlet density is associated with alcohol-related harm including violence (Britt, Carlin, Toomey, & Wagenaar, 2005; Lipton & Gruenewald, 2002; Livingston, Chikritzhs, & Room, 2007; Zhu, Gorman, & Horel, 2004; Alaniz, Cartmill, & Parker, 1998; Gorman, Speer,

Gruenewald, & Labouvie, 2001; Norström, 2000), drink driving and alcohol-involved traffic crashes (Gruenewald, Millar, Treno, Yang, Ponicki, & Roeper, 1996; Treno, Grube, & Martin, 2003). Results from investigating the relationship between outlet density and consumption among adults have been more variable. In a review of studies Gruenewald et al. (1993) reported that increased physical availability in the United States was related to increases in alcohol sales and consumption. In a different study from the U.S., outlet density at the neighbourhood level was found to predict norms and higher levels of consumption (however individual level access variables did not) (Scribner, Cohen, & Fisher, 2000). A study from California found that density of alcohol outlets was not associated with heavier drinking among an adult population (Pollack, Cubbin, Ahn, & Winkleby, 2005).

Studies that have measured the impact of outlet density on the alcohol consumption of young people are relatively rare and have tended to focus on U.S. college students. One such study showed significant positive correlations between outlet density and heavier drinking among students of eight US universities (Weitzman et al., 2003). Another study using college students found that the number of nearby alcohol outlets mediated the relationship between colleges, with high levels of binge drinking, and neighbours experiencing second hand effects of alcohol use from students (such as vomiting, vandalism and drunkenness) (Wechsler, Lee, Hall, Wagenaar, & Lee, 2002).

The impact of outlet density may be mediated by the willingness of outlets to sell alcohol to those under the minimum purchase age and therefore be of importance in predicting the consumption of young people. Other important considerations are the extent of the supply of alcohol from the family and friends. A range of demographic variables, such as ethnicity and socio-economic status are also likely to affect consumption and need to be taken into account in

the analysis. Locality measures of deprivation provide additional indications of contextual factors which may affect alcohol consumption.

This present study investigated the 'alcogenic' environment of alcohol access among a general population sample of drinkers aged 12-17 years and therefore under the minimum purchase age in New Zealand. The study utilises measures of physical and social availability to predict frequency and quantity of alcohol use and drunkenness in young people living in a largely urban environment.

Methodology

Component 1: Environmental measures - density of alcohol outlets:

Data was supplied by the Liquor Licensing Authority of the Ministry of Justice, detailing the names and addresses of all licensed premises in the Auckland Region (5 District Licensing Authorities (DLA) were urban; the other 3 were urban and rural). The list was comparable with the time period of the phone survey in Component 2.

Using geographic information systems (GIS), the location of all current on and off licences where alcohol could be readily purchased (i.e. excluding restricted outlets such as workplace social clubs that are not publicly accessible) but including premises that are frequently visited by young people, were assigned map references (geocoded). (The types of premises frequently visited by this age group were obtained from national alcohol survey data (Habgood et al., 2001)). The geocoded premises were: bottle stores, grocery stores, supermarkets, hotels and taverns, nightclubs and some sports clubs such as pool halls available to the public. The successful match rate for geocoding was 99%.

Outlet density was calculated for all 8,628 census meshblocks in the Auckland Region, using meshblock centroids as proxies for individual addresses. Meshblocks are the smallest reporting unit for census information in New Zealand, with a median population of 90.

The effective result is an area for each meshblock centroid representing 10 minutes of travel time by car which is used here to delineate the concept of a realistic neighbourhood. The density measure is the sum of all outlets within this area. Driving time was used as the majority of the sample reported in the survey that they usually either drove or were passengers in cars when they went to get alcohol and that it usually took them around 10 minutes to get there. A benefit of this method is that variations imposed by speed limits between rural and urban areas (most rural areas have a higher speed limit than urban areas) acts as a natural adjustment for the relative 'size' of a neighbourhood. The resulting measure of travel time through the road network represents concepts of both access and density, but without the Modifiable Area Unit effects and boundary-crossing problems associated with administrative units (Green & Flowerdew, 1996). By applying a standardised travel time value for all meshblock centroids in the study area, a measure of physical access can be derived which is exclusive of assumed behaviour (such as calculating travel time to the nearest facility). The 10 minute travel time value does introduce a degree of 'smoothing', but provides a clear pattern of access and maintains a practical level of detail. The approach is more realistic than kernel density approaches based upon straight-line (Euclidean) distance. Use of meshblock centroids also allows for direct aggregation within GIS to enable statement at higher levels of aggregation such as the Census Area Unit (CAU. The median number of people in a CAU is 2,000) or District Licensing Authority (DLA) level, as these are all based upon various aggregations of meshblocks. It also facilitates the use of other Census data and indices based on administrative units such as the New Zealand Deprivation Index, which will form part of the analysis.

Willingness to sell alcohol

Purchase surveys using pseudo patrons were conducted to obtain DLA locality indicators of willingness to sell alcohol to people under the minimum purchase age (based on successful sales to 18 year olds with no age identification. The minimum purchase age is 18 in New Zealand so the buyers were legal, but this measure is taken as an indicator of likely access for people below 18 years).

Using the same sampling frame of outlets as used in the geocoding for the density measure one random sample was selected for off-licences (approximately 250 premises) and one was selected for on-licences (approximately 250 premises). The data was stratified so that within the samples, representative numbers of the different types of outlets were achieved in each DLA and also for the off and on-licensed premises attained across the region. Previous research in this area had indicated that there were differences in premises selling to males and females (Grube & Stewart, 1999) so each premise was visited twice, once by a female and once by a male. Data collection took place over a number of weekends in the second half of 2004. The on-licensed premises data collection protocol was based on Lang et al. (1996). For the off-licensed premises data collection protocol see Huckle et al. (2005a).

Locality-based deprivation measure

NZDEP 2001 score (New Zealand Deprivation) was used. This is a continuous variable and is calculated for each CAU in New Zealand. NZDEP score is the first principal component score from 9 Census variables that reflect aspects of material and social deprivation. The items used in making NZDEP are: income, employment, communication, transport, support, qualifications, living space, owning a home (For further information please see Department of Public Health, 2007). NZDEP score was obtained at the CAU level for analysis.

Component 2: Telephone survey

The survey included 1179 respondents aged 12-17 years and was conducted between March and June in 2005. A simple random sample design was used. Telephone numbers were generated using random-digit dialling which included both published and unpublished phone numbers. Each household with a landline telephone had an equal chance of being selected. Households were eligible if they contained at least one person aged 12-17 years of age that had lived in the country for at least 12 months and could conduct the interview in English. One young person aged 12-17 years was randomly selected within each household. As one young person was selected per household weighting to account for household size was undertaken. The sample demographics matched the Census fairly well.

Contact and interviewing were undertaken using an in-house Computer Assisted Telephone Interviewing (CATI) system. A high level of quality control was achieved using this CATI system (for further description see Casswell et al., 2002). Telephone coverage in New Zealand is fairly high. In 2004 93% of households had accessible telephones. Certain sectors of the population are under-represented among those with access to a landline telephone and these are Maori (the indigenous people of New Zealand), Pacific peoples and single parent households.(Statistics New Zealand, 2004b; Wyllie et al., 1994)

In order to link characteristics of respondents' areas to the characteristics of the respondents themselves, we obtained information on the meshblocks respondents lived in. In some cases where a meshblock was not known respondents were asked the approximate location of their residences.

Response rate

The response rate was 74%. The response rate calculation used was the number of eligible responding / (the number of eligible responding) + (number of eligible non-responding) + (estimated numbers of eligible from the unknowns) x 100.

Measures

Data for typical occasion quantity and annual frequency were collected by asking respondents in the survey who had consumed alcohol in the past 12 months to report at which of a number of mutually exclusive locations, plus any additional locations, they had had a drink.

For each location respondents drank at they were asked how often they drank there and how much they would drink on a typical occasion at that location. This approach to collecting consumption data in general populations has been found to give a very good approximation to the alcohol available for consumption.(Casswell et al., 2002) Further information on the locations asked about in the survey or how the alcohol consumption measures were collected is provided in Casswell et al. (2002). The third dependent measure, frequency of drunkenness, was asked in a separate question.

Environmental independent measures were: outlet density at the CAU level (on and off licences were combined as they were highly correlated); locality-based willingness to sell alcohol for on and off-licensed premises combined (at the DLA level) and locality-based NZDEP Score at the CAU level. Spatial lag variables for outlet density and NZDEP were also derived.

Independent individual level measures were: (i) frequency of social supply of alcohol as reported by the young person (supply from parents, friends and others); (ii) young person's income from

all sources per annum, including pocket money (this measure was derived into a binary variable income under $1000 and over $1000); (iii) exposure to alcohol advertising – respondents reported the frequency of seeing alcohol advertisements e.g. daily, every couple of days, weekly, bi-weekly etc in and around off and on-licensed premises, billboards, sports or music events, television, radio and magazines (the variable was the sum of these frequencies); (iv) recall of brands of alcohol (up to three brands could be reported); (v) own purchase of alcohol from outlets; (vi) gender and (vii) ethnicity (Asian and other ethnicities were combined for analysis). The reference period for all individual measures was the last 12 months.

Analysis

Multilevel modeling was used to model the hierarchical structures present in the 'alcogenic' environment, that is, to account for the individuals in this study being nested within spatial units. Multilevel modelling was also applied to investigate the impact of covariates at the individual and neighborhood level on our variables of interest. A three-level model was used with the highest (third) level being the DLA level, the middle (second) level being the CAU and the lowest (first) level being the individual teenagers. Some variables were centered about their average to interpret the model intercept.

Autocorrelation was tested for the outlet density measure and NZDEP. The willingness to sell measure was at the DLA level (city level) so did not require testing. High spatial autocorrelation in the alcohol outlet density variable was expected due to the method used for its calculation. There was near perfect autocorrelation (a Moran's I of almost 1) for density. For NZDEP the Moran's I was 0.5575.

As the multilevel model is not explicitly spatial, spatial lags were calculated for NZDEP score and outlet density and were included in the model so that assumptions of independence of

observations would not be violated. *k-nearest neighbour* weights file were used to calculate spatial lags, as in some cases rook or queen based weights failed to account for the nature of the geographical units in the analysis. The nearest-neighbour criterion ensures that each observation has the same amount of spatial units in the lag calculation (in this case *eight* nearest (Euclidean) neighbours) to calculate expected values from surrounding units (lags) for each CAU.

Alcohol consumption (typical occasion quantity and annual frequency of drinking) and frequency of drunkenness were modeled separately using a random intercept model. The model included willingness to sell as a fixed effect at the DLA level, outlet density, lagged-outlet density, NZDEP 2001 score and lagged-NZDEP score as fixed effects at the CAU level. The individual level measures (self-reported survey measures from the teenagers) were included as fixed effects.

Results

The demographic characteristics of the sample are as follows ($n = 1179$): 52% were male and 48% female, 13% were aged 12 years, 16% aged 13 years, 18% aged 14 years, 17% aged 15 years, 20% aged 16 years and 16% aged 17 years. Around 63% were European, 12% Maori (the indigenous people of New Zealand), 8% Pacific people, 16% Asian and 1% other. Forty four percent of the sample were drinkers in the last 12 months, this proportion varied by age (of the 12 year olds 7% were drinkers, 13 years (18%), 14 years (36%), 15 years (53%), 16 years (62%) and 17 years (73%).

Table 5.1 shows the descriptives for the measures used in the analysis to provide an overview of the averages and the spread of the variables analysed. Some variables were not normally distributed and were logged to adjust for this. Variables that have been logged are identified in the table and estimates are on the log scale.

Table 5.1: Descriptive statistics for measures used in analysis

Measures	Median	Mean	SD
Log typical-occasion quantity (ml absolute alcohol)	3.907	3.727	1.206
Log annual frequency	3.434	3.428	1.443
Log frequency of drunkenness	1.253	1.594	1.675
Log self-reported purchases from outlets	0.000	0.210	0.766
Log exposure to alcohol advertising	5.587	5.297	1.626
Log income (in thousands of dollars)	0.405	0.638	0.562
Number of alcohol brands recalled (1, 2, 3+)	2.000	1.889	1.160
Log frequency social supply of alcohol	1.900	1.790	1.229
NZDEP (neighbourhood deprivation index)	954.000	976.591	72.312
NZDEP lag	972.688	989.570	61.142
Density	10.269	29.738	56.274
Density lag	13.440	33.335	56.694

NZDEP: New Zealand Deprivation (2001) score; SD: standard deviation.

Around 19% of drinkers aged 12-17 years had purchased alcohol for themselves in the last 12 months which meant that the majority had not done so. Purchasing was largely confined to the older ages 16 and 17 years. Friends were identified as the group who supplied the young people with alcohol most often.

The results from the multi level models are as follows. Typical occasion quantity was predicted by: frequency of social supply (by parents, friends and others), ethnicity (Maori and Pacific people drank more on a typical drinking occasion compared to Europeans, Asian people drank significantly less on a typical drinking occasion compared to Europeans), age (17 year olds drank

significantly more on a typical occasion compared to 12, 13 and 14 year olds) and outlet density. Self-reported purchasing approached significance (Table 5.2).

Annual frequency of drinking was predicted by: frequency of social supply of alcohol, self-reported purchasing, age (17 year olds drank significantly more often compared to those aged 12, 13 and 14 years) and ethnicity (Asian people drank significantly less often than Europeans; Maori approached significance for drinking more often than Europeans) (Table 5.2).

Frequency of feeling drunk was predicted by frequency of social supply of alcohol, self-reported purchasing, ethnicity (Maori and Pacific people felt drunk significantly more often than Europeans), age (17 year olds felt drunk significantly more often compared to 13 year olds (numbers of 12 year olds were small). Both outlet density and gender approached significance (with males approaching feeling drunk significantly more often than females) (Table 5.2).

Deprivation and outlet density were found to be very highly correlated within most DLAs. The effects of deprivation on consumption and drunkenness were therefore analysed in separate models (NZDEP score replaced outlet density). NZDEP score was a significant predictor of typical occasion quantity but not for annual frequency or frequency of feeling drunk. The results for the models with NZDEP were, for the most part, the same as the models which included outlet density. There was one difference; the young person's income became significant in predicting typical occasion quantity (Table 5.2).

Table 5.2: Model estimates

Variable name	Model-log of typical occasional quantity			Model-log of frequency of drinking			Model-log of frequency of drunkenness		
	Beta	t-stat	P-value	Beta	t-stat	P-value	Beta	t-stat	P-value
Constant	3.790	23.395	<0.05	3.479	20.464	<0.05	1.673	7.029	<0.05
Female versus male	0.081	0.975	NS	−0.141	−1.453	NS	−0.230	−1.854	App. sig. (0.052)
12-year-old versus 17-year-old	−1.438	−5.135	<0.05	−0.949	−2.858	<0.05	−0.389	−0.913	NS**
13-year-old versus 17-year-old	−1.525	−8.190	<0.05	−1.000	−4.566	<0.05	−0.836	−2.985	<0.05
14-year-old versus 17-year-old	−0.495	−3.413	<0.05	−0.569	−3.347	<0.05	−0.102	−0.476	NS
15-year-old versus 17-year-old	−0.150	−1.190	NS	−0.235	−1.587	NS	−0.046	−0.247	NS
16-year-old versus 17-year-old	0.019	0.171	NS	0.110	0.083	NS	0.136	0.824	NS
Maori versus European	0.705	6.077	<0.05	0.243	1.786	App. sig. (0.059)	0.587	3.316	<0.05
Pacific versus European	0.935	4.065	<0.05	−0.077	−0.292	NS	1.280	3.832	<0.05
Asian-other versus European	−0.571	−3.707	<0.05	−0.634	−3.561	<0.05	−0.431	−1.843	App. sig. (0.057)
Log of own income ($1000)	0.077	1.166	NS	0.062	0.794	NS	0.149	1.520	NS
Log of number of own purchases	0.074	0.180	App. sig. (0.055)	0.230	4.791	<0.05	0.385	6.416	<0.05
Log of number of adverts seen	0.017	0.570	NS	0.050	1.388	NS	0.055	1.195	NS
Number of brands recalled	0.002	0.050	NS	0.041	0.872	NS	−0.085	−1.393	NS
Log Frequency of social supply	0.359	9.447	<0.05	0.555	12.333	<0.05	0.535	9.553	<0.05
NZDEP score*	0.002	2.000	<0.05	0.001	1.000	NS	0.001	1.000	NS
Willingness to sell without age ID	−0.715	−0.983	NS	0.072	0.117	NS	−0.504	−0.051	NS
Density of alcohol outlets	0.004	2.000	<0.05	−0.001	−0.333	NS	0.005	1.666	App. sig. (0.058)
Deviance	1270.318			1249.225			1423.410		

NZDEP: New Zealand Deprivation (2001) score; NS: not significant; ID: identity card. *Estimate for NZDEP is from a separate model due to high correlation between NZDEP and density. **Small numbers.

Discussion

This study examined the relationship between the physical and social environments in which young New Zealanders lived in an attempt to measure the impact of a more or less alcogenic environment on drinking behaviour. We expected that in areas of higher outlet density and where there was greater willingness to sell on the part of the retailers the survey findings would show higher typical occasion quantity, annual frequency and frequency of drunkenness among the young respondents.

In this study outlet density, as measured by the number of outlets reached within ten minutes drive, was associated with typical occasion quantity and approached significance for frequency of drunkenness for drinkers aged 12-17 years. This result is consistent with previous studies that have found a relationship between density and underage drinking, these have tended to be among slightly older college students and in the United States (Weitzman et al., 2003).

Currently it is easy to obtain a liquor licence in New Zealand and there are effectively no restrictions on the numbers or density of outlets permitted. Given the relationship between density and heavier drinking among young people in this study, introducing restrictions on numbers and density of licensed premises would be a low cost and effective approach to reduce heavier consumption related to the clustering of outlets (Babor et al., 2003; Wechsler et al., 2002).

Willingness to sell alcohol was not associated with any measure of drinking in this study. An earlier study in Auckland had found that 60% of young people were able to purchase alcohol without age identification from off-licenses (Huckle et al., 2005a). However there had been some

improvements in enforcement which meant that at the time the purchase surveys occurred for this study the proportion of sales made had declined to around 44% for off-licenses across the region.

Self-reported purchasing of alcohol from outlets among this age group was low and for the most part was confined to those aged 16 and 17 years, however, it was a significant factor associated with most of the consumption measures emphasising the importance of enforcement of the minimum purchase age.

Frequency of supply of alcohol by parents, friends and others was also a significant predictor of all drinking measures among teenagers in this study. In New Zealand it is illegal to supply anyone under the age of 18 years unless it is done by their parent or guardian. However, in this study, friends were reported as the group who supplied the young drinkers most often. The relationship between outlet density and social supply of alcohol would be an interesting future research topic.

The findings in this study with regard to ethnicity are consistent with previous research from New Zealand in showing that Maori (the indigenous people of New Zealand) and Pacific peoples consumed more on a typical drinking occasion than non-Maori (Ministry of Health, 2007) or non-Pacific (Huakau, Asiasiga, Ford, Pledger, Casswell, Suaalii-Sauni et al., 2005). While Maori and Pacific peoples are over represented in deprived localities in Auckland the environmental measure of deprivation was found to have an independent association with the quantities of alcohol consumed by these young people.

In the Auckland region population distribution is very uniform. The method of calculating density used in this study may also be applied to different countries where population

distribution varies. This is possible because the density measure is an outlet count within an area based on travel time (and mode) and therefore variations in the size of geographical areas and differences in infrastructure are accounted for within the measure. It is possible to use different definitions of a 'realistic neighbourhood' for rural and urban areas. This method does require that contact is made with respondents to obtain usual time to get alcohol and usual mode of travel which may be more difficult in very isolated areas.

Conclusion

Living within ten minutes' drive of relatively more outlets was associated with larger quantities consumed by this sample of young drinkers. In this sense the alcogenic environment was found to be an important element in what is a key public health issue for many similar countries. While other aspects of the environment were found to be important influences on drinking, such as social supply and the deprivation of the locality in which the young person lived, the outlet density is an aspect which is amenable to control by public policy and therefore of considerable importance from a public health perspective.

Conclusions and Recommendations

This section returns to the research aims to summarise the major themes that have arisen from this research and to discuss the contribution this thesis has made to the alcohol policy research literature. Theoretical support for research findings are discussed, as are the limitations and strengths of the research, future work, implications for alcohol policy and finally the conclusion is drawn.

At the initiation of this thesis, understanding of drinking patterns and alcohol-related harms among young people in the context of liberalising alcohol policy change in New Zealand was limited as only a few studies had documented young people's alcohol-related behaviour in this context (Casswell & Zhang, 1998; Everitt & Jones, 2002; Guria et al., 2003). As such, the overarching aim of this thesis has been to develop the public health knowledge base within this area.

The aim of Study One was to assess trends in drinking patterns and alcohol-related problems among age and gender groups in the context of a liberalised alcohol policy environment 1990-2000. Results of this study showed that relative to other population groups more marked increases in typical occasion quantity were observed for males and females aged 14-19 years and for females 20-24 years. The increase was most marked among those aged 14-19 years. Males aged 14-19 years experienced a greater year on year increase in more serious alcohol-related problems including 'had hands shake in the morning after drinking'. Increases in other problems were observed most markedly among those aged 14-19 years. Results from Study One supported the hypothesis that greater increases in young people's consumption and problems would occur as all liberal policy changes were relevant to them.

The aim of Study Two was to examine trends in drinking patterns over three general population samples in New Zealand from 1995 to 2004. This study showed that in the context of the lowering of the purchase age, the introduction of beer for sale in supermarkets and Sunday trading that increases in quantity consumed on a typical occasion occurred for the majority of age groups surveyed between 1995 and 2000. However, young people including males aged 16-17 years and females aged 16-17, 18-19 and 20-24 years were observed to show the greatest increases in typical occasion quantity (including heavier drinking among males aged 16-17 years). Drinking levels remained relatively stable between 2000 and 2004, a period in which no further liberalising policy changes occurred.

The aim of Study Three was to assess alcohol-related harms and offences from 1990 to 2003, a period of alcohol policy liberalisation that included the lowering of the purchase age from 20 to 18 years in 1999. While positive trends were found in the rates of prosecutions for disorder for all age groups between 1994 and 2003, those 18-19 and 16-17 years of age were observed to have the largest positive trends in rates.   For 16-17 year olds, a positive trend in the rates of prosecutions for excess breath alcohol was found. Negative trends in rates were found for alcohol-related crashes (all and fatal) among all age groups before 1999, likely due to the introduction of Compulsory Random Breath Testing.

The lowering of the minimum purchase age coincided with a more marked increase in the trends of alcohol-related crashes and drink-driving observed among those directly affected by the policy change, the 18-19 years olds (the next largest increase was among the 20-24 year olds; all other age groups also increased but at a considerably lower rate relatively speaking). A similar result was found for the positive trend in driving with excess alcohol for those aged 18-19 years (followed by those aged 20-24 years). An increase in the rates of prosecutions for disorder offences occurred for the 14-15 year old group following the lowering of the purchase age. As

the legal driving age was 15 years in New Zealand numbers were too small for meaningful analysis of the alcohol-involved crashes for this age group.

The aim of Study Four was to report patterns of use of ready to drinks and to assess if ready to drink consumers had heavier drinking patterns. Study Four found that 19% of respondents aged 14-65 years in New Zealand consumed ready to drinks. Ready to drinks were most popular among young people, with over 50% of 14-15 year old females and over 60% of females aged 18-19 and 16-17 years consuming these beverages in the last 12 months. Nearly 20% of females aged 40-49 years had also done so. Of ready to drink consumers, the 14-17-year-old group, both males and females, consumed the highest proportion of their total annual volume as ready to drinks, 60% and 70%, respectively. Amount of ready to drinks consumed independently predicted higher typical occasion alcohol consumption, heavier drinking and frequency of drinking better than any other beverage for females aged 14-17 years (and this result was not found for other groups).

The aim of Study Five was to examine the relationship between physical, socio-economic and social environments and alcohol consumption and drunkenness among a general population sample of drinkers aged 12-17 years. Study Five provided evidence that alcohol outlet density was associated with increased quantities consumed among 12-17 year olds. The social supply of alcohol (from friends, family and others) also predicted drinking patterns with social supply being the most consistent/important predictor of all of the consumption measures for teenagers (typical occasion quantity, frequency and perceived drunkenness). Retailers' willingness to sell alcohol was not a significant predictor. Neighbourhood deprivation was associated with increased quantities and more deprived neighbourhoods had a higher density of alcohol outlets. Measures of recall of advertising did not predict consumption. Individual factors including age, gender and income predicted drinking patterns.

Contribution to the alcohol policy research literature

Studies One and Two contributed to the literature by assessing trends in drinking patterns and alcohol-related problems in the context of substantial liberalising policy change. Most previous studies have focused on assessing trends in behavior related to a specific policy change with recent exceptions including Andersson et al. (2002) and Measham and Ostergaard (2009) (although only 2 survey data points were assessed in the later study).

Study One utilised population survey data to assess trends in self-reported problems during a time of liberalising policy which very few studies have done (Bloomfield et al., 2010; Gustafsson, 2010). Most studies have focussed on routinely collected harm data, the more serious end of the harms gradient. Self-reported problems from surveys however are indicative of different kinds of problems and are also descriptive of drinkers in the general population who may not appear in the more serious harms categories such as alcohol-involved traffic crashes.

Studies One and Two provided evidence on trends in adult drinking patterns in the context of substantial liberalising policy change which was also rare. They provided the first evidence of increases in quantities consumed and alcohol-related problems among young people in the context of substantial alcohol policy change in New Zealand.

Study Three provided analysis of disorder offending over the time of substantial liberalising policy change which had not been undertaken previously in New Zealand. This study also added to the New Zealand evidence base regarding likely effects of the lowering of the purchase age. In addition the study provided analysis of alcohol-related harms in the context of the lowering of the purchase age from outside of the U.S, Canada and Australia where the majority of the previous international literature had originated (Wagenaar & Toomey, 2002).

Study Four provided stronger evidence that ready to drinks had a relationship with heavier drinking as analysis in Study Four was undertaken in such a way to avoid the main limitation with the international literature at that time. It was previously unclear if ready to drink consumers were just heavier drinkers that drank more of every beverage giving the appearance of drinking more ready to drinks (Metzner & Kraus, 2008). Study Four addressed this problem by controlling for volume of consumption in the analysis (based on Wicki et al 2006 from Switzerland).

Study Four found a special relationship between ready to drinks and typical occasion quantity, heavier consumption and frequency of drinking among females aged 14-17 years, possibly as this analysis was conducted separately by gender. Wicki et al. (2006), although they had controlled for volume, had not analysed by gender and associations between alcopops and drinking measures were not found any more so than for other beverages.

Study Four provided the first evidence of patterns of ready to drink consumption in New Zealand; also that ready to drinks were independently associated with typical occasion quantity and heavier drinking among females 14-17 years.

Study Five provided stronger evidence that outlet density is associated with increased quantities consumed among teenagers by addressing some of the limitations in the literature. The prospective relationship between outlet density and consumption was considered along with a range of other predictors of alcohol consumption among teenagers including social supply of alcohol, willingness to sell alcohol by outlets, alcohol promotion and individual factors.

Study Five used an innovative density measure that improved upon the measures used in the international literature at that time. Respondents' own reports of how long it usually took for

them to access or obtain alcohol were utilised allowing the concept of a realistic neighbourhood to be defined in which the density measure was the count of all outlets. This measure avoided the problem of using denominators that may produce artificial results such as road way miles or population when calculating outlet density. It also avoided making assumptions about the size of the respondents' neighbourhoods in which they accessed alcohol.

Study Five provided evidence of a relationship between teenagers living in more deprived areas and increased typical occasion quantity. There are few studies investigating relationships between area-level socio-economic status or deprivation and quantity of alcohol consumption among young people (Karriker-Jaffe, 2011). There are fewer studies utilising composite measures of area-level socio-economic status or deprivation (as used in Study Five). One of those, from Scotland, found no association between a composite measure of area-level deprivation and number of units drunk on the last occasion among those aged 15 years (Ecob & Macintyre, 2000).

Studies focussing on outlet density and young people's consumption were relatively rare at the time Study Five was undertaken and the majority of studies were from the U.S. (including (Wechsler et al., 2002; Weitzman et al., 2003). This study therefore provided evidence from outside of the U.S.

Study Five provided the first evidence that outlet density was related to increased typical occasion quantity among teenagers in the general population in New Zealand. This study also provided the first evidence that the social supply of alcohol and area-level deprivation were associated with increased typical occasion quantity in New Zealand.

Theoretical support for research findings

The theoretical framing used in this research was that alcohol policies liberalising the alcohol environment can increase levels of consumption and harms (Babor et al., 2010) but that alcohol policy relevant to all population groups may have differential effects on different parts of the drinking population (Room et al., 2002). The findings from this research provide support for this framing as, taken together, results show that in the context of the liberal policy change differential increases in drinking patterns and harms were observed among young people. Young people were observed to experience more marked increases in typical occasion quantities, alcohol –related problems and alcohol-related harms relative to other population groups.

There are several mechanisms that may help to explain how this differential behaviour among young people may have occurred:

Room et al suggest that liberalising alcohol policy change will have more effect on individuals and subgroups whose consumption is lower than their desires because of the previous restriction (Room et al., 2002). Young people could feasibly have been a group whose consumption was lower than their desires due to previous restrictive policies; when restrictions on availability and access to alcohol were lifted consumption and related harms increased.

However there may be some limitations with the above explanation. Focusing on the desire of the restricted drinker places more emphasis on the individual and does not address the role of the alcohol environment, known to affect consumption, when attempting to explain differential behaviour. The following suggestions are put forward as mechanisms that may help to understand the ways in which young people experienced differential behaviour in the context of liberal policy change in New Zealand. These suggestions focus on the role of the alcohol environment in understanding differential behaviour.

In New Zealand young people experienced the greatest increases in the physical availability of alcohol known to increase consumption and harms (Babor et al., 2010). All policy changes affecting the physical environment were relevant to young people and some were particularly relevant including the lowering of the purchase age, the introduction of the ready to drinks and the expansion in range and strengths of these beverages (also the youth-focussed night time economy which saw more young people drinking in bars and consuming larger amounts there). This suggests that young people experienced a differential increase in the physical availability of alcohol which could have worked to increase their levels of consumption and harms relative to other population groups.

There were other ways in which differential behaviour among young people may have been shaped. Some policy changes related to the promotion of alcohol, which although relevant to the whole New Zealand population, were likely to be particularly effective among young people including ready to drinks (and other aspects of alcohol advertising). Other policy changes were directly aimed at young people in New Zealand and therefore not likely to affect older adults i.e. the lowering of the purchase age that directly affected those 18-19 years of age.

Overall the research findings were consistent within the relevant theoretical framing that differential segments of the population may be influenced differently in the context of alcohol policy change (Room et al., 2002). While the desires of the restricted drinker may play a part in denoting whose drinking changes the most, it is also possible that the differential experience of the alcohol environment had a role in contributing to differential patterns of behaviour in this research. This is suggested because more liberal policy changes were relevant to young people whereas this was not the case, or less likely, for older people.

Research limitations and strengths

As all data are cross-sectional no causality can be inferred. There were however limited options with regard to implementing a stronger study design in this research. A comparison country was not available and it was not possible to randomly assign people to experience, or not experience, the alcohol policy environment. Two birth cohort studies were implemented in the mid to late 1970's in Dunedin and Christchurch in New Zealand, however there was a problem with using these data to assess policy changes. Members of these cohorts were teenagers when the policy changes occurred at a time in which they were changing developmentally. Developmental transitions have been associated with alcohol use with heavy drinking peaking during late adolescence and early adulthood (Baer & Bray, 1999). Measures that may have been able to link specific policy changes to behaviour were not included aside from questions about alcohol advertising (in one of the longitudinal studies). Without such measures it would not have been possible to separate out developmental increases in consumption from policy effects. Furthermore, these cohorts did not cover the wider New Zealand population and as time went on did not include any younger people.

There were some advantages in the study design utilised. Developmental changes in young people were not confounding results as cross-sectional measures were taken. Trend data were available over a relatively long time period and response rates were relatively good. The survey samples used were representative with respect to demographic measures and had good coverage of the alcohol available for consumption so therefore could be generalised to the wider population. Trends in behaviour were studied from different angles including drinking patterns, alcohol-related problems and harms increasing confidence in the results. Behaviour could be studied for various sub-population groups, importantly younger people.

The New Zealand situation provided its own research challenges as numerous alcohol policy changes were introduced during a relatively short time frame. In several studies, given the breadth and range of alcohol policy changes, and the lack of policy specific measures in the surveys, it was not feasible to separate out possible effects of individual policy changes as all overlap.

All surveys used self-reported data which is susceptible to reporting bias. A main concern regarding alcohol surveys is the potential underestimation of alcohol consumption which is common among international surveys (accounting for between 40-60% of the alcohol available for consumption) (Rehm, 1998). As reported previously, however, a study conducted by Casswell et al in 2002 found that the measures and methodology used in the 2000 National New Zealand Alcohol Survey, used in Studies Two and Four, accounted for high amounts of the alcohol available for consumption in New Zealand (Casswell et al., 2002). The measures and methods utilised in the 2000 National New Zealand Alcohol Survey were the same as those utilised in the Auckland Annual Alcohol Surveys (Study One) and Study Five.

In Study One the average response rate was 67% (1990-2000). In 1990, the first data point in the time series, the response rate was lower at 60%; however the effect this one data point would have had on the overall trend is likely to be very minimal. Landline coverage varied between 93.5% and 96% from 1990 to 2000. It has previously been shown however that age and gender, the two aspects of demographics most relevant in this thesis, are not strongly related to landline phone ownership (Wyllie et al 1994). We may, therefore, not expect large changes in phone ownership, or bias due to differential phone ownership, among the age and gender groups over the time of these surveys. It is not known if response rate varied by age, gender or ethnicity over time and it is possible that some bias was present (although in which direction is not known). In Study Two, a lower response rate (59%) in 2004 may have caused bias. However, as the survey

accounted for 91% of the total alcohol available for consumption population level estimates are unlikely to be biased, although it is possible that results for some-subgroups were affected. Studies assessing the effects of non-response in telephone surveys among the general population are limited but have found that it is the lighter drinkers and abstainers that are missed (Gmel 2000, Lahaut et al 2002, Lemmens et al 1988). One study, from New Zealand, assessed the effect of including late responders in an alcohol survey (response rate 82%). The study found that late respondents tended to be heavier drinkers and that excluding the late responders lowered the prevalence of hazardous drinking in the total sample by 2%. This study was a web survey conducted among tertiary students, a population biased towards heavier drinkers, and it is unclear if these findings are able to be generalised to a general population telephone survey (Kypri, Stephenson & Langley 2004).

The survey consumption measures used in this research had some methodological limitations. Asking for respondent drinking patterns by locations means that the data does not provide a measure of a respondent's drinking at more than one location on a single drinking occasion. Therefore underestimation of how much individuals drink during the one occasion may occur (Casswell et al., 2002). This may be more likely to affect young people as available data suggests that this group drink at more than one location in a night in New Zealand (Huckle & Erhat, 2005c) (although data are not available for older age groups).

The price of alcohol, a factor known to affect consumption and alcohol-related harms (Babor et al., 2010), could not be controlled for in this research. From 1989, wine and beer taxation were linked to inflation so as to maintain their real prices, however the real price of wine did decrease during the 1990's. On the other hand the greatest increases in typical occasion quantity during this time were observed among young people, particularly those 14-19 years, for whom wine was not the beverage of choice (see Appendix 4). The decrease in the real price of wine however

may have been more relevant to the more modest increase in typical occasion quantity found among older women (Study One).

The wider economic environment was also not able to be controlled for. There was a recession early in the 1990s but from the mid-1990s economic recovery did occur (Casswell & Bhatta, 2001). Young people's typical occasion quantity increased over the 1990s despite the recession (Study One). However it is possible that the recession held consumption down among older males (Study One). Nationally, more groups, including males, did increase their typical occasion quantity during the time of economic recovery later in the decade (Study Two). Economic recovery could have therefore feasibly contributed to increases in consumption later in the decade.

Study Five (outlet density) had additional limitations. The alcohol advertising brand recall measure was not significant in predicting consumption despite this measure being a good predictor among young people (Casswell & Zhang, 1998; Unger, Schuster, Zogg, Dent, & Stacy, 2003). Brand recall was however limited to three brands in the survey question reducing variance in the data and possibly contributing to this lack of result. The result that areal-level deprivation predicted increased typical quantities for 12-17 year olds was found while controlling only for a young person's income. Ideally more individual level socio-economic variables would have been included as these may explain relationships between area-level deprivation and outcome measures (Blakely & Pearce, 2002). Self-reported purchasing was low in the sample of 12-17 year olds and mainly limited to 16-17 year olds therefore numbers may have been too small to detect a relationship with retailer's willingness to sell alcohol and typical occasion quantity.

Future work

Increased typical occasion quantity was associated with higher outlet density among teenagers in this research. Given this finding there may also be relationships with outlet density and alcohol-related harms in New Zealand. However there is still very limited research on outlet density and routinely collected harms among young people, and the general population, in New Zealand. There is also limited evidence regarding differences in on and off-licensed premises and associations with alcohol outcome measures in New Zealand (Kypri et al. (2008) has analysed on and off-licensed premises in relation to survey measures of self-reported problems among tertiary students). Such research would be useful for informing policy in New Zealand.

Social supply was identified as an important predictor of teenage consumption in this research. However the international literature is still limited with regards to investigating if ecological factors, such as area-level deprivation and alcohol outlet density, predict social supply. Documenting the behaviour of the social suppliers is important to be able to accurately link the social supply to the neighborhood from which it originated.

Future work should focus on: (i) understanding how alcohol policies have differential effects as there are gaps in understanding and (ii) being able to determine the effects of policy changes when multiple policy changes are implemented as has been the case in New Zealand. Stronger study designs, such as longitudinal designs, combined with survey measurements of mediating variables that link effects of specific policy changes to outcome behaviours are needed. Stronger empirical measurements of variables that clarify the pathways between alcohol policy effects and consumption would allow better assessment of which policy changes make a difference and how impacts differ in different groups. For example, if a trading hour change occurs survey measures assessing place and time of purchase would allow assessment of, which and whose, buying practices changed in regard to this policy change and then if this translated into an alcohol

outcome behaviour change. Such measures, when taken for a range of different policy relevant aspects of the alcohol environment, would also allow for separation of the effects of individual policy changes when they occur together.

Future work should consider useful controls on the price of alcohol (ideally price relative to the disposable income of consumers) (Stockwell & Gruenewald, 2004). A control on the price of alcohol is needed to separate the effects of the economic alcohol environment from the physical alcohol environment when assessing alcohol policy change.

Policy implications

A major purpose for undertaking this research was to inform alcohol policy in New Zealand. If this research were to have an impact it would be in influencing national level alcohol policy interventions in New Zealand. Based on the findings of this research, and the evidence for the most effective strategies to reduce consumption and harms (Babor et al., 2010), the following are recommended for young people in New Zealand (some of which will also work for the wider population):

1. Increase tax on alcohol (that will capture ready to drinks as well as other beverages)

There is strong international research evidence of the effectiveness of tax increases in reducing consumption and related harms in different jurisdictions. Heavier drinkers seem to be responsive to alcohol price changes as do young people and adults (Babor et al., 2010). Increasing tax to capture ready to drinks as well as other beverages in New Zealand could work to reduce young people's consumption and harm (and work for wider population groups that also alcohol experienced increases in typical occasion quantity and alcohol-related harms, albeit to a lesser extent).

Currently there is more research evidence to support broader tax increases on beverages as a more effective measure to reduce total population consumption than more specialised taxes such those targeting, for example, ready to drinks (Babor et al., 2010). Specialised taxes can reduce consumption of the beverage to which it is applied (Hall & Chikritzhs, 2011) but beverage substitution can occur cancelling out this effect. In Australia, however a tax on alcopops was reported to reduce per capita population consumption by 2% after accounting for beverage substitution. However the authors report that wider tax reform was preferred to prevent even partial beverage substitution (Hall & Chikritzhs, 2011).

2. Increase the minimum purchase age to 20 years in New Zealand

There is strong international research evidence showing that a minimum legal purchase age is an effective strategy to reduce traffic fatalities and other alcohol-related harms. In this research those directly affected by the lowering of the purchase age, the 18-19 year olds, were observed to have the greatest increase in drink-driving and alcohol-involved crashes. Returning the purchase age to 20 years in New Zealand would be effective in reducing alcohol-involved traffic crashes and would be a low cost strategy to implement.

3. Reduce alcohol outlet density via policy restrictions

There is good international research evidence showing that restricting the numbers of alcohol outlets will reduce consumption (and related harms) (Babor et al., 2010). Given the relationship between greater outlet density and increased typical occasion quantity among teenagers in this research, introducing restrictions on numbers and density of licensed premises would be a low cost and effective approach to reduce heavier consumption related to the clustering of outlets.

4. Introduce legal restrictions on alcohol advertising

There is good international research evidence showing that a dose-response relationship exists between exposure to alcohol advertising among young people and alcohol consumption (Babor et al., 2010). Reducing exposure to alcohol among young people via legal restrictions on alcohol advertising should work to reduce consumption in this group. As alcohol advertising works to normalise alcohol in society restrictions on exposure are also recommended for the wider New Zealand environment (and population). An effective system of legal restrictions on alcohol advertising is needed in New Zealand to replace the currently ineffective system of industry self-regulation.

Conclusion

The public health problem of increased alcohol consumption and related harms among young people in New Zealand can be reduced. It will, however, take effective restrictive alcohol policy controls to achieve this. This conclusion is drawn from the findings of this research, from which a story emerged – that in the context of substantial increases in the physical availability of alcohol with increasing promotion, young people, and in particular teenagers, were observed to experience the greatest increases in typical occasion quantities, related problems and harms in relation to other population groups. Specific liberalising policy contexts relevant to young people including the lowering of the minimum purchase age, ready to drinks and alcohol outlet density were also associated with increased consumption or harms among teenagers. It could not be determined, within the confines of the study design, if the policy changes were responsible for the increases in alcohol-related behaviour. However the results from this thesis, as a whole, tell a coherent story and one that is consistent within the relevant theoretical framing. Given the consistency of the research findings the conclusion is drawn that effective restrictive alcohol

policy controls are needed to reduce consumption and harms among young people in New

Zealand.

References

ADGP. (2003). *Alcopops and teenage drinking: a New Year's Eve warning (News Release and Report).* Manuka ACT: Australian Divisions of General Practice.

Alaniz, M. L., Cartmill, R. S., & Parker, R. N. (1998). Immigrants and violence: The importance of neighborhood context. *Hispanic Journal of Behavioural Sciences, 20(2)*, 155-176.

Alcohol & Public Health Research Unit. (1998). History of the Code on Liquor Advertising and the 1998 Review [Alcohol Advertising in the Broadcast Media, 1998: An information kit]. Retrieved 18 March 2010, from http://www.aphru.ac.nz/hot/adkit.htm

Alston, J., Fuller, K., Lapsley, J., Soleas, G., & Tumber, K. (2011). *Splendide Mendax: False Label Claims About High and Rising Alcohol Content of Wine.* (AAWE Working Paper No. 82: Economics). New York: American Association of Wine Economists, New York University.

Andersson, B., Hansagi, H., Thakker, K., & Hibell, B. (2002). Long-term trends in drinking habits among Swedish teenagers: National School Surveys 1971-1999. *Drug and Alcohol Review, 21*, 253-260.

Auckland Regional Council. (2007). *Immigration and Ethnicity in the Auckland Region. Results from the 2006 Census of Population and Dwellings.* (Prepared by Social and Economic Research and Monitoring team, Auckland Regional Council in conjunction with Dr Ward Friesen, School of Geography, Geology and Environmental Sciences, University of Auckland). Auckland.

Australian Institute of Health and Welfare. (2005). 2004 National Drug Strategy Household Survey - Detailed findings [Drug Statistics Series Number 16]. Retrieved 25 November 2009, from http://www.aihw.gov.au/publications/phe/ndshsdf04/ndshsdf04.pdf

Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., . . . Rossow, I. (2003). *Alcohol: No Ordinary Commodity - Research and Public Policy.* Oxford: Oxford University Press.

Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., . . . Homel, R., et al. (2010). *Alcohol: No Ordinary Commodity Research and Public Policy* (2nd ed.). Oxford: Oxford University Press.

Baer, P., & Bray, J. (1999). Adolescent individuation and alcohol use. *Journal of Studies on Alcohol, Supplement 13*, 52-62.

Biener, L., Garrett, C., Gilpin, E., Roman, A., & Currivan, D. (2004). Consequences of declining survey response rates for smoking prevalence estimates. *American Journal of Preventive Medicine, 27(3)*, 254-257.

Birckmayer, J., Holder, H., Yacoubian, G., & Friend, K. (2004). A general causal model to guide alcohol, tobacco, and illicit drug prevention: assessing the research evidence. *Journal of Drug Education, 34(2)*, 121-153.

Blakely, T., & Pearce, N. (2002). Socio-economic position is more than just NZDep. *New Zealand Medical Journal, 115*, 109-111.

Bloomfield, K., Gmel, G., Neve, R., & Mustonen, H. (2001). Investigating Gender Convergence in Alcohol Consumption in Finland, Germany, the Netherlands and Switzerland: A Repeated Survey Analysis *Substance Abuse, 22(1)*, 39-53.

Bloomfield, K., Rossow, I., & Norström, T. (2009). Changes in alcohol-related harm after alcohol policy changes in Denmark. *European Addiction Research, 15*, 224-231.

Bloomfield, K., Wicki, M., Gustafsson, N.-K., Makela, P., & Room, R. (2010). Changes in alcohol-related problems after alcohol policy changes in Denmark, Finland, and Sweden. *Journal of Studies on Alcohol and Drugs, 71*, 32-40.

Brain, K. (2000). *Youth, Alcohol and the Emergence of the Post-Modern Alcohol Order.* (Occasional Paper No.1). London: Institute of Alcohol Studies.

Brain, K., Parker, H., & Carnwath, T. (2000). Drinking with Design: Young Drinkers as Psychoactive Consumers. *Drugs: Education, Prevention and Policy, 7(1)*, 5-20.

Britt, H., Carlin, B., Toomey, T., & Wagenaar, A. (2005). Neighborhood level spatial analysis of the relationship between alcohol outlet density and criminal violence. *Environmental and Ecological Statistics, 12*, 411-426.

Casswell, S. (1995). Does alcohol advertising have an impact on the public health? *Drug and Alcohol Review, 14*, 395-404.

Casswell, S. (2004). Alcohol brands in young peoples' everyday lives: New developments in marketing. *Alcohol and Alcoholism, 39(6)*, 471-476.

Casswell, S., & Bhatta, K. (2001). *A Decade of Drinking: Ten-year Trends in Drinking Patterns in Auckland, New Zealand, 1990-1999*. Auckland: Alcohol & Public Health Research Unit.

Casswell, S., Huckle, T., & Pledger, M. (2002). Survey data need not underestimate alcohol consumption. *Alcoholism Clinical and Experimental Research, 26*, 1561-1567.

Casswell, S., & Zhang, J. (1998). Impact of liking for advertising and brand allegiance on drinking and alcohol-related aggression: A longitudinal study. *Addiction, 93(8)*, 1209-1217.

Chikritzhs, T., Allsop, S., Moodie, A., & Hall, W. (2011). Per capita alcohol consumption in Australia: Will the real trend please step forward? *Medical Journal of Australia, 193(10)*, 1-4.

Chikritzhs, T., Catalano, P., Stockwell, T., Donath, S., Ngo, H., Young, D., & Matthews, S. (2003). *Australian Alcohol Indicators, 1990-2001: Patterns of Alcohol Use and Related Harms for Australian States and Territories*. Perth: National Drug Research Institute.

Chikritzhs, T., & Stockwell, T. (2002). The impact of later trading hours for Australian public houses (hotels) on levels of violence. *Journal of Studies on Alcohol, 63*, 591-599.

Chikritzhs, T., & Stockwell, T. (2006). The impact of later trading hours for hotels on levels of impaired driver road crashes and driver breath alcohol levels. *Addiction, 101*, 1254-1264.

Chikritzhs, T., & Stockwell, T. (2007). The impact of later trading hours for hotels (public houses) on breath alcohol levels of apprehended impaired drivers. *Addiction, 102*, 1609-1617.

Chou, S. P., & Pickering, R. B. (1992). Early onset of drinking as a risk factor for lifetime alcohol related problems. *Addiction, 87*, 1999-1204.

Connor, C., Broad, J., Rehm, J., Vander Hoorn, S., & Jackson, R. (2005). The burden of death, disease, and disability due to alcohol in New Zealand. *New Zealand Medical Journal, 118(1213).* (electronic no page numbers)

CRAN. (2005). The Comprehensive R Network Archive Retrieved 10 April 2004, from http://cran.r-project.org/

Crego, A., Holguin, S., Parada, M., Mota, N., Corral, M., & Cadaveira, F. (2009). Binge drinking affects attentional and visual working memory processing in young university students. *Alcoholism: Clinical & Experimental Research, 33(11)*, 1870-1879.

Department of Public Health. (2007). Social Indicators [Wellington School of Medicine & Health Sciences, University of Otago.]. Retrieved 17 December 2007, from http://www.wnmeds.ac.nz/academic/dph/research/socialindicators.html

Easton, B. (2002). *Taxing Harm: Modernising Alcohol Excise Duties.* Wellington: Alcohol Advisory Council of New Zealand.

Easton, B. (2005). Taxing Alcoholic Beverages in New Zealand [Revised Version of Paper for "Thinking Drinking: Achieving Cultural Change by 2020", Melbourne, 21-23 February, 2005]. Retrieved 25 November 2009, from http://www.eastonbh.ac.nz/?p=641

Ecob, R., & Macintyre, S. (2000). Small area variations in health related behaviours; do these depend on the behaviour itself, its measurement, or on personal characteristics? *Health and Place, 6(4)*, 261-274.

Edwards, G., & Holder, H. (2000). The alcohol supply: Its importance to public health and safety, and essential research questions. *Addiction, 95(Supplement 4)*, S621-S627.

Evans, L., Grimes, A., Wilkinson, B., & Teece, D. (1996). Economic reform in New Zealand 1984-95: The pursuit of efficiency. *Journal of Economic Literature, 34*, 1856-1902.

Everitt, R., & Jones, P. (2002). Changing the minimum legal drinking age - its effect on a central city Emergency Department. *New Zealand Medical Journal, 115*, 9-10.

Gmel, G. (2000). The effect of mode of data collection and of non-response on reported alcohol consumption: A split-sample study in Switzerland. *Addiction, 95(1)*, 123-134.

Goddard, E. (2006). *General Household Survey 2005 - Smoking and Drinking Among Adults, 2005*. London: Office for National Statistics.

Gorman, D. M., Speer, P. W., Gruenewald, P., & Labouvie, E. W. (2001). Spatial dynamics of alcohol availability, neighbourhood structure and violent crime. *Journal of Studies on Alcohol, 62(628-636)*.

Green, M., & Flowerdew, R. (1996). New evidence on the modifiable areal unit problem. In P. Longley & M. Batty (Eds.), *Spatial Analysis: Modelling in a GIS Environment* (pp. 41-54). Cambridge: GeoInformation International.

Grube, J., & Stewart, K. (1999). *Guide to Conducting Alcohol Purchase Surveys*. Washington, DC: Pacific Institute for Research and Evaluation for the Office of Juvenile Justice and Delinquency Prevention, US Department of Justice.

Gruenewald, P., Millar, P. J., Treno, A. J., Yang, Z., Ponicki, W. R., & Roeper, P. (1996). The geography of availability and driving after drinking. *Addiction, 91(7)*, 967-983.

Gruenewald P. J., Millar A.B., Treno A.J. (1993) Alcohol availability and the ecology of drinking behavior. *Alcohol Health and Research World. 17,* 39-45.

Guria, J., Jones, W., Leung, J., & Mara, K. (2003). Alcohol in New Zealand road trauma. *Applied Health Economics and Health Policy, 2(4)*, 183-190.

Gustafsson, N.-K. (2010). Changes in alcohol availability, price and alohol-related problems and the collectivity of drinking cultures: What happened in southern and northern Sweden? *Alcohol and Alcoholism, 45(5)*, 456-467.

Habgood, R., Casswell, S., Pledger, M., & Bhatta, K. (2001). *Drinking in New Zealand: National Surveys Comparison 1995 & 2000.* Auckland: Alcohol & Public Health Research Unit, University of Auckland.

Hall, W., & Chikritzhs, T. (2011). The Australian alcopops tax revisited. *Lancet, 377*, 1136-1137.

Hart, H. (2007). Alcohol, drugs, and the adolescent brain. *Developmental Medicine & Child Neurology, 49(12)*, 883-883.

Herttua, K., Makela, P., & Martikainen, P. (2008). Changes in alcohol-related mortality and its socioeconomic differences after a large reduction in alcohol prices: a natural experiment based on register data. *American Journal of Epidemiology, 168*, 1110-1118.

Herttua, K., Makela, P., & Martikainen, P. (2009). An evaluation of the impact of a large reduction in alcohol prices on alcohol-related and all-cause mortality: Time series analysis of a population-based natural experiment. *International Journal of Epidemiology, Advance Access published December 7, 2009*, doi:10.1093/ije/dyp1336.

Hibell, B., Andersson, B., Ahlstrom, S., Balakireva, O., Bjarnason, T., Kokkevi, A., & Morgan, M. (2000). *The 1999 ESPAD Report: Alcohol and Other Drug Use Among Students in 30 European Countries.* Stockholm: Swedish Council for Information on Alcohol and Other Drugs (CAN).

Hill, L. (1998). From '6 o'clock swill' to 24 hour trading? Liberalisation and control of liquor licensing hours in New Zealand. *Alcohol Alert, 2*, 15-17.

Hill, L. (2000). The alcohol scene in New Zealand. *The Globe, 1*, 6-7.

Hill, L. (2004a). *Planning for the Sale of Alcohol: An Issues Paper for the Ministry of Health.* Wellington: Ministry of Health.

Hill, L. (2004b). *Planning for the Sale of Alcohol: A Review of Research and Policy.* Wellington: Ministry of Health.

Hill, L., & Stewart, L. (1996). The Sale of Liquor Act, 1989: reviewing regulatory practices. *Social Policy Journal of New Zealand, 7*, 174-190.

Huakau, J., Asiasiga, L., Ford, M., Pledger, M., Casswell, S., Suaalii-Sauni, T., & Lima, I. (2005). New Zealand Pacific peoples' drinking style: too much or nothing at all? *New Zealand Medical Journal, 118(1216).* (eletronic no page numbers)

Huckle, T., Conway, K., Casswell, S., & Pledger, M. (2005a). Evaluation of a regional community action intervention in New Zealand to improve age checks for young people purchasing alcohol. *Health Promotion International, 20(2)*, 147-155.

Huckle, T., & Erhat, A. (2005c). *Auckland Regional Exit Breath Survey 2005*. Auckland: Centre for Social and Health Outcomes Research and Evaluation (SHORE) & Te Ropu Whariki, Massey University.

Huckle, T., & Huakau, J. (2005b). *Young People and Drinking in New Zealand 2004*. Auckland: Centre for Social and Health Outcomes Research and Evaluation & Te Ropu Whariki, Massey University.

Huckle, T., & Huakau, J. (2007). *Exposure and Response of Young People to Marketing of Alcohol in New Zealand*. Auckland: Centre for Social and Health Outcomes Research and Evaluation (SHORE), Massey University.

Huckle, T., Huakau, J., Sweetsur, P., Huisman, O., & Casswell, S. (2008a). Density of alcohol outlets and teenage drinking: living in an alcogenic environment is associated with higher consumption in a metropolitan setting. *Addiction, 103*, 1614–1621.

Huckle, T., Pledger, M., & Casswell, S. (2006). Trends in alcohol-related harms and offences in a liberalized alcohol environment. *Addiction, 101(2)*, 232-240.

Huckle, T., Sweetsur, P., Moyes, S., & Casswell, S. (2008b). Ready to drinks are associated with heavier drinking patterns among young females. *Drug and Alcohol Review 27*, 398-403.

Huckle, T., You, R. Q., & Casswell, S. (2011). Increases in quantities consumed in drinking occasions in New Zealand 1995–2004. *Drug and Alcohol Review, 30(4)*, 366-371.

Hughes, K., MacKintosh, A., Hastings, G., Wheeler, C., Watson, J., & Inglis, J. (1997). Young people, alcohol and designer drinks: quantitative and qualitative study. *British Medical Journal, 314(7078)*, 414-418.

Jackson, M., Hastings, G., Wheeler, C., Eadie, D., & MacKintosh, A. (2000). Marketing alcohol to young people: implications for industry regulation and research policy. *Addiction, 95(Supplement 4)*, S597-S608.

Jernigan, D. (2001). *Global Status Report: Alcohol and Young People.* Geneva: World Health Organization.

Karriker-Jaffe, K. (2011). Areas of disadvantage: A systematic review of effects of area-level socioeconomic status on substance use outcomes. *Drug and Alcohol Review, 30(1)*, 84-95.

Kelsey, J. (1995). *The New Zealand Experiment: A World Model for Structural Adjustment?* Auckland: Bridget Williams & Auckland University Press.

Kelsey, J. (1997). *The New Zealand Experiment: A World Model for Structural Adjustment?* (Revised ed.): Auckland University Press/Bridget Williams Books.

Kerr, W., Greenfield, T., Bond, Ye, Y., & Rehm, J. (2009). Age-period-cohort modelling of alcohol volume and heavy drinking days in the US National Alcohol Surveys: Divergence in younger and older adult trends. *Addiction, 104*, 27-37.

Krishnan, V., Jensen, J., & Ballantyne, S. (2002). *New Zealand Living Standards 2000.* Wellington: Centre for Social Research and Evaluation, Ministry of Social Development.

Kypri, K., Bell, M., Hay, G., & Baxter, J. (2008). Alcohol outlet density and university student drinking: A national study. *Addiction, 103*, 1131-1138.

Kypri, K., Voas, R., Langley, J., Stephenson, S., Begg, D., Tippets, A., & Davie, G. (2006). Minimum purchasing age for alcohol and traffic crash injuries among 15-to-19-year-olds in New Zealand. *American Journal of Public Health, 96(1)*, 126-131.

Kypri, K., Stevenson, S., & Langley, J. Asssessment of nonresponse bias in an internet survey of alcohol use. Alcoholism Clinical and Experimental Research, 28(4), 630-634.

Lahaut, V., Jansen, H., van de Mheen, D., & Garretsen, H. (2002). Non-response bias in a sample survey on alcohol consumption. *Alcohol and Alcoholism, 37(3)*, 256-260.

Land Transport Safety Authority. (2001). Crash Facts: Alcohol. Wellington.

Land Transport Safety Authority. (2004). *Road Crash Data from the LTSA.* Wellington: LTSA.

Lang, E., Stockwell, T., Rydon, P., & Beel, A. (1996). Use of pseudo-patrons to assess compliance with laws regarding under-age drinking. *Australian and New Zealand Journal of Public Health, 20*, 296-300.

Lash, B. (2002). *Research Findings: Young People and Alcohol - Some Statistics on the Possible Effects of Lowering the Drinking Age.* (Number 2). Wellington: Ministry of Justice.

Lash, B. (2005). *Young People and Alcohol: Some Statistics to 2003 and 2004 on Possible Effects of Lowering the Purchase Age.* Wellington: Ministry of Justice.

Lemmens, P., Tan, E., & Knibbe, R. (1988). Bias due to non-response in a Dutch survey on alcohol consumption. *British Journal of Addiciton, 83*, 1069-1077.

Lipton, R., & Gruenewald, P. (2002). The spatial dynamics of violence and liquor outlets. *Journal of Studies on Alcohol, 63(2)*, 187-195.

Livingston, M., Chikritzhs, T., & Room, R. (2007). Changing the density of alcohol outlets to reduce alcohol-related problems *Drug and Alcohol Review, 25(5)*, 557-566.

Livingston, M. (2008). Recent trends in risky alcohol consumption and related harm among young people in Victoria, Australia. *Australia and New Zealand Journal of Public Health, 32 (3)*, 266-271.

Marriott-Lloyd, P., & Webb, M. (2002). Tackling Alcohol-Related Offences and Disorder in New Zealand [Policy Unit, Office of the Commissioner, New Zealand Police]. Retrieved 10 November 2004, from http://www.ndp.govt.nz/alcohol/tackling_alcohol.htm

McEwan, B., Campbell, M., & Swain, D. (2010). New Zealand culture of intoxication: Local and global influences. *New Zealand Sociology, 25(2)*, 15-37.

McKeganey, N., Forsyth, A., Barnard, M., & Hay, G. (1996). Designer drinks and drunkeness amongst a sample of Scottish school children. *British Medical Journal, 313(7054)*, 401-.

McPherson, M., Casswell, S., & Pledger, M. (2004). Gender convergence in alcohol consumption and related problems: issues and outcomes from comparisons on New Zealand survey data. *Addiction, 99*, 738-748.

Measham, F. (1996). The 'big bang' approach to sessional drinking: changing patterns of alcohol consumption amongst young people in North West England. *Addiction Research, 4*, 283-299.

Measham, F., & Brain, K. (2005). 'Binge' drinking, British alcohol policy and the new culture of intoxication. *Crime, Media and Culture, 1(3)*, 262-283.

Measham, F. The turning tides of intoxication: young people's drinking in Britain in the 2000's. Health Education, 108(3), 207-222.

Measham, F., & Ostergaard, J. (2009). The public face of binge drinking: British and Danish young women, recent trends in alcohol consumption and the European binge drinking debate. *Probation Journal, 56*, 415-434.

Metzner, C., & Kraus, L. (2008). The Impact of Alcopops on Adolescent Drinking: A Literature Review. *Alcohol and Alcoholism, 43 (2)*, 230-239.

Ministry of Health. (2007). *Alcohol Use in New Zealand: Analysis of the 2004 New Zealand Health Behaviours Survey – Alcohol Use.* (Public Health Intelligence Occasional Bulletin No. 40). Wellington: Ministry of Health.

Ministry of Justice. (1996). Liquor Review 1996 - A Discussion Paper. Retrieved 12 September 2011, from http://www.justice.govt.nz/publications/publications-archived/1996/liquor-review-1996-a-discussion-paper/publication

Monti, P., Miranda, R., Nixon, K., Sher, K., Swartzwelder, H., Tapert, S., . . . Crews, F. (2005). Adolescence: Booze, brains and behavior. *Alcoholism: Clinical & Experimental Research, 29(2)*, 207-220.

Mosher, J., & Johnsson, D. (2005). Flavored alcoholic beverages: an international marketing campaign that targets youth. *Journal of Public Health Policy, 26*, 326-342.

New Zealand Drug Foundation. (2006). *Alcohol advertising policy in New Zealand: An experiment in industry self-regulation.* Wellington.

New Zealand Law Commission. (2010). *Alcohol In Our Lives: Curbing the Harm.* (Law Commission report; no. 114). Wellington.

Norström, T. (2000). Outlet density and criminal violence in Norway, 1960-1995. *Journal of Studies on Alcohol, 61*, 907-911.

Norstrom, T., & Skog, O. (2005). Saturday opening of alcohol retail shops in Sweden: An experiement in two phases. *Addiction, 100,* 767-76.

Pacific Institute for Research and Evaluation (PIRE). (no date). Causal Factors in the Prevention of Underage Drinking Retrieved 13 September 2011, from cpp.omni.org/Documents/Word_Docs/PIRELogicModelSummaries.doc

Pollack, C., Cubbin, C., Ahn, D., & Winkleby, M. (2005). Neighbourhood deprivation and alcohol consumption: Does the availability of alcohol play a role? *International Journal of Epidemiology, 34*, 772-780.

Redmond, A., Horne, J., Pelletier, A., Porter, J., Johnson, J., St. Martin, V., . . . Miller, J. (2004). Alcohol Use Among Adolescents and Adults --- New Hampshire, 1991--2003. *MMWR Weekly, 53(8)*, 174-175.

Rehm, J. (1998). Measuring quantity, frequency and volume of drinking. *Alcoholism: Clinical & Experimental Research, 22(Supplement 2)*, 4S-14S.

Roberts, C., Blakey, V., & Tudor-Smith, C. (1999). Impact of 'Alcopops' on regular drinking by young people in Wales. *Drugs: Education, Prevention and Policy, 6(1)*, 7-15.

Room, R. (2004). Patching together a policy study [published in Swedish]. *Nordisk Alkohol- & Narkotikatidskrift, 21*, 345-349.   (also available in english)

Room, R., Romelsjo, A., & Makela, P. (2002). Impacts of alcohol policy: the Nordic experience. In R. Room (Ed.), *The Effects of Nordic Alcohol Policies: What Happens to Drinking and Harm When Alcohol Controls Change*. Helsinki: Nordic Council on Alcohol and Drug Research.

Sale of Liquor Act. (1989).

SAS Institute. (2001). *SAS/STAT Software: Changes and Enhancements, Release 8.2*. Cary, NC: SAS Institute Inc.

Scribner, R., Cohen, D., & Fisher, W. (2000). Evidence of a structural effect for alcohol outlet density: A multilevel analysis. *Alcoholism: Clinical and Experimental Research, 24(2)*, 188-195.

SHORE. (2006a). *Alcohol Taxation in the Western Pacific Region*. Auckland: Centre for Social and Health Outcomes Research and Evaluation (SHORE), Massey University.

SHORE. (2006b). *Comparing Survey Data with Taxable Alcohol*. (Unpublished Report). Auckland: Centre for Social and Health Outcomes Research and Evaluation (SHORE), Massey Uinversity.

Smith, D. (1986). Effect on non-traffic accident hospital admissions of lowering the drinking age in two Australian states. *Contemporary Drug Problems, 13*, 621-639.

Smith, L., & Foxcroft, D. (2009). Drinking in the UK: An exploration of trends [Joseph Rowntree Foundation]. Retrieved 25 November 2009, from http://www.jrf.org.uk/sites/files/jrf/UK-alcohol-trends-FULL.pdf

Statistics New Zealand. (1997). *1996 Census of Population and Dwellings*. Wellington.

Statistics New Zealand. (2000). *Alcohol Available for Consumption*. Wellington: Statistics New Zealand.

Statistics New Zealand. (2001). *Hot off the Press: Alcohol and Tobacco Available for Consumption Year ended December 2000*. Wellington: Statistics New Zealand.

Statistics New Zealand. (2002). 2001 Census of Population and Dwellings: Families and Households Retrieved 2 July 2010, from http://www.stats.govt.nz/Census/2001-census-data.aspx

Statistics New Zealand. (2004a). Hot off the Press - Alcohol and Tobacco Available for Consumption Year Ended December 2003 [Statistics New Zealand]. Retrieved 14 July, 2011, from http://www.stats.govt.nz/browse_for_stats/industry_sectors/alcohol_and_tobacco_availability/AlcoholAndTobacco_HOTPYeDec04.aspx

Statistics New Zealand. (2004b, 25 November). Household Economic Survey (Year ended 30 June 2004) - Hot Off The Press Retrieved 10 October 2009, from http://www.stats.govt.nz/browse_for_stats/people_and_communities/Households/HouseholdEconomicSurvey_HOTPYeJun04.aspx

Statistics New Zealand. (2004c). Population Estimates Retrieved 4 December 2004, from http://www.stats.govt.nz/datasets/population/population-estimates.htm

Statistics New Zealand. (2006). *Alcohol and Tobacco Available for Consumption Year ended December 2005*. (Hot Off the Press). Wellington.

Statistics New Zealand. (2009a, Archived by WebCite® at http://www.webcitation.org/5unxtkwFk). Alcohol and Tobacco Available for Consumption: Year ended December 2008 [Hot Off the Press] Retrieved 7 December 2010, from http://www.stats.govt.nz/browse_for_stats/alcohol_and_tobacco/alcohol_and_tobacco_availability/alcoholandtobacco_hotpdec08.aspx

Statistics New Zealand. (2009b). Ethnicity Papers Retrieved 20 October 2009, from http://www.stats.govt.nz/reports/analytical-reports/review-measurement-of-ethnicity/papers.aspx

Statistics New Zealand. (2011). *Hot off the Press: Alcohol Available for Consumption: Year Ended December 2010*. Wellington.

Stewart, L., Casswell, S., & Thompson, A. (1997). Promoting public health in liquor licensing: Perceptions of the role of alcohol community workers. *Contemporary Drug Problems, 24*, 1-37.

Stockwell, T., & Gruenewald, P. (2004). Controls on the physical availability of alcohol. In N. Heather & T. Stockwell (Eds.), *The Essential Handbook of Treatment and Prevention of Alcohol Problems* (pp. 213-233). Chichester: John Wiley & Sons.

Sutherland, I., & Willner, P. (1998). Patterns of alcohol, cigarette and illicit drug use in English adolescents. *Addiction, 93(8)*, 1199-1208.

Treno, A., Grube, J., & Martin, S. (2003). Alcohol availability as a predictor of youth drinking and driving: A hierarchical analysis of survey and archival data. *Alcoholism: Clinical & Experimental Research, 27*, 835–840.

Unger, J., Schuster, D., Zogg, J., Dent, C., & Stacy, A. (2003). Alcohol advertising exposure and adolescent alcohol use: A comparison of exposure measures. *Addiction Research and Theory, 11(3)*, 177-193.

Valli, R. (1998). Forandringar i ungdomarnas alkoholvanor nar mellanolet slapptes fritt: Fallet Jakobstad (Changes in young people's alcohol consumption with improved availability of medium strength beer: The case of Pietarsaari). *Nordisk Alkohol & narkotikatidskrift (Nordic Alcohol and Drug Studies), 15(3)*, 168-175.

Wagenaar, A., & Langley, J. (1995). Alcohol licensing system changes and alcohol consumption: Introduction of wine into New Zealand grocery stores. *Addiction, 90(6)*, 773-783.

Wagenaar, A., & Toomey, T. (2002). Effects of minimum drinking age laws: Review and analyses of the literature from 1960 to 2000. *Journal of Studies on Alcohol, Supplement 14*, 206-225.

Webb, M., Marriot-Lloyd, P., & Grenfell, M. (2004). Banning the Bottle: Liquor Bans in New Zealand [National Drug Policy New Zealand]. Retrieved 20 November 2007, from http://www.ndp.govt.nz/moh.nsf/indexcm/ndp-publications-banningbottleliquorbans

Wechsler, H., Lee, J., Hall, J., Wagenaar, A., & Lee, H. (2002). Secondhand effects of student alcohol use reported by neighbors of colleges: the role of alcohol outlets. *Social Science and Medicine, 55*, 425-435.

Weitzman, E., Folkman, A., Folkman, K., & Wechsler, H. (2003). The relationship of outlet density to heavy and frequent drinking and drinking-related problems among college students at eight universities. *Health & Place, 9*, 1-6.

White, V., & Hayman, J. Australian Secondary school students' use of alcohol in 2005. Drug Strategy Branch Australian Government Department of Health and Ageing; The Cancer Council Victoria. June 2006.

Wicki, M., Gmel, G., Kuntsche, E., Rehm, J., & Grichting, E. (2006). Is alcopop consumption in Switzerland associated with riskier drinking patterns and more alcohol-related problems. *Addiction, 101*, 522-533.

Wilsnack, R., Vogeltanz, N., Wilsnack, S., & Harris, T. (2000). Gender differences in alcohol consumption and adverse drinking consequences: cross-cultural patterns. *Addiction, 95(2)*, 251-265.

World Health Organization. (2000). *International Guide for Monitoring Alcohol Consumption and Related Harm.* Geneva: Department of Mental Health and Substance Dependence, World Health Organization.

Wyllie, A., Black, S., Zhang, J., & Casswell, S. (1994). Sample frame bias in telephone-based research in New Zealand. *New Zealand Statistician, 29(2)*, 40-53.

Wyllie, A., Holibar, F., Jakob-Hoff, M., & Casswell, S. (1993). A qualitative investigation of the introduction of wine in New Zealand grocery outlets. *Contemporary Drug Problems, 20*, 33-49.

Wyllie, A., Waa, A., & Zhang, J. (1996). *Alcohol and Moderation Advertising Expenditure and Exposure.* Auckland: Alcohol & Public Health Research Unit, University of Auckland.

Wyllie, A., Zhang, J.-F., & Casswell, S. (2000). Risk functions for frequency of alcohol-related negative consequences: New Zealand survey data. *Addiction, 95*, 1821-1832.

Zhang, J.-F., & Casswell, S. (1999). The effects of real price and a change in the distribution system on alcohol consumption. *Drug and Alcohol Review, 18*, 371-378.

Zhu, L., Gorman, D., & Horel, S. (2004). Alcohol outlet density and violence: A geospatial analysis. *Alcohol and Alcoholism, 39(4)*, 369-375.

Appendix 1

Appendix 2

<u>Total population consumption</u>

Alcohol control policies that affect the availability of alcohol may not only influence particular groups within society but can have a relationship with total population consumption. Relationships between the availability of alcohol and levels of alcohol sales and harms are however complex; local contexts and contingencies condition these relationships. As such, changes in availability will not always lead to changes in total population consumption (Stockwell & Gruenewald, 2004).

Trends in total population consumption 1990's

Despite the proliferation of liquor outlets, the introduction of wine for sale in grocery outlets, the introduction of alcohol brand advertising in the broadcast media and the introduction of ready to drinks; a decline in aggregate consumption estimates occurred in New Zealand during the 1990's. According to the Statistics New Zealand Long Term Data Series per capita estimates declined from 10.07L in 1990 - to an all-time low of 8.45L in 1997. This was a decline of 1.62L per person 15+ years[6].

It is likely that New Zealand's total population estimates of consumption were underestimated during the 1990's (and to the current day). This suggestion is informed by Chikritzhs et al. (2011) who report, from Australia, that the increasing alcohol content of wine; the increasing market share of wine and the failure to adjust for the increasing alcohol content in wine in aggregate alcohol calculations has underestimated average population consumption. New Zealand has a very similar situation to Australia: (i) a similar conversion factor of 11% for wine alcohol content was/is utilised in New Zealand (ii) a similar increase in wine alcohol content from 11% to 13%

---

[6] Statistics New Zealand Long Term Data Trend:
http://www.stats.govt.nz/searchresults.aspx?q=alcohol   See table c5 3

has occurred (with wine alcohol content at 12.3% as early as 1992 in New Zealand) (Alston et al., 2011) and (iii) a similar increase, 10%, in market share of wine has occurred. This 10% increase occurred between 1990 and 1999 in New Zealand (informed by Statistics New Zealand data requested via extract).

Another factor contributing to the declining trend in total alcohol consumption may have been related to the size of young people in the population. Quite marked increases in typical quantities consumed occurred among young people during the 1990's (Study One). However as they were of a relatively small size they may not have influenced average population consumption. At the beginning of the 1990's those aged 14-19 years made up 12% of the population and those 20-24 years 10%. This compares to 77% of the population over 25 years (of which 47% were over 40 years). Nearing the end of the 1990's those aged 14-24 had declined in the population by 4% compared to a 4% increase in those over 40 years (Statistics New Zealand national population estimates). Aggregate estimates can hide what is going on in subgroups when the population is increasing unevenly.

Increasing levels of unrecorded alcohol were not likely to be contributing to decreasing per capita estimates from 1990-1997. New Zealand has little unrecorded alcohol and the two main sources of which are homemade alcohol or duty free alcohol brought in by New Zealand residents. Both of these sources have been shown to contribute little to aggregate consumption when survey estimates have been scaled up to the population level (Habgood et al. 2001; HBS survey unpublished analysis). Illegal alcohol is not known to be an issue and as New Zealand is a relatively isolated island nation with no bordering countries and there is no cross-border shopping.

Trends in total population consumption late 1990's – mid 2000's

According to Statistics New Zealand's Long Term Data Series aggregate consumption began to increase following 1997(at 8.45L). By 1998 per capita estimates were 8.80L and by 2004 9.09L per person 15+ years.

The increase in per capita coincided with a time frame in which more segments of the New Zealand population increased their consumption (as documented by national survey data Study Two). Most age groups and gender groups increased their typical quantities consumed, including older males.

Appendix 3

Appendix 4

Proportion of total volume consumed as wine during the 1990s among 14-19 year olds.

SEX	YEAR	agegrp	Proportion consumed as wine
Male	1990	14-19	**2%**
	1995	14-19	**8%**
	2000	14-19	**1%**
Female	1990	14-19	**16%**
	1995	14-19	**6%**
	2000	14-19	**9%**

Appendix 5

Statements of the candidate's contribution to the publications included in this thesis