

Guidance Title: Prevention and early identification of alcohol use disorders in adults and young people

Final draft of Report 1 Macro Level Interventions for Alcohol Use Disorders: Effectiveness Review to the National Institute for Health & Clinical Excellence

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1. LIST OF ABBREVIATIONS

A list of abbreviations used throughout this report is presented below.

LIST OF ABBREVIATIONS

AAF	Alcohol-attributable fraction
ABV	Alcohol by volume
A&E	Accident & Emergency
AMI	Adaptations of motivational interviewing
BAL	Blood alcohol level
BI	Brief intervention
CI	Confidence Interval
CTRL	Control
EBI	Extended brief intervention
ED	Emergency Department
FME	Forensic Medical Examiner
G	Gram
GGT	Gamma-glutamyltransferase
GP	General Practitioner
Hr	Hour
HRQL	Health Related Quality of Life
ICER	Incremental cost effectiveness ratios
ITT	Intention to Treat
L	Litre
MCV	Mean corpuscular volume
MI	Motivational interviewing
ml	Millilitre
MLDA	Minimum legal drinking age
MNI	Minimal intervention
MVA	Motor vehicle accident
Min	Minute
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NNT	Number Needed to Treat
NS	Not Significant
OR	Odds Ratio

PDG	Programme Development Group
QUOROM	Quality Of Reporting Of Meta-analyses
RCT	Randomised Controlled Trial
RR	Relative Risk
WHO	World Health Organisation
Wk	Week
U	Unit
Vs	Versus

2. EXECUTIVE SUMMARY

Background

Alcohol misuse is associated with significant clinical and social consequences. The National Institute for Health and Clinical Excellence has been asked by the Department of Health to develop public health guidance to promote the prevention and early identification of alcohol-use disorders in adults and adolescents.

Objectives

To undertake an assessment of the clinical and cost-effectiveness of i) measures to detect alcohol misuse amongst adults and young people; ii) brief interventions to manage alcohol misuse among adults and young people; and iii) interventions to improve management of England's alcohol market.

Methods

Systematic reviews of effectiveness evidence to address the above areas have been undertaken.

Results

This report includes the findings of the systematic reviews of the effectiveness of price controls, interventions in the management of the availability of alcohol, and the control of alcohol promotion.

Review 1: The effectiveness of price controls in reducing alcohol consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

A considerable evidence base relating to the impact of price/taxation on alcohol consumption and related outcomes was identified. Four pieces of evidence, including one extensive systematic review, were included. Evidence demonstrated a clear relationship between price/tax increases and reductions in the demand for alcohol. Similarly, the evidence base showed a relationship between price/tax increases and reductions in alcohol-related harms. Limited evidence suggested that minimum pricing may be an effective approach in reducing alcohol consumption.

Review 2: The effectiveness of interventions in managing alcohol availability to reduce levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

A large body of evidence relating to the management of alcohol availability was identified, with a total of 87 pieces of evidence included across the following sub-sections:

Minimum legal age of alcohol purchase

Seven papers were included, including one very extensive systematic review. Findings were suggestive of an inconclusive negative relationship between minimum legal age of alcohol purchase and alcohol consumption. Additional work provided further evidence of a negative association between minimum legal age and alcohol-related outcomes.

Enforcement of minimum legal age of alcohol purchase

Nineteen papers were included. Whilst serving staff appeared to support the principle of enforcement, the commitment of managers towards their responsibilities varied. Furthermore, servers and licensees appeared to perceive little risk as a result of serving alcohol to underage people. Training interventions were not shown to have a significant impact on sales; whilst the effectiveness of compliance checks by police was variable.

Management of the sale of alcohol to intoxicated individuals

Thirteen papers were included. A wide range of interventions were evaluated that differed considerably in terms of structure and content. No conclusive impact of server training on the alcohol consumption of customers was observed. Some evidence indicated that server training was linked with reductions in some alcohol-related harms. Server training appeared to increase server knowledge, and positive aspects of server behaviour, including refusals of service to intoxicated customers. UK-specific unpublished evidence suggests that community initiatives are proving beneficial in promoting responsible beverage service.

Licensed hours and days of alcohol sale

Twenty seven pieces of evidence were included. Whilst levels of alcohol consumption and crime and disorder appear to have remained stable following the introduction of the Licensing Act, a clear temporal displacement of crime and disorder and also emergency department alcohol-related attendances has occurred, with a greater proportion of incidents taking place in the early hours of the morning. Evidence also suggests that the Licensing Act has had resource implications, particularly for police and health professionals. Other UK-specific and international evidence was also identified and presented, with increases in licensing hours typically associated with increased consumption and/or harms.

Alcohol outlet density

Eighteen papers were included. A clear positive association between increases in alcohol outlet density and increases in alcohol consumption was observed among both adults and

young people. Further limited evidence was also identified that found a positive relationship between alcohol outlet density and alcohol-related harms.

Interaction between off-licence and on-licence availability of alcohol

Three papers were included. Identified evidence indicated that pre-drinking is a prevalent activity in the UK and other countries, and is associated with increased overall alcohol consumption and greater risk of alcohol-related harms.

Review 3: The effectiveness of the control of alcohol promotion (e.g. advertising) in reducing levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

Evidence was identified from two large systematic reviews that was supportive of a relationship between alcohol advertising and promotion and alcohol consumption, particularly among young people. Exposure to alcohol advertising and promotion was associated with the onset of adolescent alcohol consumption and with increased consumption amongst adolescents who were already drinking at baseline. A moderate but consistent association was also observed between point of purchase promotions and effects on alcohol consumption among underage drinkers, binge drinkers and regular drinkers. Outdoor and print advertising media may increase the probability of onset of adolescent alcohol consumption and also influence quantity and frequency of alcohol consumption among young people. Ownership of an alcohol promotional item or branded merchandise may be associated with increased initiation of drinking. Exposure to television and other broadcast media was linked with onset of and levels of alcohol consumption. Evidence was identified that advertising bans may result in reduced alcohol consumption.

Evidence statements

Review 1:

Evidence statement 1.1:

A comprehensive systematic review was identified that demonstrated a clear association between price/tax increases and reductions in consumer demand for alcohol.¹ These conclusions were based on two rigorous meta-analyses of price elasticities conducted by Gallet, 2007 and Wagenaar *et al.*, 2008.

¹ Booth *et al.*, 2008 (Systematic review, ++)

Applicability: The majority of the studies included in the review by Booth originated in the USA.

Evidence statement 1.2:

The systematic review by Booth *et al.* (2008) reported that there is some evidence that young people, binge drinkers and harmful drinkers tend to show a preference for cheaper drinks.

¹Booth *et al.*, 2008 (Systematic review, ++)

Applicability: The majority of the studies included in the review by Booth originated in the USA.

Evidence statement 1.3:

A limited evidence base was identified that indicated that minimum pricing may be effective in reducing alcohol consumption and that consulted members of the community were supportive of such measures.

¹Booth *et al.*, 2008 (Systematic review, ++)

Applicability: The evidence relating to minimum pricing was drawn from an Australian setting.

Evidence statement 1.4:

An evidence base comprising a large number of primary studies was identified that demonstrated a relationship between price/tax increases and reductions in harms.¹ Additional evidence indicates that decreases in the price of alcohol contribute towards increases in alcohol-related deaths, particularly in deaths attributable to chronic causes such as alcoholic liver disease.² Population groups specifically affected included the older population, the unemployed and individuals with lower levels of education, social class and income.² Furthermore, Wagenaar *et al.*, 2009 demonstrated that increases in tax were associated with decreases in alcohol-related disease mortality.³

¹Booth *et al.*, 2008 (Systematic review, ++)

²Herttua *et al.*, 2008 (Before and after study, ++) Finland

³Wagenaar *et al.*, 2009 (Time series analysis, ++) USA

Applicability: The majority of the studies included in the review by Booth originated in the USA. The study by Herttua *et al.* was conducted in Finland, whilst Wagenaar *et al.* based their study in Alaska.

Evidence statement 1.5:

Results of a meta-regression analysis of own price elasticity estimates found a longitudinal trend whereby consumer demand for alcohol beverages was increasingly inelastic until 1969 and subsequently decreasingly inelastic. The study authors discuss whether this effect might be potentially attributable to a substitution of alcohol with increasingly available illicit drugs. However, no evidence is currently available to support this hypothesis.

¹ Fogarty, 2006 (Meta-regression analysis)

Applicability: Elasticity estimates were drawn from a range of international studies, with the majority coming from the UK, USA, and Canada; and the remaining estimates from Australia, New Zealand, the Netherlands, France, Belgium, Germany, Portugal, Spain, Italy, Ireland, Scandinavia, Kenya and Japan.

Evidence statement 1.6:

The same meta-regression analysis also demonstrated that the higher the relative market share of a beverage, the more inelastic the consumer demand.¹ Therefore, it can be anticipated that the most popular beverages within a market will be least responsive to changes in alcohol price or taxation.

¹ Fogarty, 2006 (Meta-regression analysis)

Applicability: Elasticity estimates were drawn from a range of international studies, with the majority coming from the UK, USA, and Canada; and the remaining estimates from Australia, New Zealand, the Netherlands, France, Belgium, Germany, Portugal, Spain, Italy, Ireland, Scandinavia, Kenya and Japan.

Review 2:

Evidence statement 2.1

The very comprehensive systematic review performed by Wagenaar & Toomey provided inconclusive evidence suggestive of a negative relationship between MLDA and alcohol consumption.¹ A further study found a small negative impact of MLDA on alcohol consumption.²

¹ Wagenaar & Toomey, 2002 (Systematic review, ++)

² DiNardo & Lemieux, 2001 (Regression analysis) USA

Applicability: The majority of the primary research included in the systematic review by Wagenaar & Toomey was conducted in the USA and Canada (with the remaining studies drawn from Australia, New Zealand, Switzerland, and Norway). DiNardo & Lemieux used data from the USA for analysis.

Evidence statement 2.2

The identified evidence also pointed towards the existence of a negative relationship between MLDA and alcohol-related outcomes, including intoxicated presentations by young people at A&E,¹ alcohol-related road traffic accidents among young people,^{2,3,4,5} juvenile crime⁶ and other health and social problems.⁵

¹ Everitt *et al.*, 2002 (Before and after study, +) New Zealand

² Fell *et al.*, 2008 (Analysis of variance and regression analysis) USA

³ Kypri *et al.*, 2006 (Before and after study, ++) New Zealand

⁴ Ponicki *et al.*, 2007 (Cross-sectional time series data analysis) USA

⁵ Wagenaar & Toomey, 2002 (Systematic review, +)

⁶ Smith & Burvill, 1987 (Before and after study, +) Australia

Applicability: The majority of the primary research included in the systematic review by Wagenaar & Toomey was conducted in the USA and Canada (with the remaining studies drawn from Australia, New Zealand, Switzerland, and Norway). Other studies were performed in the USA, Australia and New Zealand.

Evidence statement 2.3

Evidence was identified demonstrating that the impact of changes in MLDA can be moderated by the existing regulatory environment, in this case the level of beer taxation.¹

¹ Ponicki *et al.*, 2007 (Cross-sectional time series data analysis) USA

Applicability: The above study was set in the USA.

Evidence statement 2.4

Evidence was identified demonstrating that serving staff in alcohol outlets were disapproving of underage sales¹ and generally positive of implementing underage checks, including electronic age verification devices.²

¹ Gehan *et al.*, 1999 (Qualitative study, +) USA

² Krevor *et al.*, 2003 (Before and after study, ++) USA

Applicability: The above studies were both conducted in the USA.

Evidence statement 2.5

The commitment of managers and licensees towards their legal responsibilities relating to underage sales was variable.^{1,2}

¹ Pratten, 2005 (Qualitative study, +) UK

² Gehan *et al.*, 1999 (Qualitative study, +) USA

Applicability: One study was specific to English licensees.

Evidence statement 2.6

Servers and licensees were reported to perceive only limited risk as a consequence of serving alcohol to underage people.^{1,2}

¹ Willner *et al.*, 2000 (Before and after study, +) UK

² Gehan *et al.*, 1999 (Qualitative study, +) USA

Applicability: One study was conducted in the UK.

Evidence statement 2.7

Training interventions for management and staff were not shown to have a significant impact in preventing underage sales.^{1,2}

¹Toomey *et al.*, 2001 (Controlled before and after study, ++) USA

² Wagenaar *et al.*, 2005 (Multi-community time-series quasi-experimental trial) USA

Applicability: Both of the above studies were performed in the USA.

Evidence statement 2.8

The effectiveness of enforcement checks in reducing alcohol sales to underage young people was variable.¹ Compliance checks conducted by local police were not effective in reducing arrests in those aged under 18 yrs² or reducing underage sales³ in the UK. Other studies showed favourable outcomes of compliance checks by local authorities in reducing underage alcohol sales.^{4,5,6,7} Checks enforced with a 30-day licence suspension or a fine were effective in reducing sales.⁸ However, the deterrent effect of enforcement was found to decay over time.^{4,7}

¹ Elder *et al.*, 2007 (Systematic review, +)

² Jeffs & Saunders, 1983 (Controlled before and after study, ++) UK

³ Willner *et al.*, 2000 (Before and after study, +) UK

⁴ Grube, 1997 (Controlled before and after study, +) USA

⁵ MMWR, 2004 (Controlled before and after study, +) USA

⁶ Wagenaar *et al.*, 2000 (RCT, ++) USA

⁷ Wagenaar *et al.*, 2005 (Multi-community time-series quasi-experimental trial) USA

⁸ Preusser *et al.*, 1994 (Before and after study, +) USA

Applicability: Two studies originated in the UK

Evidence statement 2.9

On- and off-licensees perceived the most effective approach to preventing underage sales to be test purchasing carried out in conjunction with a new nationally-accepted proof of age card.¹

¹ Scottish Centre for Social Research, 2007 (Evaluation) UK

Applicability: This study was specific to the licensees of Fife, Scotland.

Evidence statement 2.10

The range of interventions to manage the sale of alcohol to intoxicated individuals present within the identified literature showed a large degree of heterogeneity in content and structure, as described in the qualitative review by Toomey *et al.* (1998).¹

¹Toomey *et al.*, 1998 (Qualitative review) USA

Applicability: This research was conducted in the USA.

Evidence statement 2.11

The attitudes and commitment of managers and service staff to server training and policies varied considerably.^{1,2}

¹Turrisi *et al.*, 1999a (Survey, ++) USA

²Turrisi *et al.*, 1999b (Survey, ++) USA

Applicability: Both the above studies were specific to the USA.

Evidence statement 2.12

One study suggested that the lack of public awareness of the legal obligations relating to the service of alcohol to intoxicated people was a barrier to responsible beverage service.¹

¹Wyllie, 1997 (Evaluation) New Zealand

Applicability: The above study originated in New Zealand.

Evidence statement 2.13

No conclusive impact of server training on the alcohol consumption of patrons was observed.¹ Limited evidence was identified that server training was associated with a reduction in single vehicle night time crashes and police reported violence.¹ However, server training appeared to result in increased server knowledge surrounding responsible beverage service and more desirable server behaviour.¹ Server training was also shown to result in more refusals of alcohol service to customers,² decreased Driving Whilst Intoxicated arrests,² fewer signs of intoxication among pseudo-patrons,³ and reduced likelihood of illegal sales to intoxicated patrons.⁴ However, this effect was found to decay within 3 months.⁴

¹Ker & Chinnock (Systematic review, ++)

²McKnight & Streff (Controlled before and after study, ++) USA

³Geller, 1987 (Controlled before and after study, ++) USA

⁴Toomey *et al.*, 2008 (RCT, ++) USA

Applicability: The primary studies above were performed in the USA. The majority of the studies included in the Ker & Chinnock review were from the USA, Australia, and Sweden.

Evidence statement 2.14

Unpublished UK-specific literature was identified that provided indications that community alcohol prevention programmes to date have proved beneficial and may have contributed to reductions in violent crime and increased awareness of responsible beverage service. Useful strategies suggested included the provision of additional guidance for police relating to licensing legislation and enforcement and to bar staff on the identification of intoxicated people.

Evidence statement 2.15

Levels of alcohol consumption^{1,2} and alcohol-related crime and disorder^{1,2,3,4,5} appeared to have remained stable following the introduction of the UK Licensing Act 2003.

¹Department for Culture, Media and Sport, 2008 (Evaluation) UK

²Hough *et al.*, 2008 (Evaluation) UK

³Pike *et al.*, 2008 (Evaluation) UK

⁴Foster *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

⁵Local Government Association, 2008 (Cross-sectional questionnaire survey, +) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.16

Studies conducted on a national scale did not demonstrate any conclusive evidence of an increase in alcohol-related attendances at A&E as a result of the Licensing Act.^{1,2,3} The findings from peer-reviewed, published reports of the effect of the Licensing Act on alcohol-related attendances at single, local A&E departments were mixed.^{4,5,6}

¹Department for Culture, Media and Sport, 2008 (Evaluation) UK

²Hough *et al.*, 2008 (Evaluation) UK

³ Sivarajasingam *et al.*, 2008 (Cross-sectional survey, ++) UK

⁴ Newton *et al.*, 2007 (Before and after study, ++) UK

⁵ El-Maytaah *et al.*, 2008 (Before and after study, +) UK

⁶ Durnford *et al.*, 2008 (Before and after study, ++) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.17

The Licensing Act had clearly resulted in a temporal displacement of alcohol-related violence^{1,2,3} and alcohol-related attendances at A&E,⁴ with incidents shifting forwards into the early hours of the morning.

¹ Department for Culture, Media and Sport, 2008 (Evaluation) UK

² Hough *et al.*, 2008 (Evaluation) UK

³ Pike *et al.*, 2008 (Evaluation) UK

⁴ Durnford *et al.*, 2008 (Before and after study, ++) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.18

Evidence from studies with limited sample sizes suggested that pressure on workload and resources may have increased among health professionals and local authorities,¹ licensing officers,^{2,3} and police.^{2,3} Partnership working between police, local authorities and primary care trusts may also have been enhanced following the licensing reform.¹

¹ Local Government Association, 2008 (Cross-sectional questionnaire survey, +) UK

² Foster *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

³ Pike *et al.*, 2008 (Evaluation) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.19

Limited use had been made of Cumulative Impact Areas at the time of study.¹ Licensing authorities stated the importance of the development of a strong evidence base for making future decisions relating to Cumulative Impact Areas.^{1,2}

¹ Foster *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

² Herring *et al.*, 2008 (Qualitative study, ++) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.20

Other UK-specific studies of the effects of changes in licensing hours presented mixed findings, with some studies reported no apparent effects on alcohol-related outcomes.^{1,2,3} However, following two distinct extensions of licensing hours, one study⁴ reported an increase in admissions for self-poisoning by overdose in which alcohol was also involved, whilst another study found increases in the occurrence of slight accidents in the workplace.⁵

¹ Duffy & Plant, 1986 (Analysis of longitudinal ecological data) UK

² Graham *et al.*, 1998 (Before and after study, ++) UK

³ Rhodes *et al.*, 1990 (Before and after study, ++) UK

⁴ Northridge *et al.*, 1986 (Before and after study, +) UK

⁵ Duffy & Pinot de Moira, 1996 (Regression analysis) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.21

Additional international evidence of the effects of changes in licensing of the sale of alcohol was also described. Extensions in trading hours in Australia were typically associated with increased violence,¹ motor vehicle crash rates,² and increased apprehensions of impaired male drivers aged 18 to 25 yrs.³ Local community restrictions in Australia on alcohol availability were found to have modestly favourable outcomes, including reductions on alcohol consumption and violence.⁴ However, in one evaluation of the restriction of take-away trading hours and volumes for alcohol sales in Australia, many customers shifted their purchases to cheap cask port, providing an illustration of the ways in which consumers may respond to limitations in alcohol availability.⁵ An increase in alcohol-related RTAs followed the removal of the ban on Sunday sales of packaged alcohol in New Mexico, USA (McMillan *et al.*,

2007).⁶ The introduction of unrestricted serving hours in Reykjavik, Iceland resulted in increased police work episodes, more emergency ward admissions for weekend nights, increased suspected drunk driving incidents, and more people circulating in the city centre at 6am.⁷ The Saturday opening of alcohol retail outlets in Sweden also led to an increase in sales^{8,9} but no apparent change in alcohol-related harms.⁹ A range of evidence from Scandinavia and based on largely small-scale, local natural experiments showed the variable impact of changes in alcohol licensing, with decreased alcohol consumption typically observed as a result of restrictions.¹⁰ However, a USA-based study suggested that restrictions on Sunday alcohol sales had no apparent impact on consumption, whilst earlier closing hours in bars appeared to result in increased alcohol sales.¹¹

¹Chikritzhs & Stockwell, 2002 (Time series analysis, ++) Australia

²Chikritzhs & Stockwell, 2006 (Time series analysis, ++) Australia

³Chikritzhs & Stockwell, 2007 (Time series analysis, ++) Australia

⁴d'Abbs & Togni, 1999 (Literature review) Australia

⁵Hogan *et al.*, 2006 (Literature review) Australia

⁶McMillan *et al.*, 2007 (Regression analysis) USA

⁷Ragnarsdottir, 2002 (Before and after study, +) Iceland

⁸Norstrom & Skog, 2003 (Time series analysis, ++) Sweden

⁹Norstrom & Skog, 2005 (Controlled before and after study, ++) Sweden

¹⁰Mäkelä, 2002 (Literature review) Scandinavia

¹¹Hoadley *et al.*, 1984 (Cross-sectional time series analysis) USA

Applicability: The above evidence was specific to Australia, the USA, and Scandinavia.

Evidence statement 2.22

A clear positive relationship between increased outlet density and alcohol consumption among adults was demonstrated in a range of association studies.^{1,2,3,4,5,6,7} However, one study found no significant association between alcohol outlet density and heavy drinking.⁸

¹Gruenewald *et al.*, 1993 (Cross-sectional time-series analysis) USA

²Schonlau *et al.*, 2008 (Regression analysis) USA

³Scribner *et al.*, 2000 (Multi-level analysis) USA

⁴Wagenaar & Holder, 1995 (Time-series analysis, ++) USA

⁵Trollidal, 2005a (privatisation only) (Time series analysis, ++) Canada

⁶Trollidal, 2005b (Time series analysis, ++) Canada

⁷Xie *et al.*, 2000 (Cross-sectional time-series analysis) Canada

⁸Pollack *et al.*, 2005 (Multi-level modelling) USA

Applicability: The above studies were performed in the USA and Canada

Evidence statement 2.23

A similar positive relationship between alcohol outlet density and alcohol consumption was also observed in studies focusing on young people.^{1,2,3,4,5,6}

¹Weitzman *et al.*, 2003 (Analysis of correlation) USA

²Kuntsche *et al.*, 2005 (Regression analysis) Switzerland

³Kuntsche *et al.*, 2008 (Multi-level modelling) Switzerland

⁴Huckle *et al.*, 2008 (Multi-level modelling) New Zealand

⁵Kypri *et al.*, 2008 (Analysis of correlation) New Zealand

⁶Livingston *et al.*, 2008 Australia (Multi-level modelling)

Applicability: The above studies were specific to the USA, Switzerland, New Zealand, and Australia.

Evidence statement 2.24

No apparent trend differentiating the impact of alcohol outlet licence type on alcohol consumption was observed. However, Kuntsche *et al.* (2008)¹ reported that on-licensed but not off-licensed outlet density to be associated with alcohol consumption among young people.

¹Kuntsche *et al.*, 2008 (Multi-level modelling) Switzerland

Applicability: The above study was carried out in Switzerland.

Evidence statement 2.25

A number of natural experiments were described that demonstrated the effects of changes in alcohol outlet density on alcohol consumption and alcohol-related outcomes. Increases in alcohol outlet density tended to be associated with increases in alcohol consumption and

alcohol-related morbidity and mortality in Scandinavia (Mäkelä *et al.*, 2002).¹ The privatisation of alcohol retail monopolies in the USA, Canada and Scandinavia was linked with higher outlet densities, longer hours or more days of sale and changes in price and promotion, typically resulting in increased alcohol consumption.² (Her *et al.*, 1999). An positive association between alcohol outlet density and gonorrhoea (Cohen *et al.*, 2006) was also observed following the Civil Unrest in Los Angeles, USA.³

¹ Mäkelä *et al.*, 2002 (Literature review) Scandinavia

² Her *et al.*, 1999 (Literature review) USA, Canada, Scandinavia

³ Cohen *et al.*, 2006 (Analysis of longitudinal ecological data) USA

Applicability: The above research originated in Scandinavia, the USA and Canada.

Evidence statement 2.26

Evidence was identified that demonstrated that the relationship between outlet density and consumption functioned at a community rather than an individual level, suggesting that the drinking activity of a person may be influenced by the consumption of their social network and the orientation of their local environment towards alcohol.¹

¹ Scribner *et al.*, 2000 (Multi-level analysis) USA

Applicability: The above study was specific to the USA.

Evidence statement 2.27

Evidence was identified that pre-drinking is a prevalent activity, both in the UK^{1,2,3} and internationally.³

¹ Hughes *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

² Holloway *et al.*, 2008 (Case studies) UK

³ Wells *et al.*, 2009 (Literature review) International

Applicability: The two included primary studies are contemporary and specific to the English population. Further UK and international evidence was described in the literature review.

Evidence statement 2.28

Pre-drinking is particularly common among young people, those from a secular background, with evidence suggesting that this activity is participated in by people from both low income and higher social groups.¹

¹ Holloway *et al.*, 2008 (Case studies) UK

Applicability: This study was specific to the English population.

Evidence statement 2.29

Economic and social motives were cited for participating in pre-drinking behaviour.^{1,2}

¹ Holloway *et al.*, 2008 (Case studies) UK

² Wells *et al.*, 2009 (Literature review) International

Applicability: The included primary study was specific to the English population. Further UK and international evidence was described in the literature review.

Evidence statement 2.30

Evidence was identified that demonstrated that pre-drinking is associated with heavy alcohol consumption^{1,2} and increased risk of alcohol-related harm.¹

¹ Hughes *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

² Wells *et al.*, 2009 (Literature review) International

Applicability: The included primary study was specific to the English population. Further UK and international evidence was described in the literature review.

Review 3:

Evidence statement 3.1:

One systematic review¹ demonstrated a small but consistent relationship between advertising and alcohol consumption at a population level.

¹ Booth *et al.*, 2008 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Evidence statement 3.2:

A systematic review of longitudinal studies found that exposure to alcohol advertising and promotion was associated with the onset of adolescent alcohol consumption and with increased consumption amongst adolescents who were already drinking at baseline assessment.¹ Booth *et al.* presented evidence of a small but consistent relationship between advertising and alcohol consumption among young people at an individual level.²

¹ Anderson *et al.*, 2009 (systematic review, ++)

² Booth *et al.*, 2008 (systematic review, ++)

Applicability: The primary studies included in the systematic review by Anderson *et al.* were drawn from the USA (10 of 13 studies), Belgium, Germany and New Zealand. The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Evidence statement 3.3:

One systematic review presented evidence of a moderate but consistent association between point of purchase promotions and effects on alcohol consumption among underage drinkers, binge drinkers and regular drinkers.

¹ Booth *et al.*, 2008 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Evidence statement 3.4:

The systematic review by Booth *et al.* reported that outdoor and print advertising media may increase the probability of onset of adolescent alcohol consumption and also influence quantity and frequency of alcohol consumption among young people. The review by Anderson *et al.* included one USA-based study that reported that outdoor advertising media did not have any effect on alcohol behaviour, but was a predictor of intention to use alcohol among adolescents.²

¹ Booth *et al.*, 2008 (systematic review, ++)

² Anderson *et al.*, 2009 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand. The study included by Anderson *et al.* originated in the USA.

Evidence statement 3.5:

Reviewed studies showed the high prevalence of ownership of alcohol-related merchandise among young people.¹ Evidence from the USA and included in the systematic review by

Anderson *et al.* suggested that ownership of an alcohol promotional item or branded merchandise may be associated with increased initiation of drinking.² The relationship between such ownership and initiation of or current drinking was inconclusive.

¹Booth *et al.*, 2008 (systematic review, ++)

²Anderson *et al.*, 2009 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand. The two studies included in the review by Anderson and co-authors were specific to the USA.

Evidence statement 3.6:

One systematic review reported that evidence from longitudinal studies consistently demonstrated that exposure to television and other broadcast media was linked with onset of and levels of alcohol consumption. Further evidence was included in the review by Anderson *et al.* indicated that exposure to alcohol portrayals via television (including advertisements aired during sports programmes) and other broadcast media may be linked with alcohol use among adolescents.²

¹Booth *et al.*, 2008 (systematic review, ++)

²Anderson *et al.*, 2009 (systematic review, ++)

Applicability: The studies included by Booth *et al.* and Anderson *et al.* were drawn from a range of countries.

Evidence statement 3.7:

Inconclusive evidence was identified that advertising bans may result in reduced alcohol consumption.

¹Booth *et al.*, 2008 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Discussion

Evidence has been identified from a range of UK-specific and international settings for the impact of interventions in the control of pricing, management of availability, and control of promotion of alcohol. However, the limited applicability of studies conducted in non-UK settings should be taken into account during interpretation of the evidence base.

3. BACKGROUND

The National Institute for Health and Clinical Excellence (NICE) has received a referral from the Department of Health (DH) to develop public health guidance aimed at the prevention and early identification of alcohol-use disorders in adults and adolescents.

3.1 Description of health problem

The NICE guidance scope document highlights that a significant proportion of the population are drinkers, with 73% of men and 57% of women report having had a drink on at least 1 day during the preceding week (Goddard 2006). The scope also acknowledges that approximately 1.55 million people in England are classed as harmful drinkers, with an additional 6.3 million drinking at hazardous quantities (North West Public Health Observatory 2007). Alcohol misuse is a widely recognised problem with serious clinical and social consequences.

3.2 Remit of the assessment

3.2.1 Groups that will be covered

Adults and young people aged 10 years and over. The populations of interest include both individuals who consume alcohol and those who do not consume alcohol. No population groups of particular interest or concern were identified *a priori* in the scope. Where research identifies interventions that are applied to – or have differential impact in – specific population groups that can be defined, these are clearly identified and described within the assessment report.

3.2.2 Groups that will not be covered

Children under 10 years of age.

3.2.3 Activities/interventions that will be covered

i) Measures to detect alcohol misuse amongst adults and young people both within and outside primary care. These may be used by a wide range of professionals and non-professionals within the health service, social services and the criminal justice system.

ii) Brief interventions to manage alcohol misuse among adults and young people both within and outside primary care settings. These may be delivered by a wide range of professionals and non-professionals within the health service, social services and the criminal justice system. For the purposes of this guidance, they are defined as any brief intervention aimed at people who are not seeking help from specialist alcohol services.

iii) Interventions to improve management of England's alcohol market (including interventions to influence price, advertising, and availability of alcohol).

3.2.4. *Activities/interventions that will not be covered*

- i) drink-driving schemes.
- ii) self-help interventions (eg. Alcoholics Anonymous)
- iii) treatment administered by alcohol specialists
- iv) interventions in schools and pregnancy (already covered by recent NICE guidance)
- v) educational interventions to raise awareness around sensible alcohol consumption

3.3 Aims and objectives of the assessment

The reviews undertaken as part of the remit of this assessment are based on a conceptual framework for evidence synthesis that ensures the PDG can review the relevant research evidence for each section in the context of the evidence base as a whole. The reviews cover both 'upstream' and 'downstream' interventions; presenting the potential for the exploration of the relationship between preventive and early identification interventions.

The review team have addressed a series of review topics as part of the assessment.

Two linked reports have been produced:

Report 1 (Reviews 1, 2 and 3):

Review 1: The effectiveness of price controls in reducing alcohol consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

Review 2: The effectiveness of interventions in managing alcohol availability to reduce levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

Review 3: The effectiveness of the control of alcohol promotion (e.g. advertising) in reducing levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

Report 2 (Reviews 4, 5, 6 and 7)

Due to the overlap between the scope of Reviews 4, 5, 6 and 7 and the likelihood of overlap in identified evidence, these Reviews are considered in parallel and presented in a single report.

Review 4: Patterns of alcohol consumption

Review 5: The effectiveness of alcohol screening questionnaires, biochemical indicators and clinical indicators of alcohol misuse in identifying adults and young people who currently misuse or are at risk of misusing alcohol

Review 6: The effectiveness of brief interventions in preventing hazardous and harmful drinking among adults and young people

Review 7: Key barriers and facilitators to the implementation of screening and brief intervention for alcohol misuse in adults and young people

This is Report 1 and details the findings of the systematic reviews conducted to identify evidence in relation to the effectiveness of the control of price, promotion and management of alcohol availability.

4. REVIEW METHODS

4.1. Key principles of methods for identification of evidence

The challenges in searching for evidence to inform public health guidance are widely recognised (Spring *et al.*, 2008; Pawson, 2005). These challenges include the volume of literature in the subject area, the variation in the language used within public health disciplines (and therefore indexing within databases), and gaps within the evidence base. It is therefore not feasible to develop a single, definitive search strategy from the study protocol, encapsulating all the relevant complexity and inconsistency in language without retrieving an unmanageable number of redundant records. Search strategies based solely on the study protocol have been shown to yield a limited number of useful references (Spring *et al.*, 2008; Greenhalgh & Peacock, 2005); Ogilvie *et al.*, 2005). This may be because within public health, defining the review to be addressed and the information that will be relevant is often complex and uses non-standardised terminology (Alpi, 2005; Curran *et al.*, 2007).

Therefore, in order to address these challenges, the review team have built upon the existing NICE search methods (National Institute for Health and Clinical Excellence, 2006) to allow for a process in which the scope of relevance is explored and informed by the search process. Where a problem is well defined and where indexing allows a self contained literature to be defined, then the methods will default to the standard NICE approach. A targeted approach to the identification of evidence has been taken for Review 2. Instead of aiming to identify the relevant literature for Review 2 using one search, we have adopted an emergent approach, which attempts to identify evidence that will inform understanding of the problem area. This evidence was then explored in order to inform further retrieval by the identification of useful search terms and keywords/index terms. The process was cyclical and emergent, with searching continuing until no new useful ideas/evidence were identified.

In addition to free text and keyword/index term searching of databases, the following approaches were utilised:

- Searching for key authors
- Citation searching
- Searching for specific programmes or interventions
- Liaison with experts including the Programme Development Group
- Identification of evidence through liaison with the topic expert
- Searching reference lists of included papers and relevant systematic reviews
- Utilising existing searches (e.g. search records held by key stakeholders)

Once references were retrieved, they were imported into Reference Manager and keyworded appropriately. A thorough audit trail of the search process has been maintained, with all searches, number of hits and number of relevant references identified recorded, in order that searches are transparent, systematic and replicable. A version of this audit trail is available in Appendix 1.

Database search results were sifted by a systematic reviewer (RJ), who suggested to the information specialist (LG) the results and strategies which were considered ‘fruitful’ (having resulted in the identification of potentially relevant evidence), and should be run in other databases, those strategies which were not fruitful and listed keywords or key issues which should be incorporated into new searches. Following the first iteration of searching, further searches were undertaken by the information specialist as required, based on the scope of relevance developed through the first iteration of searching. Additional iterations of searching were undertaken until no further key pieces of evidence were identified.

4.1 Review 1: The effectiveness of price controls in reducing alcohol consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

4.1.1. Methods for reviewing effectiveness

A systematic review was undertaken according to the general principles recommended in the methods guide for development of NICE public health guidance (National Institute for Health and Clinical Excellence, 2006). Methods for the review are detailed below.

4.1.2. Identification of studies

A newly published and very comprehensive systematic review by Booth *et al.* (2008) of the effects of alcohol pricing and taxation on alcohol consumption and related harm was identified. Due to the extensive coverage provided by this review, it was agreed that no independent searches would be conducted for Review 1. Other pieces of evidence recommended by the topic expert and the PDG that were not already covered in the systematic review were also included to supplement the evidence base.

4.1.3. Study selection

4.1.3.1. Inclusion criteria

The following inclusion criteria were applied:

Population

Adults and young people aged 10 years and above

Interventions

Interventions that influence and/or control price of alcohol

Outcomes

Outcomes to be considered included alcohol consumption, alcohol misuse, alcohol-related harm, alcohol-related social problems, costs and economic outcomes

Study types

No restriction on inclusion was made according to study type.

4.1.3.2 Exclusion criteria

Studies only published in languages other than English were excluded. Studies in which the study population is solely below 10 years of age would also have been excluded. Evidence not originating in economically developed countries (as categorised by membership of the Organisation for Economic Co-operation and Development) was excluded on grounds of having limited relevance. However, the vast majority of identified evidence originated in economically developed countries.

Studies relating to the use of the following interventions are outside the remit of this guidance and are excluded:

- Drink-driving schemes
- Self-help interventions
- Interventions administered by alcohol specialists
- Interventions in schools and pregnancy (already covered by recent NICE guidance)
- Educational interventions to raise awareness around sensible alcohol consumption

Article selection was undertaken by one reviewer (RJ), with involvement of a second reviewer (MJ) where discussion was necessary to provide consensus on inclusion or exclusion of individual studies.

4.1.4. *Data abstraction strategy*

Data were extracted (with no blinding to authors or journal) by one reviewer (RJ) using a standardised form. As highlighted in the Cochrane Collaboration guidelines for systematic reviews of health promotion and public health interventions, extraction forms should be developed for each review in order to make them relevant to the information that is required. The form was based on the example form presented within the methods guide for development of NICE public health guidance (National Institute for Health and Clinical Excellence, 2006). The form was piloted on two randomly selected articles in order to confirm appropriateness for use. Information relating to the review addressed, study design, intervention, outcomes and conclusions were extracted and collated. Data extraction was confirmed by a second reviewer (JM) to ensure reliability.

4.1.5. *Critical appraisal strategy*

The quality of included studies was assessed by one reviewer (RJ), informed by tools currently recommended within the methods guide for development of NICE public health guidance.

Where quality assessment tools were available, studies were categorised according to study type and methodological rigour and quality (categories ++, + or -) in order to provide a clear representation of type of evidence. Study quality is annotated as outlined within the NICE methods guide for the development of public health guidance (National Institute for Health and Clinical Excellence, 2006) and described according to the following broad categorisation:

Study quality

- ++ All or most of the criteria have been fulfilled
- + Some of the criteria have been fulfilled
- Few or no criteria have been fulfilled

A quality checklist for systematic reviews was developed, using established quality criteria based on those developed by Oxman & Guyatt (1991) (as published by Kelly *et al.*, 2001), the Health Development Agency process and quality standards manual for evidence briefings (Swann *et al.*, 2005), the NHS Public Health Resource Unit Critical Appraisal Skills Programme (NHS Public Health Resource Unit, 2006) and Shea *et al.* (2007). Whilst it is noted that criteria may not be judged as having equal value in quality assessment, in the interests of consistency, a subjective cut-off score of 9 criteria fulfilled (out of a total of 14) during quality assessment for systematic reviews was applied for studies rated as ++. No

quality assessment checklists were available for technically specialised studies (eg. meta-regression analysis) included in the review.

Quality assessment was confirmed by a second reviewer (MJ), with independent assessment of a randomly selected sample of papers (representing at least 10% of the total included papers).

4.1.6. Data synthesis

Data synthesis was informed by the methods advocated by NICE (National Institute for Health and Clinical Excellence, 2006) and the recognised standards established by the NHS Centre for Reviews and Dissemination (2001). Pre-specified outcomes were tabulated in evidence tables and are presented within a narrative synthesis.

4.2. Review 2: The effectiveness of interventions in managing alcohol availability to reduce levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

4.2.1. Methods for reviewing effectiveness

A systematic review was undertaken according to the general principles recommended in the methods guide for development of NICE public health guidance (National Institute for Health and Clinical Excellence, 2006). Methods for the review are detailed below.

4.2.2. Identification of studies

A targeted and emergent approach to the identification of evidence was undertaken. Search terms listed in the protocol were used to inform a number of targeted searches, at title and abstract level, to be run in a number of databases (See Appendix 1). Searches were not restricted by the date of publication, study type or by restriction to publication in the English language. Searches were also undertaken in Google and Google Scholar to identify any grey literature. In addition, key review articles, including the review by Livingston *et al.* (2007) of the research literature relating to alcohol outlet density, were used to guide the identification of further evidence.

4.2.3. Study selection

4.2.3.1. Inclusion criteria

The following inclusion criteria were applied:

Population

Adults and young people aged 10 years and above

Interventions

Interventions in the management of alcohol availability

Following consultation with the PDG, priority areas of focus for this review were identified as follows:

- Minimum legal age of alcohol purchase
- Enforcement of minimum legal age of alcohol purchase and management of the sale of alcohol to intoxicated individuals
- Licensed hours and days of alcohol sale
- Alcohol outlet density
- Interaction between off-licence and on-licence availability of alcohol

Outcomes

Outcomes to be considered included alcohol consumption, alcohol misuse, alcohol-related harm, alcohol-related social problems, costs and economic outcomes.

Study types

No restriction on inclusion was made according to study type.

4.2.3.2 Exclusion criteria

Studies only published in languages other than English were excluded. Studies in which the study population is solely below 10 years of age would also have been excluded. Evidence not originating in economically developed countries (as categorised by membership of the Organisation for Economic Co-operation and Development) was excluded on grounds of having limited relevance. However, the vast majority of identified evidence originated in economically developed countries.

Studies relating to the use of the following interventions are outside the remit of this guidance and are excluded:

- Drink-driving schemes

- Self-help interventions
- Interventions administered by alcohol specialists
- Interventions in schools and pregnancy (already covered by recent NICE guidance)
- Educational interventions to raise awareness around sensible alcohol consumption

Article selection was undertaken by one reviewer (RJ), with involvement of a second reviewer (MJ/JM/FC) where discussion was necessary to provide consensus on inclusion or exclusion of individual studies. The intention behind these systematic reviews was not to be exhaustive but to present key evidence in order to address the reviews. Key evidence was selected for inclusion based on relevance to the UK, and richness of data relating to interventions and effectiveness. Evidence was also identified through discussion with the topic expert (PM). Decisions were made by a single reviewer (RJ) and discussed with a second reviewer (MJ/JM/FC) for consensus.

4.2.4. Data abstraction strategy

Data were extracted (with no blinding to authors or journal) by one reviewer (RJ) using a standardised form. As highlighted in the Cochrane Collaboration guidelines for systematic reviews of health promotion and public health interventions, extraction forms should be developed for each review in order to make them relevant to the information that is required. The form was based on the example form presented within the methods guide for development of NICE public health guidance (National Institute for Health and Clinical Excellence, 2006). The form was piloted on two randomly selected articles in order to confirm appropriateness for use. Information relating to the review addressed, study design, intervention, outcomes and conclusions were extracted and collated. Any studies giving rise to uncertainty were reviewed independently by a second reviewer, and discrepancies, for example where studies were not clearly reported, were resolved by discussion. Data extraction was confirmed by a second reviewer (JM) to ensure reliability.

4.2.5. Critical appraisal strategy

The quality of included studies was assessed by one reviewer (RJ), informed by tools currently recommended within the methods guide for development of NICE public health guidance.

Where quality assessment tools were available, studies were categorised according to study type and methodological rigour and quality (categories ++, + or -) in order to provide a clear representation of type of evidence. Study quality is annotated as outlined within the NICE

methods guide for the development of public health guidance (National Institute for Health and Clinical Excellence, 2006) and described according to the following broad categorisation:

Study quality

- ++ All or most of the criteria have been fulfilled
- + Some of the criteria have been fulfilled
- Few or no criteria have been fulfilled

A quality checklist for systematic reviews was developed, using established quality criteria based on those developed by Oxman & Guyatt (1991) (as published by Kelly *et al.*, 2001), the Health Development Agency process and quality standards manual for evidence briefings (Swann *et al.*, 2005), the NHS Public Health Resource Unit Critical Appraisal Skills Programme (NHS Public Health Resource Unit, 2006) and Shea *et al.* (2007). Whilst it is noted that criteria may not be judged as having equal value in quality assessment, in the interests of consistency, a subjective cut-off score of 9 criteria fulfilled (out of a total of 14) during quality assessment for systematic reviews has been applied for studies rated as ++. No quality assessment checklists were available for the technically specialised studies (eg. meta-regression analysis) included in the review.

Quality assessment was confirmed by a second reviewer (MJ), with independent assessment of a randomly selected sample of papers (representing at least 10% of the total included papers).

4.2.6. Data synthesis

Data synthesis was informed by the methods advocated by NICE (National Institute for Health and Clinical Excellence, 2006) and the recognised standards established by the NHS Centre for Reviews and Dissemination (2001). Pre-specified outcomes are tabulated in evidence tables and are presented within a narrative synthesis.

Review 3: The effectiveness of the control of alcohol promotion (e.g. advertising) in reducing levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

4.3.1. Methods for reviewing effectiveness

A systematic review of the effectiveness of interventions in the control of alcohol promotion was undertaken according to the general principles recommended in the methods guide for

development of NICE public health guidance (National Institute for Health and Clinical Excellence, 2006). Methods for the review are detailed below.

4.1.2. Identification of studies

A newly published and very comprehensive systematic review by Booth *et al.* (2008) of the effects of advertising/promotion on alcohol consumption and related-harm was identified. Due to the extensive coverage provided by this review, it was agreed that no independent searches would be conducted for Review 3. Other pieces of evidence recommended by the topic expert and the PDG that were not already covered in the systematic review were also included to supplement the evidence base.

4.3.3. Study selection

4.3.3.1. Inclusion criteria

The following inclusion criteria were applied:

Population

Adults and young people aged 10 years and above

Interventions

Interventions that restrict or modify promotional activity

Outcomes

Outcomes to be considered included alcohol consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems, change in attitudes and beliefs in relation to alcohol, costs and economic outcomes.

Study types

No restriction on inclusion was made according to study type.

4.3.3.2 Exclusion criteria

Studies only published in languages other than English were excluded. Studies in which the study population is solely below 10 years of age would also have been excluded. Evidence not originating in economically developed countries (as categorised by membership of the Organisation for Economic Co-operation and Development) was excluded on grounds of

having limited relevance. However, the vast majority of identified evidence originated in economically developed countries.

Studies relating to the use of the following interventions are outside the remit of this guidance and are excluded:

- Drink-driving schemes
- Self-help interventions
- Interventions administered by alcohol specialists
- Interventions in schools and pregnancy (already covered by recent NICE guidance)
- Educational interventions to raise awareness around sensible alcohol consumption

Article selection was undertaken by one reviewer (RJ), with involvement of a second reviewer (MJ) where discussion was necessary to provide consensus on inclusion or exclusion of individual studies.

4.3.4. Data abstraction strategy

Data were extracted (with no blinding to authors or journal) by one reviewer (RJ) using a standardised form. As highlighted in the Cochrane Collaboration guidelines for systematic reviews of health promotion and public health interventions, extraction forms should be developed for each review in order to make them relevant to the information that is required. The form was based on the example form presented within the methods guide for development of NICE public health guidance (National Institute for Health and Clinical Excellence, 2006). The form was piloted on two randomly selected articles in order to confirm appropriateness for use. Information relating to the review addressed, study design, intervention, outcomes and conclusions were extracted and collated. Data extraction was confirmed by a second reviewer (JM) to ensure reliability.

4.1.5. Critical appraisal strategy

The quality of included studies was assessed by one reviewer (RJ). A quality checklist for systematic reviews was developed, using established quality criteria based on those developed by Oxman & Guyatt (1991) (as published by Kelly *et al.*, 2001), the Health Development Agency process and quality standards manual for evidence briefings (Swann *et al.*, 2005), the NHS Public Health Resource Unit Critical Appraisal Skills Programme (NHS Public Health Resource Unit 2006) and Shea *et al.* (2007). Whilst it is noted that criteria may not be judged

as having equal value in quality assessment, in the interests of consistency, a subjective cut-off score of 9 criteria fulfilled (out of a total of 14) during quality assessment for systematic reviews has been applied for studies rated as ++. No quality assessment checklists were available for technically specialised studies (eg. meta-regression analysis) included in the review.

Quality assessment was confirmed by a second reviewer (MJ), with independent assessment of a randomly selected sample of papers (representing 10% of the total included papers).

4.3.6. Data synthesis

Data synthesis was informed by the methods advocated by NICE (National Institute for Health and Clinical Excellence 2006) and the recognised standards established by the NHS Centre for Reviews and Dissemination (2001). Pre-specified outcomes were tabulated in evidence tables and are presented within a narrative synthesis.

5. REVIEW FINDINGS

5.1 Review 1: The effectiveness of price controls in reducing alcohol consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

5.1.1. *Quantity and key characteristics of included research*

A newly published and very comprehensive systematic review of the effects of alcohol pricing and taxation on alcohol consumption and related harm was undertaken by Booth *et al.* (2008) and was included as the primary source of evidence for this review. A further three studies were identified as relevant and were also included. In addition to the included review by Booth *et al.* investigating the relationship between alcohol pricing/taxation and alcohol consumption or directly to harm, the same authors also performed a comprehensive review of the associations between alcohol consumption and related outcomes and (whilst not reported here) is available in the public domain as a further source of relevant evidence. Therefore, a total of 4 studies have been included in this review. The econometric studies presented in the review were based on estimates of elasticity, demonstrating the relationship between changes in price and consumer demand. For example, as stated by Booth *et al.*, a product is described as being price elastic when the percentage change in demand is greater than the percent change in price. Conversely, a product is deemed to be price inelastic if the percentage change in the amount of demand is less than the percentage change in price.

5.1.2 *Overall narrative synthesis of review findings*

Booth *et al.* (2008) (Systematic review, ++)

The purpose of the systematic review by Booth *et al.* (2008) was to investigate the relationships between tax/price and alcohol consumption or directly to harm.

The search methods employed to identify relevant literature were comprehensive, encompassing a range of health, economics and social sciences evidence resources and searching of sources of grey literature. Studies were included if they were systematic reviews, research studies, data analyses (reporting quantitative data from routine or ad hoc datasets irrespective of whether they had an empirical base) and economic studies (defined in a broad sense to include cost studies and economic evaluations. Whilst studies were not limited to specific population groups, Booth *et al.* carried out additional syntheses of findings relating to underage drinkers (under the age of 18 yrs), young adult binge drinkers (aged 18-25 yrs,

drinking more than the equivalent of 6 UK units (women)/8 UK units (men) on a single occasion), harmful drinkers, (individuals regularly drinking more than the equivalent of 35 UK units per week for women/50 UK units per week for men), and those on low incomes.

The types of intervention(s)/exposure(s) included were as follows:

Price

Tax increase(s)

Tax decrease(s)

Price increase(s)

Price decrease(s)

Policy

Change in coverage of tax policies

Policies with a direct effect on pricing (e.g. minimum pricing)

The types of outcome measure(s) reported included:

Consumption

Decrease in consumption

Increase in consumption

Increased intention for purchase

Increased intention for consumption

Substitution of one type of alcohol for another

Substitution of alcohol for another product

Substitution of another product for alcohol

Health

Harmful effects on health

Health benefit

Social

Social harm, including teenage pregnancy, crime, detrimental effects on social cohesion

Social benefit, including potential positive effects on social capital

Increased awareness of alcohol advertising

Economic

Economic harm

Economic benefit

Price elasticity

Alcohol prices or taxation and the consumption of alcoholic beverages

Two major meta-analyses (Gallet, 2007 (132 studies); Wagenaar *et al.* 2008 (91 studies)) and 15 further studies were included in the review in order to assess the relationship between alcohol pricing/taxation and alcohol consumption.

The evidence base was described by Booth *et al.* as being strong and consistently indicative that price increases (including through taxation) resulted in significant reductions in the demand for alcohol (and conversely that decreases in price typically resulted in increases in alcohol consumption). The median price elasticities reported by Gallet (2007) were presented as follows: beer (-0.36), wine (-0.700), spirits (-0.679) and alcohol (-0.497). The analysis by Clements *et al.* (1997) of data from Australia, Canada, Finland, New Zealand, Norway, Sweden and the UK from the mid 1950s to the mid 1980s that yielded price elasticities of -0.35 for beer, -0.68 for wine and -0.98 for spirits was also described. It was stated that in the Wagenaar *et al.* review of 91 included studies, 74 found a significant negative association between prices or taxation and alcohol consumption (indicating that alcohol consumption could be predicted to decrease in response to an increase in the price of alcohol (with an overall elasticity estimate of -0.51). Mean elasticities were found to be -0.46 for beer (105 studies), -0.69 for wine (93 studies) and -0.80 for spirits (103 studies). Wagenaar *et al.* also found significant relationships ($p < 0.001$) between alcohol price or tax measures and indices of sales or consumption of alcohol ($r = -0.17$ for beer, -0.30 for wine, -0.29 for spirits and -0.44 for total alcohol). The elasticity estimates presented by Wagenaar *et al.* were described by the review authors as being similar to those reported by Gallet (2007) (who presented median price elasticities of -0.70 for wine, -0.68 for spirits, and -0.50 for all beverages, but with a slightly greater estimate of -0.36 for beer). Studies based on natural experiments were also discussed by Booth and co-authors as being supportive of an inverse relationship between price/tax and alcohol consumption. Therefore, whilst some variation in the size of the relationship between price/tax and alcohol consumption was observed, the relationship was described as being consistently negative, indicating that alcohol consumption decreases as a result of alcohol price/tax increases. The authors also stated that the evidence base strongly suggested that young drinkers, binge drinkers and harmful drinkers typically chose cheaper drinks and therefore could be anticipated to be affected by increases in alcohol price/taxation. Studies focusing on low income groups were not identified.

Minimum pricing

An evaluation of alcohol restrictions in a remote Australian community (Gray *et al.*, 2000) was identified that made the case that minimum pricing may be an effective public health strategy in reducing alcohol consumption and that such restrictions were supported by consulted members of the community. Booth stated that, whilst the evidence identified for the inverse relationship between price/tax and alcohol consumption may be supportive of the use of a minimum pricing policy, further research is required in order to validate these findings for UK populations.

Taxation or pricing studies linked to harm

Twenty four studies met the inclusion criteria for taxation studies, the majority of which were conducted in the USA. Twenty two studies met the inclusion criteria for pricing studies, again the large majority of which originated in the USA. No systematic reviews of the effects on harm of either taxation or pricing changes were found.

The evidence base was described by Booth as being consistently suggestive of a relationship between increases in taxation or pricing of alcohol and decreases in harm. A number of studies described such a relationship between increases in the price of alcohol and reductions in road traffic accidents and fatalities, cirrhosis death rates, intentional and unintentional injuries, workplace injuries, sexually transmitted diseases, rapes and robberies, homicides, crime, child abuse, domestic abuse and violence-related injuries. The review authors also stated that in the United Kingdom, it was estimated that a 10% rise in alcoholic beverage prices would result in a decrease of 7.0% in male and 8.3% in female cirrhosis mortality, a reduction of 5.0% for male victims and 7.1% for female victims of homicide, and a decrease of 28.8% for male and 37.4% for female deaths from explicitly alcohol-involved causes (eg. alcohol dependence or poisoning) (Academy of Medical Sciences, 2004). Booth also noted that, whilst many studies use time-series data analysis, not all included control areas where changes had not been implemented in order to account for confounding variables.

Booth *et al.* presented evidence of the relationship between price/taxation and alcohol consumption and related harm. Some evidence was identified that suggests that pricing/taxation interventions may serve to reduce alcohol consumption among young people aged ≥ 18 yrs, young adult binge drinkers, and, in some studies, heavy drinkers.

Fogarty (2006) (Meta-regression analysis)

Fogarty performed a meta-regression analysis of own price elasticity estimates for beers, spirits and wines drawn from studies considering the impact of changes in the price of alcohol on alcohol demand across 18 countries. The objective of the analysis was to explore the contributory factors driving the variation in reported elasticity estimates.

The continuous variables tested in the meta-regression included beverage market share (relative), level of beverage consumption (volume), beverage tax rate, sample period (year) and sample length (range). The original data used were 46 beer own-price elasticity estimates (ranging from highly inelastic (0.09) to elastic (1.20), with a mean of 0.38), 54 wine own-price elasticity estimates (ranging from 0.05 to 1.80, mean 0.77) and 50 spirits own-price elasticity estimates (ranging from 0.10 to 2.00, mean 0.70).

The results of the meta-regression analysis indicated that year of study, length of study, per capita level of alcohol consumption and relative ethanol share of a beverage (proxy measure of market share of each beverage) acted as important factors influencing variations in the reported demand responses of consumers to changes in alcohol price. A longitudinal trend was observed whereby the consumer demand for alcohol beverages was increasingly inelastic up to 1969 and was subsequently decreasingly inelastic (displaying greater responsive consumer demand as a result of changes in price). Fogarty suggested that these temporal changes in elasticity may have been influenced by the decrease in the price of illicit drugs since the close of the 1960s, with consumers potentially having used drugs as a substitute for alcohol use. The results of the meta-regression also demonstrated that the longer the sample period of a study, the more inelastic the estimate obtained. Fogarty also found that the greater the per capita alcohol consumption level, the more inelastic the estimate of demand. A further interesting finding of this analysis was that a higher relative market share for a beverage was typically associated with more inelastic consumer demand. Such a result may be attributable to a combination of consumer preference for specific beverage types and the orientation of the alcohol market relating to different beverage types across countries (eg. lower availability of other beverage types in a setting where a beverage with a higher relative market share predominates). This study therefore concluded that a range of variables were responsible for the variations in price elasticities reported in the available literature.

Herttua *et al.* (2008) (Before and after study, ++) Finland

Herttua *et al.* conducted a before and after study to assess the impact of a large reduction in the price of alcohol in Finland in 2004 on alcohol-related mortality according to age and socioeconomic group. Taxes on alcohol fell by an average of 44%. The off-premise retail prices of spirits, wine, and beer decreased by an average of 36%, 3%, and 13% respectively.

Mortality data were examined for the periods 2001-2003 (before the decrease in the price of alcohol) and 2004-2005 (following price reduction). Alcohol-related causes were defined as both underlying and contributory causes of death. The analysis contained all Finns aged ≥ 15 yrs. The men and women in the study population were described as having lived approximately 10.4 million and 11.1 million person-years respectively. The independent variables derived from employment statistics and used in the regressions included gender, age group and socioeconomic characteristics.

Between 2001-2003 and 2004-2005, the number of alcohol-related deaths was reported to have increased by 16% (95%CI 12.1 to 19.4, or 22 deaths per 100,000 person-yrs) among males and by 31% (95%CI 22.0 to 40.0, or 8 deaths per 100,000 person-yrs) among females. The majority (82%) of the total increase was attributed to chronic causes, with alcoholic liver diseases alone found to have constituted 39% of the rise. The increase in alcohol-related mortality in absolute terms was largest among middle-aged men aged 55-59 yrs and women aged 50-54 yrs. Among those aged 30-59, the increase was described as being largest among the long-term unemployed or early-age pensioners and among individuals with lower levels of education, social class, or income. The authors concluded that a large reduction in price of alcohol resulted in significant increases in alcohol-related mortality, particularly in terms of chronic alcohol-related diseases.

Wagenaar *et al.* (2009) (Time-series analysis, ++) USA

Wagenaar *et al.* evaluated the impact of tax increases on alcoholic beverages in 1983 and 2002 on alcohol-related disease mortality in Alaska. The authors employed statistical analyses of measures of mortality from 1976 to 2004, with aggregated data from other states included for comparison. Tax increases on alcoholic beverages were implemented in Alaska in 1983 and 2002 as follows (in alcohol-tax rates per gallon in constant 2006 dollars):

Beer

1982 (Pre-increase) 0.46

1983 (Post-increase) 0.63

2001 (Pre-increase) 0.40

2002 (Post-increase) 1.20

Wine

1982 (Pre-increase) 0.46

1983 (Post-increase) 0.63

2001 (Pre-increase) 0.40

2002 (Post-increase) 2.80

Spirits

1982 (Pre-increase) 7.28

1983 (Post-increase) 9.83

2001 (Pre-increase) 6.28

2002 (Post-increase) 14.35

Statistically significant decreases in the numbers and rates of deaths caused by alcohol-related disease were observed as follows: 29% reduction in number of deaths (23 deaths averted per yr) (Cohen's $d = -0.57$) for the 1983 tax increase and an 11% decrease in deaths (additional 21 deaths averted per yr) (Cohen's $d = -0.52$) as a result of the 2002 tax increase. The authors also assessed the death rate (in order to control for temporal changes in population size), and found that the reductions were similar at 23% for the 1983 tax increase (Cohen's $d = -0.88$) and 13% for the 2002 tax increase (Cohen's $d = -0.79$). When data from comparison states were added to the model, no discernable changes in the resulting estimates were found, indicating that other states did not experience similar declines in mortality. The analysis also indicated that the impact of the tax increases showed little loss of effect over time. Wagenaar *et al.* concluded that increases in alcohol excise tax rates in Alaska were therefore related to immediate and sustained reductions in alcohol-related disease mortality.

Evidence statements

Evidence statement 1.1:

A comprehensive systematic review was identified that demonstrated a clear association between price/tax increases and reductions in consumer demand for alcohol.¹ These conclusions were based on two rigorous meta-analyses of price elasticities conducted by Gallet, 2007 and Wagenaar *et al.*, 2008.

¹Booth *et al.*, 2008 (Systematic review, ++)

Applicability: The majority of the studies included in the review by Booth originated in the USA.

Evidence statement 1.2:

The systematic review by Booth *et al.* (2008) reported that there is some evidence that young people, binge drinkers and harmful drinkers tend to show a preference for cheaper drinks.

¹Booth *et al.*, 2008 (Systematic review, ++)

Applicability: The majority of the studies included in the review by Booth originated in the USA.

Evidence statement 1.3:

A limited evidence base was identified that indicated that minimum pricing may be effective in reducing alcohol consumption and that consulted members of the community were supportive of such measures.

¹Booth *et al.*, 2008 (Systematic review, ++)

Applicability: The evidence relating to minimum pricing was drawn from an Australian setting.

Evidence statement 1.4:

An evidence base comprising a large number of primary studies was identified that demonstrated a relationship between price/tax increases and reductions in harms.¹ Additional evidence indicates that decreases in the price of alcohol contribute towards increases in alcohol-related deaths, particularly in deaths attributable to chronic causes such as alcoholic liver disease.² Population groups specifically affected included the older population, the unemployed and individuals with lower levels of education, social class and income.² Furthermore, Wagenaar *et al.*, 2009 demonstrated that increases in tax were associated with decreases in alcohol-related disease mortality.³

¹Booth *et al.*, 2008 (Systematic review, ++)

²Herttua *et al.*, 2008 (Before and after study, ++) Finland

³Wagenaar *et al.*, 2009 (Time series analysis, ++) USA

Applicability: The majority of the studies included in the review by Booth originated in the USA. The study by Herttua *et al.* was conducted in Finland, whilst Wagenaar *et al.* based their study in Alaska.

Evidence statement 1.5:

Results of a meta-regression analysis of own price elasticity estimates found a longitudinal trend whereby consumer demand for alcohol beverages was increasingly inelastic until 1969 and subsequently decreasingly inelastic. The study authors discuss whether this effect might be potentially attributable to a substitution of alcohol with increasingly available illicit drugs. However, no evidence is currently available to support this hypothesis.

¹Fogarty, 2006 (Meta-regression analysis)

Applicability: Elasticity estimates were drawn from a range of international studies, with the majority coming from the UK, USA, and Canada; and the remaining estimates from Australia, New Zealand, the Netherlands, France, Belgium, Germany, Portugal, Spain, Italy, Ireland, Scandinavia, Kenya and Japan.

Evidence statement 1.6:

The same meta-regression analysis also demonstrated that the higher the relative market share of a beverage, the more inelastic the consumer demand.¹ Therefore, it can be anticipated that the most popular beverages within a market will be least responsive to changes in alcohol price or taxation.

¹Fogarty, 2006 (Meta-regression analysis)

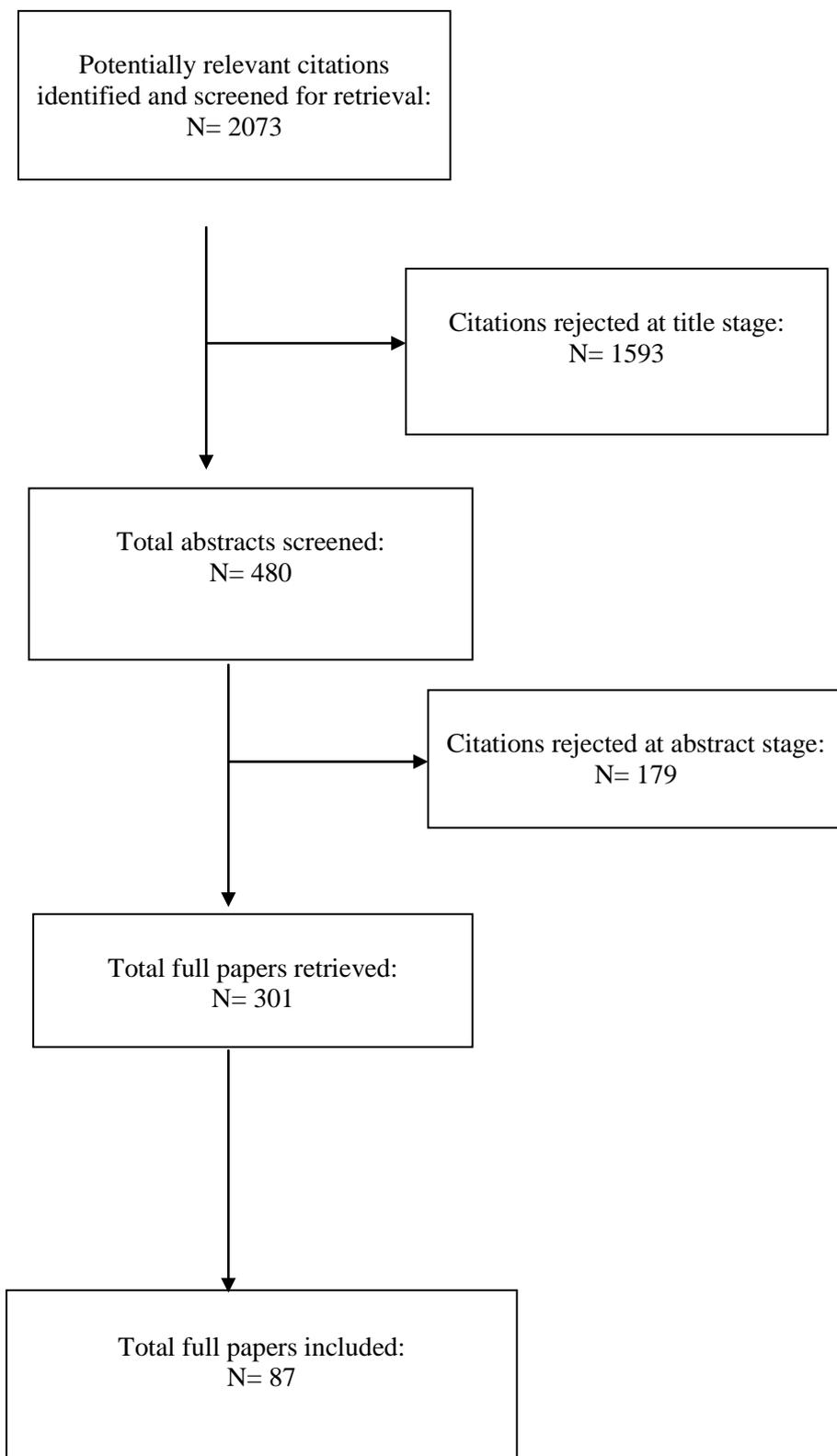
Applicability: Elasticity estimates were drawn from a range of international studies, with the majority coming from the UK, USA, and Canada; and the remaining estimates from Australia, New Zealand, the Netherlands, France, Belgium, Germany, Portugal, Spain, Italy, Ireland, Scandinavia, Kenya and Japan.

5.2. Review 2: The effectiveness of interventions in managing alcohol availability to reduce levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

5.2.1. Quantity and key characteristics of included research

As a result of the searches outlined above, a total of 2073 citations were identified, following removal of duplicates, and were screened for inclusion in the review of clinical effectiveness (see Figure 1). 1593 citations were rejected at the title stage, yielding 480 abstracts for screening. 179 abstracts were rejected upon examination. 301 full papers were retrieved and considered for inclusion. Additional UK-specific unpublished literature was also identified. A total of 87 reports were included in the review of effectiveness of interventions to manage availability of alcohol.

Figure 1: Flow chart of study inclusion and exclusion in review of effectiveness of interventions in the management of the availability of alcohol (Review 2)



5.2.2 Overall narrative synthesis of review findings

5.2.2.1 Review 2.1 Minimum legal age of alcohol purchase

Seven studies were included that investigated the effectiveness of changes in the minimum legal age of alcohol purchase. The majority of the identified evidence was conducted in the USA, where the term minimum legal drinking age (MLDA) was typically used to denote the legislation around the age restrictions on access to alcohol, with the two core laws focusing on the possession and purchase of alcohol (both currently set at 21 yrs of age).

DiNardo & Lemieux (2001) (Regression analysis) USA

DiNardo & Lemieux performed a study to investigate the effects of increasing the MLDA on the prevalence of the use of alcohol and marijuana among high school senior students. The authors found that increasing the MLDA had the effect of slightly reducing alcohol consumption among high school seniors, but that marijuana consumption appeared to become slightly more prevalent in response to the reform.

The analysis was based on a dataset covering a large sample of high school senior students from 43 states across the USA and covering the years 1980 to 1989. The data included responses from over 156,000 individuals. The focus of the study was the results of increases in the minimum legal drinking age whereby, by 1988, all states had implemented a minimum legal age for the possession and purchase of alcohol of 21 yrs. The number of students who had consumed only alcohol in the last 30 days, only marijuana, both or neither was derived from two-by-two contingency tables of the data covering 1980 to 1989. No data was reported on quantities of substances consumed. Regression models were fitted to determine the impact of the drinking age on alcohol and marijuana consumption.

Analysis demonstrated that increases in the MLDA slightly reduced the prevalence of alcohol consumption, in terms of the number of drinkers. However, increases in the MLDA were also accompanied by a slight increase in the prevalence of marijuana consumption. The evidence suggested that increasing the MLDA from 18 to 21 yrs increased the prevalence of marijuana use by 2.4 % but decreased the prevalence of alcohol consumption among this population by 4.5% (no statistics reported). The authors suggested that these results may have been due to the possible substitution of alcohol with marijuana by students upon raising the MLDA.

Everitt *et al.* (2002) (Before and after study +) New Zealand

The purpose of the before and after study by Everitt *et al.* was to determine the impact of lowering the MLDA on the presentation of intoxicated patients to a central city emergency department in Auckland, New Zealand. The authors observed an increase in the proportion of young people who were intoxicated at presentation following the decrease in age limit.

As of December 1999, a legislated reduction in the minimum legal drinking age from 20 to 18 yrs was implemented, whereby 18 and 19 yr olds could purchase alcohol in bars, restaurants, wine shops and supermarkets. All patients presenting to the adult-only (≥ 15 yrs) emergency department in Auckland, New Zealand were eligible for inclusion. All records of intoxicated patients presenting to the emergency department for 12 months before and after the change to the MLDA were studied. Patients were categorised as having laboratory confirmed intoxication, clinical suspicion of intoxication only, or no record of intoxication. Three age groups were studied: 15 to 17 yr olds, 18 to 19 yr olds and over 20 yr olds. The proportion of patients presentations who were intoxicated were compared before and after the increase in the MLDA.

The number of intoxicated 18 and 19 yr olds who presented to the emergency department in the 12 months following the reform increased from 66 to 107 (52 to 80 for laboratory confirmed intoxication and 14 to 27 for clinical suspicion only), representing an increase in the proportion of presentations in this age group who were intoxicated from 2.9% to 4.4% ($P=0.009$) ($RR=1.51$, 95%CI 1.11 to 2.03). No increase was observed in the proportion of intoxicated presentations among those aged > 19 yrs (963 vs 992, 3.4% vs 3.3%, $P=0.48$, $RR=0.97$, 95%CI 0.89 to 1.06) (as reported). However, the authors also found an increase in presentations by intoxicated 15 to 17 yr olds (72 vs 95, $p=0.07$, $RR=1.35$, 95%CI 0.98 to 1.88).

The authors concluded that the lowering of the MLDA from 20 to 18 yrs may have contributed to the increased presentations to the emergency department by intoxicated young people. Whilst there was an increase in intoxicated presentations among 18 and 19 yr olds who could now drink legally, a 'trickle down' effect appeared to have occurred, with the result that younger people (aged 15 to 17 yr olds) were apparently able to access alcohol and were drinking illegally, with an increase in intoxicated presentations among this age group also observed at the emergency department.

Fell *et al.* (2008) (Analysis of variance and regression analysis) USA

Fell *et al.* investigated the relationships between underage drinking laws and drunk drivers involved in fatal motor vehicle crashes in the USA.

The two core laws of the MLDA 21 legislation related to the possession and purchase of alcohol, and were accompanied by a range of 14 additional underage laws varying from state to state. The authors assessed the relative strength of these MLDA laws by using a scoring system to assign points for laws that should prevent underage drinking and deduct points for provisions that could increase the likelihood of underage sales or undermine enforcement, using empirical evidence and/or reasoned theoretical arguments. Scores were reviewed by experts for agreement, in order to increase the robustness of assessments. Data covering the period 1982 to 1990 were obtained from the Fatality Analysis Reporting System on drinking driver and non-drinking driver fatal crashes. Analyses were performed to assess whether the implementation of the two core MLDA laws (possession and purchase) were associated with reductions in the ratio of drinking to non-drinking drivers younger than 21 yrs of age who were involved in fatal crashes, and were controlled for as many confounding variables as possible. Further analyses using FARS data for 1998 to 2004 was undertaken to assess whether any of the underage laws were associated with a reduction in the proportion of drivers younger than 21 yrs involved in fatal crashes.

Analysis indicated that the core possession and purchase laws (as a single variable) accounted for an 11.2% (P=0.041) reduction in the ratio of drinking to non-drinking drivers aged 20 yrs and younger who were involved in fatal crashes. Of the 14 expanded underage drinking laws, making it illegal to use false ID to purchase alcohol was significant. These findings demonstrated that the possession and purchase core laws were associated with a reduction in drunk drivers involved in fatal crashes. Evidence was also supportive of legislation against the use by young people of false ID in alcohol purchase attempts.

Kypri *et al.* (2006) (Before and after study, ++) New Zealand

Kypri *et al.* undertook a study in which they confirmed a hypothesis that lowering the minimum purchasing age for alcohol from 20 to 18 yrs in New Zealand in 1999 resulted in an increase in alcohol-related road traffic crashes and hospitalised injuries among young people aged 15-19 yrs.

Data were collected for alcohol-involved road traffic crashes resulting in injury and also subsequent hospitalisations. The evaluation covered 4 yrs before and after the legislative change. The authors calculated incidence rate ratios for the after to before incidence of alcohol-related crashes and hospitalised injuries among 18 to 19 yr olds and 15 to 17 yr olds. A reference group of 20 to 24 yr olds was included in order to account for confounding variables, including the increased availability of alcohol in supermarkets, Sunday trading and concurrent road safety programmes. The authors noted that the analyses rested on the assumption that the changes in the law would affect all age groups equally. However, age groups are likely to have differed in levels of personal disposable income, a factor that may influence the ability of young people to access alcohol.

Statistically significant increases were found in the relative after-to-before incidence rate ratios of alcohol-related crash injuries and subsequent hospitalisations for young men and women aged 15 to 19 yrs, indicating more negative outcomes since the lowering of the minimum legal age of alcohol purchase.

It should be noted that in New Zealand, the age at which an individual can obtain a driving licence is relatively young compared to the UK, with a restricted licence issued on passing a test available at 15 yrs and 6 months of age.

Ponicki *et al.* (2007) (Cross-sectional time series data analysis) USA

This study by Ponicki *et al.* was carried out to investigate the relationships between MLDA, beer taxes and youth traffic fatalities.

The analyses performed by Ponicki *et al.* explored the relationships between changes in MLDA, beer taxes and US youth traffic fatalities using panel data for 48 US states over the period 1975 to 2001. Models controlled for other variables known to affect traffic fatalities (including personal income, seat belt laws, BAC laws, zero tolerance laws, keg registration laws, vehicle miles travelled, and demographic characteristics). The dependent variable used was the number of age-specific vehicle-occupant fatalities occurring in a state divided by the number (in thousands) of state residents of relevant age group (Fatal Accident Reporting System data). Crashes were included regardless of whether they were categorised by FARS as having a high probability of alcohol involvement.

The anticipated interaction between the availability measures was discussed by the authors, who argued that beer taxes would exert a stronger negative influence on drunk driving when more people in the relevant age group can drink legally (eg. in the presence of lower MLDA), and that increasing legal youth access would have a smaller positive impact on drunk driving when tax rates are high than when they are low.

The analysis indicated that raising the MLDA results in a decrease in youth traffic fatalities. The reduction in the MLDA had the greatest and most significant impact on fatalities aged 18 to 20 yrs, with no significant effects observed for younger (16-17 yrs) and older (25+ yrs) age groups. A smaller but still significant effect on fatalities aged 21 to 24 yrs was found.

Ponicki *et al.* reported that increasing either MLDA or beer taxes in isolation resulted in fewer youth traffic fatalities, with a given change in MLDA resulting in a larger proportional change in fatalities when beer taxes are low than when they were high, as had been expected. The evidence indicated that increasing MLDA from 18 to 21 yrs was less effective in preventing youth traffic fatalities when beer taxes are high, with the MLDA increase yielding an 11.4% decrease in fatalities among this age group if real beer taxes are unchanged at 25% below mean level; a decrease of 8.9% if prices remain at their mean level; and a reduction of 6.0% if beer taxes are 25% above their mean value. This study therefore provided a good demonstration of the manner in which measures to reduce availability may interact. The effects of interventions to manage the availability of alcohol are likely to be influenced by the regulatory context of the setting in which they are implemented.

Smith & Burvill (1987) (Before and after study, +) Australia

A before and after study was carried out by the authors in order to determine the effects of lowering the legal drinking age on juvenile crime in three Australian states. Lowering the MLDA was associated with increases in juvenile crime.

South Australia lowered the MLDA from 20 to 18 yrs in April 1971; Queensland lowered the MLDA from 21 to 18 yrs in February, 1974; whilst Western Australia reduced the MLDA from 21 to 18 yrs from July 1970. Data were collected and analysed for all juvenile offences, where a juvenile was defined as being aged ≤ 17 yrs.

Analyses indicated that lowering the MLDA to 18 yrs resulted in significant increases in male juvenile crime, particularly for burglary ($p < 0.05$), larceny of motor vehicles ($p < 0.05$), and drunkenness ($p < 0.01$). The observed increases were greater than those for between-state control groups of similar age and also older control groups within the same state. Among females, the resulting effects of the change in MLDA varied from state to state, with juvenile crime in this group also appearing to have increased. The authors concluded by suggesting that a 20 or 21 yr MLDA would be preferable to the existing age restriction.

Wagenaar & Toomey (2002) (Systematic review, +)

The authors undertook a very comprehensive systematic review of the impact of minimum legal drinking age (MLDA) on alcohol consumption, traffic crashes and health and social problems.

Two hundred and forty one analyses of MLDA were identified. The review covered peer-reviewed evidence published between 1960 and 2000. Identified studies were cross-sectional and longitudinal in design. The majority of included studies were drawn from the USA and Canada, with 4 analyses drawn from Australia, 1 from Switzerland, 1 from Norway, and 1 from New Zealand. No studies were undertaken in the UK. The vast majority of studies focused on adolescents and young adults, with the youngest individuals drawn from Grade 7 educational level (approximately 12-13 years of age) to young adults aged 24 years of age. One study included individuals of any age group within the population. No data were presented by gender or ethnic group. The review authors categorised results from analyses as either indicating an inverse relationship or a positive relationship between MLDA and an outcome of interest. For example, in an inverse (or negative) relationship, as the legal age was lowered, an outcome measure would increase and, conversely, as the legal age was raised, the outcome measure would decrease. In a positive relationship, as the legal age was raised, so would the outcome measure and vice versa. The review authors also attempted to identify the impact of MLDA on college student populations, in order to contribute towards contemporary discussion on the effectiveness of MLDA in this subgroup. The effects of changes in MLDA on various categories of alcohol-related outcomes are listed below.

Effects of MLDA on alcohol consumption

Forty eight published studies were identified that measured a total of 78 alcohol consumption-related outcomes. Of these 78 analyses, 55 (71%) included a comparison group. For 3 analyses, it was not clear whether a comparison group had been included.

Of the 78 consumption-related analyses, 27 (35%) generated a statistically significant inverse relationship between legal age and alcohol consumption; suggesting that a lower MLDA was associated with increased alcohol consumption and, conversely, a higher MLDA was linked with decreased levels of alcohol consumption. Eight additional analyses also found a negative relationship but did not report levels of statistical significance. Of the 78 analyses, only 5 reported a positive relationship between MLDA and consumption (no further data presented on statistical significance by review authors). Just under half (45%) of all alcohol consumption-related analyses showed that a higher MLDA was associated with reduced consumption.

The authors assessed the findings of the included evidence on the basis of quality, judging higher quality studies to be longitudinal in design (defined as any analyses consisting of repeated measures over time), possessing a comparison group and having been conducted on a probability sample or complete census of a relevant population.

Of the 78 analyses of consumption, 21 were cross-sectional in design and 57 were pre-post, longitudinal or time series designs. Of the 21 cross-sectional analyses, 8 (38%) generated a statistically significant negative relationship between MLDA and alcohol consumption, whilst only 3 analyses found a significant positive relationship. A further 4 analyses yielded a negative relationship and 1 a positive relationship; however statistical significance levels were not available. Of the 57 identified longitudinal analyses, 19 (33%) resulted in a significant negative relationship, whilst only 1 longitudinal study reported a significant positive relationship. A further 4 longitudinal analyses found a negative relationship but did not present significance levels. Of the 55 studies with a comparison group, 23 (42%) described a significant inverse relationship between MLDA and alcohol consumption. A further 3 analyses found an inverse relationship and 1 analysis reported a positive relationship but no statistical significance levels were available. Of the 20 analyses that did not include a comparison group, 4 resulted in a significant inverse relationship and none found a positive relationship. Of the 78 consumption-related analyses, 58 (74%) included probability samples or a complete census of the relevant population, but 11 analyses clearly did not use a probability sample or census. For a further 9 analyses, it was not clear whether a probability sample or census was used. Of the 58 analyses based on a probability sample or census, 20 (34%) demonstrated a statistically significant inverse relationship between MLDA and consumption, and only 1 study found a positive relationship. In a further 8 studies an inverse relationship was observed but significance levels were not presented. In twenty six studies no significant relationship between MLDA and consumption was present. Only 1 study found a positive relationship but did not report statistical significance. Of the 9 analyses for which it

was unclear whether a probability sample or census was used, 5 generated a significant inverse relationship, and none found a significant positive relationship. Therefore, it can be seen that, even when study quality is taken into account, the relationship between MLDA and alcohol consumption was equivocal.

Twenty four of the 78 consumption-related analyses were specific to college student populations. Of these, 3 (13%) produced a significant negative relationship between MLDA and consumption, 3 showed a significant positive relationship and 15 found no significant relationship. One further study reported an inverse relationship but did not present statistical significance levels. Of the 54 studies that were not college specific, 24 (44%) found a significant inverse relationship, and only 1 a significant positive relationship. A further 7 analyses yielded an inverse relationship and 1 a positive relationship, but no statistical significance levels were reported.

Of all analyses that reported significant effects, the majority (87%) found that a higher MLDA was associated with lower alcohol consumption. However, almost half of the total consumption-related analyses (46%) found no association; but when authors focused on the 33 (42%) analyses that were rated as being of high methodological quality (including longitudinal design, comparison groups and probability sampling or census) (out of a total of 78 analyses), 11 (33%) of the 33 resulted in a significant inverse relationship and 1 (3%) found a significant positive relationship. Therefore, 21 studies showed no relationship, resulting in an inconclusive evidence base. Only 3 of the higher quality studies were college-specific and results were not statistically significant in any of the studies.

The evidence included in the review by Wagenaar and Toomey was inconclusive, with an unclear relationship between MLDA and alcohol consumption.

Effects of MLDA on driving after drinking and traffic crashes

A total of 57 published studies were identified that focused on MLDA and indicators of driving after drinking and traffic crashes (where the term ‘crashes’ is used by the authors to include a range of traffic-related outcome measures). In these 57 studies, a total of 102 crash outcome measures were investigated (eg. fatal crashes, drink-driving crashes, self-reported driving after drinking). Of the 102 analyses, 52 (51%) demonstrated a significant inverse relationship between MLDA and crashes (ie. as MLDA was lowered, the number of crashes increased, and as MLDA was raised, the number of crashes decreased). A further 12 analyses resulted in an inverse relationship but did not report statistical significance. Of these 102 analyses, only 2 found a positive relationship between MLDA and crashes.

As previously, the review authors presented findings according to the judged methodological quality. Of the 102 analyses of traffic crashes, 14 were of cross-sectional designs and 88 were of longitudinal design (judged to be of higher methodological quality). Of the 14 cross-sectional analyses, 5 (36%) reported a significant inverse relationship, whilst only 1 found a significant positive relationship. Of the 88 longitudinal analyses, 47 (53%) yielded a significant inverse relationship, whilst none gave a significant positive relationship. A further 12 analyses showed an inverse relationship and 1 found a positive relationship but significance levels were not reported. Of the 102 traffic crash-related analyses, 95 (93%) included a comparison group (unclear whether comparison group used for 2 analyses). Of those, 50 (53%) demonstrated a significant inverse relationship, only 1 found a significant positive relationship, whilst a further 11 presented an inverse relationship but significance not reported. Of the 5 analyses that did not include a comparison group, 1 was of a significant inverse relationship, 1 found an inverse relationship and a further 1 described a positive relationship but did not report significance levels. Of the 102 analyses of traffic crashes, 94 (92%) used probability samples or a complete census of the relevant population, 3 clearly did not and status was unclear for a further 5. Of those 94 analyses, 49 (52%) described a significant inverse relationship, 1 study a significant positive relationship, an inverse relationship was observed in 11 studies and an additional 1 analysis found a positive relationship but did not report significance. Thirty-four analyses found no significant association. Of the 3 analyses without a probability sample or census, 2 gave a significant inverse relationship and none found a positive relationship. Of the 5 analyses for which sample method was unclear, a significant inverse relationship was observed in 1 study and no studies reported a significant positive relationship.

Only 6 of the 102 traffic crash-related analyses were specific to college student populations. Two analyses (33%) described a significant inverse relationship, 1 a positive relationship (but statistical significance was not reported) and 3 found no significant relationship. Of the 96 non-specific analyses, 50 (52%) presented a significant inverse relationship, 1 found a significant positive relationship and 12 analyses described an inverse relationship but did not report significance.

Of all analyses that reported significant effects, 98% found a higher MLDA to be associated with lower rates of traffic crashes, whilst only 2% of analyses described the opposite. However, 35% of total analyses found no association between MLDA and indicators of traffic crashes; but, of the 79 higher quality analyses of MLDA and traffic crashes, 46 (58%) found a

higher MLDA to be related to decreased traffic crashes. None found the opposite. None of the studies of higher quality were college-specific.

Therefore, the evidence would suggest that raising the MLDA would result in lower rates of traffic crashes in young adults.

Effects of MLDA on other health and social problem outcomes

Twenty four published studies were identified assessing the effects of changes in MLDA on indicators of other health and social problem outcomes (other than traffic crashes), such as suicide, homicide or vandalism. Across these 24 studies, 61 outcome measures were analysed. Of these 61 analyses, 10 (16%) yielded a statistically significant inverse relationship between MLDA and other outcomes (ie. as the legal age lowered, number of problems increased and vice versa). Of the 61 analyses, only 4 found a positive relationship (no further detail presented by review authors on statistical significance, a further 2 described an inverse relationship and 1 a positive relationship but significance levels were not reported.

As for the previous 2 outcomes, findings were discussed in terms of methodological quality. 16 of the 61 analyses were of cross-sectional design, of which 1 (6%) found a significant inverse relationship and none gave a significant positive relationship. Of the 45 longitudinal analyses (viewed to be methodologically stronger than cross-sectional designs), 9 (20%) presented a significant inverse relationship, and 3 found a significant positive relationship. 36 of the 61 analyses (59%) included a comparison group (with the presence of a comparison group unclear for 4 analyses). Of these 36 analyses, 9 (25%) demonstrated a significant inverse relationship, and none found a significant positive relationship. A further one study described a positive relationship but statistical significance was not reported. Of the 25 analyses that did not include a comparison group, 1 found a significant inverse relationship and 3 generated a positive relationship (no further detail presented by review authors on statistical significance). In these 61 analyses, 47 (77%) included probability samples or used a complete census of the relevant population, 12 clearly did not and status was unclear for 2 analyses. Of those 47, 9 (19%) analyses yielded a significant inverse relationship and 2 reported a significant positive relationship. Of the 12 analyses not based on a probability sample or census population, 1 gave a significant inverse relationship and 1 found a significant positive relationship. Of the 2 for which it was unclear, neither presented a significant relationship.

Of the 61 health and social problem-related analyses, 34 were specific to college student populations. Two (6%) found a significant inverse relationship and 3 a significant positive

relationship between MLDA and health and social problems. A further 2 demonstrated an inverse relationship but statistical significance was not reported. Of the 27 analyses that were not college population-specific, 8 (30%) described a significant inverse relationship, none found a significant positive relationship, whilst a further 1 presented a positive relationship but did not report significance.

Of all health and social problem-related analyses that reported significant effects, 75% found a higher MLDA to be associated with lower rates of problems. Almost three quarters (72%) of all analyses found no association, but for the 23 studies judged to be of higher quality, 8 (35%) described a significant inverse relationship, whilst none found a significant positive relationship. Two of the higher quality studies were college-specific but results were not statistically significant.

The higher methodological studies were presented by the review authors according to 4 subgroups, due to the considerable diversity in outcomes reported by the health and social problem-related). Of the 16 analyses of non-traffic injuries (fatal and nonfatal), 4 generated a significant inverse relationship (for outcomes including suicide and acquaintance homicide) whilst none found a positive relationship. Of the 10 analyses of 'other crime' outcomes, 3 described a significant inverse relationship (including vandalism and disorderly conduct, but none gave a positive relationship. Only 1 study of higher methodological quality focused on social, academic and employment problems and did not find a significant result. Only 3 studies that analysed 'other problems' (eg. alcoholism, cirrhosis) were judged to be of higher quality and did not generate significant results.

There is inconclusive evidence suggestive of an inverse relationship between MLDA and health and social problems.

Only 6 of the total of 64 college-specific studies (9%) were of high quality. None found a statistically significant relationship between the MLDA and outcome measures. Therefore, the review authors could not draw any definitive conclusions regarding the impact of MLDA in this population subgroup.

The evidence identified in this review is suggestive but inconclusive of the existence of a negative relationship between MLDA and two outcome measures: alcohol consumption and traffic crashes. The relationship between MLDA and other health and social problems is less clear. The lack of higher quality studies conducted in college student populations prevented any specific conclusions from being made for this group. The authors underlined the necessity

for effective enforcement in the implementation of MLDA legislation. For the purposes of this guidance it is important to note that, whilst this review was considered to be comprehensive, no UK-based studies could be identified.

Summary of findings

The evidence identified for this review demonstrated the effects of changes in the minimum legal age of alcohol purchase on a range of outcomes.

The systematic review by Wagenaar & Toomey (2002) was extremely comprehensive in its coverage, identifying 241 analyses of the effects of MLDA. The findings were suggestive of the existence of a negative relationship between MLDA and alcohol consumption, although the trend was inconclusive. The study by DiNardo & Lemieux (2001) supported this link between alcohol consumption and MLDA, with an increase in MLDA related to a slight decrease in drinking among young people. Furthermore, DiNardo & Lemieux (2001) suggested the potential substitution of marijuana for alcohol by young people in the event of a rise in the MLDA and concomitant reduction in alcohol availability.

Additional primary studies provided further evidence of a negative association between MLDA and alcohol-related outcomes. Everitt *et al.* (2002) observed a greater proportion of intoxicated young people presenting to the emergency department following a reduction in legal age. This increase occurred among young people aged 18 to 19 yrs who could now drink legally, but also among younger individuals, indicating that this subgroup was able to access alcohol more easily since the reduction in MLDA.

The systematic review by Wagenaar & Toomey (2002) was also suggestive of a negative relationship between MLDA and traffic crashes, although once more, findings were not conclusive. Kypri *et al.* (2006) and Fell *et al.* (2008) presented further data to support the negative association between increases in MLDA and reductions in road traffic crashes. The study by Ponicki *et al.* (2007) also described the reduction in youth traffic crash fatalities as a consequence of raising the MLDA.

In addition, Ponicki *et al.* (2007) demonstrated the interaction between components of alcohol availability, where the potential impact of a change in MLDA would be mitigated by other limitations on alcohol availability, for example in this case those imposed by prevailing high beer taxes. It could be anticipated that, in instances where beer taxes were already high, the availability of alcohol to young people would already be limited on an economic basis, and therefore any further impact resulting from an increase in MLDA would be moderated.

Therefore, this study provided an interesting example of the way in which the effectiveness of an intervention may be influenced by the existing regulatory environment.

As would be expected, the evidence base was limited to countries where a change in MLDA had taken place, presenting a natural experiment for study. Thus, no studies were identified that were specific to the UK and the applicability of evidence is therefore limited. Country-specific characteristics (for example the potential impacts of variables such as legal driving age, car ownership and geographical remoteness on youth traffic fatalities) may influence findings and should be taken into consideration during interpretation of these results. Cultural attitudes held among young people towards underage drinking would also be anticipated to have differed across countries. Furthermore, levels of enforcement of MLDA are likely to have varied considerably across study settings and may further limit the comparability and applicability of evidence.

Evidence statements

Evidence statement 2.1

The very comprehensive systematic review performed by Wagenaar & Toomey provided inconclusive evidence suggestive of a negative relationship between MLDA and alcohol consumption.¹ A further study found a small negative impact of MLDA on alcohol consumption.²

¹ Wagenaar & Toomey, 2002 (Systematic review, ++)

² DiNardo & Lemieux, 2001 (Regression analysis) USA

Applicability: The majority of the primary research included in the systematic review by Wagenaar & Toomey was conducted in the USA and Canada (with the remaining studies drawn from Australia, New Zealand, Switzerland, and Norway). DiNardo & Lemieux used data from the USA for analysis.

Evidence statement 2.2

The identified evidence also pointed towards the existence of a negative relationship between MLDA and alcohol-related outcomes, including intoxicated presentations by young people at A&E,¹ alcohol-related road traffic accidents among young people,^{2,3,4,5} juvenile crime⁶ and other health and social problems.⁵

¹ Everitt *et al.*, 2002 (Before and after study, +) New Zealand

² Fell *et al.*, 2008 (Analysis of variance and regression analysis) USA

³ Kypri *et al.*, 2006 (Before and after study, ++) New Zealand

⁴ Ponicki *et al.*, 2007 (Cross-sectional time series data analysis) USA

⁵ Wagenaar & Toomey, 2002 (Systematic review, +)

⁶Smith & Burvill, 1987 (Before and after study, +) Australia

Applicability: The majority of the primary research included in the systematic review by Wagenaar & Toomey was conducted in the USA and Canada (with the remaining studies drawn from Australia, New Zealand, Switzerland, and Norway). Other studies were performed in the USA, Australia and New Zealand.

Evidence statement 2.3

Evidence was identified demonstrated that the impact of changes in MLDA can be moderated by the existing regulatory environment, in this case the level of beer taxation.¹

¹Ponicki *et al.*, 2007 (Cross-sectional time series data analysis) USA

Applicability: The above study was set in the USA.

5.2.2.2 Review 2.2 a) Enforcement of minimum legal age of alcohol purchase

Nineteen pieces of evidence relating to the enforcement of minimum legal age of alcohol purchase were included in the review.

Elder *et al.* (2007) (Systematic review, +)

A systematic review was performed to explore the effectiveness of enhanced enforcement programmes in the reduction of underage alcohol sales. Enforcement programmes aim to increase retailer compliance and increase the perceived risk of detection. Interventions included in the review were community based efforts that included training and attempts to change alcohol related policies. Studies were mostly drawn from the USA. The evaluated studies presented evidence of the effectiveness of enhanced enforcement of laws prohibiting sale of alcohol in reducing underage alcohol purchases.

During enhanced enforcement programmes, the proportion of successful purchase attempts made by decoys fell by a median figure of 42% (inter quartile interval (IQI): -57%; -17%). All of the studies reviewed found that enhanced enforcement was associated with a decrease in sales to decoys, but variations in effect size were attributed to the nature of the enforcement programme.

Studies focusing on the enhanced enforcement at off-licensed premises reported a 60% relative decrease (Barry, 2004) and a 78% relative decrease (Perry *et al.*, 1996) in the proportion of purchase attempts that were successful.

Barry (2004) also found that enhanced enforcement was associated with a 20% reduction (RR = 0.8; 95% CI: 0.7; 0.9) in both self-reported alcohol consumption and binge drinking among young people from Grades 9 to 12. Community mobilisation was associated with a 2% reduction in the prevalence of any alcohol consumption.

Gehan *et al.* (1999) (Qualitative study, +) USA

Focus groups were carried out in this USA-based study by Gehan *et al.* in order to explore the perceptions and practices of workers in on-licensed premises relating to the service of underage and intoxicated customers. The aim was to collect these views in order to inform the development of a responsible service training programme.

The majority expressed disapproval towards the sales of alcohol to underage youth. Although several group members reported having served an underage friend or allowed an underage

person to enter an establishment to drink, most participants stated that it was not worth the risk to serve underage people. Reported concerns surrounding the consequences of irresponsible service included losing their job or causing the establishment to lose its licence. However, some staff thought police visited establishments to make their presence known, rather than to enforce alcohol service laws.

The perceived level of support received by serving staff from managers varied. Several participants described their actions as being influenced by whether their employing establishment placed an emphasis on financial gain or serving alcohol responsibly. Some stated that they knew their manager would support them if they refused an alcohol sale. However, other employees described a lack of support in instances where the intoxicated or underage person was known to the manager or was a regular customer. In such cases, decisions to refuse service were over-riden, with a few stated they would be dismissed in such a situation. The reported type and duration of previous training varied widely among participants.

Grube (1997) (Controlled before and after study, +) USA

Grube reported the findings of a before and after study investigating the effectiveness of a community based approach in reducing sales to underage youth.

Increased underage sales enforcement activities were taken by the local police in each experimental community. Warning letters were mailed to all outlets informing them that routine enforcement of underage sales laws was being initiated. The letters were followed by a series of decoy operations in which the police had underage buyers attempt to purchase alcohol at selected outlets. Outlets selling to the decoy buyers were cited. Such decoy operations were implemented beginning in June 1995 in Southern California and somewhat later in the other experimental communities. To further increase perceptions of enforcement, warning letters reminding off-license owners and managers about the ongoing decoy activities were sent to all outlets on a regular basis.

Overall, in South Carolina, outlets in the comparison community were about 1.9 times more likely to sell to a buyer than were outlets in the experimental community. The decrease in sales between the pre-test and post-test phases was significantly greater in the experimental community than in the comparison community. For Southern California, the reductions in

sales from the pre-test to the post-test phases were greater in the experimental than in the comparison community.

Jeffs & Saunders (1983) (Controlled before and after study, ++) UK

Licensed premises in a coastal UK setting were visited by authorities to monitor underage alcohol sales and offences related to drunkenness. Visits by police were made 2-3 times per week, taking into account sales and conditions on the premises. Offences during the intervention period were compared with a year prior and one year after police visits, when police reverted back to normal practices. A comparable seaside community with no additional enforcement was included as a control. The rates of recorded crime and public order offences during summer 1978 were compared with those for the previous year (1977) and the following year (1979).

During the year of the altered enforcement practice, all arrests in the resort town fell by 21% and rose in the following year by 20%. No such fluctuation was observed in the control town. In 1977 and 1978, analysis of the arrests relating to under 18 year olds in the towns in 1977 and 1978 fell short of statistical significance ($P=0.20$). While differences in arrests did not reach statistical significance, underage drinking may be a factor in crimes. Almost two thirds (65%) of arrested individuals aged under 18 years indicated that they were drinking prior to arrest in 1979.

Krevor *et al* (2003) (Controlled before and after study, ++) USA

Krevor *et al.* studied the effects of the use of electronic age verification (EAV) to prevent underage alcohol sales in Florida and Iowa, USA.

Approaches included i) mystery shopper inspections: two pre- and five post-EAV installation mystery shopper inspections of tobacco and alcohol retailers; ii) retail clerk and manager interviews; and iii) customer interviews. Stores that did not elect to test EAV were used for comparison.

Treatment group stores provided with EAV devices and comparison stores did not differ significantly in age verification behaviour for tobacco or alcohol sales at either baseline or at the final post-test. At 6 months follow-up, stores with EAV devices did not significantly increase their age verification rates over baseline; neither did they display significant increases in the rate of age verification compared to comparison stores.

Just under half of the sales clerks (48% of the Florida clerks and 42% of the Iowa clerks) interviewed reported frequently using the devices for alcohol purchases and that using EAV devices made their jobs easier. The majority of clerks found that using EAV devices made it easier to request that customers show ID (85% Florida, 70% Iowa) and also made it easier to refuse to sell alcohol to underage customers (85% Florida, 84% Iowa).

Most customers interviewed stated that they did not mind if clerks checked their ID (96% Florida, 81% Iowa).

Whilst the use of EAV devices shows promise, installing EAV devices with minimal training and encouragement did not appear to increase age verification and underage sales refusal. Sales staff require training and advice on the importance of using such devices to prevent underage sales. The authors argue that comprehensive training of all staff (not just managers), integration of EAV devices in standard protocols, and changing the physical configuration of checkouts to facilitate the use of EAVs may prove effective in reducing underage sales.

MMWR/ Concord Police Department (2004) (Controlled before and after study, +) USA
A pilot programme was implemented (MMWR/Concord Police Department) consisting of enhanced law enforcement with quarterly compliance checks of off-licensed alcohol licensees in New Hampshire, USA. Compliance checks elsewhere in New Hampshire (outside of Concord) were also assessed for comparison. Findings were supportive of the effectiveness of enhanced enforcement of alcohol sales.

In the experimental setting, 28.2% of 220 licensees sold alcohol to underage youths before the intervention. During the intervention, 10.2% of 383 licensees sold alcohol to underage youths (relative risk (RR) = 0.4; 95% confidence interval (95%CI) = 0.3-0.5). Additionally, young people reported less binge drinking following the pilot programme.

In the control area, 30.5% of 1,007 licensees sold alcohol to underage youths in compliance checks between October 1999 and February 2002. Between March 2002 and February 2004, 27.7% of 832 licensees made sales of alcohol to underage people (RR = 0.9; 95% CI = 0.8-1.1). No differences in binge drinking were reported by young people.

Pratten (2005) (Qualitative study, +) UK

A qualitative study was conducted by Pratten to determine the views of licensees on their legal responsibilities relating to the service of alcohol in a market town in the North West of England.

All participants interviewed were part of the local Pubwatch scheme. All were positive of the principles of the scheme and supportive of the imposition of bans where required. However, reported attitudes towards legal responsibilities were variable, with some licensees carefully adhering to laws relating to the prevention of sales to underage people, other participants appeared to be less stringent, and also suggesting that economic factors may be considered more important than legal limits.

Preusser *et al.* (1994) (Before and after study, +) USA

A before and after study in the USA by Preusser *et al.* assessed the effectiveness of a sting or decoy operation in which underage police cadets attempted to buy packaged beer at randomly selected grocery, convenience, liquor, and drug stores in Denver, Colorado.

During the first round of purchase attempts (June 26, 1992), 59% of premises sold beer to the underage police cadet. During the second round, 32% of premises sold beer to the underage cadet. Offending stores received a 30-day licence suspension. All were eligible to pay a fine in lieu of suspension (\$200 to \$3,000 based on volume and sales of establishment).

The third round of purchase attempts (October 23, 1993) included the stores selected for the second random list. Just over a quarter of premises (26%) of premises completed the underage sale. This proportion (26%) was also observed during the fourth round of attempts (April 23 1993).

The licence type, clerk, number of registers and number of customers had little apparent effect on the overall rate of sales. Therefore, cadets were able to buy beer on 59% of attempts at baseline, whilst underage sales decreased to 28% (summed across the subsequent rounds of purchase attempts), indicating the success of the operation in reducing underage alcohol sales.

Rehman *et al.* (2005) (Controlled before and after study, ++) Sweden

A campaign was conducted in inner-city Stockholm, Sweden to reduce underage sales of beer, consisting of a series of activities over 2 years using information/training, media advocacy, and monitoring.

The programme involved the establishment of a steering group, meetings with parents, merchants, and visits to shops. Postcards were sent to teenagers. Additional components included parental monitoring of shops, issuing of letters to outlet owners, training of sales staff, purchase attempts, and media advocacy. An inner-city with a similar composition to the intervention city, but without the implementation of the intervention programme, was included as a control.

At baseline, 66% (intervention site) and 60% (comparison site) of underage purchase attempts resulted in a successful sale. One year following the programme, increases in the purchase success rate for purchase attempts were seen at both sites (73%, intervention site (NS), 86% control site). The increase in the intervention site was not significant, but the increase in the comparison site was significant. In the second follow up study, decreases were seen (29% intervention site, 42% control site (decreases from first follow-up study)). Purchase attempts were apparently more successful if fewer people were in the shop at the time of purchase and if the clerk was under 25 yrs of age.

A survey of students suggested no significant differences in underage alcohol sales from baseline to follow-up as a result of the intervention, with the same proportion of students reporting that it was easy to purchase alcohol (46% at baseline vs 47% at second follow-up).

Both parents (75% to 74%) and shopkeepers (95%) were aware of the campaign. A large proportion (86%) of shopkeepers stated that the campaign led to discussions with sales staff on preventing underage sales and undertaking ID checks.

Overall reductions in underage beer purchases were observed in both intervention and control areas. Students still described being able to purchase alcohol with ease. Therefore this intervention would not in itself be sufficient to prevent underage sales.

Scottish Centre for Social Research (2007) (Evaluation) UK

A pilot programme was implemented in Scotland (Scottish Centre for Social Research) in order to improve the prevention of underage alcohol sales. The pilot consisted of trial test purchasing attempts in Fife and interviews with stakeholders on views and feasibility of the pilot.

Knowledge of test purchasing was found to have increased between baseline and follow-up, with a larger proportion licensees reporting that they knew a lot about test purchasing at follow-up (51% vs 26%, $P < 0.001$)

About 48% of respondents who failed the initial test purchase visit reported that the pilot would have an impact on their retail practice. 36% of licensees stated that they made changes to their premises following the test phase, claiming to have increased vigilance and following of procedures. However, 31% ($n=13$) of those that represented premises that failed the test also said that their retail behaviour would not change.

38% of those licensees who failed the test at follow-up felt that proof of age card schemes which were already in existence were not a good idea. Over 83% of licensees who failed the initial test now reported giving at least 'quite a lot of training' to staff.

At follow-up, 99% of licensees stated that they would ask for proof of age information (cards, driving licences, passports etc) if they had doubts about age. Even given the fact that the percentage of licensees giving a similar response at baseline was relatively high (92%) this difference was statistically significant ($P < 0.05$), suggesting that the pilot had affected reported behaviour.

The most popular response at baseline and follow-up relating to the most effective means of preventing underage drinking was for test purchasing to be utilised in combination with a nationally-accepted proof of age card scheme (i.e. one not already in existence), with over half (54%) of licensees holding this view. About one-quarter of interviewees thought that a move towards a nationally-accepted proof of age card scheme was the most appropriate way to restrict sales of alcohol to those under the age of 18 years. Whilst not all police were convinced that the national proof of age card scheme was required, they accepted that licensees were calling for such an approach and this method may assist future partnership working between police and the licensed trade.

Scottish Executive Social Research (2003) (Literature review)

A review by the authors identified evidence relating to the use of information gathering and dissemination in enforcement of the licensing responsibilities. This function can include the identification of licensed premises where trouble has occurred. Work in Canada was described whereby apprehended drunk drivers were asked to state the site of their last drink and the resulting licensed establishments were reported to the licensing authorities and was linked to the issuing of warnings and risk of licence suspension. The evidence suggested that this activity contributed to reductions in the number of arrests in the location of the named bars. Furthermore, work in Cardiff included the publication of a league table of pubs and clubs where violent incidents had occurred, where data were provided to the local media and police. Findings suggested that such an approach may have played a role in reducing assault-related A&E attendances associated with named premises. Whilst no hard effectiveness evidence can be identified relating to these activities, such reports are applicable to the consideration of interventions for use in the enforcement of the legal minimum age and the management of the sale of alcohol to intoxicated people.

Toomey *et al.* (2001) (Controlled before and after study, ++) USA

Toomey *et al.* described an evaluation of the effectiveness of Project ARM in the enforcement of underage alcohol sales.

Project ARM (Alcohol Risk Management) was a US-specific programme consisting of 5 tailored one-on-one consultation sessions for owners and managers relating to sales of alcohol to underage and/or intoxicated individuals. Each consultation session lasted 1 to 2 hours. Sessions were implemented once a week during a 5-week period. The project focused on the implementation of policies to prevent illegal sales. The evaluation was performed in 5 bars (and 9 control bars), where pre and post-intervention rounds of purchase attempts were made.

Purchase rates for underage sales were similar across experimental and control sites at baseline (intervention 46.0%, control 48.0%). Following the intervention, the purchase rate increased slightly for the control condition (to 49.4%) and decreased marginally (but not significantly) in the intervention condition (to 42.0%). The lack of significance may be due to the relatively small sample size of the study (requiring the participation of 830 bars per condition to demonstrate statistical significance).

Owners and managers reported having enjoyed and valued participation in Project ARM. Outlet employees were also positive of Project ARM, indicating the benefit of establishing clear rules for beverage service.

Toomey *et al.*, 2008 (RCT, ++) USA

Toomey *et al.* investigated the effectiveness of a training programme to increase enforcement of the minimum legal age of alcohol purchase. The study was based in the USA.

The objective of training was to help owners/managers to select and implement alcohol control policies in their establishments. The full-ARM training consisted of four one-to-one sessions, whilst the ARM Express was a single session.

Just over a quarter (27%) of the 104 included establishments implemented the recommended policy of confiscating false IDs, whilst 19% revised policy, and 54% rejected the policy.

Wagenaar *et al.* (2000) (RCT, ++) USA

This report presented the findings of the USA-based Communities Mobilising for Change on Alcohol (CMCA) trial.

The trial was an evaluation of a community organising intervention designed with the aim of reducing the availability of alcohol to underage young people. The study was based across 15 communities and included matched control communities for comparison. The study comprised school-based surveys and telephone surveys with 18 to 20 yr olds, surveys of outlet owners, and purchase attempts.

On-licensed and off-licensed alcohol outlets in the intervention group experienced 17% and 15% increases respectively in ID checks. Sales to underage buyers decreased by 24% and 8% for on-licensed and off-licensed premises respectively. 'Checking all ID for people who look under 30' did not appear to be an effective approach. Intervention communities demonstrated a 5% and 12% increase in perceived likelihood of being cited/caught for making underage sales for on-licensed and off-licensed outlets. Stores that reported that they would serve alcohol to a 21 yr old accompanied by an underage person decreased by 17% for on-licensed and 25% for off-licensed premises.

The student survey showed a 25% reduction in young people who tried to buy alcohol, whilst students also reported increased difficulty in obtaining alcohol post-intervention. The supply of alcohol to young people by adults also decreased by 17%. However, high school seniors demonstrated a 30% increase in alcohol purchases.

Wagenaar *et al.* (2005) (Literature review)

This review of evidence by Wagenaar *et al.* drew together findings relating to alcohol control policies for the reduction of underage drinking. Relevant studies in the area of underage enforcement reviewed the effects of server and management training, advertising restrictions, and compliance checks. Studies originated from a range of countries, including some evidence from the UK. Evidence indicated that some policies appeared to be successful in limiting underage sales.

One study demonstrated that trained servers were more knowledgeable about underage enforcement. A further three studies showed that training had no apparent effect in reducing underage drinking. However, study sample sizes were small and server training was inconsistent and highly variable across programmes. Six out of 10 studies found that advertising age restrictions was associated with reductions in alcohol consumption. Three studies demonstrated that compliance checks were effective in reducing underage drinking versus control groups. A further two uncontrolled studies supported this result.

Wagenaar *et al.* (2005) (Multi-community time-series quasi-experimental trial with a nested cohort design) USA

The Complying with the Minimum Drinking Age (CMDA) project reported by Wagenaar *et al.* was performed in order to assess the effectiveness of two interventions designed to reduce underage alcohol sales: 1) training for management of retail alcohol establishments 2) enforcement checks of alcohol establishments. Alcohol premises included on and off-premise outlets. The study was undertaken in 20 cities across 4 geographic areas in the Midwest of the USA between 1999 and 2001. Intervention sites included 1 large urban city and 10 surrounding suburban incorporated cities; whilst comparison sites included 1 large urban city and 8 surrounding suburban incorporated cities. Alcohol outlets in these areas were broken down into 10 cohorts, with each cohort containing a random sub-sample drawn from a census of all licensed on-premise (including bars and restaurants) and off-premise (including liquor stores, grocery stores) alcohol outlets. Intervention sites were selected on the basis of their

commitment to reducing underage sales through enforcement. Comparison sites were chosen according to similar size, demographics and number of licensed alcohol outlets to intervention sites.

The interventions to be evaluated were as follows:

A) All intervention-community establishments in business on 1 Feb 1999 were offered a free, one-on-one 2 hour training programme entitled Alcohol Risk Management-Express (ARM Express). ARM Express was designed for the self-identified decision-maker at the establishment (either owner or manager) to encourage them to select and implement up to 19 model alcohol policies and practices. These policies had been designed to create an operational and normative environment that supports responsible service of alcohol. One hundred and nineteen of eligible intervention group outlets (38%) participated in the programme between Feb 1999 and Jan 2000. Outlets were also offered a 1 hour booster session between March and July 2001 (to allow the reviewing of recommended policies and updating of resource materials), with 96 (31%) of the outlets participating in the booster training (comprising 81% of outlets that had participated in the initial training session).

B) A deterrence-based intervention was implemented consisting of enforcement checks by local law enforcement (in which a youth aged under 21 years attempted to buy alcohol from licensed outlets). Each intervention community decided the schedule and number of checks. A total number of 959 checks were conducted in the intervention communities. However, following the project initiation, some comparison sites began independently performing enforcement checks (with a total of 894 checks performed in the comparison communities). However, the authors state that the temporal patterns of enforcement were considerably different between the two conditions, and were handled by the multiple time-series design.

The primary outcome assessed was the propensity for underage alcohol sales. The propensity for underage alcohol sales was assessed using research staff that made attempts to purchase alcohol without showing age identification using a standardised protocol in 602 on-premise and 340 off-premise alcohol outlets. These pseudo-underage buyers were individuals aged 21 or older but who appeared to be underage without using ID. 77 buyers (55 females, 22 males) and 83 observers (64 females, 19 males) conducted purchase attempts. The buyers' median perceived age was judged by age assessment panels and ranged from 17 to 20 (with the actual age range being 21 to 26 for buyers and observers). Analyses were performed using data from 7242 purchase attempts made at 942 outlets. A random sample of establishments was visited

every 2 weeks, with observations of a random sample of outlets made every other week for 4.5 years. Outlets in all 10 cohorts were revisited every 20 weeks. Data were collected every other week in all communities over a 4 year period.

The effects of the training intervention were described as mixed. The training and booster variables were not found to be significant for off-premise outlets (demonstrating that training had no effect on the likelihood of successful underage alcohol sales). On-premise outlets showed an effect of training, but not of the expected pattern. Participation in training was associated with a short-term, albeit non-significant reduction in the likelihood of underage alcohol sales, with a significant long-term increase in sales of approximately 7%.

Specific deterrent effects for enforcement checks were observed, with a 17% reduction in the likelihood of underage sales at off-licence outlets, immediately following a law enforcement check (having controlled for buyer age, seller age, presence of signs warning against sales to minors or entrance to minors, number of customers in line and linear trend). This effect decayed to an 11% decrease in likelihood of successful sales at 2 weeks following the check and to a 3% decrease in likelihood of sales at 2 months following the enforcement check.

The effects of the enforcement intervention in on-premise outlets had significant immediately and long-term effects. The authors reported a 17% decrease in the likelihood of selling following an enforcement check, decaying over time to a 14% reduction at 2 weeks and a 10% decrease at 2 months. The long-term decrease in likelihood of underage alcohol sales was 8.2%.

Media coverage did not appear to have a significant impact on the effectiveness of the intervention programme.

The evidence therefore suggests that the training intervention was not successful in preventing the sale of alcohol to minors but that enforcement checks were effective in the prevention of underage alcohol sales. Most of the enforcement effect decayed within 3 months, indicating the importance of maintaining enforcement programmes.

Wallin *et al.* (2004) (Controlled before and after study, ++) Sweden

The authors reported the findings of a before and after evaluation of the impacts of a community alcohol prevention programme on underage alcohol sales at licensed premises in Stockholm, Sweden.

The intervention consisted of training for serving staff in responsible beverage service, policy initiative, and enforcement of existing alcohol regulations.

A decrease in alcohol service to adolescents was observed within the whole study area, as well as in the intervention and the control areas. The reduction in frequency of alcohol service in the 2001 study from the baseline in 1996 was statistically significant for both the intervention and the control area, and for both areas combined. One third of the licensed premises visited had doormen (42% in the intervention area, compared to 32% in the control area), and the majority of study adolescents were denied entrance (77 of 88). Neither the number, nor estimated average age of the patrons, nor the time of the visits had any effect on the serving rate. The only secondary factor that had a statistically significant impact odds of being served was whether the licensed premises had a doorman (estimated odds ratio [OR], 0.18; 95% confidence interval [CI], 0.09–0.38). Therefore it appears that fewer adolescents were served beer in licensed premises in the central parts of Stockholm in 2001 than in 1996 but no difference was found between the intervention and control areas.

Willner *et al.* (2000) (Before and after study, +) UK

Willner *et al.* conducted a longitudinal study in the UK in order to assess the ability of adolescents to buy alcohol, obtain information concerning vendors' views regarding underage alcohol sales and to evaluate a police intervention with the goal of reducing underage alcohol sales. The study was performed in two University cities, one located in the South-East and one in the North-East of England. Across both sites, the locations in which purchases were attempted were partly urban, part suburban and part semi-rural in geography. The choice of study sites was determined by the willingness of police force to cooperate with the study.

The study involved the covert observation of vendors in visited licensed premises. The choices of visited premises were described as having been made semi-randomly (informed by

location, ease of access and parking). The licensed premises included all the supermarkets and off-licences in the areas studied and a smaller proportion of corner shops and pubs. The majority of the vendors studied were female (corner shops 46%, off-licences 64%, supermarkets 73%, pubs 62%, $p < 0.001$). In phase 1 of the study, at least 82% of test purchases by 16 year olds and at least 87% of test purchases by 13 year olds involved different vendors.

Pairs of 13 and 16 year old boys and girls were trained to make purchase attempts for different types of alcohol (alcopops, beer, cider, wine spirits) from 4 different types of alcohol retail outlets (corner shop, off-licence, public house and supermarket).

In light of initial findings from phase 1 of the study, police at one of the performance sites decided to plan and implement an intervention in the aim of reducing underage alcohol sales. Therefore, the research team undertook a second round of underage alcohol purchase attempts as Phase 2, in order to evaluate the intervention (with the other performance site serving as a no-intervention control site). Thus, outlets were allocated to the intervention group on the basis of location within the area in which police implemented their intervention. The areas in which the intervention was not implemented served as a control group. Phase 1 (baseline) was conducted between late August and early December 1998; the police intervention was implemented in February 1999; Phase 2 followed in March and April 1999.

Between the 2 phases (in January 1999), a sample of vendors were surveyed by structured interview via telephone (control area $n=46$, intervention $n=40$). Topics discussed included underage alcohol purchase attempts, methods by which retailers handled the problem of underage alcohol purchase attempts and perceived consequences of the vendor proceeding with an underage alcohol sale.

The police intervention consisted of a number of components. These included:

A) A letter from the area police commander was sent to all licensed premises within the test area presenting the summary findings from the first round of test purchases in the study and reminding licensees of their legal obligations relating to underage alcohol sales. The letter recommended that vendors should request of proof of age from any young person appearing to be below the age of 21 and that only a passport or Prove-it card should be accepted. The

letter also indicated that police would be implementing their own campaign of test purchases for the purposes of collating judicial evidence.

B) The contents of letter were re-emphasised in personal visits to most of the licensed premises in the area and via telephone calls to regional and area managers of major brewery, off-licence and supermarket chains.

C) A press release was issued to disseminate information relating to the programme, which resulted in considerable coverage of the initiative by local press and local radio.

D) A small number of police cautions were issued in response to police test purchases.

The second round of purchase attempts (phase 2) was performed with the omission of the 13 year old male group, on the basis of anxiety experienced by this subgroup during purchase attempts in phase 1. Outcomes measured included successful purchase attempts and challenges for ID. Sixty two underage confederates attempted overall totals of 470 test purchases in phase 1 and 348 in phase 2.

Phase 1 (Baseline) results:

The majority (82.7%) of test purchases by 16 year olds were successful in obtaining alcohol. Sales resulted from 88.1% of purchase attempts by 16 year old girls and 77% of attempts by 16 year old boys ($P<0.02$). Overall, around a quarter (24.5%) of test purchases by 13 year olds were successfully made (41.6% of 13 year old girls and 4.1% of 13 year old boys) ($P<0.001$). Prove-It ID cards were requested in less than 12% of purchase attempts. The authors stated that these findings were broadly comparable in terms of location, alcohol type and outlet type.

Vendor telephone survey

Only 12.5% of respondents perceived that they had a problem with underage adolescents attempting alcohol purchases (this group did not differ significantly from other respondents with respect to any other questions asked by the research team). In terms of perceptions relating to the consequences of approving underage sales, 57% of vendors thought they might receive a fine if caught and 6% that they might lose their licence, whilst 39% did not know of the likely consequences. Only 2 vendors believed that adverse consequences would arise in actual fact if they sold alcohol to underage customers.

Phase 2 (Post-intervention evaluation):

In phase 1, successful sales to 16 year old girls were slightly lower in the control site than the intervention site ($P < 0.05$, no further data) but the 2 groups of 16 year old boys and 13 year old girls were well matched. In phase 2, sales to 16 year old girls in the control site increased to a level comparable with that in the intervention site ($P < 0.05$, no further data). The intervention did not appear to decrease sales in any of the 3 groups of adolescent confederates, with sales approved to both the 16 year old boys and 13 year old girls actually increasing significantly post-intervention ($P < 0.001$, no further data).

The authors concluded by stating that there was no evidence obtained that the police intervention was effective in reducing sales of alcohol to 16 year olds, but that it was possible that the intervention may have generated a decrease in sales of alcohol to 13 year old girls, albeit a decrease of very short duration (but that this decrease was contained within an overall increase in sales to this group). Therefore, it can be seen that, in the UK, adolescents as young as 13 years can purchase alcohol relatively easily. The evaluated police intervention did not appear to be successful in decreasing underage alcohol sales, suggesting that vendors did not change their serving behaviour in response to the threat of legal activity.

Wolfson *et al.* (1996) (Regression analysis) USA

This USA-based research by Wolfson *et al.* examined the policies, practices and characteristics of alcohol outlets and likelihood of sales to underage individuals.

Outlets reported employing the following strategies against underage sales: warning signs for minors (77%), had a manager onsite at all times (64%), restricting entry to 21 years plus (60%) and asking everyone for ID (54%). Of the interventions, the authors reported that the presence of a manager on site at all times led to a 15% reduction in the purchase success rate; whilst formal training resulted in a 19% reduction in the purchase success rate in bars.

Summary of findings

Most interventions in the included studies were based on enhanced enforcement and compliance checks. Training for management and/or serving staff was evaluated in some studies. Some interventions related to increasing managerial presence, having a doorman to check identification prior to entry, or better signage in establishments. In one study, the use of electronic age verification devices was implemented in conjunction with compliance checks.

Servers in alcohol outlets were described in USA-based studies as being disapproving of underage sales (Gehan *et al.*, 1999) and positive overall of implementing underage checks, including electronic age verification devices (Krevor *et al.*, 2003).

However, the commitment of managers and licensees towards their legal responsibilities relating to underage sales was found to vary among participants in studies originating in the UK (Pratten, 2005) and the USA (Gehan *et al.*, 1999).

Evidence was also identified that showed that servers and licensees perceived only limited risk as a consequence of making illegal sales. Studies were conducted in the UK (Willner *et al.*, 2000) and the USA (Gehan *et al.*, 1999). This evidence indicates that infringement of licensing should be accompanied by penalties that are taken seriously by licensees and staff.

Training interventions for management and staff were not found to be particularly effective in preventing underage sales in the USA (Toomey *et al.*, 2001; Wagenaar *et al.*, 2005).

The identified evidence showed that the effectiveness of enforcement interventions in reducing alcohol sales to underage young people was variable (Elder *et al.*, 2007). UK-specific evidence showed that compliance checks conducted by local police were not effective in reducing arrests in those aged under 18 yrs (Jeffs & Saunders, 1983) or reducing underage sales (Willner *et al.*, 2000). Some studies from the USA showed favourable outcomes of compliance checks by local authorities in reducing underage alcohol sales (Grube, 1997; MMWR, 2004; Wagenaar *et al.*, 2000; Wagenaar *et al.*, 2005). Compliance checks enforced with a 30-day licence suspension or a fine were observed to be effective in reducing sales in a US setting (Preusser *et al.*, 1994).

However, the deterrent effect of enforcement was found to decay over time in USA-based research (Grube, 1997; Wagenaar *et al.*, 2005).

An evaluation performed by the Scottish Centre for Social Research (2007) in Fife, Scotland showed the most popular response among consulted on- and off-licensees relating to the perceived most effective approach in preventing underage sales was test purchasing conducted in combination with a new nationally-accepted proof of age card.

These findings are supportive of the requirement for simple and maintained strategies for the enforcement of licensing responsibilities relating to underage alcohol sales.

Evidence statements

Evidence statement 2.4

Evidence was identified demonstrating that serving staff in alcohol outlets were disapproving of underage sales¹ and generally positive of implementing underage checks, including electronic age verification devices.²

¹ Gehan *et al.*, 1999 (Qualitative study, +) USA

² Krevor *et al.*, 2003 (Before and after study, ++) USA

Applicability: The above studies were both conducted in the USA.

Evidence statement 2.5

The commitment of managers and licensees towards their legal responsibilities relating to underage sales was variable.^{1,2}

¹ Pratten, 2005 (Qualitative study, +) UK

² Gehan *et al.*, 1999 (Qualitative study, +) USA

Applicability: One study was specific to English licensees.

Evidence statement 2.6

Servers and licensees were reported to perceive only limited risk as a consequence of serving alcohol to underage people.^{1,2}

¹ Willner *et al.*, 2000 (Before and after study, +) UK

² Gehan *et al.*, 1999 (Qualitative study, +) USA

Applicability: One study was conducted in the UK.

Evidence statement 2.7

Training interventions for management and staff were not shown to have a significant impact in preventing underage sales.^{1,2}

¹ Toomey *et al.*, 2001 (Controlled before and after study, ++) USA

² Wagenaar *et al.*, 2005 (Multi-community time-series quasi-experimental trial) USA

Applicability: Both of the above studies were performed in the USA.

Evidence statement 2.8

The effectiveness of enforcement checks in reducing alcohol sales to underage young people was variable.¹ Compliance checks conducted by local police were not effective in reducing arrests in those aged under 18 yrs² or reducing underage sales³ in the UK. Other studies showed favourable outcomes of compliance checks by local authorities in reducing underage

alcohol sales.^{4,5,6,7} Checks enforced with a 30-day licence suspension or a fine were effective in reducing sales.⁸ However, the deterrent effect of enforcement was found to decay over time.^{4,7}

¹ Elder *et al.*, 2007 (Systematic review, +)

² Jeffs & Saunders, 1983 (Controlled before and after study, ++) UK

³ Willner *et al.*, 2000 (Before and after study, +) UK

⁴ Grube, 1997 (Controlled before and after study, +) USA

⁵ MMWR, 2004 (Controlled before and after study, +) USA

⁶ Wagenaar *et al.*, 2000 (RCT, ++) USA

⁷ Wagenaar *et al.*, 2005 (Multi-community time-series quasi-experimental trial) USA

⁸ Preusser *et al.*, 1994 (Before and after study, +) USA

Applicability: Two studies originated in the UK

Evidence statement 2.9

On- and off-licensees perceived the most effective approach to preventing underage sales to be test purchasing carried out in conjunction with a new nationally-accepted proof of age card.¹

¹ Scottish Centre for Social Research, 2007 (Evaluation) UK

Applicability: This study was specific to the licensees of Fife, Scotland.

5.2.2.3 Review 2.2 b) Management of the sale of alcohol to intoxicated individuals

Evidence from thirteen papers concerning the management of alcohol sales to intoxicated individuals was reviewed. Included papers were all published outside of the UK, and so findings should be extrapolated with caution. This review also included non-peer reviewed literature from the UK.

Published non-UK literature

Gehan (1999) (Qualitative study, +) USA

The authors conducted four focus groups each including 7-9 participants (n=33). Managers, bartenders, waiting staff and security personnel working in bars and restaurants were invited to discuss their perceptions and practices concerning service of underage and intoxicated customers in order to develop a training programme. Previous training varied widely. Waiting staff commented that training had been informative, that it increased the sense of teamwork, created more awareness of a server's possible liability, and helped them to train other staff. Bartenders and security staff were more inclined toward negative comments, stating that the information was common knowledge and could contradict practices, as well as that training was carried out for insurance purposes and was repetitive. There was a lack of standardised policies and procedures on how to cut off service to intoxicated customers.

Bar tenders and wait staff reported that cutting off of service was reported to occur less with 'regulars' providing that they are not creating problems. There was a fear that cutting off such patrons might limit tips as well as cause bad feeling, and might not be supported by management. Some staff were concerned that they might lose their job or create problems for the establishment should they be found to have served intoxicated patrons. Level of support from managers varied, with some reported as not wanting to deal with such situations. Suggestions for future policy included financial incentives, increased management support, implementing training for managers, increasing the promotion of non-alcoholic drinks, installation of breathalysers, and standardised, enforced rules. In terms of external policies, increased public awareness and personal responsibility were cited, as well as enforcement of laws.

Focus groups with owners / managers largely confirmed the portrait of management that was given by employees. They largely refused to accept any primary responsibility for the drinking behaviours of customers or the service behaviours of employees; rarely had a written internal service policy and depended more on intuition for making decisions. They rarely had

internal systems in place for motivating staff and enforcing prohibitions; and were confused about the wording and requirements of state and local alcohol laws.

The study identified the difference in perceptions, particularly around the issue of responsibility, between bar staff and management. Servers would place more responsibility with management for support whilst management look toward the patrons and other outside forces for solutions to alcohol intoxication.

Ker & Chinnock (2008) (Systematic review, ++)

A systematic review was performed by Ker & Chinnock (2008) in order to investigate the effectiveness of interventions implemented in the server setting that attempted to modify the conditions under which alcohol was served, with the goal of reducing alcohol consumption and/or alcohol-related harm.

The studies investigated a range of interventions relevant to this assessment, including server training. Legislative interventions (including server liability, licensing hours, advertising restrictions) were not eligible for inclusion into this sub-section of the review by Ker & Chinnock. The following randomised and non-randomised study designs were eligible for inclusion: RCTs, non-randomised trials and controlled before and after studies. Of the 20 included studies, 6 were randomised trials, 9 were non-randomised trials and 5 were controlled before and after studies. The target populations of the included studies were workers in licensed alcohol serving premises, owners and managers of alcohol serving premises, and patrons in licensed alcohol serving premises. Licensed alcohol serving outlets included on-licensed and off-licensed premises. Primary outcomes of studies were fatal and non-injuries; secondary outcomes included behaviour change (including alcohol consumption) and knowledge change. Included studies were published between 1987 and 2004. Overall, the methodological quality of the included studies was judged by the review authors to be poor.

Fourteen included studies compared responsible server training intervention with no training. Duration of training interventions ranged from 1-2 hrs to 2 days. In all studies (with one exception) training was provided, focusing on responsible service of alcohol. In 1 study, training was not focused on responsible service but on prevention and management of aggression in bars. Common training themes included raising awareness of alcohol service

laws, recognition of early signs of alcohol intoxication, and tips for dealing with intoxicated patrons. Five studies included a specific focus and/or training for managers/owners in responsible alcohol service policies.

Two studies reported the impact of training on injury outcomes. Holder (1994) (USA) assessed the effect of a state-wide mandated server training policy on single vehicle night time (SVN) crashes. The intervention consisted of a one day training course covering the effect of alcohol on the body, interactions of alcohol with other drugs, problem drinking and alcoholism, legal responsibilities in relation to alcohol service (the state of Oregon legal requirements for alcohol service permits includes completion of a state-approved server training course, and the state also has its own service and drink driving laws but the details of these are not made explicit in the paper), effective server intervention techniques, with a standardised written test to be passed by all participants in order to obtain a permit to serve alcohol. The analysis included an adjustment for seasonal fluctuations in crashes and alcohol-related policy changes (DUI legislation and reduction in legal driving BAL). An effect estimate of -0.524 (95%CI-0.956 to -0.091) was observed, demonstrating a moderate reduction in single vehicle night time crashes as a result of the server training policy. The net estimated reductions in single vehicle night time crashes after implementation of the server training policy were 4% after 6 months, 11% after 12 months, 18% after 24 months, 23% after 36 months (no statistics reported). In an additional study, Wallin (2003) (Sweden) analysed the impact of a server training course (targeting restaurant owners, bartenders, servers and doormen and covering effects of alcohol consumption, information on alcohol laws, server intervention training and group discussion) on police-reported violence and obtained an intervention parameter (check analysis) of -0.344 (SE=0.046) (P<0.001), equating to a 29% reduction in police-reported violence in the experimental area.

Alcohol consumption by patrons was measured in 4 studies. Three studies utilised breath tests, whilst 1 study included self-reported consumption. Johnsson (2003) (Sweden) reported a mean difference in BAC between experimental and control bars of -0.011% (95%CI 0.022 to 0.000) showing a positive but small effect of server training intervention. The training programme was based on the Alcohol Skills Training Programme and the Swedish version of the Responsible Beverage Service. Bartenders in key positions attended an educational programme focusing on the servers' own relation to alcohol. Krass (1994) (Australia) observed no significant differences in mean BAC and total consumption of alcohol between experimental and control sites pre and post intervention as a result of a server training

intervention, which involved a 4 hour training package for all staff of licensed alcohol serving establishments including information on responsible hospitality practices, and skills for refusing or modifying service to individuals recognised as being intoxicated. Lang (1998) (Australia) found that, following a responsible service training programme (of 1-2 hrs length including information on alcohol and legal responsibilities and strategies for recognising and dealing with intoxicated customers), the proportion of tested patrons with a blood alcohol level (BAL) (mg%) >0.15 reduced over the study period, with the observed decline greater for experimental sites (17.4% to 5.3%) than control sites (10.1 to 3.7%) (not statistically significant, $P=0.389$). The proportion of patrons with a BAL >0.08 decreased from 52% to 26.9% in experimental sites and from 34.8% to 24% in control sites, with the decline being significantly greater for the experimental group ($P<0.029$). No difference between experimental and control in refusal of service to intoxicated pseudo patrons was observed. The per capita consumption (in terms of number of drinks) of patrons was found by Saltz (1987) (USA) to have reduced from 5.6 to 5 in experimental and 6 to 5.5 in comparison sites as a result of server training (involving the development of new and revised management policies relating to alcohol service and an 18 hour training course for all venue personnel (5 weekly sessions of 3-4 hours each). The rate of consumption (drinks per hour) also reduced from 3.5 to 2.3 in the experimental site and 3.25 to 3.75 in the control site. (It should be noted that values reported in the review were estimated by the review authors from graphical figures presented in the publication of the primary research).

Buka (1999) (USA) assessed the impact of CAAIPP Alcohol Server Training (24 courses, each lasting five hours) on self-reported server behaviour. Alcohol serving practices were measured in each community using a Desired Server Behaviour Index (DSBI) score ranging from 1 to 5 (with a higher score indicative of more desirable server behaviour). Mean DSBI scores ranged from 3.59 (SD=0.74) in the experimental community to 3.59 (SD=0.61) in control community A and 3.24 (SD=0.65) in control community B ($P=0.06$), each of which included 26 bars, indicating more desirable server behaviour as a result of CAAIPP training. Gliksman (1993) (Canada) observed a greater increase in responsible server behaviour to pseudo-intoxicated study participants, using a behaviour score based on observations of a number of scenarios (with a higher score indicating more desirable behaviour). The mean Desired Server Behaviour Index (DSBI) score in experimental sites increased from -15 to 21.5 pre to post intervention, whilst the score in control sites changed from -16.5 to 16.5 pre to post intervention ($P<0.01$), thereby representing a more marked improvement in responsible server behaviour in the intervention group. The intervention was developed by the National Highway Traffic Administration, and features the use of peer servers as educators. In

a further study, Howard-Pitney (1991) (USA) calculated the mean number of interventions made by servers calculated for 8 different responsible interventions. The overall mean for all 8 interventions (with a higher mean demonstrating more desirable server behaviour), for experimental bars was 0.95 and 1.26 for control bars. (Statistical significance of these findings was not available to Ker & Chinnock; however the review authors state that Howard-Pitney stated that no differences were observed). A further study (McKnight, 1991) (USA) focused on the impact of the 6-hour long 'Program of Responsible Alcohol Service' developed by the National Public Service Research Institute, on self-reported server behaviour. The mean score of desirable server intervention increased in experimental sites from 0.19 to 0.34 ($P < 0.01$) between pre- and post-intervention periods. The mean score in control sites remained at 0.22 ($P = 0.97$). The behaviour of trained and untrained servers was observed in a study by Russ & Geller (1987) (USA). Training for Intervention Procedures by Servers of Alcohol (TIPS) was approximately six hours in duration. Trained servers were reported as attempting a greater frequency of intervention than servers without training ($P < 0.05$). Saltz (1997) (USA) found no statistical differences in self-reported server behaviour in refusing service to intoxicated patrons following an 18-hour training course for all club personnel (five weekly sessions of 3-4 hours each). The observed responses of servers to pseudo-intoxicated purchase attempts following 5 one-on-one consultations (each 1-2 hours) once a week, for owners and managers of bars were described by Toomey (2001) (SA). Post-intervention, the purchase rate reduced in the intervention site (from 68.4% to 40.0%), and increased in the control site from 70.1% to 72.9%. The relative decline was not statistically significant ($P = 0.27$). Wallin (2003) (Sweden) observed server behaviour following the 'STAD project', a multi-component community alcohol prevention project initiated in 1996. Refusal rates to intoxicated patrons were 55% in experimental sites (northern Stockholm) which had received no training, 48% in intervention sites yet to receive training and 38% in the control area (southern Stockholm). No further details were presented.

Some increases in server knowledge were reported, though knowledge was measured in trained staff only. Gliksman (1993) (USA) found significant increases in the true / false section of the test post-intervention ($P < 0.001$). Howard-Pitney (1991) (USA) showed that servers and managers increased their knowledge and beliefs that customers would respond favourably to responsible alcohol service and policies ($P < 0.001$). In the Krass (1994) (Australia) study, mean total knowledge score increased from 23.98 to 30.8 ($P < 0.001$). Lang (1998) reported a 'statistically significant' ($P > 0.05$) increase in knowledge of laws regarding serving drunk patrons, maintained at follow-up. Overall knowledge showed a minor increase

which was not retained at follow-up. None of the other studies included in the review measured server knowledge.

Ker & Chinnock stated that the evidence base for the effectiveness of interventions in the alcohol server setting in reducing injury was inconclusive. Server training appeared to reduce single vehicle night-time crashes and police-reported violence, promote desirable server behaviour, but no definitive impact on alcohol consumption by patrons could be observed. The authors reflected that, as compliance with interventions appeared to be an issue, compulsory or mandated interventions may show greater effectiveness.

McKnight & Streff (1994) (Controlled before and after study, ++) USA

The authors assessed the effects of enforcing laws prohibiting the service of alcohol to intoxicated patrons of bars and restaurants. They used three male 'pseudo-patron' observers aged 21 to 25 yrs acting as intoxicated patrons who visited 40 random bars and restaurants four times each during the pre-intervention phase, the warning phase, the first citation phase (after 6 months), and the second citation phase (after 1 year). They also visited 20 establishments in a comparator county at the same four points in time. Servers were observed for three responses: 1) no intervention – serving alcohol without comment; 2) partial intervention – discouraging but still serving; and 3) refusal to serve. In addition, observers noted the numbers of other patrons, how many appeared intoxicated and whether their orders were taken by a bartender or waitperson.

A total of 457 visits were made. Refusals in the intervention county rose from 17.5% prior to the initiation of effort to 54.3% after the first 3 months. Over the next 3 months, refusals dropped to 47.4%, and after 1 year to 41% ($P < 0.001$). Results in the comparison county showed a similar pattern but the rates were consistently lower.

Whilst each of the first two post-intervention refusal rates significantly exceeded that of baseline ($P < 0.05$), the third did not ($P = 0.07$). This shows that steps to discourage drinking declined in both cases as refusals rose. There was a decrease in Driving Whilst Intoxicated arrests in the intervention county from 31.7% to 23.3% ($p < 0.01$). No interactions were found between the characteristics of establishments and either refusals or DWI arrests.

Server intervention was more likely to occur when business volume was moderate than at either extreme. Intervention was more likely when observers saw no truly intoxicated patrons than when they saw one or more ($P=0.01$). Refusals of service were unrelated to whether the clientele was primarily white collar or blue-collar ($P=0.76$) or whether establishment was classified as 'upscale' (lounges and expensive restaurants) or 'downscale' (tavern, college hang-out) ($P=0.19$).

Establishments that were sources of one or more drunk drivers during the 18 months prior to and following initiation of program were characterised by: 1) selling special drinks containing >0.52 - 0.60 ml absolute ethanol ($P=0.04$); 2) selling doubles and triples ($P<0.001$); 3) collecting for drinks after every round ($P<0.01$); 4) using tent cards to explain alcohol policies ($P=0.05$); 5) providing free coffee late at night ($P=0.03$); 6) not requiring that instances of Reviewable age be referred to manager ($P<0.01$); 7) requesting patrons to attest in writing that their ID was checked ($P=0.03$); 8) having received a report of visit enforcement agency ($P=0.03$); 9) requiring immediate termination of service to impaired patrons ($P<0.01$); 10) offering alternative non-alcoholic beverages ($P=0.03$).

Refusals were mainly spread equally across various types of establishments. The 3-fold increase in refusals to intoxicated patrons immediately following implementation represents a large change in server behaviour, particularly in comparison with changes resulting from efforts solely through training.

Simple enforcement of existing laws and regulations prohibiting service of alcohol to already intoxicated patrons of bars and restaurants represents what appears to be a potentially beneficial way of reducing accidental injury and death.

Geller (1987) (Controlled before and after study, ++) USA

The study by Geller aimed to evaluate the effectiveness of a programme Training for Intervention Procedures by Servers of Alcohol (TIPS) on driving under the influence of alcohol and customer satisfaction. Measures included Blood Alcohol Concentration (BAC) levels of patrons and amounts of gratuities received. Interactions between servers and 'pseudo-patrons' were recorded to identify alcohol impairment (giggling, excessive loudness, loss of train of thought, slurred speech); active server interventions (checking age by driver licence, offering food, asking who was driving) and passive server interventions (delaying serving, delivering food and drink together).

During training, servers were informed of physiological signs of potential alcohol over-indulgence, and taught a variety of tactics for dealing with intoxicated customers or those who appear to be reaching their limits. For example, slowing alcohol consumption by delaying drink service, offering food, serving non-alcoholic beverages. Video vignettes helped servers evaluate behaviour and interventions. Role-play situations were used to enable practice and receive feedback on techniques. At the end of the training, servers were encouraged to share their personal experiences and complete a 40-question test in which 28 correct answers /70% need to be achieved. Training was tested by pseudo-patrons attempting to drink 3 alcoholic beverages per hour for 2 hours (>legal limit). They were blind to whether servers were trained or not and were instructed to behave in a normal manner when servers attempted to carry out the intervention.

Pseudo-patrons showed more signs of intoxication after their third drink with untrained servers. By the sixth drink, these patrons had displayed at least 8 signs of intoxication, whilst those with trained servers displayed on average 5. The anonymity of servers made it difficult to separate tips for trained and untrained servers and some staff would not give this information. For those amounts that could be measured, the mean gratuities in Bar 1 increased from \$24.48 per report before training to \$28.75 (14%), and in Bar 2 the mean increased from \$22.57 per report before training to \$25.62 (12%).

The study shows preliminary evidence of a beneficial impact of server intervention training. However, the effect may be less dramatic when carried out on a larger scale. Reinforcement of server skills is required, which points to repeated training. Practice also requires support from management and peers. Potential for increased gratuities may act as an incentive for servers.

Stockwell (2001) (Literature review)

Stockwell reviewed the evidence for the potential effectiveness of responsible beverage service (RBS) and law enforcement initiatives. The rationale for such initiatives lies in the association between public violence and drinking on licensed premises. An early study by Saltz (1987) involved the participation of 2 Navy clubs that served as intervention and control, the former of which introduced changes to club policy. Changes included the introduction of 18 hours training for detecting intoxication, slowing down service and refusing service if necessary. Beer was no longer served in pitchers, and food was made more

available. In addition, staff monitored alcohol consumption within the premises. There was a significant reduction in BAC in the intervention site (33% to 15%), with little change in the control site.

Russ & Geller (1987) evaluated a training programme (TIPS) in 2 bars where half the staff had attended and passed a training course with similar objectives to the Navy training course. Researchers posed as customers and attempted to buy a drink every 20 minutes for 2 hours. Trained staff intervened more frequently to slow or stop consumption (mean 3.24 times per performance compared to 0.75 for untrained staff). Lower BACs were achieved by patrons served by trained staff (0.059% compared to 0.103%).

A modest but significant change in server behaviour towards RBS ideals was shown in intervention sites in a study by Gliksman *et al.* (1993). These early studies led to the development of larger programmes, but the early promise was not realised in these studies. Stockwell proposes that to some extent this is explained by dilution of effect when RBS is applied at community level compared to the demonstration projects. There seems to be an effect of management support that cannot always be guaranteed in larger scale studies.

Stricter law enforcement appears to have a more significant effect on RBS than server training alone at a community level, and appears to work through visible deterrent.

Toomey *et al.* (1998) (Qualitative review) USA

Toomey *et al.* assessed the available training programs for employees and managers in a qualitative review of server training packages commonly used throughout the US. Training programmes were rated for 1) content (legal issues; physiological effects; policy development; social problems); 2) behaviour change elements (preventing intoxication; preventing underage drinking; behaviour change methods); 3) communication methods (realism; respectful of audience; production quality).

Bartenders and wait staff, owners and managers at establishments where alcoholic beverages are sold for on-site consumption, as well as clerks at establishments where alcoholic beverages are sold for off-site consumption were included. A 69-item Questionnaire was sent to each beverage control agency, and a 117-item Questionnaire to each legislative bureau. Respondents were asked about changes in their states' alcohol control laws since 1967, and if this legislation was found to encourage server training. They were then asked if training was

mandated by state law or encouraged by a means by which establishments could reduce their legal liability for sales to intoxicated customers that result in injuries to third parties.

Eight programmes were developed by alcohol industry groups; 7 were developed by for-profit training companies; 6 were developed by non-profit / research groups; 1 was developed by a state alcohol beverage control agency. Rating scores were highly consistent across the 3 raters. Response rate was 80% for control agencies; 58% for legislative research bureaus. Completed Questionnaires were received from either one or both agencies in 46 states.

Existing training program packages varied – some had only one intended audience, while others had multiple components, each directed at a different audience. 8 targeted only bartenders and waiting staff. 9 included at least one component that addressed owners or managers. 4 had components that dealt with either off-site alcohol sales or alcohol sales at stadiums and arenas. Some contents were more comprehensively covered than others. 6 had at least one component rated ‘moderately’ to ‘strongly’ covering legal issues. Most discussed alcohol-related social problems only in context of traffic crashes and alcohol-related violence. 12 addressed underage youth issues, such as ID checking and underage sales at least moderately well. 2 exclusively focused on preventing sales to intoxicated patrons. 15 were found to cover issues related to intoxicated patrons moderately well or better. 8 had at least one component that appropriately covered physiological issues, providing neither too much nor too little information. 12 were at least moderately successful in covering the importance of establishment policies. Three of these did not target owners and managers however.

Few of the packages used behaviour change techniques. Role playing and discussion could not be used by video-tape approaches alone, though some tapes incorporated peer leaders as on-screen spokespeople instead of experts. Programs varied in terms of mode of presentation with 11 consisting of only a video-tape; one was delivered by an interactive computer program. Six used videotapes and a trainer and the rest used a combination of trainers and written material.

Less than half had at least one component that adequately used realistic scenarios and recommendations. The majority were respectful of the audience though 8 had more than one component that could be improved by incorporating realistic scenarios such as a busy and loud bar scene, or by being more respectful of the audience.

Overall scores ranged widely across components and programs, from 0.83 to 2.87. Two received an overall rating of 2.5 or better, though both these targeted only bartenders and staff. As of 1994, 13 states had enacted some form of legislation with 8 requiring servers to receive training, 4 encourage training but do not mandate.

Although several states mandated server training and others reduced establishments' liability if employees are trained, a standardised curriculum had not yet been developed. Of those that existed, some were designed by private, for-profit companies, some were part of publicly funded research projects, and some had been developed by organisations with strong ties to the alcohol industry.

There was great variation across programmes in terms of coverage of content, use of behaviour change techniques and communication methods. Only a few scored highly across all categories and components. No single program was outstanding in all respects. The 2 scoring highest covered all content areas, good production values, and used behaviour change techniques, but focused solely on bartenders and waiting staff, with no attention to owners and managers. Existing server training programs need further refinement.

Toomey *et al.* (2008) (RCT, ++) USA

A randomised trial to evaluate the effectiveness of a training intervention (full-ARM) and delayed intervention/control (ARM Express) conditions was carried out by Toomey *et al.* (2008). The training programme was developed for owners/managers of alcohol establishments. Evaluation aimed to assess the effects in practice on Alcohol Risk Management (ARM) in terms of i) propensity to sell alcohol to obviously intoxicated patrons, and ii) changing establishment level policies / practices.

231 establishments were randomised using a random numbers table (122 to Full-ARM; 109 to ARM Express). If owners had more than one establishment, all of them entered into the same arm of the trial. Unmatched pairs were formed to control for the timing of data collection. The intervention (full-ARM) consisted of 4 one-to-one 1-2 hour long training sessions with the decision-maker at each establishment. The goal was to help owners / managers to select and implement alcohol control policies in their establishments. Each establishment was provided with an establishment-specific policy manual introduced at the meeting. The delayed intervention/control (ARM Express) consisted of less intensive, single 2-hour session offered

to increase participation in the study. The trainer presented the owner/manager with an overview of relevant state laws and spoke to staff about importance of written establishment policies. Participants received handouts on how to conduct staff meetings, introduce new policies and implement and enforce selected policies.

Intervention and control groups had similar baseline sales rates (74% and 70% respectively). At the first follow-up, rates were 61% in the intervention establishments and 74% in controls, but this improvement was not maintained over time, with rates 75% in intervention and 82% in controls by the second follow up. Time x condition was marginally significant ($P=0.06$) at first follow-up, but not at second ($P=0.21$), indicating that over time the intervention did not have an effect on likelihood of sales to obviously intoxicated patrons.

Establishments in Full-ARM adopted on average 13-18 of the recommended policies for implementation. Prohibiting sales to intoxicated customers and providing copies of policies to staff, monitoring for suspicious behaviour were most likely to be adopted. Least likely were prohibiting last call and measuring all drinks.

There was no effect over time on reported policies and practices between baseline and follow-up management practices. One month after ARM training there was a 23% relative reduction in likelihood of illegal sales to obviously intoxicated patrons at bars and restaurants in the 4 session Full-ARM programme. However, the effects dissipated within 3 months indicating that this programme is not sufficient to create sustained changes in likelihood of illegal alcohol sales. It is not certain what happened following the training programmes – many of the managers had left the establishments in the delayed ARM Express arm on contact to begin training. If new managers are not supportive it is unlikely that reductions in illegal sales will be sustained.

Results indicated that policies mandating training programmes to prevent sales to obviously intoxicated patrons are unlikely, by themselves, to have long-term effects. Further work is needed to determine the optimal combined strategy for creating long-term reductions in illegal alcohol sales and related harm.

Turrisi *et al.* (1999a) and Turrisi *et al.* (1999b) (Survey, ++) USA

Two papers by Turrisi and team reported the findings of one survey of attitudes to server training and policies. The aim was to identify policies that are favourably or unfavourably viewed by owners, servers and students that might assist in future policymaking decisions. In addition the study sought to utilise perspectives from psychological decision theory to identify perceived cognitive outcomes underlying owner and server attitudes toward server intervention policies.

Questionnaires that included measures for attitudes toward different server intervention policies and perceived expectancies about the policies were utilised. A list of 12 server intervention policies were presented and respondents (185 bar owners; 185 servers at 331 bars; 330 college students) asked to indicate how favourably / unfavourably they would feel if each policy were implemented, using a 5-point Likert scale.

There was a significant main effect of policy ($P < 0.01$). Most favourable (mean; SD where 1 = very unfavourable and 5 = very favourable) were 1) offer to call a taxi for intoxicated patrons (4.67 SD 0.57); 2) train employees in alcohol awareness and server intervention (4.47 SD 0.87); serve free non-alcoholic beverages to non-drinking designated drivers (3.90 SD 1.13); 3) supervise / spot-check employees to ensure they follow house rules (3.65 SD 1.19); 4) sponsor non-alcoholic promotions involving food / entertainment (3.30 SD 1.09); 5) have security circulate bar to inform management of intoxicated patrons (3.25 SD 1.37); 6) post information about consequences of drunk-driving accident / arrest visibly in establishment (3.19 SD 1.22).

The overall findings suggested that owner and server attitudes varied considerably and that there were some interventions that could potentially be adopted without negative reactions by either party. Statistically significant unique effects were observed between the perception of policy that reduces Driving Under the Influence (DUI), and attitudes toward posting information in bars about consequences of drunk-driving arrest and serving beer by glass or bottle. As the perception of reducing DUI increased, attitude towards those policies improved. The more individuals thought that policies would attract customers, those policies became more favourable. Policies encouraging the sponsoring of non-alcoholic promotions and posting information about the consequences of drunk driving were associated significantly with the perception that customers might be offended, and attitudes toward these policies were more negative. Offering to call a taxi and training in alcohol awareness had statistically significant unique effects observed for perceptions about customer affect and social

atmosphere. As perceptions that customers would be offended or that policies create a less social atmosphere increased, attitude toward server training decreased. In general, policies perceived to create a less social atmosphere, being a hassle, or offending customers were perceived as more negative. Those perceived to attract more customers and reduce drink driving were perceived more favourably.

Owners and servers tended to have similar orientations toward the policies in that they were more favourable toward those that provided service to customers. This congruence is likely to have a direct influence on the adoption of, or compliance with policies, with policies favourable to owners being more likely to be accepted by servers. Findings suggest that owner and server concerns with customers are based on trade-offs between beliefs about providing students with a social atmosphere and concern with negative consequences of excessive consumption. The findings also showed some promise in terms of preventing DUI as policies related to prevention were viewed favourably.

Comparisons were made between perceptions of a high-risk population (e.g. student customers) and owners. Students comprised of 52% female, mean age 20.3 years, 82.7% white. Findings revealed a significant group by policy interaction ($P < 0.01$). Bar owners were more likely than students to favour training employees in alcohol awareness and server interventions (3.84 SD 0.97) ($P < 0.01$); supervising / spot-checking employees to ensure they follow house rules (3.02 SD 1.11) ($P < 0.01$). Students were more likely than bar owners to favour serving free non-alcoholic beverages to non-drinking designated drivers (4.59 SD 0.70) ($P < 0.01$), sponsoring non-alcoholic promotions involving food / entertainment (3.95 SD 0.94) ($P < 0.01$), posting information about consequences of drunk-driving accident / arrest visibly in the establishment (3.64 SD 1.14) ($P < 0.01$), and making free food available for customers (4.57 SD 0.74) ($P < 0.01$). Although bar owners' and students' attitudes varied considerably, policies could possibly be adopted without the owners having to fear negative reactions from students.

Generally, owners perceived the policies in a more negative manner than the students. If owners were aware of this, their own attitudes might become more favourable. This could result in more policies being favourably adopted. Motivation is low for owners if they perceive that students will be negatively affected by the policy. However this was not found to be the case. The data show some promise in reducing DUI. Campus-based educational efforts might incorporate the identification of what types of establishments provide an

environment that is less conducive to alcohol-related problems than those that typical college students experience.

Warner-Smith *et al.* (2000) (Evaluation) Australia

This study aimed to determine the acceptability of intervention strategies that increase the responsible service of alcohol by non-metropolitan rugby league clubs. The intervention strategy included use of a Responsible and Safe Drinking Information Kit with training for local public health workers to deliver the intervention. Workers mailed the information kits to the clubs and contacted each club twice to offer support. All police districts in non-metropolitan areas were mailed the information kit and asked to audit the alcohol service practices of rugby league clubs in their area.

Clubs (n=200) were telephoned by the lead agency after 3 months to assess the adoption of recommended practices. Feedback and advice offered to those that reported non-adoption of practices. Clubs in urban areas were more likely to be contacted (97%) than those in remaining rural areas (84%). 71% of participating clubs reported being contacted by a public health worker; 61% of participating clubs reported being contacted by local police, 96 (59%) clubs found public health worker contact useful, 82 (96%) clubs found police contact useful, 135 (88%) clubs found the information kit useful, 133 (96%) clubs found the information kit easy to use, 134 (98%) clubs found the information in the kit credible, and 134 (99%) clubs found the information kit easy to understand.

The 12 public health workers all felt that their role was sufficiently clear; none felt anything should be added to training, 11 found the workload reasonable; 10 found it a worthwhile use of time; 8 thought public health workers were the most suitable for the role, and 5 worked with rugby league outside the project. All 12 found the training day useful; 11 found information kit useful; 12 found the information in the kit to be credible; 12 found the information in the kit user friendly; 7 found police contact useful; 11 found police important to the project, and 3 felt a sense of ownership.

Non-metropolitan rugby clubs appear receptive to strategies that increase their responsible service of alcohol. This provides an opportunity to work more actively in this setting. Not all public health workers reported that such interventions are part of their role, and only just over half of clubs found them useful.

The study suggests the appropriateness of including sports settings in community-based approaches to reducing alcohol-related harm. However the role of public health workers in this endeavour needs further study.

Wyllie (1997) (Evaluation) New Zealand

A multi-method campaign was evaluated in terms of the acceptability of a national mass-media campaign to discourage intoxication and encourage host responsibility practices. Stakeholders were involved from the onset, with campaign materials being assessed by national level and community level individuals as well as the APHRU (Alcohol and Public Health Research Unit); prior to evaluation. Materials were also pre-tested with 15 managers of licensed premises and 40 patrons who drank at pubs and clubs at least once a month (age 18-59). The campaign was monitored among the general public aged 18-55 years and managers of bars and clubs. At this point the campaign had been on air for around 2 months (April – June 1994).

An ad-hoc telephone survey of 1000 randomly selected 18-55 year olds was carried out throughout New Zealand. In addition, an interview study was undertaken with 90 managers of randomly selected licensed premises: 32 pubs/clubs; 26 sports clubs; 17 chartered clubs; 15 nightclubs.

The campaign comprised of a TV ('Bars') advertisement, 2 posters with the heading 'We're Here to Serve Drinks'; 'We Can't Serve Drunks', and an ALAC (Alcohol Advisory Council) leaflet listing 20 behavioural signs of intoxication for possible use with managers and staff of licensed premises. Police were asked for their opinion about a small card issued by national police headquarters that listed 20 signs of intoxication, intended for use by police when enforcing liquor laws.

The dominant perception of stakeholders was that dealing with intoxication on licensed premises was a major problem. It was frequently suggested that lack of public awareness of legal obligations was contributing to the problem. Managers responded mainly positively to the ALAC leaflet, reporting that it was informative and useful for training bar staff. The 'Bars' advert was well received by managers who liked the fact that their point of view was being communicated, and the legal responsibilities in terms of intoxication were being made clear, and that co-operation between staff and patrons was encouraged. The multiple meanings of 'bars' was pertinent for both staff and patrons.

Response to the card was muted, with over 50% of police feeling it did not tell them anything new. The ad-hoc telephone survey of 18-55 year olds suggested a large increase in awareness of managers' legal liabilities regarding serving of intoxicated patrons. Those now aware of the illegality of selling alcohol to intoxicated patrons rose to 65% (compared to 27%). Among those who visited pubs and clubs awareness increased from 44% to 77%. Awareness that it was illegal to allow a drunk person onto the premises rose from 12% to 30%, and for allowing drunk to be on premises from 8% to 27%. All were statistically significant ($P < \text{or} = 0.001$). Two-thirds recalled having seen the advert when it was described to them with 18-29 year olds having the highest rate of recall (84%). Recall increased along with frequency of visiting pubs and clubs. These figures decreased a little in a follow-up survey in 1994 following another period of advertising.

Most of the managers interviewed had seen the TV advert and most responded positively to it. They felt it helped educate patrons and supported them in dealing with their patrons. Many managers had not received either of the posters, but those that had were generally positive. Many had not received the leaflet, and those that had thought it was of some usefulness to staff. A number had left them on the bar and patrons had read them. The majority of managers felt that a prosecution was unlikely – they did not think they had an intoxication problem on their premises, or that there was sufficient police monitoring, and had not heard of people being prosecuted. Some thought they might be prosecuted if reported, or if problems were traced back to the bar. Some perceived an increase in prosecution over the previous 12 months. Many managers felt there had been a general positive change in attitudes of patrons to host responsibility in the previous 12 months. Most had had contact with at least one agency in previous 3 months in relation to host responsibility or licensing issues. A minority had been visited by police in last 3 months for monitoring purposes. Most enjoyed a good or reasonable relationship with the police.

Some managers interviewed a year later felt there had been no changes. The aspect of the campaign that managers felt had most assisted licensed premises was the TV advert 'Bars', but also the drink-driving campaign. Most managers thought there had been a positive change in patron attitudes toward host responsibility and efforts to reduce intoxication. Suggestions to further this effort focused on continuing to educate the public and make them more aware; continuing training and provision of information to management / staff; providing alternatives such as entertainment, non-alcoholic drinks and food. Stakeholders from the non-licensed

premises sometimes mentioned the need for tighter, more stringent, licensing criteria and stronger police support – more presence and prosecutions. A number of managers were unable to make any suggestions, feeling that intoxication will always occur among a sector of patrons and that it is not a problem at their premises, or that all that can be done is being done. It was generally felt that the threat of loss of licence or other penalties were the main motivation for adopting responsible practices. Providing an environment that people are attracted to drink in was an important factor. For some there was the perception that society is changing and less accepting of drunks.

Pre-testing helped to ensure that an advertisement and posters were developed that would have sufficient appeal and communicate the correct messages. Surveys following the campaign showed a large increase in public and drinker awareness that bar staff can be fined for serving someone who is drunk. The campaign was well received and thought to be making a useful contribution.

UK literature, non-peer reviewed

Hughes & Anderson (2008) Identifying drunkenness and preventing sales of alcohol to intoxicated customers in Manchester (Cross-sectional questionnaire survey, ++) UK

In Manchester, a wide range of initiatives have been developed to improve management of alcohol-related activities. In particular, sales of alcohol to intoxicated individuals, whilst illegal, is difficult to manage since identifying intoxication and refusing service is difficult, and there is a lack of clear guidance for staff. In addition, enforcing the law is complicated as illegal sales are difficult to detect and prove.

A survey of bar servers (n=87) working in the city, and a smaller survey (n=15) of police working in the nightlife environment was carried out to identify perceptions and practices in this area of work. Half of the bar server sample was male (51.7%) with a mean age of 24.5 (range 18-41). Over half (59.3%) worked in a late night bar, 44.2% in a pub, 29.1% in a restaurant, 16.3% in a nightclub. The majority reported that they had received training (61.4%) with 12% having undertaken an external course. 26.5% reported having received no training. Those in more senior roles were more likely to have undergone training. Content of training varied widely; 50.6% had been instructed not to serve intoxicated customers, while 41.0% had received specific information on refusals. The remainder had not received either, with completed training not significantly related to length of service. 19.8% reported seeing

drunken customers on all shifts. More than half (59.8%) were aware of the illegality of serving alcohol to intoxicated patrons, while 6.1% were not aware of this. Awareness of the illegality of this practice increased with the level of training and advice received on this topic. Over half (51.2%) reported that they would never serve alcohol to a customer that they believed to be drunk; 39.5% sometimes serving them, and 9.3% stated that they would usually or always serve them. Managers and supervisors were significantly more likely than bar tenders to report that they would never serve drunken customers (61.0% compared to 22.2% $p < 0.005$).

The majority of bartenders (53.0%) thought that serving intoxicated customers depended on circumstances. Most of those who had undertaken external courses reported that they believed service to intoxicated patrons should be prevented. The latter view was more likely to be held by older (>25 years) and more senior staff. Circumstances in which drunken customers were less likely to be served were when the patron is aggressive, already causing trouble, or known to be troublemakers. Most however would be more likely to serve if the patron was a friend, a third if the customer was sexually attractive, and 25% if the customer was in a group.

The most commonly selected signs of drunkenness were slurred speech (94.2%), being unsteady on their feet (86.0%), and loudness (76.7%). Fewer used the amount of alcohol that they had served / seen the customer drink as a guide. The majority of staff thought that responsibility for preventing drunkenness was with staff themselves (managers 88.1%; bar staff 83.3%; door staff 73.8%), with only 31.0% believing that the customer held this responsibility. The most frequently cited preventive measure was a fine (70.0%), with clear guidance on how to refuse service next most common (65.0%). Also important was support from managers and other staff as well as the threat of losing one's job. Most bar staff reported that their employers did not provide incentives for serving more alcohol (82.5%), or permit them to drink whilst working. There were minority cases of free drinks or cash incentives provided for high sales achievements. Bar servers were asked about their own drinking behaviour, which was found to be on average more than the recommended daily limits over the previous week.

All the police surveyed believed that responsibility for preventing drunkenness and related problems rested with bar staff, with 82% also believing that the customer held this responsibility, and 53% that this rested with the police themselves. Training in dealing with drunkenness was reported by 36%, with 53.8% being provided with guidelines. Only 2 of the

sample had received neither training nor guidelines, and one of these felt it was difficult to recognise drunkenness. The signs most commonly cited as depicting drunkenness were consistent with those of bar staff. Eight of the 15 police surveyed worked directly with the licensing trade; 3 had observed the service of alcohol to intoxicated patrons, and most reported that if this occurred they would explain the law to the bar server and the owner / licensee. Five reported that they would issue a fixed penalty notice to the bar server, 3 to the owner / licensee. All stated they would organise a visit to the premises at a later date. Five were unsure of the powers available to them, and four felt that lack of a clear definition of drunkenness was a barrier. The most commonly rated issues around enforcement of the law against serving alcohol to intoxicated patrons were 1) stricter enforcement against premises and those breaking the law; 2) covert police operations to detect illegal sales, and 3) increased enforcement visits to premises. Also mentioned were use of CCTV, mystery shopper or test purchasing operations.

The majority of the sample felt that additional guidance is needed for police or bar staff. For police, this would be around licensing legislation and enforcement of law on alcohol service to drunks. For bar staff, guidance on identification of drunkenness was cited as a requirement. The sample of police in this survey is very small, therefore findings need to be treated with caution. The findings suggest that training for bar staff may be beneficial, though staff turnover can be high in this industry. Providing in-house resources such as a handbook would assist bar staff in increasing their own knowledge. In Manchester, such a resource has been developed ('Calling Time'). The confusion around defining and recognising drunkenness further complicates the issue. In addition, managerial practices and gratuity payments might influence service behaviours. Efforts to prevent excess alcohol intake may also improve the health of bar staff themselves, as there was a tendency for high rates of drinking among this group. Managing sales to intoxicated individuals needs to be worked on in partnership between managers, bar staff and the police, combining practices that are jointly understood.

UKCAPP: an evaluation of 3 UK Community Alcohol Prevention Programmes (2007) (Evaluation)

A joint endeavour was undertaken by the University of Bath & Avon & Wiltshire Mental Health Partnership NHS Trust (2007). Three part-funded projects were carried out in Cardiff, Glasgow and Birmingham, jointly known as UKCAPP, aiming to reduce alcohol-related harm and disorder. Efforts were directed toward policy-makers to influence social, economic and environmental structures in the local environment. Interventions associated with this review

(i.e. addressing the management of alcohol sales to intoxicated individuals) were focussed on raising awareness in the general public as well as political arenas, engaging with licensed premises to promote server training, award good practice and enforce licensing regulations.

A community systems approach was adopted, making interventions and their impacts complex in terms of measuring inputs against outputs. The rationale for this approach was the limited evidence of effectiveness of targeted community interventions to reduce alcohol problems whilst existing social, economic and cultural structures remain unchanged. In Glasgow an existing network of community interventions had been operating for some years prior to the initiative; some of these were closely aligned to the aims of UKCAPP. In Cardiff, the project surveyed levels of intoxication in the city centre, focussing on hot-spots and individual drinkers. There was no such prior work being carried out in Birmingham.

A mixed methodology included a range of quantitative and qualitative approaches including in-depth discussions and interviews, minutes from group meetings, and quantitative data from Emergency Departments, Police, ambulance and site surveys. Site visits occurred every 6 months, and key individuals such as representatives from the alcohol trade and a server training provider were interviewed.

In Glasgow, the Greater Glasgow NHS Board commissioned a research project to identify factors in licensed premises associated with 'binge' drinking and violence / disorder. The study utilised a postal questionnaire survey of city centre pubs, observations in a sub-sample of these pubs, and in-depth interviews with bar staff. The main factors associated with risk of violence, such as sexual tension, aggravation, were also associated with certain establishments that endeavoured to foster a party atmosphere by showing TV channels transmitting scenes of partial nudity, 'sexy' dancing and patrons drinking expensive cocktails and premium brands of alcohol. There was an absence of food / non-alcoholic drink provision or consumption. The research found that pubs where staff had undergone server training programmes with social responsibility components tended to have lower levels of crime and risk factors for disorder. In addition, staff felt positive about the potential for training programmes to assist them, reduce disorder and provide them with accreditation. Recommendations included more server training, and recruitment of experienced bar staff.

The 'Best Bar None' award was initiated in 2003 by Greater Manchester Police and is now a multi-agency national programme. It sets standards of good practice in management of pubs / bars/ nightclubs. It aims to raise awareness of safety levels and reduce alcohol-related crime and irresponsible drinking.

In terms of server training, one issue is the amount licensees are willing to spend on bar staff, especially those that are working on a temporary or part-time basis. Serve-Wise charges £40-50 per person trained. The Glasgow team started training in March-April 2006 for £10; by September the first round of 3-session training had been completed. A report attributes server training with having contributed toward improved communication between award applicants (All Bar None) and the police, with a reduction of 13% violent crime in the city centre.

In Cardiff, training comprised self-study using BIIAB booklets. This was followed by a telephone examination of 30 minutes duration. Topics included social responsibility, strength and effects of drinks, preventing and dealing with violence, and issues concerning young people. Impact of combined interventions showed a decrease of 4% in alcohol-related assaults in central Cardiff despite a 10% increase in premises. However, there was a 49% increase in alcohol related disorder (though authors point out that the incidence of 'alcohol related disorder' is more difficult to define and measure than cases of 'assault'). There were great differences in commitment to RBS training between licensees and staff; some licensees stated that they already provided appropriate training. 22 premises agreed to refer for training. Of these, 5 were unable to get staff to sit the exam, 5 referred and all staff passed the exam. Of 160 staff referred in total, 79 (49%) passed the exam.

There was no apparent impact of reduced drunkenness in premises where staff received training, with those where staff did not refer for training showing significantly lower levels in comparison. Explanations for this may be that these staff already had been trained, and that the mean intoxication levels were already low.

In Birmingham it was agreed that extra points would be awarded toward the Best Bar None award if at least 50% of staff had to be trained. The Route 50 project included 10 highly visible police officers searching premises for underage, drunk and incapable people. The team noted that police seemed more focused on underage drinking than drunk and incapable people. Due to 'lack of leverage' the project found it difficult to convince licensees to commit

to training. Reasons given were staff turnover, and that staff were already well trained. Independently owned pubs appeared more committed than corporate pubs. The project engaged 5 pubs with 50% of staff trained. Reaction to the course was positive in terms of usefulness. Test purchasing showed that the majority of these premises were following advice in asking for ID and using Refusal Books. One licensee that was used as an example case increased prices of beers and lagers, stopped serving Alco pops and displayed posters informing of responsible drinking.

In conclusion, it is difficult to relate any particular intervention to associated changes in crime and emergency department figures but the teams in the 3 sites are reported to have had an impact on the environment, including increasing awareness, co-operation and collaboration, instigating positive community responses to alcohol-related harm.

Incentives to social responsibility in the hospitality trade

Best Bar None National Award Scheme UK

The scheme was developed in Manchester to address alcohol related crime and improve the night time environment. Schemes vary in detail but premises are assessed from an application form that covers drinking and drunkenness, asking how sensible drinking is promoted, for example, drawing attention to 'happy hours', ensuring that customers do not drink and drive and that they are safe in regard to drunkenness and disorderly conduct. The form requests that training packages used in the establishment for staff are described.

Assessor guidelines state that that the applicant must show clear and effective policies in place in regard to alcohol consumption. The applicant must demonstrate a responsible attitude toward the sale and consumption of alcohol at all times and show commitment to the reduction of alcohol-related crime and disorder. There must be sufficient procedures in place to monitor levels of drunkenness and take appropriate action when required.

Possible areas for consideration in addressing this issue are sales of large volumes such as pitchers; the sale of strongly alcoholic cocktails and multi shot drinks; encouragement to consume soft drinks such as offers for designated drivers.

All staff require training in regard to intoxication with awareness of legal obligations in terms of what to do if a customer is found to be excessively drunk. The form includes tests of applicants' reactions to scenarios depicting individuals who are clearly drunk.

National Pubwatch UK

Through a database, the scheme provides practice and other information to the trade, and a best practice guide as well as supporting setting up a watch. Information is accessible in newsletters as well as via the website. Links have been forged with industry bodies and the Home Office. Licensees who are part of the scheme agree on a number of actions that can be taken against those that threaten or cause damage, disorder, violence, nuisance (this usually means refusal to serve or admit offenders), publicising these policies and abiding by them. Problems and troublemakers are also publicised and excluded so that they cannot move between premises. Pubwatch state that their survey has shown that the scheme is associated in some cases with reduction in crime and disorder.

Summary of findings

Evidence was sought that related to the management of sales of alcohol to intoxicated individuals. All included published papers report research conducted outside of the UK where legislation might differ from that in the UK. Nevertheless, interventions share a common aim to reduce harm from intoxication, and findings show that responsibility for such a reduction is in part perceived to be the domain of alcohol retail and hospitality. Therefore, efforts to ascertain optimal ways of encouraging responsible service behaviour (RBS) may be regarded as generalisable to some extent across settings. Included studies provide an overview of efforts that may or may not be effective, and issues that might influence effectiveness.

Legal Framework

One common theme within the studies and in the unpublished UK literature is the influence of a legal framework that discourages sales of alcohol to intoxicated individuals through the imposition of penalties that potentially affect licensees and employees. Threat of loss of one's job or licence is a factor mentioned in a number of studies. However this threat is not perceived in identical ways across staff and owners; some are fearful of the potential consequences of selling to intoxicated patrons, whilst others do not appear to take this threat so seriously. This could be due to the perceived likelihood and seriousness of potential consequences.

Server training

Efforts to encourage training and to test such training by observing server behaviour and measuring patron alcohol consumption have been described in the papers. A new study is underway in the UK that includes such methods, and as far as we are aware this will be the first UK RCT conducted with these objectives. Those already conducted have stressed the importance in the effective training of bar servers and managers of including an increase in knowledge of signs of intoxication as well as strategies for reducing the volume of consumption over time. A list of strategies up to refusal of service have been tested in the field by ‘pseudo-patrons’ who visit bars unannounced and behave as if intoxicated. In addition, breath tests and observations of real patrons have been carried out in order to compare consumption in intervention and control settings and contexts. Outcomes from these observations have been mixed, with some studies reporting reduction in harm following training of staff, and others showing the opposite effect.

Context Dynamics

Training is intuitively unlikely to incur harm, but a closer exploration of context shows a complex dynamic within the hospitality trade. In reality, patrons are free to move between premises, are influenced by the actions of others, and are enticed by particular environments that might encourage consumption of alcohol over other beverages. In addition, servers and managers do not remain in post indefinitely, some servers work on a temporary or part-time basis, and may therefore be less likely to carry out or use their training. Managers may be disinclined to pay for training in such circumstances, or believe that the staff have received sufficient training. Servers also differ from managers in some cases in their perceptions of support which can range from very supportive of server training and implementation of RBS, to lacking support in which case servers feel left to deal with difficult situations alone.

Ethics

A root cause for the difference in attitude between owner/managers and servers and other employees might be financial incentive; to discourage drinking in any situation may have consequences for profits, though this could be offset by encouraging non-alcoholic beverages and / or food. Servers who are rewarded by sales either through bonus payments or tips may be influenced against responsible behaviour.

Community Action

Studies suggest that accurate measures of individual change effects in legal frameworks, law enforcement, training, environments and financial incentives are, because of the complex interplay inherent in hospitality activity, almost impossible. UK grey literature addresses such

a problem in highlighting community-wide and complex interventions that aim to have wide-ranging effects with the prior assumption that no single intervention or effect can be measured in isolation. Overall reductions in local crime, injury and death figures might give some indication of success as well as assuring that harm has not increased as a result of implementation. Interviews with key figures can identify issues that interrelate with particular actions. However, it cannot be known which of these actions is more or less successful in terms of effectiveness.

National Action

In addition to community action, national schemes have been developed in the UK to support those involved in the alcohol trade. Recognising that owners/managers and employees are on the front line in dealing with alcohol-related behaviour, training schemes and web-based support organisations aim to provide a buffer and a sense of collaboration. Award schemes provide an incentive for licensees to increase the ethical and environmental standards of their establishments with promises of visible status.

Literature included in the review of managing sale of alcohol to intoxicated patrons originates mainly from outside of the UK, and varies in design, method and outcomes. It is difficult therefore to make firm conclusions regarding optimal management. One RCT is under way in the UK that addresses the gap in current local knowledge, and more research is required that investigates the effect of recognised interventions in this country.

Evidence statements

Evidence statement 2.10

The range of interventions to manage the sale of alcohol to intoxicated individuals present within the identified literature showed a large degree of heterogeneity in content and structure, as described in the qualitative review by Toomey *et al.* (1998).¹

¹Toomey *et al.*, 1998 (Qualitative review) USA

Applicability: This research was conducted in the USA.

Evidence statement 2.11

The attitudes and commitment of managers and service staff to server training and policies varied considerably.^{1,2}

¹ Turrisi *et al.*, 1999a (Survey, ++) USA

² Turrisi *et al.*, 1999b (Survey, ++) USA

Applicability: Both the above studies were specific to the USA.

Evidence statement 2.12

One study suggested that the lack of public awareness of the legal obligations relating to the service of alcohol to intoxicated people was a barrier to responsible beverage service.¹

¹ Wyllie, 1997 (Evaluation) New Zealand

Applicability: The above study originated in New Zealand.

Evidence statement 2.13

No conclusive impact of server training on the alcohol consumption of patrons was observed.¹ Limited evidence was identified that server training was associated with a reduction in single vehicle night time crashes and police reported violence.¹ However, server training appeared to result in increased server knowledge surrounding responsible beverage service and more desirable server behaviour.¹ Server training was also shown to result in more refusals of alcohol service to customers,² decreased Driving Whilst Intoxicated arrests,² fewer signs of intoxication among pseudo-patrons,³ and reduced likelihood of illegal sales to intoxicated patrons.⁴ However, this effect was found to decay within 3 months.⁴

¹ Ker & Chinnock (Systematic review, ++)

² McKnight & Streff (Controlled before and after study, ++) USA

³ Geller, 1987 (Controlled before and after study, ++) USA

⁴ Toomey *et al.*, 2008 (RCT, ++) USA

Applicability: The primary studies above were performed in the USA. The majority of the studies included in the Ker & Chinnock review were from the USA, Australia, and Sweden.

Evidence statement 2.14

Unpublished UK-specific literature was identified that provided indications that community alcohol prevention programmes to date have proved beneficial and may have contributed to reductions in violent crime and increased awareness of responsible beverage service. Useful strategies suggested included the provision of additional guidance for police relating to licensing legislation and enforcement and to bar staff on the identification of intoxicated people.

5.2.2.4 Review 2.3 Licensed hours and days of alcohol sale

Twenty seven papers were included in the review of the effects of changes in licensed hours and days of alcohol sale. Data relating to the impact of the Licensing Act (2003) is presented first, followed by further UK-specific findings and international evidence.

Impact of the Licensing Act (2003)

Department for Culture, Media and Sport (2008) (Evaluation) UK

The Department undertook an evaluation of the impact of the Licensing Act (2003) in order to assess the extent to which the objectives of the legislative reform had been subsequently fulfilled. The four statutory objectives of the Licensing Act (2003) were as follows: the prevention of crime and disorder; public safety; the prevention of public nuisance; and the protection of children from harm. This legislation was implemented in November 2005, permitting licensed premises to close at different times in England and Wales (having applied for licences to trade for longer hours).

The evaluation presented the findings that, whilst crime and alcohol consumption appeared to have remained stable overall, one notable observation was a temporal displacement of violent crime, with an increase in alcohol-related violence occurring during the early hours of the morning and some local increases in disorder. The Department evaluation also concluded that, whilst it was apparent that the freedoms facilitating by the Act were being implemented, a requirement existed for increased enforcement and use of regulatory powers.

The evaluation stated that, as of 31st March 2007, there were 123,700 licences and certificates in force authorising the sale of alcohol in England and Wales (DCMS Statistical Bulletin). 32,900 of these premises licences were for off-sales only, 28,100 licences were for on-sales

only (including 4900 club premises certificates), whilst 62,700 licences allowed both on- and off-sales (approximately 70% response rate). Over 50,000 premises were licensed for late night refreshment (approximately 72% response rate). 5100 premises actually had 24 hour licences for the sale of alcohol, comprising 3320 hotel bars, 920 supermarkets and stores, and 470 pubs, bars and nightclubs. No data were available for the actual sales hours used by this subgroup of licensees.

A database of 44,968 on-licensed premises with pre and post-reform closing time data was examined (CGA Strategy Limited Data). The dataset included the time recorded by the licensee for a typical Saturday night closure. The analysis showed that, subsequent to the Licensing Act (2003), the average closing time across all on-licensed premises in England and Wales increased by 21 min. Over half of reporting establishments (56%) maintained a closing time of 11pm (vs 68% pre-reform), 7% closed at 11.30pm (vs 4% pre-reform), the proportion closing at midnight had shown an increase (17% post-reform vs. 9% pre-reform), 1% more closed at 1am (5% post-reform vs 4% pre-reform) and 1% more at 3 am (2% post-reform vs 1% pre-reform). These data therefore suggest that the Act had some success in achieving the staggering of closing times.

The evaluation by Hough *et al.* (described in full below) did not present any evidence of significant reductions in crime and disorder in terms of the overall volume of incidents of crime and disorder. It was clear that cases of violent incidents had temporally shifted, with an observed increase in the proportion of violent crime occurring in early hours of morning. Alcohol-related presentations to A&E appeared to have been stable. However, such evidence would suggest that the Licensing Act had not succeeded in decreasing crime and disorder levels.

The DCMS evaluation was not able to identify any evidence to link the impact of the Licensing Act with instances of road traffic accidents (RTAs) as a result of drunk driving. However, the report quoted data from Road Casualties Great Britain 2006 that was suggestive of a decrease of 4% from 2005 in the number of people killed or seriously injured in road accidents involving drunk drivers. However, the DCMS evaluation acknowledged that it was not possible to attribute such a reduction to the effects of the Licensing Act but that such data showed no evidence of an increase in events following the reform.

Whilst the protection of public health was not a licensing objective of the Act, data suggested that levels of alcohol consumption had neither risen nor decreased following the Act. Figures were reported from the General Household Survey showing a decrease of 6% in the average number of units consumed per week between 2005 and 2006 and that the proportion of men and women who were drinking more than 21/14 units per week continued to decrease. Furthermore excise duty returns showed a 2% decrease in 2005 and a 3.3% fall in 2006 (HM Revenue and Customs). The DCMS evaluation acknowledged again that such decreases may not be attributable to the licensing reforms. These findings are likely to be influenced by a combined effect of alcohol prevention programmes and prevailing socioeconomic conditions.

The evaluation also incorporated work by the Violence and Society Research Group at University of Cardiff that involved the collection of data on violence-related attendances across 33 A&E departments across England and Wales in 2006. The results of their analysis demonstrated that 6000 fewer people presented to A&E for violence-related injury in 2006 (representing a decrease of 2% from 2005, and continuing the decline observed since 2000 but at a slower rate). A study by United Bristol Healthcare Trust conducted for the Alcohol Education and Research Council that covered A&E departments from September 2005 for a period 4 months showed no initial evidence of an increase in alcohol-related presentations (although the time period for intoxicated presentations was temporally extended). Research performed by Liverpool John Moores University found that assault-related attendances at A&E on the Wirral had decreased by 15% (representing an estimated reduction of 160 assault attendances per year at the A&E), an effect that was potentially attributable to licensing reform and better policing and enforcement, including the Home Office Alcohol Misuse Enforcement Campaigns. London Ambulance Service data indicated a 2% increase in alcohol-related call-outs during the first 10 months after the implementation of the Licensing Act, and a greater increase of 10% in the subsequent 10 months. Therefore, these data provided inconclusive evidence that the Licensing Act had not had a significant impact on A&E attendances for violence-related injury.

The DCMS report concluded that further monitoring and research would be required in order to assess the longer-term effects of the Licensing Act on health and other outcomes.

Durnford *et al.* (2008) (Before and after study, ++) UK

The impact of the Licensing Act on alcohol-related attendances at an inner city emergency department in Birmingham, UK was assessed by Durnford *et al.* (2008).

The proportion and time of alcohol-related presentations to the emergency department in one week periods in January 2005 and 2006 were compared. An alcohol-related presentation was classed as any attendance where there was a record of the patient having consumed alcohol before presentation, if they appeared intoxicated during their examination, or if alcohol attributed to their diagnosis.

The authors found that total weekly attendances showed a slight increase from 1912 in 2005 to 2146 in 2006. There was a non-significant reduction in the proportion of alcohol-related attendances between 2005 (3.6%) and 2006 (2.9%). A significantly larger proportion of alcohol-related attendances occurred at the weekend between 6pm and 11.59pm in 2005 (61.4%) than in 2006 (17.2%). There was a significant increase in the weekend proportion of attendances presenting between 3am and 5.59am in 2006 (34.5%) than in 2005 (10.2%) ($P=0.015$). A significantly greater proportion of alcohol-related presentations were made on weekdays between 3am and 5.59am in 2006 (18.2%) than 2005 (0.0%) ($P=0.025$).

These data therefore show that, whilst there was no significant change in the total proportion of alcohol-related attendances, there was a temporal shift in the pattern of attendances, with more patients presenting in the early hours of the morning during the weekend following the introduction of the Licensing Act.

El-Maaytah *et al.* (2008) (Before and after study, +) UK

El-Maaytah *et al.* (2008) investigated whether presentations at A&E due to head and neck trauma resulting from alcohol-associated assault had changed since the introduction of the UK Licensing Act (2003).

Data were collected from attendance databases at the Accident & Emergency department of the University College Hospital in London for two six-month periods (24th November 2004 to 30th April 2005, and 24th November 2005 to 30th April 2006). Alcohol-associated head and

neck trauma secondary to assault was the primary outcome of interest. It was unclear how alcohol association was defined.

In the first study period (24th November 2004 to 30th April 2005) there were 1102 attendances for head and neck trauma secondary to alcohol-associated assaults; whilst between 24th November 2005 to 30th April 2006 there were 730 reported similar attendances, equating to a reduction of 34% (95%CI 31 to 37%). These attendances were similar in terms of gender across both study periods (77% and 79% male in 2004-2005 and 2005-2006 respectively). More cases presented during weekends than on weekdays during both study periods (P=0.04). The authors stated that there was no effect of rainfall or temperature on findings.

Therefore, following the UK Licensing Act (2003), there appears to have been a reduction in attendances at A&E for head and neck trauma resulting from alcohol-associated assaults.

Foster *et al.* (2007) (Cross-sectional questionnaire survey, ++) UK

Foster *et al.* conducted a national questionnaire survey investigating views on the early implementation and impact of the Licensing Act from key respondents across a wide range of Licensing Authority areas in England. A sample size of 225 was obtained (63% response rate), consisting of 53 Chairs of Licensing Committees, 168 heads of licensing teams, and 4 other members of licensing teams.

Respondents were requested to classify their area according to urbanicity and economic disadvantage. 51% respondents described their area as mixed, 28% as urban and 21% as rural. 63% of respondents reported that their area was economically mixed, 19% advantaged, and 18% disadvantaged. Variables relating to area-based alcohol consumption were reported as follows: consistent flow of tourists (29%), seasonal flow of tourists (48%), heavily populated by day (44%), heavily populated by students (23%), high number of evening visitors (45%), none of above (5%)

The report presented data on the use of Cumulative Impact Areas. The concept of cumulative impact relates to the effects of a considerable number of licensed premises concentrated in one area. The guidance issued under section 182 of the Licensing Act 2003 states that ‘a

licensing authority may be satisfied that it is appropriate and necessary to include an approach to cumulative impact in the licensing policy statement (*and*) should indicate in the statement that it is adopting a special policy of refusing new licences whenever it receives relevant representations about the cumulative impact on the licensing objectives.’ The Cumulative Impact Area presents a possible approach for the control of an area of high alcohol outlet density. Only 38 respondents (17%) reported that their areas had created a Cumulative Impact Area. A significant relationship was found to exist between urbanicity and the creation of Cumulative Impact Areas ($p<0.001$), with none located in rural areas, the majority in urban areas ($n=20$, 52%) and a further 18 (48%) in mixed areas. Variation was also observed between geographical location and Cumulative Impact Areas, with none in Eastern England. 16 (42%) in the South of England and London, 12 (31%) in the Midlands, 10 (26%) in the North West, 3 (7%) in the North East, and 2 (5%) in Yorkshire (but it should be noted that the West Midlands and the North East were under-represented among the study respondents). No relationship emerged between the creation of Cumulative Impact Areas and economic advantage or disadvantage.

19 (50%) interviewees reported that the primary reasons for establishing Cumulative Impact Areas were related to police concerns. The most common sources of evidence used in making the decision to create Cumulative Impact Areas were the police (94%) and views of residents (58%). In relation to information required for making future policy/licensing decisions, 69% of requests were for more information from health professionals and health statistics, 24% for more information from local businesses/licensees, and 30% for more input, information and statistics from police sources.

The impact of the Licensing Act on resources was also investigated. Around a half of respondents (51%, $n=111$) reported that level of police activity had increased initially and been maintained, whilst 37% found that levels had remained stable. 63% of respondents reported that increases in licensing officers had been maintained (63%) and 57% stated that levels of other licensing staff had also increased and been maintained. Almost all respondents (99.5%) reported that their Licensing Authority provided training for committee members.

The survey also took perceptions of changes in alcohol-related harms into account. 59% ($n=133$) of respondents described no changes in public noise levels (32% increased, 9% decreased). 60% ($n=130$) of the sample viewed alcohol-related violence/fights as having

shown no post-reform change (13% increased, 27% decreased). 86% (n=157) perceived no change in drink driving (5% increased, 9% decreased). 68% (n=141) reported no changes in alcohol-related crime (13% increased, 19% decreased). A considerable proportion (67%, n=143) also felt that there had been no change in underage drinking following the implementation of the Act (22% increased, 11% decreased). Two thirds (66%) of the respondents who presented an opinion felt that the licensing reforms would not lead to the generation of a 'café culture.'

Therefore, this survey indicates that key informants from Local Authorities viewed the Licensing Act as having had a relatively mixed impact, with the establishment of very few Cumulative Impact Areas at the time of survey.

Herring *et al.* (2008) (Qualitative study, ++) UK

Herring *et al.* undertook a preliminary investigation of the local implementation of initial local implementation of the Licensing Act 2003 in Greater London. The study was carried out in 2 stages: with the analysis of licensing policies of 33 London boroughs (in Autumn 2005) and open discussion; and in-depth interviews in 5 London boroughs with licensing officers and chairs of licensing committees (elected councillors). A qualitative approach was employed, based on content analysis of policy documents and in-depth interviews with key informants. The analysis of policy documents specifically focused on the degree to which local policies involved national guidelines for implementation, the use of local data were used to guide the identification and description of current alcohol-related harm, and the extent to which local discussions relating to cumulative impact were reported in policy statement. A sample of London boroughs were then chosen for further investigation (including a range of inner and outer London boroughs), none of which had established a Cumulative Impact Area. A total of 11 in-depth interviews across 5 London boroughs with licensing officers and chairs of licensing committees were conducted in 2005 to collect views on the development and early implementation of policy.

Herring *et al.* reported that variation was evident between licensing authorities in their level of engagement with licensing issues. The majority of respondents were supportive of the changes in administration and procedures and increased control over local licensing. Respondents did not report any significant problems associated with the new arrangements and the extension of hours resulting from the Act at the time of study. Respondents typically had exercised caution in the preparation of their policy statements, producing policies that

would stand up to any legal challenge. In addition, a tendency to produce basic policy statements resulted from a stated lack of time or expertise. Respondents reported a requirement for a strong evidence base to support decisions relating to Cumulative Impact Areas and possible related challenges. Issues raised included the collection of evidence, associated costs, and definitions of what information would be classed as evidence. Some respondents also requested further training for Chairs. The engagement of senior council members was viewed as being important for the integration of a successful local licensing policy into council strategies.

Hough *et al.* (2008) (Evaluation) UK

The authors reviewed key findings from the multiple component evaluation by the Home Office of the impact of the Licensing Act (2003) on levels of crime and disorder in England and Wales, with a key focus on 5 case study areas. The evaluation was based on 2 year baseline and 1 year post-implementation data. Sources of evidence included: 1) a statistical exercise involving 30 of 43 police forces in England and Wales; 2) a national telephone survey of police licensing officers; 3) results from the British Crime Survey (BCS) Night Time Economy module with reference to pre and post-reform periods; and 4) case studies of 5 towns and cities. These five case study sites selected in order to accommodate the profile of violent crime in England, including type and intensity of violent crime. The sites included Birmingham (179 pubs and bars and 15 clubs in case study area); Blackpool (170 pubs and bars and 23 clubs in case study area); Croydon (226 pubs and bars and 9 clubs in case study area), Guildford (100 pubs and bars and 2 clubs in case study area); and Nottingham (260 pubs and bars and 20 clubs in case study area). The evaluation also considered evidence in the forms of Department of Culture Media and Sport statistics, HM Revenue and Customs statistics as published by British Beer and Pub Association, a survey of demands on 33 A&E hospital services (Sivarajasingamen, 2007) (already described above), Department for Transport statistics on injuries and deaths caused by drunken driving and a national survey of local authorities. Data also included a Home Office national survey 6 months post-implementation of police licensing officers from 26 of the 43 police forces in England and Wales (total n=27). The survey of 30 police forces reported by Babb (2007) provided a source of crime statistics.

Impact on licensing hours and consumption

As reported previously, according to Department for Culture, Media and Sport figures, 470 pubs, bars and nightclubs had 24 hr licences, with actual closing times extending by an average of 21 min. Data from the British Crime Survey (BSC) Night Time Economy module

presented no change in frequency of pub use. Two YouGov surveys for the British Beer and Pub Association also reported that over 4 out of 5 consulted members of the population viewed the Licensing Act reform as not having changed their drinking activity (no information on remaining 20%). The British Beer and Pub Association also reported statistics from HM Revenue & Customs demonstrating that the reduction in alcohol consumption in licensed premises in 2005 continued into 2006. Therefore, these data would suggest that the licensing reform did not impact on overall measures of alcohol consumption.

Impact of levels of alcohol-related crime and disorder: national level

Home Office data from a survey of 30 police forces were reported demonstrating that, when 12 month periods pre and post-reform were compared, a 1% decrease in recorded incidents involving violence, criminal damage and harassment, and a 5% decrease in serious violent crime were observed. Incidents of crime and disorder were occurring later in the night, with a 1% increase in the overall number of incidents recorded occurring between 6pm and 6am. The increase in the number of offences committed between 3am and 6am was described as being small in absolute terms (representing 236 incidents) but being proportionally large (25%). The peak time for the occurrence of serious violent crime was observed to have shifted forwards by approximately 1 hour. The police force survey also showed a 7% increase in recorded harassment offences in the year following reform (but the authors postulated that this effect may have been linked to new policing practices, including the issuing of penalty notices for disorder). Analysis of the BCS Night Time Economy module found no post-reform change in the proportion of people who reported feeling unsafe in town centres at night or in the proportion of people who reported having witnessed drunken antisocial behaviour in town centres.

Impact on levels of alcohol-related crime and disorder: 5 case studies

Overall, the 5 case study sites show little change in levels of alcohol-related crime and disorder following implementation of the act. In aggregate, violent crime decreased by 3% (with a range of increases and decreases reported across sites). A single site experienced a significant increase in calls to police relating to disorder in 2006. The case study sites provided additional evidence of the temporal displacement in violence crime, with decreased levels between 11pm and midnight in 4 of 5 sites; and an increase in the proportion of violent that occurred between 3 am and 5am in the year post-reform. Overall across all case study sites, there a decrease of 17% in serious violent offences (but the authors noted that this findings may be confounded by changes in recording of these offences).

The evaluation also collated data for the 5 case study areas from hospital A&E hospital departments or from ambulance services on recorded assaults and deliberate injuries for attendances on weekend nights (defined as 10pm Friday to 5am Saturday and 10pm Saturday to 5am Sunday) for people aged between 17 and 35 yrs for all presenting symptoms. Ambulance data were requested from for recorded call-outs for people aged between 17 and 35 yrs and for all presenting symptoms. The data obtained were described as volatile. Trends were stable in two sites and showed marginal increases at two sites. Relevant episodes at A&E at the fifth site were seen to have doubled, with violent crimes recorded by police at this site also increasing in 2006.

The report concluded that there were no discernable changes in overall crime levels as a consequence of the implementation of the Licensing Act, but that some incidents of crime had been displaced into the early hours of the morning.

Local Government Association/TNS UK (2008) (Cross-sectional questionnaire survey, +) UK

The authors presented an investigation of the effects of the Licensing Act (2003) on Local Authorities, PCTs, A&Es and police authorities in England and Wales.

The stated population sizes for each organisational subgroup were as follows: 376 Local Authorities, 174 PCTs (Health Board in Wales), and 43 Police Authorities. A total of 120 Questionnaire-based telephone interviews were conducted with 51 respondents from Local Authorities, 49 from PCTs, and 20 from Police Authorities.

Just under a third (29%) of respondents from PCTs were of the opinion that the licensing reform had increased alcohol-related incidents in their area (vs 10% from Police Authorities and 4% from Local Authorities). Over two thirds of local authority respondents (69%) in perceived no change at all (vs. 55% from police authorities and 45% from PCTs). A quarter (25%) of police authority respondents felt that alcohol-related incidents/disorders had decreased (vs. 18% from PCTs and 16% from local authorities).

All PCT and police authority respondents who felt that the Licensing Act had increased incidents were also asked whether this had impacted on resources. The majority (86%) of PCT respondents pressure on resources had been created, of which 43% cited increased pressure on A&E and hospital admissions and having spread problems over wider time frame (21%), increased pressure on police and other agencies (21% and also increased pressure on ambulances (21%) (based on a sample of 14 respondents). The majority (94% of 51) of local authority respondents also felt they were more stretched in terms of workload and resources since the implementation of the Act.

Half (50%) of a total of 20 police authority respondents stated that incidents were occurring later. 10% reported a perception of resources being stretched.

Views were also captured on partnership working, with 96% of those from local authorities reporting closer working with police and 49% reporting no impact on working with PCTs. Whilst the majority (80%) of police authority respondents stated that the implementation of the Act had no effect on their working with PCTs, 70% viewed themselves as working more closely with local authorities. However, 73% and 61% of respondents from PCTs felt there was closer working with local authorities and police authorities respectively.

Local authority respondents (n=51) were also asked whether they anticipated using alcohol disorder zones following implementation of legislation. Views were variable, with 33% answering yes, 33% no and 33% stated they were unsure. Where the response was negative, the main reasons cited for not using zones were the views that they would be ineffective (47%), a perception of no need (29%) or of them being too complicated/bureaucratic to implement (12%). Of the respondents who proposed developing alcohol disorder zones, anticipated effects included the reduction of alcohol-related incidents (41%), the passing of more control to police/authorities (24%), helping combat bad behaviour (18%), whilst 6% anticipated the zones to have no effect and 18% were unsure of outcomes.

Morleo *et al.* (2007) (Qualitative study, +) UK

Morleo *et al.* (2007) conducted a series of semi-structured interviews with key individuals from Licensing Authorities and other responsible authorities involved in licensing to explore

the implementation and impact of the Licensing Act 2003 in Lancashire. Around 40 interviews were reported to have been conducted between April and September 2007.

The authors described the implementation of licensing legislation as having been successful according to respondents, facilitating a quicker, more streamlined process with increased partnership, flexible ways of trading for licensees, and allowing more local input. Reviews were also reported to be a credible deterrent against infringement of licensing conditions. However, barriers were discussed, including the capacity for a venue to remain open during appeal against licence revoke, and a lack of a register for personal licensees.

None of the study areas appeared to have experienced an increase in night-time violence or disorder, with a decrease or no change in overall levels typically reported. Some areas felt that incidents were easier to manage, since they were spread over an increased timeframe since the reform. At least one authority had undergone a clear decrease in noise complaints since the introduction of the Licensing Act. Key recommendations made in the report included the development of a national database for personal licence holders, the consideration of whether a venue can continue to trade during appeal against a licence removal, and the revisiting of the decision of whether to include public health as a licensing objective in the Licensing Act.

Newton *et al.* (2007) (Before and after study, ++) UK

A before and after study was performed to determine the effect of the introduction of UK Licensing Act (2003) in November 2005 on overnight attendances to the emergency department of St Thomas' Hospital, London, UK.

All adult patients over the age of 16 years making overnight attendances at the ED between 21:00 and 09:00 during the 2 study periods (1-31 March 2005 and 1-31 March 2006) were included. Alcohol-related attendance was defined as having occurred if there was documentation in the patient's ED attendance card or London Ambulance Service patient record form (PRF) of alcohol consumption before attendance or if there was documentation in the ED card of alcohol intoxication in relation to the patient's physical examination or final diagnosis (inconsequential consumption of alcohol before attendance was not typically recorded). The primary outcome measure was the change in number and percentage of alcohol-related attendances to emergency department between the 2 study periods. Secondary

outcome measures included the number and percentage of alcohol-related attendances as a result of assault, and of injury, and number and percentage of alcohol-related attendances resulting in admission to hospital.

The total number of attendances at the emergency department in March 2005 was 10,290, and 9978 in March 2006 (a reduction of 3%, statistical significance not reported). The total number of overnight attendances in March 2005 was 2736, with 3135 recorded in March (an increase of 15%, statistical significance not reported). Of these, 2.9% (n=79) and 8.0% (n=250) were classed as alcohol-related attendances, representing a statistically significant increase ($P<0.001$).

Statistically significant increases in the presentation of alcohol-related attendances as a result of injury (March 2005 n=44 (1.61%), March 2006 n=129 (4.11%), $P<0.001$) and assault (March 2005 n=27 (0.99%), March 2006 n=62 (1.98%), $P=0.002$) were observed between the 2 study periods. In addition, admission rates for alcohol-related attendances also significantly rose (March 2005 n=24 (0.88%), March 2006 n=71 (2.46%), $P<0.001$) between the 2 study periods.

This research therefore demonstrated that overnight alcohol-related attendances and alcohol-related harm increased after the introduction of the new licensing legislation. The authors noted that this effect was the converse of the effect that the legislation had been developed to produce.

Pike *et al.* (2008) (Evaluation) UK

Pike *et al.* presented an evaluation of two studies of the early experiences of the Licensing Act (2003) in the East of England and the Yorkshire and Humber regions on behalf of the Home Office. The specific objectives of the two studies were to explore the opinions and experiences of key stakeholders (including the police, licensees, licensing officers, crime and disorder reduction partnership representatives); to examine the degree of use of extended trading hours; and to investigate trends in alcohol-related crime and disorder following the implementation of the Act. Both studies adopted mixed-methods approaches using qualitative interviews with police, licensing officers, licensees and also Crime and Disorder Reduction Partnership representatives in Yorkshire and the Humber (with a total of 29 interviews in East

of England and 30 in Yorkshire and the Humber). In addition, an examination was made of licensing applications for pubs and clubs, and quantitative data analysis of police-recorded crime figures for the first 6 months post-reform. The study was based in the East of England and covered 6 market towns across the region, whilst 4 locations were covered in the Yorkshire and Humber assessment (2 market towns, 1 city and 1 industrial town). The authors stated that the selected locations were not intended to be locally or nationally representative.

In the East of England, 16 of the 19 licensees interviewed had applied for extended licensing hours. In the Yorkshire and Humber work, having made an application for an extension was a condition of study inclusion. None of the pubs and clubs included in the studies had applied for a 24 hour licence. None of licensees reported making full use of their licensed extended hours throughout the working week, but the majority used at least some extended hours during weekend periods, pubs typically opening until 1am or 1.30am and clubs until 3am or 4am. Some pub licensees reported 'playing it by ear' as to whether to remain open towards the end of the evening. Most licensees did not take on extra staff following their extensions but instead were able to extend the hours worked by their existing staff. Licensing officers who were interviewed reported working extra hours to deal with the initial large volume of licensing applications and with Temporary Event Notices for extended hours. Police also reported increased workload, with changes and increases in shift patterns occurring and some concern about the impact on officers. No interviewees reported that sales of alcohol had increased following extended licensing hours. The Licensing Act appeared to have had an effect on clubs, with consumers staying in pubs with extended trading hours rather than moving on to clubs following closing of pubs, as previously occurred pre-reform. No clear impact on levels of recorded crime and disorder could be observed, with some towns reporting decreases, some increases and some experiencing no apparent change. The largest change was seen in the Yorkshire and Humber included city, where violent crime was seen to decrease by approximately a third, from 616 (November 2004 to May 2005) to 410 (November 2005 to May 2006) offences. The total alcohol-related offences recorded by police during night-time economy hours showed considerable variation across sites. The authors noted the limitations in these data, since only certain crime types were included as a proxy measure for alcohol-related crime, data were based on relatively small numbers of offences and there was potential confounding by variations in police activity. Similarly, local area evaluations will be influenced by local variations in implementation and enforcement of the Licensing Act.

Change in timing of offences

Evidence supported the observation of a temporal displacement of criminal activity as a result of the Act, with some towns finding that offences were more spread out across the evening in the 6 months post-reform. Other towns experienced a shift in activity, with peak times for offences being later in the evening. Changes in criminal activity patterns were observed in 6 of the 9 towns for which data were available, whilst the remaining 3 showed little or no change in timing of incidents.

Sivarajasingam *et al.* (2008) (Cross-sectional survey, ++) UK

Data collected from a structured sample of 29 A&E departments in England and Wales showed that there was an overall decrease of 12% in England and Wales in 2007 vs 2006, with approximately 43,000 fewer presentations at A&E as a result of violence-related injury. Violence-related injury was described as being most frequent on Saturday and Sunday. These data provide further evidence supporting the findings that an increase in violence in England and Wales has not occurred following the implementation of the Licensing Act.

Other UK-specific evidence

Duffy & De Moira (1996) (Regression analysis) UK

The authors of this work studied trends in alcohol-related problems subsequent to the 1988 amendments to Licensing Act in England and Wales. As stated by the authors, on-licensed premises were permitted to open from before 11am (but not earlier than 10am) until 11pm on weekdays and Saturdays, whilst, on Sundays, the addition of an extra hour of trading meant that premises were allowed to service alcohol from noon until 10.30pm (with a break of 4 hours commencing at 3pm). Data relating to indicators of alcohol-related problems such as accidents and absenteeism in the workplace, RTAs, drunken driving and criminal offences were compared with control data for trends in Scotland. A number of variables including personal disposable income, unemployment and prices per unit of alcohol sold from on-licensed premises for 1986-92 for beer, fortified wine and spirits in Scotland and England and Wales were included as covariates in the analysis.

Levels of absenteeism were stable throughout the period of study, with no evidence of increase in absenteeism due to the licensing amendments. A significant increase in the occurrence of slight accidents (over 3 days absence) in the workplace was evident, with an

employee based in England and Wales being 1.134 times more likely than a Scottish employee to have a slight accident in 1989. No increases in drunk driving were observed in England and Wales, with no increase in positive breath tests occurring during extra permitted licensing hours. No changes were found in the number of people in England and Wales who were cautioned or convicted for drunkenness. Duffy & Pinot de Moira reported that, in the short-term, recorded crimes of violence increased by about 15.5% in England and Wales relative to Scotland, but that the increase tailed off slightly, being 8.8% in 1989.

Duffy & Plant, 1986 (Analysis of longitudinal ecological data) UK

Duffy & Plant undertook a longitudinal study in order to assess the impact of changes in Scotland's liquor licensing laws by comparing Scottish trends in alcohol-related problems with those in England and Wales. The study covers trends since 1970, 6 years before introduction of the first of the Scottish licensing changes, until approximately 1983.

The licensing laws in Scotland were changed in December 1976 to allow public bars to open for an extra hour in the evenings (changing from a previous requirement to close at 10pm). Public houses were subsequently permitted to open on Sundays. Some 'all day licences' (regular extensions of permitted opening hours) were also issued by licensing courts, which were introduced during 1977. The effects of these changes on trends in alcohol-related problems in the home population of Scotland aged 15 years and above were compared with those in England and Wales.

Deaths from liver cirrhosis

Deaths from liver cirrhosis both in Scotland and England and Wales showed an increasing trend. Relative risks for mortality from liver cirrhosis for Scotland vs. England and Wales were above 1 for the whole study period and showed an increasing trend. Risks for death from liver cirrhosis for both sexes in Scotland relative to those in England and Wales increased (although to a small degree) since 1970, to a relative risk (RR) of approximately >2 for males and <2 for females in Scotland vs. England and Wales) by the early 1980s. The authors found no apparent impact of events during or since 1976 on cirrhosis mortality.

Mortality due to alcohol dependence

Duffy & Plant highlighted the fact that data collection may have been biased by to a requirement (before June 1984) in England and Wales to automatically refer deaths certified

as due to alcohol dependence to the coroner (which may potentially have discouraged doctors from using this death certification). Rates of mortality due to alcohol dependence had been considerably higher for some years in Scotland than in England and Wales. Risks for mortality due to alcohol dependence in Scotland relative to England and Wales also showed an rising trend (with data presented graphically, to a highest approximate relative risk of >10 for men and <10 for women by the early 1980s). (However, the patterns of data showed noise and related to small numbers of deaths.) No effects of licensing changes from 1976 were apparent.

Total alcohol-related mortality

Deaths attributable to liver cirrhosis, alcoholism and alcoholic psychosis and those attributable to alcohol poisoning were aggregated and showed an increase over time for both men and women in Scotland and England and Wales (with rates highest for Scotland). Relative risk values for total alcohol-related mortality for Scotland vs England and Wales increased until 1978 to approximately 3 and then decreased to >3 for men and <3 for women.

Hospital admissions for alcohol dependence

Admissions to psychiatric hospitals for alcohol dependence were also analysed. The relative risk for first admission for alcohol dependence in the Scottish population vs England and Wales showed a decreasing trend. However, the relative risks for first admission for alcohol dependence remained >3 for Scottish men and <3 for Scottish women than their English counterparts. However, admission policies may show considerable variation and not be a true representation of population alcohol misuse.

Public order offences

The majority of convicted offenders were male. Rates of drink-driving convictions in England and Wales showed upward trend, reducing the resulting risks in Scotland relative to those in England and Wales (from RR <2 for both sexes combined in 1970 to <1 by the early 1980s). Convictions for drunkenness in Scotland declined after 1975, with the rate of decrease accelerating between 1980 and 1983, whilst rates in England and Wales showed an increasing pattern. Relative risk values for convictions for drunkenness in Scotland vs England and Wales (for both sexes combined) decreased markedly from a peak of RR >3 in 1975 to >1 by the early 1980s. However, it should be recognised that these trends are likely to reflect any changes in policing policies, in addition to underlying trends in alcohol-related behaviour.

Other evidence

Individuals aged 18 years and above residing in 4 main cities and the central belt of Scotland were interviewed in surveys and stated their views on the licensing changes. Almost three

quarters of participants (73%) agreed that ‘the present licensing laws are an improvement on the old ones.’ Over half (52%) disagreed that the new laws encouraged heavier drinking. Fifty one percent agreed that ‘these days you don’t see as many drunks as you used to.’ Therefore, the Scottish public appeared to approve of the revisions in licensing.

This evidence would indicate no apparent effect of the licensing changes on level of alcohol-related morbidity and mortality in the Scottish population. Public order offences in the Scottish population appeared to have declined (but this was potentially attributable to policing policies). The licensing changes introduced since 1976 appeared to be neutral in impact and were popular amongst the surveyed members of the general public.

Graham *et al.*, 1998 (Before and after study, ++) UK

The authors performed a study to determine the effect of restricting extensions to permitted licensing hours on the numbers of alcohol or assault-related attendances at an inner city A&E department in Edinburgh. Following the Licensing (Scotland) Act (1976), flexible licensing arrangements were implemented, with extensions granted to trading hours. Since 1993, regular extensions were granted to licensed premises in the centre of Edinburgh according to location within a zone, in order to restrict noise pollution in residential areas of the city. However, this system led to the movement of large numbers of people between premises and subsequent public disorder. Therefore, a uniform closing time was introduced. As of 25th March 1996 in Edinburgh, all public houses, hotels and restaurants were permitted to close by 01:00, clubs and public places with entertainments licences to close by 03:00 and casinos by 04:00.

The study was based in the sole A&E department in Edinburgh (with Edinburgh having 677 licensed public houses, including 165 licensed restaurants at the time of study).

Data were collected on consecutive attendances at A&E between 17:00 and 09:00 during 3 study periods: Monday 11th March 1996 to Monday 25th March 1996 (pre-period, 2 weeks before the introduction of the restriction); Monday 25th March to Monday 8th April 1996 (post-period 1, 12 weeks immediately following the introduction); Monday 13th May to Monday 27th May 1996 (post-period 2, 2 week period beginning 5 weeks after the introduction). A total of 5023 patients presented to A&E during 3 study periods (pre-period

n=1537, postperiod 1 n=1664, postperiod 2 n=1822). Of these, 2187 patients (43.5%) failed to take a breath test, with 284 refusing the test, whilst 1903 failed due to an inability to be administered the test due to high staff workload at the time of presentation.

Of the 2836 patients taking the breath test (pre-period=1033, postperiod 1=838, postperiod 2=965), the majority (71.7%, n=2017) had no alcohol detected, 7.8% (n=222) were positive within the legal driving limit (80mg/100ml) and 21.1% (n=597) were positive over the legal driving limit. Overall, 56.5% (n=2836) of patients provided a breath sample, and 28.9% of these (n=819) were positive. There were no statistically significant differences in the proportion of patients testing positive across the 3 study periods (pre-period=30.9%, postperiod 1=27.3%, postperiod 2=28.1%). The proportion of patients with positive tests peaked between 02:00 and 04:00, which followed closure of public houses, hotels and restaurants at 01:00. There were no significant differences in the proportion of patients testing positive attending before 20:00, between 20:00-24:00, between 24:00-04:00 or after 04:00 hours. Patients aged 40 to 49 years were more likely than any other age group to test positively (38.5%) and had the highest mean blood alcohol concentration (205mg/100ml). Patients who tested positively were more likely to have been drinking in a pub/hotel or restaurant (42.8%) than in a club or other place with a public entertainment licence (6.6%) or at home (21.9%) (no breakdown by location of drinking presented across the 3 study periods).

A total of 444 attendees (8.8%) were involved in incidents of assault. A third of these involved a weapon (n=133). No statistically significant difference was observed in the proportion of assault-related cases attending over the 3 study periods (pre-period=8.1%, postperiod 1=10.5%, postperiod 2=8.0%, NS).

During time periods identical to those in this study, operational staff in the police divisional control rooms covering the city recorded numbers of incidents of 16 classifications of crimes of violence and public disorder (no further information presented) (personal communication to study authors by Lothian and Borders Police). During the study pre-period, 866 incidents were logged, with 1053 and 786 incidents recorded during postperiods 1 and 2 respectively. Overall, 43.4% were coded as 'drink-related' and the authors reported no significant differences between time periods (no further data presented).

Therefore, whilst this work did not assess the potential impact of seasonal trends, this study would suggest that no significant changes in pattern of alcohol or assault-related attendances followed restriction in extensions to permitted licensing hours. The policy of uniform closing of licensed premises did not influence alcohol or assault-related attendances at A&E in this study.

Northridge *et al.*, 1986 (Before and after study, +) UK

A cohort study was performed by Northridge *et al.* to determine the frequency of alcohol intake associated with admissions for self poisoning by overdose before and after the liberalisation of Scotland's liquor licensing laws and the effects of alcohol on the clinical outcome of these episodes. As a result of the examination of alcohol-related problems in Scotland in 1972 by the Clayson committee, Scotland's liquor licensing laws were relaxed in December 1976, to allow bars to trade for an extra hour in the evenings. The following year, public houses were permitted to open on Sundays and some 'all day licences' were granted.

Data relating to all patients aged 12 years and over admitted to the acute medical unit of Milesmark Hospital, West Fife, Scotland between 1971 and 1982 for self-poisoning by overdose were analysed. The hospital served a mixed urban and rural population of approximately 130,000 people.

2868 consecutive patients were included. 1214 patients (393 male, 821 female) were admitted between January 1971 and December 1976. 1654 patients (593 male, 1061 female) were admitted between January 1977 and December 1982. The age and sex distributions were described as similar across the two time periods. Over half (55%) of those patients who took alcohol with their overdose (497/905) were admitted between midnight and 6am; compared with 26% (514/1963) of patients who did not. This distribution was similar during both time periods and across both sexes.

The frequency of alcohol taken in association with self poisoning overdose showed a considerable increase during the first two years after the liberalisation of the licensing laws. Between 1971 and 1976, 29.0% (114/393) of men took alcohol with their overdose. This proportion increased to 51.6% (306/593) between 1977 and 1982, representing a 23% increase (95%CI 17% to 29%). Between 1971 and 1976, 14.3% (117/821) of women

consumed alcohol with their overdose, with this value increasing to 34.7% (368/1061) between 1977 to 1982, equating to an increase of 21% (95% CI 17% to 25%).

Whilst the total yearly admission rate for self poisoning had been rising before 1976 (>160 admissions in 1971 to >220 admissions in 1976) this rate of increase subsequently rose markedly following change in licensing laws (to a maximum of >300 yearly admissions in 1978 for all overdoses) before decreasing to subsequent levels (>220 yearly admissions in 1985) (data presented graphically only). This increase did not appear to affect the severity of overdoses or outcome. In recent years, the authors noted there had been a decrease in the incidence of overdoses associated with benzodiazepines, barbiturates and dextropropoxyphene (drugs which react adversely with alcohol).

This study has shown that the total admission rates for cases in which alcohol was taken in association with self poisoning by overdose showed an increase in the first two years following relaxation of the licensing laws in Scotland.

Rhodes *et al.*, 1990 (Before and after study, ++) UK

Rhodes *et al.* investigated the impact of the 1988 changes in licensing laws in England (described above) on health-related outcomes in patients attending the Accident & Emergency Department, of Newcastle General Hospital.

All patients aged 16 years and over able to cooperate were breathalysed in October 1986 (before the liberalisation of Licensing Laws in England and Wales) and repeated in October 1988 (following change). All patients over 16 years of age were breathalysed during 2 consecutive weeks of the day shift (08:00-20:00) and 2 consecutive weeks of the nightshift (20:00-08:00) (1986 n=760, 37% (n=281) attended at night, 1988 n=400, 32% (n=128) attended at night). The impact of the licensing amendments on blood alcohol levels, time of attendance and patient characteristics on A&E attendees were measured.

In 1986, a blood alcohol level of greater than 50mg/100ml was observed in 13% (n=99) of all attendees. In 1988, a proportion of 14% (n=56) of all attendees had a blood alcohol level of greater than 50mg/100ml, representing a non-statistically significant difference between the two time periods. Across both years, males made up the majority of patients who presented at

A&E with excess blood alcohol levels (no further data presented). The authors stated that the patterns of presentation to A&E were very similar in 1986 and 1988, despite change in alcohol availability. The conditions most strongly associated with alcohol consumption were tablet overdose and fifth metacarpal fracture (no further data). Over two thirds (69%) patients with tablet overdoses in 1986 had >50mg/100ml alcohol in blood, compared with 60% in 1988. Over half (59%) of fifth metacarpal fractures occurred in presence of >50mg/100ml alcohol in 1986 vs. 30% in 1988. A non-significant trend towards increased frequency of alcohol consumption in patients attending at night-time was also observed.

This UK-based study therefore demonstrated that, at the time of data collection, the revised Licensing Laws had not yet produced a significant alteration in the alcohol consumption of patients prior to attending A&E.

International evidence

Chikritzhs & Stockwell (2002) (Interrupted time series analysis, ++) Australia

The objective of this study was to determine the impact of later trading hours for licensed hotels (public houses) in Perth, Western Australia on violent assault levels on or located close to these premises. Following the Liquor Act 1988, hotels (public houses) in Western Australia were permitted to trade for additional hours via an Extended Trading Permit (ETP). The term 'hotel' was used to refer to business establishments, primary function of which is to serve alcohol on the premises, including public houses, taverns, bars, ale houses and saloons.

Data were collected on assault offenses reported to police between July 1991 and June 1997 to identify those that occurred on or near to hotels. During the study period, 45 (24%) of the 188 included hotels received an extended trading permit to allow 1am closing (ETP hotel), whilst the remainder maintained a closing time of midnight (non-ETP hotels). Time series analysis was employed to examine the relationship between ETPs and monthly assault rates associated with ETP hotels, and controlling for the general trend in assault rates among non-ETP hotels.

When the general trend in assaults among Perth hotels was controlled for, there was a significant increase in monthly assault rates associated with ETP hotels, largely attributable to higher volumes of high alcohol content beer, wine and distilled spirits bought by ETP hotels.

The authors concluded that greater violence was associated with hotels that were granted an extension in trading hours, and that greater numbers of customers and/or increased levels of drunkenness may be contributory factors to the increase in violence associated with these premises.

Chikritzhs & Stockwell, 2006 (Interrupted time series analysis, ++) Australia

A study was conducted by the team to ascertain the impact of later trading hours for some licensed hotels after mid-1993 in Perth, Western Australia on levels of impaired driver road crashes and driver breath alcohol levels. Following the Liquor Act 1988, hotels (public houses) in Western Australia were permitted to trade for additional hours via an Extended Trading Permit (ETP). The term 'hotel' was used to refer to business establishments, primary function of which is to serve alcohol on the premises, including public houses, taverns, bars, ale houses and saloons. Forty three (23%) of the 186 hotels meeting study eligibility criteria were granted an ETP for 1am closing time, while the remainder continued to close at midnight (non-ETP hotels). Data concerning hotels and their trading hours (and wholesale alcoholic beverage purchases) were linked to police data from June 1990 to July 1997 that identified the last place of drinking of impaired drivers involved in road crashes and their associated breath alcohol levels (BALs).

During the study period, a total of 955 crashes (79.8% of total) associated with 182 hotels (74.6% of total) were eligible for inclusion in analyses. When the association between ETP crashes and hotels with ETPs granted was tested (without controlling for non-ETP crashes), the finding was significant. However, when the trend in monthly non-ETP crash rates was controlled for, no significant relationship between hotels with ETPs granted and crashes could be observed. There was no evidence of a relationship between impaired driver age or driver sex and ETP-related crashes. However, when the presence of booze buses or freeway booze buses (mobile breath testing units) (in addition to non-ETP crash rates) were controlled for, analyses yielded a significant association between hotels with ETPs granted and ETP crashes. Following adjustment for impaired driver crash trends associated with non-ETP hotels and the

introduction of 'booze buses' to freeways, the mean crash rate for ETP hotels after introduction of ETPs was found to be 0.081 of a crash per hotel per month, equating to approximately 0.97 crashes/hotel/yr; an increase of approximately 47.0% on the period before the introduction of ETPs (0.055 crashes/hotel/month). Strong correlations were identified between the wholesale alcohol purchases made by hotels and impaired driver road crash rates associated with these hotels. When entered into the model, the high alcohol content beverage purchases by ETP hotels had a strong mediating effect on association between ETPs granted and ETP crashes. No relationship was observed between impaired driver BALs and the introduction of ETPs, a finding that was retained having controlled for non-ETP BALs).

Therefore, having controlled for non-ETP crash rates and the introduction of mobile police breath testing units to Perth freeways, a significant increase in monthly crash rates for hotels that had been granted ETPs was observed. This relationship was largely attributable to the higher volumes of high alcohol content beer wine and spirits purchases by ETP hotels. The authors concluded that later trading was associated with increased levels of impaired driver road crashes and alcohol consumption (particularly high alcohol content beverages), but that characteristics of the patrons of later trading hotels may have influenced the findings.

Chikritzhs & Stockwell (2007) (Interrupted time series analysis, ++) Australia

Chikritzhs & Stockwell (2007) determined the impact of extended trading permits (ETPs) for licensed hotels in Perth, Western Australia on impaired driver breath levels (BALs) between July 1993 and June 1997. As a result of the Liquor Act 1988, hotels (public houses) in Western Australia were able to trade for additional hours via an Extended Trading Permit (ETP). Forty three (23%) of the 186 hotels that met study eligibility criteria were granted an ETP for a 1am closing time, whilst the remainder continued to close at midnight (non-ETP hotels). As in the previous related studies by Chikritzhs and Stockwell (2002; 2006), the term 'hotel' refers to business establishments, primary function of which is to serve alcohol on the premises, including public houses, taverns, bars, ale houses and saloons. Prior to the introduction of ETPs, ETP and non-ETP hotels were significantly different in terms of a number of variables. ETP hotels purchased significantly less low/mid-strength alcohol content beer, wine and spirits but bought similar quantities of regular strength beer to non-ETP hotels. Impaired drivers associated with ETP hotels were younger and more likely to be female than apprehended patrons who last drank at non-ETP hotels.

Three mutually exclusive time periods were categorised to reflect key times of day were as follows:

- 1) 10.01pm to 12 midnight (2 hours immediately preceding a midnight closing time (n=2614 offences))
- 2) 12.01am to 2.00 am (2 hours immediately following a midnight closing time/first hour preceding and first hour immediately following extended closing time) (n=2526)
- 3) All other remaining times of day (n=4740)

Overall, BALs of apprehended impaired drivers were lower during the post-intervention period, in line with an overall downward trend (potentially linked to a lower 0.05 BAL limit having been introduced in June 1993). With the exception of female drivers apprehended between 10.01pm and midnight, older drivers had higher BALs. Female impaired drivers apprehended between 10.01pm and midnight having last drunk at an ETP hotel had significantly lower BALs than all other females apprehended during that time period. Among females apprehended between 10.01pm and midnight, mean BALs associated with non-ETP hotels increased by approx 3%, whilst BALs associated with ETP hotels decreased by approx 14%. Among males charged between 12.01am and 2.00am, the highest BALs occurred during the before period and were associated with non-ETP hotels. BALs associated with non-ETP hotels during the after period were lowest overall, and patrons who last drank at ETP hotels had second highest BALs.

Post hoc analyses grouped impaired drivers according to age group. The higher BALs for male drivers apprehended between 12.01am and 2.00am who last drank at ETP hotels were specific to 18-25 year olds. The average BAL for males who were apprehended between 10.01pm and midnight after drinking at an ETP hotel was 0.126 mg/ml. The mean BAL for drivers associated with non-ETP hotels during after period was 0.123 mg/ml. Mean BALs for drivers during before period were 0.135 mg/ml and 0.124 mg/ml for non-ETP and ETP hotels respectively. Therefore, the mean BALs associated with non-ETP hotels among males apprehended between 12.01am and 2.00am decreased by approx 9% (as reported), whilst mean BALs among drivers who last drank at an ETP hotel increased by approx 1.5% (as reported).

Therefore, this study showed that impaired female drivers apprehended between 10.01 pm and 12 midnight (before closing time) had significantly lower BALs after drinking at ETP

hotels. Male drivers aged 18-25 years apprehended between 12.01 and 2.00am after drinking at ETP hotels had significantly higher BALs than drivers who drank at non-ETP hotels. The authors concluded that at a peak time for alcohol-related offences, extended trading was associated with higher BALs in those groups most at risk of alcohol-related harm.

d'Abbs & Togni (2000) (Literature review) Australia

The authors performed a literature review of the effectiveness of various community-based initiatives with a focus on restrictions on alcohol availability in remote and regional areas of Australia. Included evaluations were based in the following communities. Impact on consumption was assessed indirectly using data collected by licensing authorities.

Restrictions on alcohol availability, including limitations on hours and days of licensed sales, were implemented in the communities of Tennant Creek, Derby, Halls Creek, Elliott and Curtin Springs. Whilst the evidence is of limited applicability to a UK setting, being based in remote areas of Australia and including a considerable proportion of people of Aboriginal origin in the local population, the evaluations were suggestive of a modest, positive impact on alcohol consumption and indicators of alcohol-related harm.

Hoadley *et al.* (1984) (Cross-sectional time series analysis) USA

The authors conducted a data analysis (covering the years 1955-1980) to determine the significance of associations between regulation of spirits and per capita consumption for the 48 states of the USA (looking at data for 5 yr intervals as opposed to year by year). The dependent variable was per capita consumption of distilled spirits in gallons of ethanol for a state during a given year.

Independent variables included weekday closing hours for on-premise sale of spirits; sale of spirits for on-premise consumption on Sundays; total density of outlets for purchase of spirits in number of licences per 1000 population. Social control variables were also used, including per capita personal income, proportion of Baptist and Mormon population, and tourist activity in the state.

Restrictions on Sunday sales had no apparent impact, whilst earlier closing hours in bars appeared to result in increased sales. Data were not available for off-premise sales. The presence of more on- and off-licensed outlets was associated with higher consumption levels.

Hogan *et al.* (2006) (Literature review) Australia

Hogan *et al.* reported findings from evaluations of a trial of alcohol restrictions that was implemented in Alice Springs, Northern Territory, Australia from April 2002 to June 2003. The local population included a large proportion of people of Aboriginal origin. The trial included restrictions on take-away trading hours for all outlets to between 2pm and 8pm on weekdays (reduction of 2 hours per day) and removal of alcohol of any type from the market in containers greater than 2 litres, and a provision that only light beer could be sold in bars before noon.

The evaluation showed that during the trial period, the reduction in trading hours resulted in decreased levels of alcohol-related harm. Incidents of drunkenness and protective custodies decreased by a third. Alcohol-related assaults decreased by 13%. However, alcohol-related offences were reported to have risen by 20%, particularly relating to criminal damage and disturbances (although Hogan acknowledged that this finding may be due to wide fluctuations in monthly police data). The ambulance service received around a quarter fewer alcohol-related call-outs, whilst selection presentations to the emergency department of the local hospital were seen to fall by 19%. Admissions of patients with acute conditions to the local hospital were reported to have increased.

No significant reduction was observed in the quarterly wholesale sales of pure alcohol over the trial period. However, consumers made a shift to the cheapest form of alcohol (2 litre port), with sales of this type of beverage increasing by 1000%. By time of the trial, the price of port had been lowered by approximately 25% and was also being heavily promoted by liquor outlets, a situation that would have been likely to have contributed towards the increase in sales of this beverage. It was therefore apparent that consumers shifted to a beverage with a lower volume (in order to meet the restrictions on off-sales volume) but having equal alcohol content. This study, whilst of limited applicability to a UK setting, provides a good case study of the interplay between alcohol availability, alcohol price and consumption.

Mäkelä *et al.* (2002) (Literature review) Scandinavia

The authors performed an extensive literature review of evaluation studies of changes in alcohol availability from the previous 50 yrs in Nordic countries, providing a considerable body of natural experiments of the impacts of interventions affecting the availability of alcohol. Detail is presented according to the reported findings.

Interventions relating to changes in hours and days of sale

Saturday closing

Finland, 1977, 1978

Findings were reported from two separate trials of Saturday closing of alcohol retail outlets in Finland. In 1977, an 8 month trial closure of Alko monopoly retail stores on Saturdays of 10 retail outlets in an area consisting of three municipalities was conducted. A slight decrease in total alcohol consumption was observed in the trial area (-0.5% vs +1.1% in the whole country), with a larger decrease in sales from Alko stores (-4.0% vs +2.6%), an increase in retail sales of medium-strength beer in grocery stores (+6.4% vs +0.4%) and an increase in on-premise sales of medium strength beer (+2.4% vs -1.5%) and no impact on on-premise sales of other alcoholic drinks (-1.6% vs -2.1%). A second trial was performed in 1978 when all national Alko stores were closed on Saturdays during a 4 month trial period. During this second trial, Alko sales decreased by 7%, whilst medium-strength beer sales from grocery stores increased by 5%. No alcohol-related harms in terms of illegal alcohol production and sales, arrests or crime were evident. A decrease in arrests for drunkenness on Saturdays was seen, particularly among people aged 30+ and among the homeless. No increase in the use of non-beverage alcohol was found.

Norway, 1984

In Norway in 1984 a trial occurred involving the temporary closing of wine and liquor monopoly outlets on Saturdays in 1984. Findings included a decrease in sales of spirits, less frequent but larger single quantity of purchases, a significant decrease in detoxification centre admissions on Saturdays and Sundays, and a decrease in arrests by police for public drunkenness on Saturdays but an increase on other days of the week.

Sweden, 1981, 1982

State-owned monopoly stores were closed on Saturdays during a trial period between June and Sept 1981. The evaluation indicated no change in total alcohol consumption, reduced public drunkenness, less frequent but larger single quantity of purchases, no effect on

emergency visits or injuries in traffic accidents, fewer domestic disturbances but more frequent outdoor assaults. This Saturday closure of outlets was made permanent in 1982. A time-series analysis was performed, producing findings consistent with those from the first evaluation.

Strikes

Finland, 1972, 1985

Strikes in Finland in 1972 of 180 Alko off-premise retail outlets for 5 weeks and in 1985 of 210 stores for 4 weeks acted as further natural experiments. Other outlets remained open as normal. Impacts of the strikes included reduced sales, increased consumption among alcoholics, increased consumption of strong home brews, moonshine and non-beverage alcohol. Alcohol-related crimes and arrests for drunkenness decreased.

Norway, 1978

During a strike in 1978 of alcohol outlets in Norway, alcohol sales decreased by approximately a quarter, consumption decreased by 5 to 10%, an increase in home production and smuggled spirits (particularly among heavy consumers) was observed. Police reports of drunkenness and domestic disturbances decreased. Reported accidents, particularly falls, also decreased.

Sweden, 1963

A strike in Sweden in 1963 resulted in reductions in police interventions due to drunkenness, decreases in accidents among both moderate and heavy drinkers and a decrease in the number of patients in alcohol clinics.

McMillan *et al.* (2007) (Regression analysis) USA

McMillan *et al.* conducted Bayesian hierarchical binomial regression modelling to investigate alcohol-related motor vehicle crash rates in New Mexico, USA between July 1st 1990 and June 30th 2000. The analysis did not take into account unreported crashes or crashes on private property. As of July 1st 1995, the ban on Sunday packaged alcohol sales was lifted in the state of New Mexico, with legislation including a local option for individual communities to re-implement the restrictions on Sunday packaged alcohol sales.

The analysis showed that alcohol-related crash rates across New Mexico were 1.32 times greater subsequent to the relaxation of licensing than pre-reform (RR=1.32, 95%CI 1.07 to 1.64). Variability in relative risks was apparent across states, with values ranging from 1.04 to 1.90. Counties that promptly made the local re-implementation of the ban on Sunday packaged alcohol sales were described as being able to limit the negative impact on alcohol-related motor vehicle crashes.

Norström & Skog (2003) (Interrupted time series analysis, ++) Sweden

The authors modelled the estimated size of effect of the Saturday opening of alcohol retail outlets in Sweden. Before February 2000, all alcohol monopoly outlets were closed on Saturdays. For a trial period, stores in an experimental area of 6 counties were open on Saturdays (with a control area of 7 counties, and a border area separating experimental and control areas of 7 counties). No data presented for relative increase in sales-hours during trial period. Sales of beer, wine and spirits (expressed in litres of 100% alcohol per month per inhabitant aged 15 or older) were determined. A statistically significant increase in total alcohol sales of 3.3% was observed (beer 7%, wine 2%, spirits 3%).

Norström & Skog (2005) (Controlled before and after study, ++) Sweden

The study by Norström & Skog was conducted in order to assess the impact of Saturday opening of alcohol retail shops on alcohol sales and indicators of assaults and drink driving. Prior to February 2000, all alcohol monopoly outlets in Sweden were closed on Saturdays. Subsequent to this date, outlets in an experimental area consisting of 6 counties were open on Saturdays (Phase 1). In the control area (7 counties), outlets remained closed on Saturdays. In order to protect against biases arising from trade leakage, the experimental and control areas were separated by a buffer zone of 7 counties. Since continuous evaluations of Phase 1 did not demonstrate any negative consequences as a result of the intervention, Saturday opening was implemented across the whole of Sweden after 17 months in Phase 2. The experimental area included 43% of Sweden's total population, the control area 34% and buffer areas 22%. The 3 periods of the study were as follows: pre-intervention period (January 1995 to January 2000), post-intervention Phase 1 (February 2000 to June 2001, ie. 17 months), post-intervention phase 2 (July 2001 to July 2002, ie. 13 months). Sales of beer, wine and distilled spirits, assaults indoors against women where perpetrator and victim were acquainted (indicator of domestic violence), all assaults indoors, all assaults outdoors, drink driving and

positive breathalyser tests were used as outcome measures in a population aged 15 years and above.

Alcohol sales

Border trade activity constituted a potential methodological complication to the evaluation of effects in phase 2. To determine whether the extension of Saturday opening magnified border trade to Norway, sales in 6 shops in the control area and 1 in the experimental area that were located close to Norwegian border were compared with sales in the remaining shops in the control area. The increase in sales following Saturday opening in July 2001 was considerably higher in these 6 border shops. For the period July 2001 to July 2002, this increase was 61% higher than rest of control area. Whilst the sales volume in these 6 shops comprised only approximately 5% of the overall sales volume in the control area, the authors felt that Norwegian border trade must therefore be controlled for, with the decision made to exclude the border shops from analyses.

Differences between observed and predicted sales for the experimental area during January 1998 to July 2002 were calculated. For beer, wine and distilled spirits, there was an increase in sales during the trial period (data presented graphically only). During phase 2, the difference between experimental and control area became much smaller, showing that Saturday opening also impacted significantly on sales volume in the control area. A statistically significant increase in total alcohol sales of 3.7% ($P < 0.001$) was observed during Phase 1, with alcohol sales increasing by 3.6% ($P < 0.001$) during Phase 2.

Assault indicators

The differences between observed and predicted values for all assaults were calculated. No significant changes in any of the assault indicators were observed during Phase 1 or Phase 2. Therefore, the Saturday opening of alcohol outlets and increase in sales of alcohol did not have any noticeable effect on assault rates.

Drink driving indicators

A statistically significant increase in drink driving (12.0%) occurred during Phase 1; however no change was observed during Phase 2. The difference between the 2 phases was statistically significant ($P < 0.01$). No discernable increases in positive breathalyser tests after 2pm on

Saturdays were observed for either Phase 1 or Phase 2. The authors suggested that the increase in drink driving observed during Phase 1 may have been due to a change in the surveillance strategy employed by the police, rather than as a result of increased consumption promoted by Saturday opening.

Increased accessibility to alcohol facilitated by Saturday opening of alcohol outlets appears to have increased sales of alcohol. However, no increase in alcohol-related harm could be detected. The authors acknowledged that the lack of an intervention effect on harm indicators may have been attributable to insufficient statistical power.

Ragnarsdottir *et al.* (2002) (Before and after study, +) Iceland

Ragnarsdottir reported on the effects of a trial involving the unrestricted alcohol serving hours in Reykjavik, Iceland. Data were collected from statistics from police reports and the emergency ward, a telephone survey of all 33 barkeepers who had permission to serve alcohol round the clock, interviews with representatives for inhabitants in neighbourhood of city centre, and two field visits. Data were collated for 8 weekend nights in March and April 1999 and 8 weekend nights in March and April 2000 (defined as Saturday and Sunday nights between midnight and 7am).

The number of calls or working episodes of police in the city centre was described as increasing from 251 in 1999 to 286 in 2000 (14%). In comparison, the number of police working episodes across the whole town underwent a smaller increase from 573 cases in 1999 to 610 in 2000 (6%). Whilst being based on a crude estimate, fewer people were reported by police as being present in the city centre between 3am and 5 am in 2000 than 1999 (-36%), whilst considerably more people were in the city centre at 6am (+267%).

A telephone survey of 30 of the 33 barkeepers (91%) who could serve alcohol round the clock showed variability in the use of extended hours. The mean closing time following the liberalisation was 4.30am on Saturdays and 5am on Sundays. Half (50%) of establishments remained open after 4am.

An increase of 31% in the total number of cases admitted to emergency wards during weekend nights was experienced. The number of cases admitted on Saturdays and Sundays increased by 20% but decreased by 2% on other days of the week. Increased admissions for

potentially alcohol-related incidents, including accidents and fighting were observed, particularly among men. No changes were observed in suicide attempts subsequent to the relaxation in licensing. A clear increase in the number cases of suspected drink driving was seen (29 in 1999 vs 52 in 2000, +80%). Some residents and merchants reported increased disturbance due to nightlife and a lack of receptivity of police to complaints. Street cleaning workload also increased. Half (50%) of barkeepers reported extended hours as having yielded financial benefits. 48% reported more consumers in bars, 43% did not perceive an increase in alcohol consumption among guests, whilst 68% said guests stayed longer despite their later arrival. Serving hours were subsequently restricted in response to growing concerns over the problems associated with the unrestricted hours.

Summary of findings

A body of evidence was collated that described the impacts to date of the UK Licensing Act 2003. Overall levels of alcohol consumption and crime appeared to have remained stable (Department for Culture, Media and Sport, 2008; Hough *et al.*, 2008). Alcohol sales were also stable at a more local level following the implementation of the licensing reform (Pike *et al.*, 2008). Further evidence also supported the findings that the Licensing Act had a mixed impact on alcohol-related crime and disorder (Foster *et al.*, 2007; Local Government Association, 2008). At a local level, crime and disorder showed little change on aggregate, but differences across sites (Hough *et al.*, 2008; Pike *et al.*, 2008), potentially due to variations in policing, implementation and enforcement of the Act.

However, the Licensing Act had clearly resulted in a temporal displacement of alcohol-related violence, with incidents shifting forwards into the early hours of the morning (Department for Culture, Media and Sport, 2008; Hough *et al.*, 2008; Pike *et al.*, 2008).

No conclusive evidence of an increase in alcohol-related attendances at A&E as a result of the Licensing Act was found in national-level studies (Department for Culture, Media and Sport, 2008; Hough *et al.*, 2008; Sivarajasingam *et al.*, 2008). Peer-reviewed, published findings relating to the impact of the Licensing Act on alcohol-related attendances at single A&E departments were contradictory (Newton *et al.*, 2007; El-Maytaah *et al.*, 2008). However, Durnford *et al.* (2008) observed a temporal shift in alcohol-related attendances to an A&E department, with a greater proportion of such presentations being made in the early hours of the morning.

Evidence suggested that pressure on workload and resources had increased among health professionals and local authorities (Local Government Association, 2008), licensing officers (Foster *et al.*, 2007; Pike *et al.*, 2008) and police (Foster *et al.*, 2007; Pike *et al.*, 2008). Partnership working between police, local authorities and primary care trusts may also have been enhanced following the licensing reform (Local Government Association, 2008). Limited use had been made of Cumulative Impact Areas (Foster *et al.*, 2007), with licensing authorities stating the importance of the development of a strong evidence base to support future decision-making relating to Cumulative Impact Areas (Foster *et al.*, 2007; Herring *et al.*, 2008).

The evidence identified to date relating to the Licensing Act 2003 suggests that levels of alcohol consumption and related harm may have remained stable since the introduction of the licensing reform. However, the identified evidence clearly demonstrates that temporal shifts in alcohol-related crime and disorder and also alcohol-related attendances at A&E have occurred, with more incidents taking place during the early hours of the morning. This change in the pattern of alcohol-related activity has considerable workload and resource implications for health professionals, police, and licensing officers, with a number of consulted parties reporting increased pressure as a result of the Licensing Act. The Licensing Act does therefore not appear to have decreased alcohol-related crime and disorder. It should also be noted that whilst no overall increases in alcohol-related crime and disorder were observed to have followed the licensing reform, these assessments were undertaken against a background of increased police and enforcement activity. Further monitoring and research is required to determine the long-term health and social impacts of the Licensing Act.

Other UK-specific evidence relating to the effects of changes in licensing hours was also presented. Whilst Duffy & Plant (1986) observed no apparent impact of the liberalisation of Scotland's licensing law in the late 1970s on alcohol-related morbidity and mortality, Northridge *et al.* (1986) reported an increase in admissions for self-poisoning by overdose incidents in which alcohol was also involved. Following the implementation of uniform closing times for alcohol premises in Edinburgh, no significant changes were observed for alcohol-related attendances or assaults at A&E (Graham *et al.*, 1998).

No discernable impact on alcohol consumption by patients prior to attendance at A&E was found as a result of the 1988 amendments to licensing law in England & Wales. However, some evidence of increases in the occurrence of slight accidents in the workplace was identified (Duffy & Pinot de Moira, 1996).

Additional international evidence of the effects of changes in licensing of the sale of alcohol was also described. However, the applicability of the international evidence should be considered carefully, as a range of country-specific factors (eg. remoteness, population demographics, cultural attitudes and drinking practices) will significantly limit the generalisability of findings. Extended trading hours was associated in Australia with increased violence, motor vehicle crash rates and increased apprehensions of impaired male drivers aged 18 to 25 yrs (Chikritzhs & Stockwell, 2002; 2006; 2007). d'Abbs & Togni (1999) also showed local community restrictions in Australia on alcohol availability to have modestly favourable outcomes, including reductions on alcohol consumption and violence. However, one evaluation of the restriction of take-away trading hours and volumes for alcohol sales in Australia (Hogan *et al.*, 2006) showed that many customers shifted their purchases to cheap cask port, providing a useful insight into the manner in which consumers can respond to limitations in alcohol availability. However, Hoadley *et al.* (1984) reported that restrictions on Sunday sales had no apparent impact on consumption, whilst earlier closing hours in bars appeared to result in increased sales (although it should be noted that these data dated from the 1950s onwards and may not necessarily reflect contemporary consumer behaviour in a UK setting). The lifting of the ban on Sunday sales of packaged alcohol in New Mexico, USA resulted in an increase in alcohol-related RTAs (McMillan *et al.*, 2007).

Ragnarsdottir (2002) described the introduction of unrestricted serving hours in Reykjavik, Iceland as having increased police work episodes, emergency ward admissions for weekend nights, suspected drunk driving incidents, and more people circulating in the city centre at 6am. The Saturday opening of alcohol retail outlets in Sweden also led to an increase in sales (Norstrom & Skog, 2003; 2005) but no apparent change in harms (Norström & Skog, 2005). A range of evidence reviewed by Mäkelä (2002) and based on natural experiments showed the variable impact of changes in alcohol licensing, with decreased alcohol consumption typically observed as a result of restrictions.

Evidence statements

Evidence statement 2.15

Levels of alcohol consumption^{1,2} and alcohol-related crime and disorder^{1,2,3,4,5} appeared to have remained stable following the introduction of the UK Licensing Act 2003.

¹ Department for Culture, Media and Sport, 2008 (Evaluation) UK

² Hough *et al.*, 2008 (Evaluation) UK

³ Pike *et al.*, 2008 (Evaluation) UK

⁴ Foster *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

⁵ Local Government Association, 2008 (Cross-sectional questionnaire survey, +) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.16

Studies conducted on a national scale did not demonstrate any conclusive evidence of an increase in alcohol-related attendances at A&E as a result of the Licensing Act.^{1,2,3} The findings from peer-reviewed, published reports of the effect of the Licensing Act on alcohol-related attendances at single, local A&E departments were mixed.^{4,5,6}

¹ Department for Culture, Media and Sport, 2008 (Evaluation) UK

² Hough *et al.*, 2008 (Evaluation) UK

³ Sivarajasingam *et al.*, 2008 (Cross-sectional survey, ++) UK

⁴ Newton *et al.*, 2007 (Before and after study, ++) UK

⁵ El-Maytaah *et al.*, 2008 (Before and after study, +) UK

⁶ Durnford *et al.*, 2008 (Before and after study, ++) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.17

The Licensing Act had clearly resulted in a temporal displacement of alcohol-related violence^{1,2,3} and alcohol-related attendances at A&E,⁴ with incidents shifting forwards into the early hours of the morning

¹ Department for Culture, Media and Sport, 2008 (Evaluation) UK

² Hough *et al.*, 2008 (Evaluation) UK

³ Pike *et al.*, 2008 (Evaluation) UK

⁴ Durnford *et al.*, 2008 (Before and after study, ++) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.18

Evidence from studies with limited sample sizes suggested that pressure on workload and resources may have increased among health professionals and local authorities,¹ licensing officers,^{2,3} and police.^{2,3} Partnership working between police, local authorities and primary care trusts may also have been enhanced following the licensing reform.¹

¹ Local Government Association, 2008 (Cross-sectional questionnaire survey, +) UK

² Foster *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

³ Pike *et al.*, 2008 (Evaluation) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.19

Limited use had been made of Cumulative Impact Areas at the time of study.¹ Licensing authorities stated the importance of the development of a strong evidence base for making future decisions relating to Cumulative Impact Areas.^{1,2}

¹ Foster *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

² Herring *et al.*, 2008 (Qualitative study, ++) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.20

Other UK-specific studies of the effects of changes in licensing hours presented mixed findings, with some studies reported no apparent effects on alcohol-related outcomes.^{1,2,3} However, following two distinct extensions of licensing hours, one study⁴ reported an increase in admissions for self-poisoning by overdose in which alcohol was also involved, whilst another study found increases in the occurrence of slight accidents in the workplace.⁵

¹ Duffy & Plant, 1986 (Analysis of longitudinal ecological data) UK

² Graham *et al.*, 1998 (Before and after study, ++) UK

³ Rhodes *et al.*, 1990 (Before and after study, ++) UK

⁴ Northridge *et al.*, 1986 (Before and after study, +) UK

⁵ Duffy & Pinot de Moira, 1996 (Regression analysis) UK

Applicability: All the above evidence was specific to the UK.

Evidence statement 2.21

Additional international evidence of the effects of changes in licensing of the sale of alcohol was also described. Extensions in trading hours in Australia were typically associated with increased violence,¹ motor vehicle crash rates,² and increased apprehensions of impaired male drivers aged 18 to 25 yrs.³ Local community restrictions in Australia on alcohol availability were found to have modestly favourable outcomes, including reductions on alcohol consumption and violence.⁴ However, in one evaluation of the restriction of take-away trading hours and volumes for alcohol sales in Australia, many customers shifted their purchases to cheap cask port, providing an illustration of the ways in which consumers may respond to limitations in alcohol availability.⁵ An increase in alcohol-related RTAs followed the removal of the ban on Sunday sales of packaged alcohol in New Mexico, USA (McMillan *et al.*, 2007).⁶ The introduction of unrestricted serving hours in Reykjavik, Iceland resulted in increased police work episodes, more emergency ward admissions for weekend nights, increased suspected drunk driving incidents, and more people circulating in the city centre at 6am.⁷ The Saturday opening of alcohol retail outlets in Sweden also led to an increase in sales^{8,9} but no apparent change in alcohol-related harms.⁹ A range of evidence from Scandinavia and based on largely small-scale, local natural experiments showed the variable impact of changes in alcohol licensing, with decreased alcohol consumption typically observed as a result of restrictions.¹⁰ However, a USA-based study suggested that restrictions on Sunday alcohol sales had no apparent impact on consumption, whilst earlier closing hours in bars appeared to result in increased alcohol sales.¹¹

¹Chikritzhs & Stockwell, 2002 (Time series analysis, ++) Australia

²Chikritzhs & Stockwell, 2006 (Time series analysis, ++) Australia

³Chikritzhs & Stockwell, 2007 (Time series analysis, ++) Australia

⁴d'Abbs & Togni, 1999 (Literature review) Australia

⁵Hogan *et al.*, 2006 (Literature review) Australia

⁶McMillan *et al.*, 2007 (Regression analysis) USA

⁷Ragnarsdottir, 2002 (Before and after study, +) Iceland

⁸Norstrom & Skog, 2003 (Time series analysis, ++) Sweden

⁹Norstrom & Skog, 2005 (Controlled before and after study, ++) Sweden

¹⁰Mäkelä, 2002 (Literature review) Scandinavia

¹¹Hoadley *et al.*, 1984 (Cross-sectional time series analysis) USA

Applicability: The above evidence was specific to Australia, the USA, and Scandinavia.

5.2.2.5 Review 2.4 Alcohol outlet density

Eighteen studies were reviewed relating to the effects of changes in alcohol outlet density. A considerable evidence base was identified based on association studies that typically used statistical analyses to quantify the relationships between alcohol outlet density and alcohol consumption. Association studies that focused primarily on the quantitative determination of the relationships between outlet density and alcohol consumption only were reviewed. However, a systematic review by Booth *et al.* (2008) has been performed and provides a full assessment of the relationships between alcohol consumption and related harms and is available as a further source of evidence. The included association studies typically took the form of cross-sectional or time-series study designs. Whilst outlet density usually undergoes gradual change over time, a number of opportunities, such as the privatisation of retail monopolies, provided a basis for natural experiments. Further evidence based on such natural experiments of the effects of a change in alcohol outlet density on alcohol consumption and related outcomes are also included in this assessment.

Studies investigating the association between alcohol outlet density and alcohol consumption

Gruenewald *et al.* (1993) (Time-series cross-sectional analysis) USA

Gruenewald undertook an analysis of aggregate time series cross-sectional data from US states in order to investigate the relationships between alcohol availability, pricing and sales. An objective of the study was the exploration of the potential simultaneous relationship between per capita alcohol outlet density and alcohol sales.

Separate analyses were conducted for the demand for spirits using price data (from 36 states over 1977-1984), spirits using tax rate data (from 24 states, 1975-1984), wine using price data (from 38 states, 1982 to 1984) and wine using tax rate data (from 29 states, 1975-1984). No appropriate measures of beer physical availability existed, and therefore beer could not be included in the analysis). The analysis took into account the effects of socioeconomic factors influencing availability and consumption (including personal income, state economic activity, tourism, index of retail conditions in state, social norms, controls for changes in legislation relating to availability, and cross-border purchasing activity). Per capita outlet densities were determined for a study population aged ≥ 15 yrs. A measure of land area per adult (aged ≥ 15 yrs and over) was also included.

The findings indicated that physical availability of alcohol was directly related to levels of sales of spirits and wine, independent of effects of prices. The direction of the simultaneous relationship was shown to be strongest from outlets to consumption, with increased outlet density driving increased sales. No significant association existed between sales and MLDA in this study, a result that the authors stated was potentially due to the high proportion of beer consumption among young people.

Huckle *et al.* (2008) (Multi-level modelling) New Zealand

A multi-level model was used to analyse the relationship between on- and off-licensed alcohol outlet density and measures of drinking activity including typical occasion quantity of alcohol consumption, frequency of consumption and drunkenness among 1179 young people aged 12 to 17 yrs in Auckland, New Zealand. Data were collected by means of a telephone survey between March and June 2005. The study population was 52% male and covered a range of ages (13% aged 12 yrs, 16% aged 13 yrs, 18% aged 14 yrs, 17% aged 15 yrs, 20% aged 16 yrs and 16% aged 17 yrs) and ethnic groups (63% European, 12% Maori, 8% Pacific, 16% Asian and 1% other). Just under half of the young people surveyed (44%) reported consuming alcohol during the past 12 months. The environmental independent measures used in the analysis included outlet density at census area unit level (for on and off licensed premises combined). Personal income, exposure to advertising and number of brands recalled were included as additional covariates in the model.

Alcohol outlet density was significantly associated with typical-occasion quantity of alcohol consumption ($b=0.004$, $p<0.05$), whilst other covariates proved non-significant. No covariates demonstrated a significant relationship with frequency of drinking among young people. Only the relationship between alcohol outlets and frequency of drunkenness among young people was marginally significant ($b=0.005$, $P=0.058$). No other covariates displayed a significant relationship with this dependent variable. This study therefore showed that typical-occasion quantity of alcohol consumption is predicted by alcohol outlet density.

Kuntsche *et al.* (2005) (Regression analysis) Switzerland

The objective of the study presented by Kuntsche *et al.* was to investigate the relationships between alcohol outlet density, perception of adolescent drinking in public (at a school level), and adolescent drinking and drunkenness at an individual level. The research involved the collection of data via a questionnaire from 1194 9th grade students from 68 classes across 61

schools in Switzerland (mean age 15.3 yrs, SD=0.7, range 12 to 18 yrs, 50.5% male, data collection April and May 2002) and their schoolmasters (n=61) (82.0% male, age range 30 to 64 yrs, mean 48.0 yrs, SD=7.8). Questions relating to alcohol outlet density and adolescents drinking in public were asked. For outlet density, schoolmasters were asked to what extent they agreed with the variable 'we have a lot of small shops and kiosks here.' At an individual level, the highest frequency of consumption of beer, wine, spirits and premixed drinks or alcopops (at least 1 drink per occasion) was used as the frequency of consumption variable. Frequency of lifetime drunkenness among adolescents also assessed by asking 'have you every had so much alcohol that you were really drunk'? Data were analysed using linear regression models.

Over half (51.3%) of pupils consumed beer, wine, spirits, or premixed drinks or alcopops and around a third (32.1%) were repeatedly drunk. Alcohol outlet density was a significant predictor of adolescent alcohol use (unstandardised regression coefficient = 0.17 (SE 0.07), $p < 0.05$).

Kuntsche *et al.* (2008) (Multi-level modelling) Switzerland

The authors undertook analysis of data from a nationally representative sample of 6183 12 to 17 yr old adolescents from the 8th and 9th grades of school (mean age 14.8 yrs, 49.7% male) from 254 communities in Switzerland in order to assess the relationship between alcohol outlet density and alcohol-related measures including perceived availability and adolescent alcohol use.

Individual student data were taken from the 2003 European School Survey on Alcohol and Drugs and included drinking volume (in total number of drinks consumed in the past 12 months), risky single occasion drinking (how many times over last 30 days respondents had 5 or more drinks in a row) (RSOD); and perceived availability. Mean (SD) quantity consumed was 33.2 (59.5), whilst frequency of RSOD was 1.0 (2.1). A total of 5433 off-premises and 23,408 on-premise alcohol outlets were in the study areas. Density was represented as alcohol outlets per 1000 inhabitants (in order to compensate for differences in population density by community). The on-premises alcohol outlet density mean (SD) was 3.4 (2.5) per 1000 inhabitants; whilst the off-premises alcohol outlet density mean 0.8 (0.5) per 1000 inhabitants.

The study found that the density of on-premises ($b=0.13$, $p<0.05$) but not off-premises alcohol outlets was related to perceived availability. The density of on-premises ($b=0.19$, $p<0.05$) but not off-premises outlets was also related to volume drinking but not to the frequency of risky drinking occasions among young people.

Kypri *et al.* (2008) (Analysis of correlation) New Zealand

The study by Kypri was based on University campuses in New Zealand and included the analysis of data from a large sample of students (mean age 20.2 yrs, 60% female, 41% New Zealand European, 31% New Zealand Maori, 15% Chinese, 13% other, 42% frequent binge drinking in high school).

The aim of the study was to model the relationship at campus-level and individual-level between outlet numbers within 1km and 3 km of student residences and individual drinking levels or problems, with controls for gender, age, ethnicity and high school binge drinking frequency and adjusting for campus-level clustering. 1022 students who lived within 3km of campus centre were included in ecological analyses, whilst a further 961 students who lived between 3km and 2km from campus were included in student-level analyses. Data were collected from participants on the number of days they drank alcohol during a typical 4 week period, and the typical number of drinks consumed per occasion. Men were asked the number of days on which they consumed 6 or more standard drinks (60 g ethanol), whilst women reported the number of days on which they drank 4 or more standard drinks (40g ethanol). Alcohol-related personal problems were determined using the Alcohol Problems Scale. The median number of drinks consumed per typical drinking day as reported by participants was (IQR) 5 (2.8). Alcohol outlet density for both on and off sales was determined. The median campus areas outlet density (3 km) was as follows: on-licence 25 (range 1 to 407); off-licence 94 (range 0 to 100); all licensed 119 (range 1 to 507).

For each additional 10 off-licensed outlets within 3 km of respondents' residences, respondents consumed on average 1.017 (95%CI 1.001, 1.033, $P=0.0317$) times as many drinks per drinking day; had 1.032 (95%CI 1.023, 1.042, $P<0.0001$) times as many alcohol-related problems and experienced 1.057 (95%CI 1.022, 1.092, $P=0.0011$) times as many second hand effects.

For each additional 10 on-licensed outlets within 3 km of respondents' residences, respondents consumed on average 1.005 (95%CI 0.999, 1.010, $P=0.0910$) times as many drinks per drinking day; had 1.008 (95%CI 1.005, 1.010, $P<0.0001$) times as many alcohol-

related problems and experienced 1.013 (95%CI 1.005, 1.022, P=0.0020) times as many second hand effects.

For each additional 10 off-licensed outlets within 1km of respondents' residences, respondents consumed on average 1.047 (95%CI 0.978, 1.121, P=0.1855) times as many drinks per drinking day; had 1.069 (95%CI 1.044, 1.095, P<0.0001) times as many alcohol-related problems and experienced 1.133 (95%CI 1.025, 1.207) times as many second hand effects.

For each additional 10 on-licensed outlets within 1km of respondents' residences, respondents consumed on average 1.005 (95%CI 0.999, 1.012, P=0.1235) times as many drinks per drinking day; had 1.011 (95%CI 1.006, 1.016, P<0.0001) times as many alcohol-related problems and experienced 1.018 (95%CI 1.006, 1.031, P=0.045) times as many second hand effects.

Significant positive associations were seen between both on- and off-licensed outlet densities with all outcomes in student-level adjusted models. Effects were greatest for 1 km densities and of-licensed outlets. These associations held when demographic variables and pre-university drinking were controlled for.

Livingston *et al.* (2008) (Multi-level modelling) Australia

Livingston performed a survey of drinkers and multi-level analysis of individual and community-level correlates of regular very-high risk drinking (more than 20 drinks at least 12 times a year for males and more than 11 drinks at least 12 times a year for females) among young drinkers (aged 16 to 24 yrs) in Victoria, Australia. Only current drinkers were included, yielding a sample of 10,879 residents of 568 different postcodes (average 19.2 respondents per postcode, min = 1, max = 144). Approximately 20% (2167) of the sample reported regular (at least once per month) very high risk drinking (more than 20 drinks at least 12 times a year for males and more than 11 drinks at least 12 times a year for females). The density of packaged liquor outlets was found to be significantly associated ($p<0.01$) with very high-risk drinking in young people.

Pollack *et al.* (2005) (Multi-level modelling) USA

A multi-level analysis of cross-sectional survey data was performed to investigate the relationships between neighbourhood-level deprivation, alcohol availability and individual-level alcohol consumption.

The dependent variable in the analysis was heavy alcohol consumption defined according to total number of drinks consumed per week (>7 drinks per week/females, >14 drinks per week/males). The Townsend Material Deprivation Index was used as a measure of neighbourhood deprivation. Density of alcohol outlets was determined as the sum of alcohol outlets in neighbourhood divided by neighbourhood's square mileage, with the variable defined as high or low outlet density. The study population was made up of 8197 adults aged 25 to 74 yrs (54.6% female) residing in four northern/central California cities and 82 neighbourhoods. The majority (30.8%) were aged 25-34 yrs, 83.1% were White and 77.1% were moderately deprived according to Townsend Index. 70.8% lived in an area classed as being of low alcohol outlet density. A total of 865 on- and off-sale alcohol outlets were included.

Multi-level analyses showed that the least deprived neighbourhoods were associated with the highest levels of alcohol consumption, even when individual-level sociodemographic factors controlled for (OR=1.30, 1.08 to 1.56). The density of alcohol outlets (high vs low) (OR=1.12 (0.96 to 1.31) was not significantly associated with heavy drinking in this study.

Schonlau *et al.* (2008) (Regression analysis) USA

This study focused on an analysis of data from respondents based in 2881 households across Los Angeles County and pre-Katrina southern Louisiana (based within 220 randomly selected urban census tracts stratified by site; 114 in LA and 106 in Louisiana; where an urban census tract was defined as containing at least 2000 persons per square mile). Sample characteristics for Louisiana were as follows: 44.1 yrs mean age (SD=13.0); 33.0% male; respondent's income (US\$) <15,000 24.3%, 15,000-25,000 16.3%, 25,000-50,000 24.6%, 50,000-75,000 14.2%, >75,000 20.6%; non-Hispanic white 50.4%, non-Hispanic black 42.1%, other 1.9%, Asian 1.0%, Hispanic 4.6%. Characteristics of the sample drawn from Los Angeles were 41.9 yrs mean age (SD=13.3); 38.6% male; respondent's income (US\$) <15,000 22.9%, 15,000-25,000 18.8%, 25,000-50,000 21.4%, 50,000-75,000 13.3%, >75,000 23.6%; non-Hispanic white 35.1%, non-Hispanic black 16.3%, other 4.1%, Asian 5.5%, Hispanic 38.9% (separate analyses conducted by state and adjusted for sample characteristics). Neighbourhood (number

of outlets in census tract in which respondent resided and number of outlets in buffers of 0.1, 0.25, 0.5 and 1.0 mile radii around respondents' residences) and individual (network distance to closest alcohol outlet) measures of off-premise alcohol outlet density were determined. Data relating to self-reported alcohol consumption were collected using a telephone household survey using the most recent birthday method for respondent selection. An average of 13.8 and 12.3 respondents were included per census tract in Louisiana and LA respectively. Gender, age, ethnicity and self-reported income were adjusted for in analyses.

Schonlau *et al.* found that off-premise alcohol outlet density was associated with the quantity of alcohol consumption among respondents in Louisiana but not Los Angeles County, with a stronger association between alcohol consumption and outlet density within a one mile buffer of the respondent's home than for outlet density within the census tract of the respondent's residence.

Scribner *et al.* (2000) (Multi-level analysis) USA

A multi-level analysis of data from telephone surveys of 2604 households within 24 census tracts in New Orleans, Louisiana stratified by poverty status and alcohol outlet density was conducted in order to assess the relationship between off-sales alcohol outlet density and alcohol consumption.

Study respondents were adults aged over 18 yrs who were sampled using the most recent birthday method. The sample was described as being representative of the general population in composition in terms of age, ethnicity and education. The sample had a mean age of 44.3 yrs. Alcohol consumption, drinking norms (relating to drinking attitudes, social acceptability and perceived norms) and alcohol outlet density were represented as a score on a scale. Individual sociodemographic factors were controlled for in the analysis. The analysis was conducted at individual and neighbourhood levels. The individual level measure of outlet density used was the individual distance to the closest alcohol outlet; the neighbourhood level measure of outlet density was the mean distance to the closest alcohol outlet for all individuals within a census tract.

The analysis demonstrated that, whilst individual distance to closest alcohol outlet was not related to alcohol consumption, the mean distance to the closest alcohol outlet was negatively related to drinking norms (-5.50, SE=2.37) and alcohol consumption (-0.447 SE=0.195), meaning that the lower mean distance to the closest alcohol outlets, the greater the mean drinking norms score (indicating a greater acceptability of drinking activity) and mean level

of alcohol consumption. This study therefore showed that, in this case, the effect of alcohol outlet density on alcohol measures appeared to function at a neighbourhood rather than individual level, in that all individuals living in a neighbourhood of high alcohol outlet density are affected by the exposure. The authors suggested that individuals may be influenced by the drinking patterns of the social network in their neighbourhood, resulting in drinkers being clustered together.

Treno *et al.*, 2008 (Regression analysis) USA

Treno investigated the effect of alcohol outlet density on perceived and actual informal and formal adolescent alcohol access in California, USA.

Data were taken from a survey of 30 youths aged 14 to 16 in each of 50 zip codes, which had been purposively selected in order to provide variability in median household income and off-premise outlet densities. The mean age of the study population was 14.98 yrs (SD=0.82), the sample was 50.7% male, with a range of ethnic groups represented (34.46% Hispanic, 6.77% African American, 5.07% Asian or Pacific (no other data reported)). Perceived informal access was determined according to the views of respondents as to the ease with which they could obtain alcohol from parents, friends, sibling, or a person aged over 21. Perceived formal access was assessed by the viewed ease of purchasing alcohol themselves without identification. Actual access was measured according to the number of times in the past year that the respondent drank alcohol obtained from various informal sources (obtained from a personal contact aged younger than or over age 21, from the home with parental permission, from home without parental permission, from a purchase by a sibling, relative or stranger or taken without paying from store). The purchasing of alcohol by the respondent with or without fake identification was used as the measure of formal access. The number of off-premise outlets within 2 mile buffer of respondent's address was also determined. The mean number of off-premise alcohol outlets within 2 miles was 50.89 (SD=54.23).

Off-premise outlet density was found to be positively associated with both actual use of ($b=0.391$, $p \leq 0.01$) and perceived ease of access ($b=0.081$, $p \leq 0.001$) to formal sources of alcohol among young people. Off-premise alcohol outlet density was negatively associated with actual use of informal sources ($b= - 0.228$, $p \leq 0.05$).

Trolldal (2005a) (Interrupted time-series analysis, ++) Canada

Interrupted time-series analysis was used to determine the effects of the privatisation of retail sale of alcohol in Alberta, Canada (primarily between end of 1980s and early 1990s) on alcohol-related measures including annual sales of alcohol (1950 to 2000) and fatal traffic crashes among people aged ≥ 15 yrs. The remainder of Canada was used as a control area. A privatisation variable was created in order to account for changes in the numbers of outlets, licensing hours and promotion. Therefore, a range of impacts are assessed simultaneously and, whilst it is not possible to unpick the contribution of changes in outlet density to the overall effects of privatisation, this study is presented as a further piece of relevant evidence.

Subsequent to privatisation in 1994, the number of off-premise outlets selling wine or spirits was described as having increased almost 3-fold compared to the number existing in 1989 (no further data presented).

It was reported that privatisation had a significant and permanent effect on the sale of spirits (estimate 0.12, $p < 0.01$) (but not wine or beer sales). However, this effect was not large enough to influence total sales. No significant impact was observed in terms of the number of fatal motor vehicle traffic accidents.

Trolldal (2005b) (Interrupted time series analysis, ++) Canada

Trolldal employed interrupted time-series analysis to assess the effects of privatisation on wine sales, total sales and sales of spirits and beer in Quebec, Canada.

Grocery stores were permitted to sell domestically produced wine and wine imported and bottled by the Liquor Board from 1978. This liberalisation was extended in 1983, allowing the sale of wine bottled by privately owned manufacturers in Quebec. As previously, the remainder of Canada was used as a control area, with alcohol prices and disposable personal income used as control variables. The potential effects of policy changes measures on alcohol sales per inhabitant aged 15 yrs and over were investigated using intervention variables across a study period of 1950 to 2000. Strikes at Liquor Board stores during the study period were also controlled for. An increase in outlet density for off-premise outlets selling wines was observed (no baseline or post-privatisation data presented on outlet density).

Trolldal observed a significant and permanent effect of policy change in 1978, whereby sales of wine increasing by 10% (but no significant effect on spirits or beer sales) ($p < 0.01$). However, as previously, the beverage-specific increase was not sufficient to have an influence on total sales. There was no apparent increase in the sales of wine observed between 1983 and 1984.

Change in prices of beverages had a significant negative effect on wine sales ($p < 0.01$), with evidence indicating that, when price increased by 1%, sales decreased by 0.40%.

Wagenaar & Holder (1995) (Interrupted time series analysis, ++) USA

The study authors investigated the results of the privatisation of wine sales in 5 states of the USA between 1968 and 1991 that had not undergone previous investigation (Alabama, Idaho, Maine, Montana and New Hampshire). Interrupted time series analysis was used. No data on baseline or post-privatisation alcohol outlet densities were reported.

Significant increases in sales of wine were observed after the privatisation of retail wine monopolies of 42% for Alabama, 150% in Idaho, 137% in Maine, 75% in Montana and 15% in New Hampshire (representing increases in litres of pure ethanol per year in the form of wine of 621,000, 432,000, 364,000, 363,000 and 171,000 respectively).

No significant decreases in wine sales were observed in states adjacent to focal states. Furthermore, no significant increases in the sales of beer or spirits occurred alongside sales of wine, suggesting no general contemporaneous trend in increased sales.

Weitzman *et al.* (2003) (Analysis of correlation) USA

Analysis of the correlations between on and off-premise alcohol outlet density and heavy and frequent drinking among college students was performed by Weitzman *et al.*

The study sample was made up of 3421 college students (51-67% female, 73 to 94% White, 48 to 64% Underage) at 8 Universities across the USA (participating sites in the A Matter of Degree programme to reduce binge drinking) (Universities located in different regions of USA and set in different conurbation types). Outlet data were collected over 2-mile radius of central location point on or near campuses. Outlets were excluded if they did not typically serve college students. 966 alcohol outlets were identified within 8 2 mile study areas, with total densities/site ranging from 32 to 185. Measures of drinking were taken from the 1999

Harvard School of Public Health College Alcohol Study and included heavy drinking (% of drinkers consuming 5 or more drinks at an off-campus party in the last 30 days); frequent drinking (% of drinkers who reported drinking on at least 10 occasions in the past 30 days); and drinking-related problems (% of drinkers with 5 or more alcohol-related problems since beginning of school year). 27 to 41% of students reported heavy drinking; 1/5 to 1/3 reported frequent drinking; whilst 18 to 32% reported having drinking-related problems.

A significant correlation was observed for all drinkers between outlet density and heavy drinking ($r=0.82$, $p=0.01$), which held for subgroups, including men ($r=0.73$, $p=0.04$) and students who acquired binge drinking in college ($r=0.75$, $p=0.03$). In addition, a significant correlation was found between outlet density and frequent drinking among all drinkers, ($r=0.73$, $p=0.04$), women ($r=0.72$, $p=0.02$), underage students ($r=0.79$, $p=0.02$) and students who picked up binge drinking in college ($r=0.84$, $p=0.01$). Outlet density and drinking-related problems were also significantly correlated among all drinkers ($r=0.79$, $p=0.02$), women ($r=0.90$, $p=0.002$), underage students ($r=0.73$, $p=0.04$), overage students ($r=0.79$, $p=0.02$) and students who acquired binge drinking in college ($r=0.76$, $p=0.03$).

Xie *et al.* (2000) (Cross-sectional time series analysis) Canada

Xie assessed the relationships between alcohol availability measures (rate of licensed premises, year in which legal drinking age was reduced) and per capita consumption of alcohol in adults aged 15 yrs and over in Canada. Alcohol outlet density was expressed as the number of retail outlets or agencies per 10,000 adult population. The real price per litre of absolute alcohol and legal drinking age were also included as covariates. Alcohol outlet density was described as having had a significant positive relationship with alcohol consumption ($p \leq 0.05$).

Reports of natural experiments of the impact of changes of alcohol outlet density on alcohol consumption and related outcomes

Cohen *et al.* (2006) (Analysis of longitudinal ecological data) USA

The longitudinal analysis by Cohen *et al.* was undertaken to examine the effect of neighbourhood changes, including alcohol outlet density, on rates of gonorrhoea. The Civil Unrest that occurred in Los Angeles in 1992 resulted in the closure of 270 alcohol outlets due to arson and vandalism. A community mobilisation effort, in conjunction with new conditional use zoning laws that restricted the opening of alcohol outlets, led to the 270 alcohol outlets surrendering their licences.

The primary outcome of the analysis was the annual age and sex-adjusted gonorrhoea rate (1988-1996) at census tract level. The mean proportion of off-premise outlets that surrendered their licence in 1992 was 3% (SD=12). The mean pre-post Civil Unrest change in number of off-premise outlets per road mile was 0.01 (SD=0.09). Four individual growth models were used to predict age-sex adjusted gonorrhoea rates. The first three models investigated separately the hypothesised association of a riot-related key predictor (including the proportion of off-premise alcohol outlets surrendered, physical damage due to the Unrest, and alcohol outlet density) with gonorrhoea rates, after controlling for other time-varying and tract level covariates and an overall time trend. A fourth model included all three riot-related predictors. All models controlled for baseline gonorrhoea rates, proportions of the population who were Black, Hispanic, and male, and socioeconomic status. The final model explained 92% of between-tract variance and 93% of within-tract variation. All predictors except for socioeconomic status were statistically significant ($P < 0.01$). The average gonorrhoea rate in 1992 for census tracts with no damage was 110 per 100,000. In 1992, a tract with damage had 56 additional cases of gonorrhoea per 100,000 than a tract without damage. The overall temporal trend was for a decline of 11 gonorrhoea cases per 100,000 for a non-damaged, 'average' tract and a more rapid decline of 33 cases per 100,000 annually for damaged tracts. Tracts with more off-premise liquor outlets surrendered in 1992 had higher gonorrhoea rates ($P < 0.001$) at baseline than tracts with fewer licences surrendered. However, the rate of decline over time for tracts with more surrendered licences was more rapid than in tracts with fewer surrendered licences. For a typical tract in LA with 5 off-premise outlets, the effect size of closure of one of the outlets equated to 42 fewer gonorrhoea cases per 100,000 (with other census tract characteristics set at an average value). Having controlled for the effect of property damage and surrendered licences, there was a positive association between alcohol outlets and gonorrhoea rates. The median number of off-premise outlets per roadway mile was 0.36, with an average number of 16 roadway miles per census tract. Therefore, for a census tract with a median outlet density and average characteristics, there would be 62 additional gonorrhoea cases per 100,000 compared to a tract with zero outlet density. Following the Civil Unrest, a unit decrease in the number of alcohol outlets per mile of roadway was associated in 21 fewer gonorrhoea cases per 100,000 ($P < 0.01$) in tracts affected by the Unrest compared to those areas not affected.

Thus, this study demonstrated that alcohol outlets appear to be significantly associated with changes in gonorrhoea rates. However, it is unclear whether other social changes that

occurred following the Unrest and were not controlled for in the analysis may have contributed to the increase in gonorrhoea.

Her *et al.* (1999) (Literature review)

This work was based on a review of the research evidence relating to the effects of the privatisation of alcohol retail monopolies in the USA, Canada and Scandinavia. The authors found that the privatisation of alcohol retail monopolies tended to result in higher outlet densities, longer hours or more days of sale, and changes in price and promotion, typically resulting in increased per capita rates of alcohol consumption.

Mäkelä *et al.* (2002) (Literature review) Scandinavia

The authors performed a literature review of evaluation studies of changes in alcohol availability from the previous 50 yrs in Nordic countries, providing a large evidence base consisting of natural experiments of the impacts of interventions affecting the availability of alcohol. Detail is presented as the reported findings allow.

Introduction of new types of beer in grocery stores

Finland, 1968/69

Prior to the policy change, beverages >2.8% abv were only available in the 132 Alko state-owned alcohol retail monopoly stores and in the 940 licensed restaurants. Furthermore, pre-reform, there were no Alko stores allowed in rural communities and very limited licensed restaurants. From 1969, medium-strength beer <4.7% abv was permitted for sale in grocery stores (17,431) and cafes (2716) following receipt of a licence from Alko. The ban on rural Alko stores also ceased. Therefore, in 1969, the number of fully licensed restaurants rose by 46% and Alko retail stores by 22%, resulting in a 46% increase in total consumption, 125% increase in consumption of beer, 242% increase on consumption of medium-strength beer, 12% rise in consumption of spirits and a fall in consumption of light beer of 50%. The relative increases were greater for women and people living in previously 'dry' rural areas. The frequency of light drinking occasions (1-4 cl pure alcohol, approximately 3 drinks) increased the most.

Clear increases were observed in morbidity, mortality and arrests for drunkenness (with arrests increasing particularly among men <18 yrs (230% increase) and among women (160% for all women, 340% women under 18). Between 1968 and 1974 (during which time alcohol consumption rose 120%), the male admission rate for alcohol psychosis increased by 110%, pancreatitis 100%, alcoholism 70%, liver cirrhosis 20% and small increase in alcohol poisonings. Increases were even greater among women: alcoholism 140%, alcohol psychosis 130%, alcohol poisoning 90%, pancreatitis 40%, with no increase observed for cirrhosis. Mortality from liver cirrhosis increased by 50%.

Finland, 1993/94

Following the policy change described above, some municipalities in Finland did not permit sales of medium-strength beer or subsequently cancelled permits for sales. A case study based in Jakobstad in 1993 was carried out. In this case, increased availability did not result in increased overall alcohol consumption. Sales from Alko were found to have decreased by 30% vs the previous year. Medium strength beer consumption increased among youth (13-17 yrs) (30 to 44%) but not total consumption. There was no visible impact on public drunkenness.

Sweden, 1965-77

Medium strength beer (maximum 4.5% abv) was introduced in Sweden for sale from grocery stores in 1965. No age limits for purchase were set initially, but an age limit of 18 yrs was introduced in 1972. Medium-strength beer was subsequently withdrawn from grocery stores in 1977. Following the change, total consumption increased by 15% between 1961 and 1977. This beer was found to be popular among youth, being the predominant drink during 1977. Following abolition, consumption of less strong beer and strong beer increased, but a decrease in total beer consumption among youth was seen (with consumption of wine and liquor remaining stable).

Sweden, 1967-68

In November 1967, an experiment with sales of strong beer (max 5.6% abv) in grocery stores was undertaken in 2 counties (where previously beer of only 4.5% abv was available). It was found that sales of strong beer increased by 1124%, compared to 30% for control counties. One year after the trial, experimental counties still had higher sales vs 1967 than controls,

indicating that the experiment had long-term consequences on alcohol consumption. No clear impact on arrests for drunkenness were apparent.

Abolition of beer in grocery stores

Finland 1975-77

During the 1970s, permits for the sale of medium strength beer were withdrawn in several municipalities in Finland. A case study was conducted in five municipalities. Four of the five areas included an alternative source for the purchase of alcohol. A decrease of approximately 8% in total alcohol consumption was observed, showing that, whilst the introduction of medium-strength beer caused a considerable increase in alcohol consumption, local bans could only produce a small decrease. The uses of illegal and non-beverage alcohol also increased in some municipalities

Norway 1972, 1975, 1981

The abolition of beer in grocery stores in Norway resulted in no significant change in total alcohol consumption and a shift from medium-strength beer to other alcoholic beverage types.

Legalisation of beer sales

Iceland, 1989

The ban on beer stronger than 2.25% abv was lifted in 1989 and this beverage was permitted for sale in monopoly stores and licensed restaurants. The legalisation of this beverage type caused an increase in total alcohol consumption (particularly among men and male adolescents aged 13-19 yrs), with a shift from spirits to beer being observed.

Opening of wine or liquor stores

Finland, 1951

Surveys were conducted in 3 test municipalities and 2 control municipalities in 1951 before introduction of Alko beer and wine stores in previously 'dry' rural areas in Finland and were repeated in either 1952 or 1953. Strong wines included in stores (as result of liberalisation of purchase permit buyer surveillance system) within few months after opening and came to dominate sales. The introduction caused an increase in the consumption of alcohol, with an increase in volume and frequency among men.

Norway, 1961, 1968, 1971, 1991

An increase in the numbers of state-owned monopoly outlets resulted in no changes in total alcohol consumption, a slight increase in consumption among women and older people, smaller but more frequent alcohol purchases, an increase in wine consumption, decrease in consumption of moonshine and no evident changes in alcohol-related consequences.

Introduction of light beer

Norway, 1985

Light beer with content less than 2.5% abv was introduced in Norway in 1985. This beer was found to be cheaper than other beers and well marketed. Sales increased by 60% on a 12 month basis but still only represented 6-7% of the total beer sales in litres. No effect on total consumption was found.

This review therefore provided evidence of the variable impact of changes in alcohol outlet density.

Summary of findings

The positive association between increases in outlet density and increases in alcohol consumption among adults was demonstrated in a range of studies drawn from the USA (Gruenewald *et al.*, 1993; Schonlau *et al.*, 2008; Scribner *et al.*, 2000; Wagenaar & Holder, 1995) and Canada (Trollid, 2005a (privatisation only); Trollid, 2005b; Xie *et al.*, 2000). A similar relationship was also observed in studies focusing on young people in the USA (Treno *et al.*, 2008; Weitzman *et al.*, 2003), Switzerland (Kuntsche *et al.*, 2005; Kuntsche *et al.*, 2008), New Zealand (Huckle *et al.*, 2008; Kypri *et al.*, 2008) and Australia (Livingston *et al.*, 2008). However, Pollack *et al.* (2005) found no significant association between alcohol outlet density and heavy drinking among adults in a USA-based study. Studies focused on either on-licensed, off-licensed premises or both, with no apparent trend differentiating the impact of alcohol outlet type on alcohol consumption. However, Kuntsche *et al.* (2008) found on-licensed but not off-licensed outlet density to be associated with alcohol consumption among young people.

An evidence base grounded in natural experiments of the effects of changes in alcohol outlet density on alcohol-related outcomes was also described. Increases in alcohol outlet density were typically associated with increases in alcohol consumption and alcohol-related morbidity and mortality in Nordic countries (Mäkelä *et al.*, 2002). A literature review relating to the effects of the privatisation of alcohol retail monopolies also showed a link between privatisation and higher outlet densities, longer hours or more days of sale and changes in price and promotion, which, in combination, tended to result in increased per capita rates of alcohol consumption (Her *et al.*, 1999). An association between alcohol outlet density and gonorrhoea (Cohen *et al.*, 2006) was also found.

A considerable body of evidence has therefore been identified that indicates a link between alcohol outlet density and a range of outcomes, particularly alcohol consumption. However, whilst these association studies clearly demonstrate the existence of a relationship between alcohol outlet density and alcohol consumption, it should be borne in mind that the relationship between density and drinking may be simultaneous, as reported in the studies by Godfrey *et al.* (1988) and Gruenewald *et al.* (1993) and reviewed by Livingston *et al.* (2007). Godfrey *et al.* (1988) observed a relationship between licensing and beer consumption, whereby new licences stimulated more demand. Similarly, Gruenewald *et al.* reported that the relationship was strongest from the direction of outlets to sales, with increased outlets leading to increased sales. Neighbourhood characteristics are likely to influence drinking patterns. Indeed, among our included studies, Scribner *et al.* (2000) demonstrated that the relationship between outlet density and consumption operated at a community rather than individual level, suggesting that the drinking activity of a person may be influenced by the consumption of their social network and the physical and social configuration of their local environment towards alcohol. Livingston *et al.* (2007) concluded their review by suggesting that consideration should be focused towards the effects of bunching of alcohol outlets, and that any such policies should be grounded in local level information and research.

A limitation of the evidence base relates to the difficulty in disentangling the relative contributions of each type and size of outlet to changes in outcomes. Many of the studies assessed the impact of the privatisation of alcohol retail monopolies. It should be taking into account that, in addition to changes in outlet density, privatisation may also be accompanied by changes in pricing, promotion, licensing hours, enforcement of minimum legal age of purpose and responsible service. Therefore, the degree to which individual studies have attempted to control for such confounding variables affecting availability should be

considered. Furthermore, issues such as the variable degrees of remoteness and differences in the legal driving age that differ across settings should be taken into account during consideration of the evidence.

Evidence statements

Evidence statement 2.22

A clear positive relationship between increased outlet density and alcohol consumption among adults was demonstrated in a range of association studies.^{1,2,3,4,5,6,7} However, one study found no significant association between alcohol outlet density and heavy drinking.⁸

¹ Gruenewald *et al.*, 1993 (Cross-sectional time-series analysis) USA

² Schonlau *et al.*, 2008 (Regression analysis) USA

³ Scribner *et al.*, 2000 (Multi-level analysis) USA

⁴ Wagenaar & Holder, 1995 (Time-series analysis, ++) USA

⁵ Trollidal, 2005a (privatisation only) (Time series analysis, ++) Canada

⁶ Trollidal, 2005b (Time series analysis, ++) Canada

⁷ Xie *et al.*, 2000 (Cross-sectional time-series analysis) Canada

⁸ Pollack *et al.*, 2005 (Multi-level modelling) USA

Applicability: The above studies were performed in the USA and Canada

Evidence statement 2.23

A similar positive relationship between alcohol outlet density and alcohol consumption was also observed in studies focusing on young people.^{1,2,3,4,5,6}

¹ Weitzman *et al.*, 2003 (Analysis of correlation) USA

² Kuntsche *et al.*, 2005 (Regression analysis) Switzerland

³ Kuntsche *et al.*, 2008 (Multi-level modelling) Switzerland

⁴ Huckle *et al.*, 2008 (Multi-level modelling) New Zealand

⁵ Kypri *et al.*, 2008 (Analysis of correlation) New Zealand

⁶ Livingston *et al.*, 2008 Australia (Multi-level modelling)

Applicability: The above studies were specific to the USA, Switzerland, New Zealand, and Australia.

Evidence statement 2.24

No apparent trend differentiating the impact of alcohol outlet licence type on alcohol consumption was observed. However, Kuntsche *et al.* (2008)¹ reported that on-licensed but not off-licensed outlet density to be associated with alcohol consumption among young people.

¹ Kuntsche *et al.*, 2008 (Multi-level modelling) Switzerland

Applicability: The above study was carried out in Switzerland.

Evidence statement 2.25

A number of natural experiments were described that demonstrated the effects of changes in alcohol outlet density on alcohol consumption and alcohol-related outcomes. Increases in alcohol outlet density tended to be associated with increases in alcohol consumption and alcohol-related morbidity and mortality in Scandinavia (Mäkelä *et al.*, 2002).¹ The privatisation of alcohol retail monopolies in the USA, Canada and Scandinavia was linked with higher outlet densities, longer hours or more days of sale and changes in price and promotion, typically resulting in increased alcohol consumption.² (Her *et al.*, 1999). An positive association between alcohol outlet density and gonorrhoea (Cohen *et al.*, 2006) was also observed following the Civil Unrest in Los Angeles, USA.³

¹ Mäkelä *et al.*, 2002 (Literature review) Scandinavia

² Her *et al.*, 1999 (Literature review) USA, Canada, Scandinavia

³ Cohen *et al.*, 2006 (Analysis of longitudinal ecological data) USA

Applicability: The above research originated in Scandinavia, the USA and Canada.

Evidence statement 2.26

Evidence was identified that demonstrated that the relationship between outlet density and consumption functioned at a community rather than an individual level, suggesting that the drinking activity of a person may be influenced by the consumption of their social network and the orientation of their local environment towards alcohol.¹

¹ Scribner *et al.*, 2000 (Multi-level analysis) USA

Applicability: The above study was specific to the USA.

5.2.2.6 Review 2.5 Interaction between off-licence and on-licence availability of alcohol

This sub-section of the review relates to the interaction between off-licence and on-licence availability, namely the practice of pre-drinking, whereby individuals consume off-licensed purchased alcohol in a private setting, usually the home, before attending an on-licensed venue, and that of post-drinking, where individuals consume alcohol after they return home. Three papers have been included for this section.

Holloway *et al.* (2008) (Case studies) UK

Case studies were conducted to explore domestic drinking practices, the meaning of home and alcohol policy in England.

Two case study sites were selected: Eden in Cumbria and Stoke-on-Trent. A mixed methods approach was adopted, employing i) a Questionnaire survey of a sample stratified to reflect the make-up of the local population in each area (n=1139); and ii) in-depth interventions (n=63) with a purposive sample including a range of drinkers and non-drinkers balanced in terms of gender, age and class (and being 100% White in Eden and more ethnically diverse in Stoke). The reported outcomes of pre-drinking attitudes and activity are relevant to this assessment and are described.

40% reported being likely to have drink before going out for the night, whilst 23% were likely to have drink after returning home from a night out. Quantitative data demonstrated that the likelihood to drink before a night out did not vary by gender but varied significantly by age, religion and social class (no data reported). Young people were over-represented among those very likely to drink before a night out; whilst those aged over 55 were over-represented among those very unlikely to do so. 47% of religious people reported being very unlikely to drink before going out vs 32% of their secular counterparts. Those from a higher social class were over-represented among those who drink before a night out (although the authors stated that 'all social groups were represented to some degree') (no further data presented). However, qualitative data indicated that young people of low income drank to intoxication before going out in order to save money. The findings from the interviews also suggested that motives for drinking before a night out included winding down with friends and socialising

whilst preparing for the night. The authors argue that the increased availability of alcohol via supermarkets has facilitated home drinking, with one respondent stating that 'Sainsbury's is my local.'

Hughes *et al.* (2008) (Cross-sectional Questionnaire survey, ++) UK

A cross-sectional survey was conducted by Hughes *et al.* in order to investigate the potential differences in alcohol consumption and negative nightlife experiences between young people who drink before attending city night-life venues and those who do not drink until reaching bars and nightclubs. The survey was performed between July and October 2006 in bars and nightclubs in a large city centre in the North-west of England and included 380 young people aged 18 to 35 years. All on-licensed pubs and bars in the city centre were grouped by location in one of eight nightlife zones. 10% of venues within each zone were then selected randomly for inclusion. Where venues were unwilling to participate (n=4) or unable to participate (eg. due to closure, n=7), further venues in the same zone were selected randomly. Eighteen venues participated in total. An anonymous Questionnaire investigated participants' basic demographics, frequency of utilisation of night-life, quantities of alcohol consumed prior to and during typical night out in the city and negative experiences experienced in city night-life in previous year (fighting, being verbally abused, being sexually molested, being too drunk to walk). Questionnaires were administered opportunistically by researchers (5pm to 11pm, Mondays, Wednesdays, Thursdays, Fridays, Saturdays). 85% of individuals approached agreed to participate (424/499). The Questionnaire was completed by researchers interviewing participants on a one-to-one basis. Outcomes were measured in terms of units of alcohol consumed on- and off-licence, use of and negative experiences of city nightlife venues. These outcomes were compared between individuals who reported drinking at home before visiting nightlife venues and those who did not drink until reaching the city nightlife.

The included sample was 52.1% male, with a mean age of 24.3 years. Most participants (69.0%) reported being in employment, with 28.6% being students and 2.4% unemployed. Most participants frequented pubs, bars or nightclubs at least weekly (83.9% anywhere, 65.3% specifically in city centre). Over three quarters of participants (77.4%) always drank alcohol when frequenting the city nightlife. Only 1.3% of participants never drank alcohol on a night out (and were therefore excluded from analyses). Of those who drank in the city's nightlife venues (n=375), 195 were male and 180 were female. Over half of drinkers (57.6%) consumed alcohol prior to a night out (55.4% male vs female 60.0%, P=0.366), with no significant difference according to gender evident in pre-nightlife units consumed (both

genders combined=6.9, male=6.6, female 7.2 units consumed ($P=0.228$)). 26.5% of female and 15.4% of male alcohol consumption over a night out occurred prior to attending nightlife. It should be noted that the units consumed as part of pre-drinking already exceed the recommended units per day for men and women. In public drinking places, total alcohol consumption was significantly higher for men than women (mean values (units), both genders combined=16.2, male=20.1, female 12.0, $P<0.001$). Therefore, although women consumed a higher proportion of their overall alcohol intake before visiting nightlife, the total alcohol consumption (prior and during typical night out) was higher among males than women (mean units: both genders combined=20.2, male= 23.7, female=16.3, $P<0.001$). Although there were no differences in the quantity of alcohol consumed in bars, pubs and nightclubs between those who drank before going out (15.8 units) than those who do not (16.8 units, $P=0.300$), when combining total alcohol consumption, participants who reported drinking prior to attending nightlife (such as at their own or a friend's home) reported a significantly higher total alcohol consumption over a night out than individuals who did not drink until reaching bars and nightclubs.

A total of 10.5% of participants had been involved in fight in the city nightlife in the previous 12 months. Fighting was found to be more likely among pre-nightlife drinkers (13.4% vs. 6.9%, $P<0.05$). Pre-nightlife drinkers were also more likely to have been sexually molested whilst drunk (11.6% vs 5.0%, $P<0.05$) or too drunk to walk than individuals who had not drunk alcohol before visiting nightlife venues (43.7% vs 29.6%, $P<0.01$).

Logistic regression analysis was used to investigate the factors independently related to negative experiences and high alcohol consumption (defined as >20 units before and during nightlife drinking combined). Subjects who drank before going out were 2.5 times more likely to have been in a fight (OR (drinking before/no drinking before night out)=2.575, 95%CI 1.22 to 5.45) and over 4 times as likely to drink >20 units (OR=4.481, 95%CI 2.73 to 7.37). People drinking >20 units were more than twice as likely to have been sexually molested (OR (>20 units/1-10 units) = 2.333, 95%CI 0.86 to 6.22). Women were much more likely than men to have been sexually molested (OR=6.697, 95%CI 2.65 to 16.90) Students were significantly less likely to have been involved in a fight (OR (not student/student)=4.757, 95%CI 1.62 to 13.96) and to have consumed >20 units than non-student participants (OR (not student/student)=1.722, 95%CI 1.03 to 2.88). Individuals drinking on more than 1 day in the preceding 7 days before survey were more likely to have been in a fight in the last 12 months,

with those drinking 2 to 4 days a week being at greatest risk (OR vs. 0-1 days drank in last week=4.718, 95%CI 1.38 to 16.10).

This evidence therefore that demonstrates people who drink before visiting nightlife venues consume more alcohol over the course of the evening and are at greater risk of being involved in violent incidents. The authors suggested that prevailing differences in pricing and policing of alcohol between on and off licensed premises may promote at-home drinking before nights out. No evidence was presented relating to alcohol consumption after returning home.

Wells *et al.* (2009) (Literature review)

The purpose of this review was to report the research, policy and prevention implications of pre-drinking or pre-gaming, defined by the authors as planned heavy drinking prior to going to a public drinking establishment.

Heavy pre-drinking before going out was described as being a common and popular practice among young adults internationally. Apparent motivations for pre-drinking included: avoiding paying for high priced drinks at commercial drinking establishments; achieving drunkenness and the enhancement and extension of leisure time; socialising with friends, reducing social anxiety or enhancing male group bonding before night out. Wells noted that private drinking sometimes occurs in preparation for event where alcohol not available, particularly among young drinkers (Pedersen and LaBrie, 2007) and is popular and celebrated activity among young adults (especially in college/university drinking culture).

Pedersen and LaBrie (2007) found 64% of students at US college setting engaged in pre-drinking before attending a bar, party or concert, with increased negative consequences. Of those students who had been referred for mandatory intervention at private liberal arts university in USA following alcohol-related violation, 31% had been pre-drinking on that night, with higher consumption than non-pre-drinkers (Borsari *et al.*, 2007).

An economic motive for pre-drinking was shown in studies in the USA (DeJong & DeRicco, 2005) and Glasgow, UK (Forsyth, 2006). Becoming intoxicated was also a deliberate motive for pre-drinking in the USA (DeJong & DeRicco, 2005) and UK, where intoxication was described as being a strategic goal (Parker & Williams, 2003). Some individuals favour pre-drinking as an option for socialising with friends in quieter pre-nightlife setting, as reported in

studies from the USA (DeJong & DeRicco, 2005) and Glasgow, UK (Forsyth, 2006). Grazian (2007) also found use of pre-drinking in male bonding in male college students. Pre-drinking also is used to relieve social anxiety at the individual's intended destination (Pedersen and LaBrie, 2007, DeJong & DeRicco, 2005, Forsyth, 2006).

Limited existing evidence indicated that pre-drinking is linked with uncontrolled, heavy drinking and harmful consequences. Two studies described young people passing out or becoming too intoxicated to go out through pre-drinking (DeJong & DeRicco, 2005; Kellner, 2008). Pre-drinking also has been observed to result in participants consuming increased amounts of alcohol over the course of the evening, above planned levels (DeJong&Ricco, 2005; Pedersen & LaBrie, 2007; Glindemann et al., 2006; LaBrie & Pedersen, 2008).

The authors argued that alcohol policies restricting the availability of alcohol licensed premises may lead to the displacement of drinking to pre-drinking in private settings, possibly resulting in greater harm to individuals. Suggested approaches included making on- and off-licensed alcohol prices more balanced (with Wells stating that the differential in prices between on- and off-licence premises potentially supporting pre-drinking), and attempting to attract young people back to licensed premises for early drinking, where this activity could be under more control.

Summary of findings

Pre-drinking was described as being a prevalent activity in England, particularly among young people, those from a secular background and higher social class (although low income groups were described as participating in this drinking activity) (Holloway *et al.*, 2008).

Motives for pre-drinking included the goal of saving money by consuming more cheaply-priced alcohol at home, socialising with friends in a quieter setting, winding down and reducing social anxiety (Hollway *et al.*, 2008; Wells *et al.*, 2009).

However, some evidence was identified that showed than pre-drinking was associated with greater alcohol consumption over the course of the night (Hughes *et al.*, 2008; Wells *et al.*, 2009) and greater risk of harm, including being involved in violent incidents (Hughes *et al.*, 2008).

Evidence statements

Evidence statement 2.27

Evidence was identified that pre-drinking is a prevalent activity, both in the UK^{1,2,3} and internationally.³

¹ Hughes *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

² Holloway *et al.*, 2008 (Case studies) UK

³ Wells *et al.*, 2009 (Literature review) International

Applicability: The two included primary studies are contemporary and specific to the English population. Further UK and international evidence was described in the literature review.

Evidence statement 2.28

Pre-drinking is particularly common among young people, those from a secular background, with evidence suggesting that this activity is participated in by people from both low income and higher social groups.¹

¹ Holloway *et al.*, 2008 (Case studies) UK

Applicability: This study was specific to the English population.

Evidence statement 2.29

Economic and social motives were cited for participating in pre-drinking behaviour.^{1,2}

¹ Holloway *et al.*, 2008 (Case studies) UK

² Wells *et al.*, 2009 (Literature review) International

Applicability: The included primary study was specific to the English population. Further UK and international evidence was described in the literature review.

Evidence statement 2.30

Evidence was identified that demonstrated that pre-drinking is associated with heavy alcohol consumption^{1,2} and increased risk of alcohol-related harm.¹

¹ Hughes *et al.*, 2007 (Cross-sectional questionnaire survey, ++) UK

²Wells *et al.*, 2009 (Literature review) International

Applicability: The included primary study was specific to the English population. Further UK and international evidence was described in the literature review.

5.3 Review 3: The effectiveness of the control of alcohol promotion (e.g. advertising) in reducing levels of consumption, alcohol misuse, alcohol-related harm or alcohol-related social problems among adults and young people

5.3.1. Quantity and key characteristics of included research

A newly published and very comprehensive systematic review of the effects of advertising/promotion on alcohol consumption and related-harm was undertaken by Booth *et al.* (2008) and was included as the primary source of evidence for this review. A further systematic review was identified and has also been included. In addition to the included review by Booth *et al.* investigating the relationship between advertising/promotion and alcohol consumption or directly to harm, the same authors also performed a comprehensive review of the associations between alcohol consumption and related outcomes and (whilst not reported here) is available in the public domain as a further source of relevant evidence. A total of two comprehensive systematic reviews have been included to address this review.

5.3.2 Overall narrative synthesis of review findings

Anderson *et al.* (2009) (Systematic review, ++)

This systematic review was performed in order to examine the effects of alcohol advertising and media exposure on future alcohol use among adolescents.

The searches undertaken were comprehensive, covering a range of health, sociological, psychological and grey literature resources. Studies were included if they were longitudinal studies assessing individuals' exposure to commercials and media and alcohol drinking behaviour at baseline and also assessed alcohol drinking behaviour at follow-up in participants aged ≤ 18 yrs (with the exception of studies conducted in the USA, where legal drinking age of 21 yrs was taken as the cut-off). The intervention reviewed was alcohol mass media advertising by the alcohol industry (including the portrayal of alcohol in the mass media, alcohol promotion and media exposure containing alcohol advertisements. Mass media routes included advertising delivered via television, radio, newspapers, outdoor advertising, posters and so on. Alcohol promotion included give-aways and items bearing alcohol industry branding.

Thirteen longitudinal studies were included that followed up a total of >38,000 young people, with sample sizes in individual studies ranging from 630 to 6522. These studies included

differing age groupings that ranged between 10 and 21 yrs at baseline. Ten studies were performed in the USA, one in Belgium, one in Germany and one in New Zealand, with data collection periods ranging between 1985 and 2005. Two studies assessed the effects of media exposure (television and music videos) on alcohol use; three studies focused on alcohol use in motion pictures; two studies covered a range of marketing exposure (including television, magazines, concession stands at sports or music events, and in store advertisements; two studies tested ownership of alcohol branded merchandise; one study looked at TV alcohol commercials alone; one study, recall and liking of advertisements; one study, outdoor advertising; one study, brand recognition, recall and receptivity to alcohol marketing; and one study, volume of and expenditure on advertisements. Drinking activity was reported by included studies as follows: seven studies described initiation of alcohol use amongst non-drinkers, three studies reported on maintenance and frequency of drinking amongst baseline drinkers, and seven studies presented alcohol use of the total sample of non-drinkers and drinkers at baseline. In 10 studies, participants were followed up once. Data were collected at time points ranging from a few months to several years.

Twelve of the thirteen studies reported that exposure had an impact on subsequent alcohol use among adolescents, including initiation of drinking and heavier drinking amongst existing drinkers, when potentially confounding variables (including family and peer drinking and relevant demographic variables) were controlled for. A single study (testing the effects of outdoor advertising located near school settings) did not observe an impact on alcohol use. However, an impact on intentions to use alcohol in the next month was found. Seven studies demonstrated a dose-response relationship between exposure and alcohol use. However, the review authors stated that it is not possible to determine whether all potentially confounding variables were controlled for.

Anderson *et al.* concluded that exposure to alcohol advertising and promotion was associated with the initiation of adolescent alcohol consumption and with increased consumption amongst adolescents who were drinking at baseline assessment.

Booth *et al.* (2008) (Systematic review, ++)

Booth and co-authors performed a systematic review to investigate the relationships between advertising/promotion and alcohol consumption or directly to harm.

The search methods employed to identify relevant literature were comprehensive, encompassing a range of health, economics and social sciences evidence resources and searching of sources of grey literature. Studies were included if they were systematic reviews, research studies, data analyses (reporting quantitative data from routine or ad hoc datasets irrespective of whether they had an empirical base) and economic studies. Booth *et al.* carried out additional syntheses of findings relating to underage drinkers (under the age of 18 yrs), young adult binge drinkers (aged 18-25 yrs, drinking more than the equivalent of 6 UK units (women)/8 UK units (men) on a single occasion), harmful drinkers, (individuals regularly drinking more than the equivalent of 35 UK units per week for women/50 UK units per week for men), and those on low incomes.

The following interventions were included in the review:

Promotion:

- Advertising interventions
- Promotion interventions

Types of outcome measure(s) included were as follows:

Consumption

- Decrease in consumption
- Increase in consumption
- Increased intention for purchase
- Increased intention for consumption
- Substitution of one type of alcohol for another
- Substitution of alcohol for another product
- Substitution of another product for alcohol

Health

- Harmful effects on health
- Health benefit

Social

- Social harm, including teenage pregnancy, crime, detrimental effects on social cohesion
- Social benefit, including potential positive effects on social capital
- Increased awareness of alcohol advertising

Economic

- Economic harm

Economic benefit

Price elasticity

Seventy studies including 2 meta-analyses met inclusion criteria.

Measuring the impact of alcohol advertising

The meta-analysis performed by Gallet (2007) included 132 studies. Studies were published between 1945 and 2003, with the majority of studies originating in the USA. Smith & Foxcroft (2007) undertook a systematic review of the effect of advertising on alcohol consumption among young people and identified 7 cohort studies from a range of settings including the USA, Belgium and New Zealand.

Booth *et al.* presented the median advertising elasticities calculated by Gallet (2007) as follows: beer (0.020); wine (0.007); spirits (0.070) and alcohol (0.032), and described an advertising elasticity for beer of 0.020, representing that for every 10% increase in advertising expenditure, the expenditure on beer increased by 0.2%.

Findings from the systematic review by Smith and Foxcroft (2007) were also described, which demonstrated the relationship between exposure to alcohol advertising and subsequent alcohol consumption. Booth noted that the form of analysis employed by Gallet used high-level aggregates of advertising expenditure and that such an approach was not able to differentiate between different forms of advertising or types of consumers. Furthermore, it was noted that the cohort studies, as identified by Smith and Foxcroft (2007), can be prone to confounding and that residual confounding may have influenced the analysis. Booth *et al.* described the evidence as demonstrative of a small but consistent relationship between advertising and alcohol consumption at a population level and among young people at an individual level. In addition, the evidence was considered to be supported by consumer studies, which show alcohol advertisements to result in positive expectancies and attitudes related to alcohol.

Specific types of advertising and promotion

Price & Point of Sales Promotions

Twelve studies were included by Booth *et al.*, the earliest of which was published in 2000, with the majority being published in the USA (with isolated evidence emerging from the UK,

Australia and New Zealand). Studies were typically longitudinal in design. The evidence base was described by the authors as being moderately but consistently suggestive of the likely influence of point of purchase promotions on the overall alcohol consumption of underage drinkers, binge drinkers and regular drinkers.

Booth described the findings by Kuo *et al.* (2003). This study utilised a scoring system for establishments made up of an off-premises establishment index score (consisting of a summed score of 5 items; sale of party balls or kegs, low sales price on 12 and 24-packs, any beer promotions and exterior and interior ads) and an on-premises establishment index score (made up of a summed score of 8 items: beer specials, special promotions in the following 30 days, low sale prices, interior and exterior signage, promotions, no interior or exterior signage of alcohol warning and any age verification policies). These two establishment indices were then combined to produce a single total alcohol environment score. This study found that campuses with higher on- and off-premise establishment index scores were associated with higher binge-drinking, past 30-day drinking and past year drinking rates. The study by Pedersen (2002) that showed that binge drinkers were likely to be differentially impacted by promotions was presented. In addition, early experimental work by Babor *et al.* (1978) suggested that consumption to increase significantly during happy hour promotions among both occasional and heavy drinkers was discussed.

Billboard & Print Media

Ten studies were included in this subsection of the systematic review, most of which focused on magazines or billboards as advertising media. The earliest study was published in 1997, most were cross-sectional in design and the majority were performed in the USA. Most of these investigated the impact of either magazines or billboards as advertising media.

Booth described that the evidence consistently suggested that exposure to billboard and print media may serve to increase initiation of alcohol consumption, and also frequency and quantity of consumption among young people.

Alcohol related merchandising

Four studies were included that examined the effect of alcohol-related merchandising on alcohol awareness or participation in USA populations.

Booth *et al.* reported that the evidence from cross-sectional studies was consistently demonstrative of high levels of ownership of such merchandise among young people, especially among underage drinkers and binge drinkers. Some inconclusive evidence was identified that ownership of alcohol-related merchandise was linked with initiation of or current alcohol consumption.

Broadcast media

Thirty one studies met the inclusion criteria, the earliest of which was published in 1988. Studies were drawn from a range of countries: 21 from the USA, 5 from the UK, 3 from New Zealand, 1 from Belgium and 1 from Canada.

Booth *et al.* reported that evidence from longitudinal studies consistently demonstrated that exposure to television and other forms of broadcast media were related to initiation of and levels of alcohol consumption, but that evidence relating to the impact of the home-viewing videos was inconclusive.

Advertising bans and other restrictions

Ten studies were included, 9 of which were undertaken in the USA. Studies were either econometric studies modelling the anticipated effect of a ban or were natural experiments evaluating the actual impact of a ban.

The authors discussed the findings of the UK-based study by Godfrey (1994) that had estimated that a 1% reduction in alcohol advertising would be associated with a 0.1% reduction in alcohol consumption. Furthermore, the estimation by Saffer & Dave (2003) that the total elimination of alcohol advertising could reduce adolescent monthly alcohol participation by approximately 24% and binge participation by approximately 42% was presented. Booth *et al.* discussed the prevailing argument that advertising bans would not reduce consumption and presented findings from the modelling exercise by Fisher & Cook (1995), in which changes in advertising were un-related to changes in consumption, but advertising played a role in influencing market share for different beverage types. Booth *et al.* reported that the evidence base was inconclusive but suggested that bans on advertising may reduce consumption and that bans might be most effective alongside other restrictive measures.

Industry self-regulation of alcohol advertising standards

No studies were identified by the review authors relating to the impact of industry self-regulation of alcohol advertising standards.

Booth *et al.* concluded that the available evidence, whilst limited, was indicative of a modest association between alcohol advertising/promotion and alcohol initiation and consumption, but that evidence as to whether bans on alcohol advertising would reduce consumption was inconclusive. The authors suggested that elasticities in the range of 0.02 to 0.04 (Chisholm *et al.*, 2004) and 0.05 and 0.08 (Saffer and Dave, 2003) for the impact of advertising bans were credible.

Evidence statements

Evidence statement 3.1:

One systematic review¹ demonstrated a small but consistent relationship between advertising and alcohol consumption at a population level.

¹ Booth *et al.*, 2008 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Evidence statement 3.2:

A systematic review of longitudinal studies found that exposure to alcohol advertising and promotion was associated with the onset of adolescent alcohol consumption and with increased consumption amongst adolescents who were already drinking at baseline assessment.¹ Booth *et al.* presented evidence of a small but consistent relationship between advertising and alcohol consumption among young people at an individual level.²

¹ Anderson *et al.*, 2009 (systematic review, ++)

² Booth *et al.*, 2008 (systematic review, ++)

Applicability: The primary studies included in the systematic review by Anderson *et al.* were drawn from the USA (10 of 13 studies), Belgium, Germany and New Zealand. The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Evidence statement 3.3:

One systematic review presented evidence of a moderate but consistent association between point of purchase promotions and effects on alcohol consumption among underage drinkers, binge drinkers and regular drinkers.

¹ Booth *et al.*, 2008 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

Evidence statement 3.4:

The systematic review by Booth *et al.* reported that outdoor and print advertising media may increase the probability of onset of adolescent alcohol consumption and also influence quantity and frequency of alcohol consumption among young people. The review by Anderson *et al.* included one USA-based study that reported that outdoor advertising media did not have any effect on alcohol behaviour, but was a predictor of intention to use alcohol among adolescents.²

¹ Booth *et al.*, 2008 (systematic review, ++)

² Anderson *et al.*, 2009 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand. The study included by Anderson *et al.* originated in the USA.

Evidence statement 3.5:

Reviewed studies showed the high prevalence of ownership of alcohol-related merchandise among young people.¹ Evidence from the USA and included in the systematic review by Anderson *et al.* suggested that ownership of an alcohol promotional item or branded merchandise may be associated with increased initiation of drinking.² The relationship between such ownership and initiation of or current drinking was inconclusive.

¹ Booth *et al.*, 2008 (systematic review, ++)

² Anderson *et al.*, 2009 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand. The two studies included in the review by Anderson and co-authors were specific to the USA.

Evidence statement 3.6:

One systematic review reported that evidence from longitudinal studies consistently demonstrated that exposure to television and other broadcast media was linked with onset of and levels of alcohol consumption. Further evidence was included in the review by Anderson *et al.* indicated that exposure to alcohol portrayals via television (including advertisements aired during sports programmes) and other broadcast media may be linked with alcohol use among adolescents.²

¹ Booth *et al.*, 2008 (systematic review, ++)

² Anderson *et al.*, 2009 (systematic review, ++)

Applicability: The studies included by Booth *et al.* and Anderson *et al.* were drawn from a range of countries.

Evidence statement 3.7:

Inconclusive evidence was identified that advertising bans may result in reduced alcohol consumption.

¹ Booth *et al.*, 2008 (systematic review, ++)

Applicability: The majority of the studies included in the review by Booth *et al.* were drawn from the USA, with others from Belgium and New Zealand.

6. DISCUSSION

These systematic reviews have presented a considerable body of evidence relating to the effects of changes in pricing, availability and promotion of alcohol.

A number of considerations exist relating to the interpretation of the findings of the systematic reviews and are discussed briefly. The effects of interventions to control the price, availability and promotion of alcohol will be influenced by the regulatory environment in which they are implemented. Each study would have been undertaken under a specific combination of regulatory conditions that would have impacted on the estimate of the effectiveness of the intervention. Whilst some UK-specific evidence was identified, particularly in relation to the effects of changes in licensing hours, the majority of the included research was drawn from other countries, particularly the USA, Canada, Scandinavia, Australia, and New Zealand, typically where historical policy changes have afforded an opportunity for the study of the impacts of such changes. Therefore, country-specific factors should be taken into account during consideration of the evidence.

Equality and diversity

Evidence review criteria were inclusive, with all relevant inequalities data (relating to eg. age, sex, sexual orientation, disability, ethnicity, religion, place of residence, occupation, socioeconomic position and social capital) included, extracted and presented in the evidence reviews and evidence statements where available.

Cross-review Synthesis of Clinical and Cost Effectiveness Evidence

Control of alcohol price/taxation

The systematic review of the effects of alcohol price/taxation controls presented a considerable evidence base that was indicative of a clear relationship between price/tax increases and reductions in the demand for alcohol. Similarly, a large number of studies were discussed demonstrated a relationship between price/tax increases and reductions in alcohol-related harms. Limited evidence was found that suggested that minimum pricing may be an effective approach in reducing alcohol consumption. Limited evidence of the cost effectiveness of price controls was identified, based on two studies (one with an international perspective and one based in Estonia). Evidence suggested that in areas with a high prevalence (greater than 5%) of hazardous drinkers (such as the UK), taxation may be more cost effective than other alcohol misuse macro interventions.

Interventions to manage the availability of alcohol

Minimum legal age of alcohol purchase

Findings were suggestive of an inconclusive negative relationship between minimum legal age of alcohol purchase and alcohol consumption. Further evidence also supported the existence of a negative association between minimum legal age and alcohol-related outcomes. One US-specific study presented evidence of the theoretical economic advantages of taxation policies compared with a minimum legal age of alcohol purchase policy. However, this result may not be relevant to practice.

Enforcement of minimum legal age of alcohol purchase and management of the sale of alcohol to intoxicated individuals

Training interventions for the enforcement of underage sales were not shown to have a significant impact on sales; whilst the effectiveness of compliance checks by police in enforcing the minimum legal age of alcohol purchase was inconclusive. The systematic review also found no conclusive impact of server training to manage the sale of alcohol to intoxicated customers on the alcohol consumption of customers. However, some evidence showed reductions in alcohol-related harms, including RTAs, as a result of server training. Server training showed some positive impacts on server knowledge and refusals of service to intoxicated people. Two studies (based in the USA and Sweden) reported favourable findings for the cost effectiveness of server interventions. However the analyses were open to considerable bias.

Licensed hours and days of alcohol sale

Evaluations of the UK Licensing Act 2003 were included in the systematic review and found that, whilst levels of alcohol consumption and crime and disorder appeared to have remained stable, a temporal displacement of crime and disorder and also emergency department alcohol-related attendances had occurred, with more incidents taking place in the early hours of the morning. The Licensing Act also appeared to have had resource implications, particularly for police, health professionals. Other UK-specific and international evidence showed that increases in licensing hours were typically associated with increased consumption and/or harms. One study of moderate quality was included in the cost-effectiveness review that took an international perspective and provided evidence that reducing licensed hours of sale provided relatively small quality of life benefits compared to other alcohol misuse interventions, although the intervention was also relatively low cost.

Alcohol outlet density

The systematic review presented evidence indicative of a positive association between increases in alcohol outlet density and increases in alcohol consumption was observed among both adults and young people. Additionally, limited evidence reported a positive relationship between increases in alcohol outlet density and increases in associated harms. However, no evidence relating to the cost-effectiveness of outlet density interventions was found.

Control of alcohol promotion

The systematic review included evidence that was suggestive of a relationship between alcohol advertising and promotion and alcohol consumption, particularly among young people. The cost-effectiveness review presented limited evidence, of international, Estonian, and Canadian perspectives that suggested that in areas with a low prevalence (less than 5%) of hazardous drinkers (and not currently the case in the UK), an advertising ban would be more cost effective than other alcohol misuse macro interventions. However, the evidence for this was not strong. The available evidence indicated that in the UK a promotion intervention may be less cost effective than a taxation intervention.

7. APPENDICES

APPENDIX 1: Search Audit Table

Review 2 – Availability

#	Search terms	Database	Hits
A1	Using articles identified from search of Alcohol Reviews database (three articles), find similar articles and limit to humans and alcohol not ethanol.mp	Medline In Process and Medline 1950-2008 via OVID SP	104
A2	((alcohol or (drink* not water)).ti.) AND ((review* or systematic or meta or synthesis or analysis).ti.)	Medline In Process and Medline 1950-2008 via OVID SP	23
A3	Cited reference searching for relevant articles (41 suggested, 21 possible to search) identified from A1 and A2	Web of Science Cited Reference Search	492
A4	(alcohol and primary\$ and prevent\$.ti.	Medline In Process and Medline 1950-2008 via OVID SP	38
A5	(alcohol and restrict\$.ti. Limit to Humans and English Language	Medline In Process and Medline 1950-2008 via OVID SP	32
A6	(alcohol and enforce\$.ti	Medline In Process and Medline 1950-2008 via OVID SP	22
A7	alcohol.ti and (legislation or law or legal).ti not (driv\$ or fetal or foetal).ti. Limit to humans and English Language	Medline In Process and Medline 1950-2008 via OVID SP	103
A8	Articles from Liddy added to reference manager library	Manually added as not yet in Ref Man	4
A9	(alcohol and outlet\$.ti.	Medline In Process and Medline 1950-2008 via OVID SP	43
A10	(alcohol and premis\$.mp.	Medline In Process and Medline 1950-2008 via OVID SP	193
A11	((pub or nighclub or bar) and (alcohol)).ti.	Medline In Process and Medline 1950-2008 via OVID SP	21
A12	(licence or license) and (alcohol).ti.	Medline In Process and Medline 1950-2008 via OVID SP	18
A13	(shop\$ or supermarket\$ or store\$ or vendor\$.ti. and alcohol.ti.	Medline In Process and Medline 1950-2008 via	28

	LIMIT TO HUMANS	OVID SP	
A14	(sale\$ or sell\$ or purchas\$ or buy\$).ti. and (alcohol).ti.	Medline In Process and Medline 1950-2008 via OVID SP	103
A15	((drinking or under or legal or minimum) and age).ti. AND (alcohol or drinking).ti. LIMIT TO HUMANS	Medline In Process and Medline 1950-2008 via OVID SP	188
A16	(alcohol\$ and server).mp.	Medline In Process and Medline 1950-2008 via OVID SP	51
A17	(responsible adj2 beverage adj2 service\$).mp.	Medline In Process and Medline 1950-2008 via OVID SP	23
A18	Identified by Rachel during sourcing of articles via PubMed	PubMed	
A19	(alcohol and restrict\$).ti. Limit to Humans and English Language	Embase 1969-2008 via OVID SP	25
A20	(alcohol and enforce\$).ti	Embase 1969-2008 via OVID SP	7
A21	alcohol.ti and (legislation or law or legal).ti not (driv\$ or fetal or foetal).ti. Limit to humans and English Language	Embase 1969-2008 via OVID SP	42
A22	(alcohol and outlet\$).ti.	Embase 1969-2008 via OVID SP	34
A23	(alcohol and premis\$).mp.	Embase 1969-2008 via OVID SP	202
A24	((pub* or nightclub or bar) and (alcohol)).ti.	Embase 1969-2008 via OVID SP	17
A25	(licence\$ or licens\$) and (alcohol).ti.	Embase 1969-2008 via OVID SP	35
A26	(shop\$ or supermarket\$ or store\$ or vendor\$).ti. and alcohol.ti.	Embase 1969-2008 via OVID SP	25
A27	(sale\$ or sell\$ or purchas\$ or buy\$).ti. and (alcohol).ti.	Embase 1969-2008 via OVID SP	74
A28	((drinking or under or legal or minimum) and age).ti. AND (alcohol or drinking).ti. LIMIT TO HUMANS	Embase 1969-2008 via OVID SP	35
A29	(alcohol\$ and server\$).mp. LIMIT TO HUMANS	Embase 1969-2008 via OVID SP	45
A30	(responsible adj2 beverage adj2 service\$).mp.	Embase 1969-2008 via OVID SP	23
A31	Citation searches for records #911, #1235, #1570, #1571	Web of Science Cited Reference Search	8
A32	Author=(anderson p) AND Topic=(alcohol or drink\$)	Web of Science (all citation indices)	56
A33	outlet ADJ density) AND (alcohol	Web of Science (all citation	29

	or drink\$	indices)	
A34	Identified by Rachel during reference list searching of #237		
A35	Alcohol AND (Restrict* or enforce* or legislat* or law or legal or Outlet* or premis* or licenc* or licens* or shop* or supermarket* or store* or vendor* or sale* or sell* or purchas* or buy*) or Pub* or nightclub* or bar*) or ((drinking or minimum or under or legal) and age) or Server or (responsible adj2 beverage adj2 service\$) or outlet adj density IN TITLE,ABSTRACT	Econlit via OVID SP – limit to English	237
A36	Search as A35 except in title, abstract,keyword	NHS EED via Cochrane Library	5
A37	Title=(alcohol) AND Title=(enforc\$ or restrict\$ or legislation or law or legal or licenc\$ or licens\$)	Social Science Citation Index via Web of Knowledge	131
A38	Title=(alcohol) AND Title=(pub or nightclub or bar or server or outlet or premis\$ or responsible)	Social Science Citation Index via Web of Knowledge	79
A39	Title=(alcohol) AND Title=(shop\$ or supermarket\$ or store\$ or vendor\$ or sale\$ or sell\$ or purchas\$ or buy\$)	Social Science Citation Index via Web of Knowledge	108
A40	(TI=enforc* or restrict\$ or legislation) or law or legal or licens* or licenc*) and (TI=alcohol)	ASSIA via CSA	42
A41	(TI=alcohol) and(TI=(pub or nightclub or bar) or TI=(server* or responsible or outlet*) or TI=premis*)	ASSIA via CSA	42
A42	(TI=alcohol) and(TI=(shop or supermarket or store) or TI=(vendor or sale or sell) or TI=(purchas* or buy))	ASSIA via CSA	15
A43	Citation searches for papers highlighted on document from Rachel	Web of Science OR Google Scholar (if record not in Web of Science)	207
A44	(alcohol and (outlet or premises) and (density or densities)).ab.	Medline in Process and Medline 1950-2009 via OVID SP	67
A45	((licence or license or licencing or licensing or trade or trading) adj9 alcohol).ab.	Medline in Process and Medline 1950-2009 via OVID SP	121
A46	(pre-drinking or front	Medline in Process and	60

	loading).ti,ab.	Medline 1950-2009 via OVID SP	
A47	((alcohol or drinking) and ((premises or licenc* or licens*) and (home* or domestic))).ab.	Medline in Process and Medline 1950-2009 via OVID SP	31
A48	Topic=((alcohol and (outlet or premises) and (density or densities)))	Social Science Citation Index via Web of Knowledge	100
A49	Topic = ((licence or license or licencing or licensing or trade or trading) AND alcohol).ab.	Social Science Citation Index via Web of Knowledge	414
A50	Topic=(((alcohol or drinking) and ((premises or licenc* or licens*) and (home* or domestic))).)	Social Science Citation Index via Web of Knowledge	26
A51	Topic=((pre-drinking or front loading))	Social Science Citation Index via Web of Knowledge	51
A52	evaluation "UK Licensing Act"	Google	N/A
A53	UK Licensing Act	SIGLE	N/A
A54	evaluation "UK Licensing Act"	Web of Knowledge - Conference Proceedings Citation Index- Science (CPCI-S)	N/A
A55	evaluation alcohol purchase or Minimum alcohol age or Drinking age alcohol evaluation	Google	N/A
A56	Minimum age	SIGLE	N/A
A57	Minimum age alcohol in Topic	Web of Knowledge - Conference Proceedings Citation Index- Science (CPCI-S)	N/A
A58	("Responsible Beverage Service" Evaluation) or ("Server Training" Evaluation) or ("Bar staff training" Evaluation) or ("bar staff training" evaluate)	Google	N/A
A59	(outlet density alcohol evaluation) or (Outlet density uk) or (Cumulative impact UK)	Google	N/A

APPENDIX 2: Systematic review quality assessment tool (used for Review 6)

Criterion	Decision
Did the review ask a clearly focused question?	
Did the review incorporate primary studies of appropriate study design?	
Were the search methods used to find evidence on the primary research question stated?	
Was the search for evidence reasonably comprehensive?	
Were the criteria used for deciding which studies to include reported?	
Was bias in the selection of studies avoided? (e.g. language restrictions not applied, unpublished trials included)	
Was there duplicate study selection and data extraction?	
Were the criteria used for assessing the validity of the included studies reported?	
Was the validity of all studies referred to in the text assessed using appropriate criteria?	
Were the characteristics of the included studies provided?	
Were the methods used to combine the findings of the relevant studies reported?	
Were the findings of the relevant studies combined appropriately relative to the primary question of the overview?	
Were the conclusions made by the author(s) supported by the data and/or analysis reported in the overview?	
Can the results be applied to the UK population/population group?	
Additional comments	
Y – item addressed; N – no; P – partially; U – not enough information or not clear; NA – not applicable	

APPENDIX 3: Characteristics and main findings from studies included in the review of alcohol price controls

First author and date	Study Design & Quality	Research Objective	Setting & Study Population	Intervention(s) & Comparator(s)	Main findings
Booth et al. 2008	Systematic review, ++	To investigate the relationships between tax/price and alcohol consumption or directly to harm	Whilst studies were not limited to specific population groups, Booth <i>et al.</i> carried out additional syntheses of findings relating to underage drinkers (under the age of 18 yrs), young adult binge drinkers (aged 18-25 yrs, drinking more than the equivalent of 6 UK units (women)/8 UK units (men) on a single occasion), harmful drinkers, (individuals regularly drinking more than the equivalent of 35 UK units per week for women/50 UK units per week for men), and those on low incomes.	The types of intervention(s)/exposure(s) included were as follows: Price Tax increase(s) Tax decrease(s) Price increase(s) Price decrease(s) Policy Change in coverage of tax policies Policies with a direct effect on pricing (e.g. minimum pricing)	<p><u>Alcohol prices or taxation and the consumption of alcoholic beverages</u></p> <p>Two major meta-analyses (Gallet, 2007 (132 studies); Wagenaar <i>et al.</i> 2008 (91 studies)) and 15 further studies were included in the review in order to assess the relationship between alcohol pricing/taxation and alcohol consumption. The evidence base was described by Booth <i>et al.</i> as being strong and consistently indicative that price increases (including through taxation) resulted in significant reductions in the demand for alcohol (and conversely that decreases in price typically resulted in increases in alcohol consumption). The median price elasticities reported by Gallet (2007) were presented as follows: beer (-0.36), wine (-0.700), spirits (-0.679) and alcohol (-0.497). The analysis by Clements <i>et al.</i> (1997) of data from Australia, Canada, Finland, New Zealand, Norway, Sweden and the UK from the mid 1950s to the mid 1980s that yielded price elasticities of -0.35 for beer, -0.68 for wine and -0.98 for spirits was also described. It was stated that in the Wagenaar <i>et al.</i> review of 91 included studies, 74 found a significant negative association between prices or taxation and alcohol consumption (indicating that alcohol consumption could be predicted to decrease in response to an increase in the price of alcohol (with an overall elasticity estimate of -0.51). Mean elasticities were found to be -0.46 for beer (105 studies), -0.69 for wine (93 studies) and -0.80 for spirits (103 studies). Wagenaar <i>et al.</i> also found significant relationships ($p < 0.001$) between alcohol price or tax measures and indices of sales or consumption of alcohol ($r = -0.17$ for beer, -0.30 for wine, -0.29 for spirits and -0.44 for total alcohol). The elasticity estimates presented by Wagenaar <i>et al.</i> were described by the review authors as being similar to those reported by Gallet (2007) (who presented median price elasticities of -0.70 for wine, -0.68 for spirits, and -0.50 for all beverages, but with a slightly greater estimate of -0.36 for beer).</p> <p><u>Minimum pricing</u></p> <p>An evaluation of alcohol restrictions in a remote Australian community (Gray <i>et al.</i>, 2000) was identified that made the case that minimum pricing may be an effective public health strategy in reducing alcohol consumption and that such restrictions were supported by consulted members of the community. Booth stated that, whilst the evidence identified for the inverse relationship between price/tax and alcohol consumption may be supportive of the use of a minimum pricing policy, further research is required in order to validate these findings for UK populations.</p> <p><u>Taxation or pricing studies linked to harm</u></p> <p>Twenty four studies met the inclusion criteria for taxation studies, the majority of which were conducted in the USA. Twenty two studies met the inclusion criteria for pricing studies, again the large majority of which originated in the USA. No systematic reviews of the effects on harm of either taxation or pricing changes were found. The evidence base was described by Booth as being consistently suggestive of a relationship between increases in taxation or pricing of alcohol and decreases in harm. A number of studies described such a relationship between increases in the price of alcohol and reductions in road traffic accidents and fatalities, cirrhosis death rates, intentional and unintentional injuries, workplace injuries, sexually transmitted diseases, rapes and robberies, homicides, crime, child abuse, domestic abuse and violence-related injuries. The review authors also stated that in the United Kingdom, it was estimated that a 10% rise in alcoholic beverage prices would result in a decrease of 7.0% in male and 8.3% in female cirrhosis mortality, a reduction of 5.0% for male victims and 7.1% for female victims of homicide, and a decrease of 28.8% for male and 37.4% for female deaths from explicitly alcohol-involved causes (eg. alcohol dependence or poisoning) (Academy of Medical Sciences, 2004),</p>

Fogarty, 2006	Meta-regression analysis	To explore the contributory factors driving the variation in reported elasticity estimates.	Range of international settings	Changes in price of alcohol	The results of the meta-regression analysis indicated that year of study, length of study, per capita level of alcohol consumption and relative ethanol share of a beverage (proxy measure of market share of each beverage) acted as important factors influencing variations in the reported demand responses of consumers to changes in alcohol price. A longitudinal trend was observed whereby the consumer demand for alcohol beverages was increasingly inelastic up to 1969 and was subsequently decreasingly inelastic (displaying greater responsive consumer demand as a result of changes in price). Fogarty suggested that these temporal changes in elasticity may have been influenced by the decrease in the price of illicit drugs since the close of the 1960s, with consumers potentially having used drugs as a substitute for alcohol use. The results of the meta-regression also demonstrated that the longer the sample period of a study, the more inelastic the estimate obtained. Fogarty also found that the greater the per capita alcohol consumption level, the more inelastic the estimate of demand. A further interesting finding of this analysis was that a higher relative market share for a beverage was typically associated with more inelastic consumer demand. Such a result may be attributable to a combination of consumer preference for specific beverage types and the orientation of the alcohol market relating to different beverage types across countries (eg. lower availability of other beverage types in a setting where a beverage with a higher relative market share predominates). This study therefore concluded that a range of variables were responsible for the variations in price elasticities reported in the available literature.
Herttua <i>et al.</i> , 2008 Finland	Before and after study, ++	To assess the impact of a large reduction in the price of alcohol in Finland in 2004 on alcohol-related mortality according to age and socioeconomic group.	Finland	A large reduction in the price of alcohol in Finland in 2004 on alcohol-related mortality according to age and socioeconomic group. Taxes on alcohol fell by an average of 44%. The off-premise retail prices of spirits, wine, and beer decreased by an average of 36%, 3%, and 13% respectively.	Mortality data were examined for the periods 2001-2003 (before the decrease in the price of alcohol) and 2004-2005 (following price reduction). Alcohol-related causes were defined as both underlying and contributory causes of death. The analysis contained all Finns aged \geq 15 yrs. The men and women in the study population were described as having lived approximately 10.4 million and 11.1 million person-years respectively. The independent variables derived from employment statistics and used in the regressions included gender, age group and socioeconomic characteristics. Between 2001-2003 and 2004-2005, the number of alcohol-related deaths was reported to have increased by 16% (95%CI 12.1 to 19.4, or 22 deaths per 100,000 person-yrs) among males and by 31% (95%CI 22.0 to 40.0, or 8 deaths per 100,000 person-yrs) among females. The majority (82%) of the total increase was attributed to chronic causes, with alcoholic liver diseases alone found to have constituted 39% of the rise. The increase in alcohol-related mortality in absolute terms was largest among middle-aged men aged 55-59 yrs and women aged 50-54 yrs. Among those aged 30-59, the increase was described as being largest among the long-term unemployed or early-age pensioners and among individuals with lower levels of education, social class, or income. The authors concluded that a large reduction in price of alcohol resulted in significant increases in alcohol-related mortality, particularly in terms of chronic alcohol-related diseases.
Wagenaar <i>et al.</i> , 2009	Time series analysis, ++	To evaluate the impact of tax increases on alcoholic beverages in 1983 and 2002 on alcohol-related disease mortality in Alaska	Alaska, USA	Tax increases on alcoholic beverages were implemented in Alaska in 1983 and 2002	Statistically significant decreases in the numbers and rates of deaths caused by alcohol-related disease were observed as follows: 29% reduction in number of deaths (23 deaths averted per yr) (Cohen's $d = -0.57$) for the 1983 tax increase and an 11% decrease in deaths (additional 21 deaths averted per yr) (Cohen's $d = -0.52$) as a result of the 2002 tax increase. The authors also assessed the death rate (in order to control for temporal changes in population size), and found that the reductions were similar at 23% for the 1983 tax increase (Cohen's $d = -0.88$) and 13% for the 2002 tax increase (Cohen's $d = -0.79$). When data from comparison states were added to the model, no discernable changes in the resulting estimates were found, indicating that other states did not experience similar declines in mortality. The analysis also indicated that the impact of the tax increases showed little loss of effect over time. Wagenaar <i>et al.</i> concluded that increases in alcohol excise tax rates in Alaska were therefore related to immediate and sustained reductions in alcohol-related disease mortality.

APPENDIX 4: Characteristics and main findings from studies included in the review of interventions to manage the availability of alcohol

First author and date	Study Design & Quality (++)/+/(-)	Research Objective	Setting & Study Population	Intervention(s) & Comparator(s)	Main findings	Review Team Comments
<i>Minimum legal age of alcohol purchase</i>						
DiNardo & Lemieux 2001	Regression analysis	To investigate the effects of increasing the MLDA on the prevalence of the use of alcohol and marijuana among high school senior students	The analysis was based on a dataset covering a large sample of high school senior students from 43 states across the USA and covering the years 1980 to 1989	Increases in the minimum legal drinking age whereby, by 1988, all states had implemented a minimum legal age for the possession and purchase of alcohol of 21 yrs.	Analysis demonstrated that increases in the MLDA slightly reduced the prevalence of alcohol consumption, in terms of the number of drinkers. However, increases in the MLDA were also accompanied by a slight increase in the prevalence of marijuana consumption. The evidence suggested that increasing the MLDA from 18 to 21 yrs increased the prevalence of marijuana use by 2.4 % but decreased the prevalence of alcohol consumption among this population by 4.5% (no statistics reported).	USA
Everitt <i>et al.</i> , 2002	Before and after study, +	To determine the impact of lowering the MLDA on the presentation of intoxicated patients to a central city emergency department in Auckland, New Zealand.	All patients presenting to the adult-only \times 15 yrs) emergency department in Auckland, New Zealand	As of December 1999, a legislated reduction in the minimum legal drinking age from 20 to 18 yrs was implemented, whereby 18 and 19 yr olds could purchase alcohol in bars, restaurants, wine shops and supermarkets.	The number of intoxicated 18 and 19 yr olds who presented to the emergency department in the 12 months following the reform increased from 66 to 107 (52 to 80 for laboratory confirmed intoxication and 14 to 27 for clinical suspicion only), representing an increase in the proportion of presentations in this age group who were intoxicated from 2.9% to 4.4% (P=0.009) (RR=1.51, 95%CI 1.11 to 2.03). No increase was observed in the proportion of intoxicated presentations among those aged > 19 yrs (963 vs 992, 3.4% vs 3.3%, P=0.48, RR=0.97, 95%CI 0.89 to 1.06) (as reported). However, the authors also found an increase in presentations by intoxicated 15 to 17 yr olds (72 vs 95, p=0.07, RR=1.35, 95%CI 0.98 to 1.88).	New Zealand

Fell <i>et al.</i> , 2008	Analysis of variance and regression analysis	To investigate the relationships between underage drinking laws and drunk drivers involved in fatal motor vehicle crashes in the USA	USA	The two core laws of the MLDA 21 legislation related to the possession and purchase of alcohol, and were accompanied by a range of 14 additional underage laws varying from state to state.	Analysis indicated that the core possession and purchase laws (as a single variable) accounted for an 11.2% (P=0.041) reduction in the ratio of drinking to non-drinking drivers aged 20 yrs and younger who were involved in fatal crashes. Of the 14 expanded underage drinking laws, making it illegal to use false ID to purchase alcohol was significant.	USA
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<p>Kypri <i>et al.</i>, 2006</p>	<p>Before and after study, ++</p>	<p>To assess the impact of lowering the minimum purchasing age for alcohol from 20 to 18 yrs in New Zealand in 1999 on alcohol-related road traffic crashes and hospitalised injuries among young people aged 15-19 yrs</p>	<p>The authors calculated incidence rate ratios for the after to before incidence of alcohol-related crashes and hospitalised injuries among 18 to 19 yr olds and 15 to 17 yr olds. A reference group of 20 to 24 yr olds was included in order to account for confounding variables, including the increased availability of alcohol in supermarkets, Sunday trading and concurrent road safety programmes . The study was conducted in New Zealand.</p>	<p>Lowering the minimum purchasing age for alcohol from 20 to 18 yrs in New Zealand in 1999</p>	<p>Statistically significant increases were found in the relative after-to-before incidence rate ratios of alcohol-related crash injuries and subsequent hospitalisations for young men and women aged 15 to 19 yrs, indicating more negative outcomes since the lowering of the minimum legal age of alcohol purchase.</p>	<p>New Zealand</p>
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Ponicki <i>et al.</i> , 2007	Cross-sectional time series data analysis	To investigate the relationships between MLDA, beer taxes and youth traffic fatalities	48 US states	The analyses performed by Ponicki <i>et al.</i> explored the relationships between changes in MLDA, beer taxes and US youth traffic fatalities using panel data for 48 US states over the period 1975 to 2001.	The analysis indicated that raising the MLDA results in a decrease in youth traffic fatalities. The reduction in the MLDA had the greatest and most significant impact on fatalities aged 18 to 20 yrs, with no significant effects observed for younger (16-17 yrs) and older (25+ yrs) age groups. A smaller but still significant effect on fatalities aged 21 to 24 yrs was found. Ponicki <i>et al.</i> reported that increasing either MLDA or beer taxes in isolation resulted in fewer youth traffic fatalities, with a given change in MLDA resulting in a larger proportional change in fatalities when beer taxes are low than when they were high, as had been expected. The evidence indicated that increasing MLDA from 18 to 21 was less effective in preventing youth traffic fatalities when beer taxes are high, with the MLDA increase yielding an 11.4% decrease in fatalities among this age group if real beer taxes are unchanged at 25% below mean level; a decrease of 8.9% if prices remain at their mean level; and a reduction of 6.0% if beer taxes are 25% above their mean value. This study therefore provided a good demonstration of the manner in which measures to reduce availability may interact. The effects of interventions to manage the availability of alcohol are likely to be influenced by the regulatory context of the setting in which they are implemented.	USA
Smith & Burvill, 1987	Before and after study, +	To determine the effects of lowering the legal drinking age on juvenile crime in three Australian states	3 Australian states. Data were collected and analysed for all juvenile offences, where a juvenile was defined as being aged \leq 17 yrs.	South Australia lowered the MLDA from 20 to 18 yrs in April 1971; Queensland lowered the MLDA from 21 to 18 yrs in February, 1974; whilst Western Australia reduced the MLDA from 21 to 18 yrs from July 1970	Analyses indicated that lowering the MLDA to 18 yrs resulted in significant increases in male juvenile crime, particularly for burglary ($p < 0.05$), larceny of motor vehicles ($p < 0.05$), and drunkenness ($p < 0.01$). The observed increases were greater than those for between-state control groups of similar age and also older control groups within the same state. Among females, the resulting effects of the change in MLDA varied from state to state, with juvenile crime in this group also appearing to have increased.	Australia

Wagenaar & Toomey, 2002	Systematic review, +	To systematically review the impact of minimum legal drinking age (MLDA) on alcohol consumption, traffic crashes and health and social problems.	The majority of included studies were drawn from the USA and Canada, with 4 analyses drawn from Australia, 1 from Switzerland, 1 from Norway, and 1 from New Zealand. No studies were undertaken in the UK.	Changes in MLDA	The evidence identified in this review is suggestive but inconclusive of the existence of a negative relationship between MLDA and two outcome measures: alcohol consumption and traffic crashes. The relationship between MLDA and other health and social problems is less clear.	The majority of included studies were drawn from the USA and Canada, with 4 analyses drawn from Australia, 1 from Switzerland, 1 from Norway, and 1 from New Zealand. No studies were undertaken in the UK.
<i>Enforcement of minimum legal age of alcohol purchase</i>						
Elder <i>et al.</i> , 2007	Systematic review, +	To explore the effectiveness of enhanced enforcement programmes in the reduction of underage alcohol sales	Studies were mostly drawn from the USA	Enforcement programmes aim to increase retailer compliance and increase the perceived risk of detection. Interventions included in the review were community based efforts that included training and attempts to change alcohol related policies.	During enhanced enforcement programmes, the proportion of successful purchase attempts made by decoys fell by a median figure of 42% [inter quartile interval (IQI): -57%; -17%]. All of the studies reviewed found that enhanced enforcement was associated with a decrease in sales to decoys, but variations in effect size were attributed to the nature of the enforcement programme. Studies focusing on the enhanced enforcement at off-licensed premises reported a 60% relative decrease (Barry, 2004) and a 78% relative decrease (Perry <i>et al.</i> , 1996) in the proportion of purchase attempts that were successful. Barry (2004) also found that enhanced enforcement was associated with a 20% reduction (RR = 0.8; 95% CI: 0.7; 0.9) in both self-reported alcohol consumption and binge drinking among young people from Grades 9 to 12. Community mobilisation (in which only one of the seven intervention communities was exposed to enhanced enforcement) was associated with a 2% reduction in the prevalence of any alcohol consumption.	Studies were mostly drawn from the USA

Gehan <i>et al.</i> , 1999	Qualitative study, +	To explore the perceptions and practices of workers in on-licensed premises relating to the service of underage and intoxicated customers	USA	Service of underage and intoxicated customers	The majority expressed disapproval towards the sales of alcohol to underage youth. Although several group members reported having served an underage friend or allowed an underage person to enter an establishment to drink, most participants stated that it was not worth the risk to serve underage people. Reported concerns surrounding the consequences of irresponsible service included losing their job or causing the establishment to lose its licence. However, some staff thought police visited establishments to make their presence known, rather than to enforce alcohol service laws. The perceived level of support received by serving staff from managers varied. Several participants described their actions as being influenced by whether their employing establishment placed an emphasis on financial gain or serving alcohol responsibly. Some stated that they knew their manager would support them if they refused an alcohol sale. However, other employees described a lack of support in instances where the intoxicated or underage person was known to the manager or was a regular customer. In such cases, decisions to refuse service were over-riden, with a few stating they would be dismissed in such a situation. The reported type and duration of previous training varied widely among participants.	USA
Grube, 1997	Controlled before and after study, +	To investigate the effectiveness of a community based approach in reducing sales to underage youth.	USA	Increased underage sales enforcement activities were taken by the local police in each experimental community. Warning letters were mailed to all outlets informing them that routine enforcement of underage sales laws was being initiated. The letters were followed by a series of decoy operations in which the police had underage buyers attempt to purchase alcohol at selected outlets. Outlets selling to the decoy buyers were cited.	Overall, in South Carolina, outlets in the comparison community were about 1.9 times more likely to sell to a buyer than were outlets in the experimental community. The decrease in sales between the pre-test and post-test phases was significantly greater in the experimental community than in the comparison community. For Southern California, the reductions in sales from the pre-test to the post-test phases were greater in the experimental than in the comparison community.	USA

<p>Jeffs & Saunders, 1983</p>	<p>Controlled before and after study, ++</p>	<p>To determine the effects of enforcement in a coastal UK town</p>	<p>Coastal UK setting</p>	<p>Visits by police were made 2-3 times per week, taking into account sales and conditions on the premises. Offences during the intervention period were compared with a year prior and one year after police visits, when police reverted back to normal practices. A comparable seaside community with no additional enforcement was included as a control. The rates of recorded crime and public order offences during summer 1978 were compared with those for the previous year (1977) and the following year (1979).</p>	<p>During the year of the altered enforcement practice, all arrests in the resort town fell by 21% and rose in the following year by 20%. No such fluctuation was observed in the control town. In 1977 and 1978, analysis of the arrests of under 18 year olds in the towns in 1977 and 1978 fell short of statistical significance (P=0.20). While differences in arrests did not reach statistical significance, underage drinking may be a factor in crimes. Almost two thirds (65%) of arrested individuals aged under 18 years indicated that they were drinking prior to arrest in 1979.</p>	<p>UK</p>
<p>Krevor <i>et al.</i>, 2003</p>	<p>Before and after study, ++</p>	<p>To study the effects of the use of electronic age verification (EAV) to prevent underage alcohol sales in Florida and Iowa, USA</p>	<p>Florida and Iowa, USA</p>	<p>Approaches included i) mystery shopper inspections: two pre- and five post-EAV installation mystery shopper inspections of tobacco and alcohol retailers; ii) retail clerk and manager interviews; and iii) customer interviews. Stores that did not elect to test EAV were used for comparison.</p>	<p>Just under half of the sales clerks (48% of the Florida clerks and 42% of the Iowa clerks) interviewed reported frequently using the devices for alcohol purchases and that using EAV devices made their jobs easier. The majority of clerks found that using EAV devices made it easier to request that customers show ID (85% Florida, 70% Iowa) and also made it easier to refuse to sell alcohol to underage customers (85% Florida, 84% Iowa).</p> <p>Most customers interviewed stated that they did not mind if clerks checked their ID (96% Florida, 81% Iowa).</p> <p>Whilst the use of EAV devices shows promise, installing EAV devices with minimal training and encouragement did not appear to increase age verification and underage sales refusal. Sales staff require training and advice on the importance of using such devices to prevent underage sales. The authors argue that comprehensive training of all staff (not just managers), integration of EAV devices in standard protocols, and changing the physical configuration of checkouts to facilitate the use of EAVs may prove effective in reducing underage sales.</p>	<p>Florida and Iowa, USA</p>

MMWR/ Concord Police Department, 2004	Controlled before and after study, +	To assess the effects of enhanced law enforcement with quarterly compliance checks of off-licensed alcohol licensees in New Hampshire, USA.	New Hampshire, USA	Enhanced law enforcement with quarterly compliance checks of off- licensed alcohol licensees in New Hampshire, USA. Compliance checks elsewhere in New Hampshire (outside of Concord) were also assessed for comparison	In the experimental setting, 28.2% of 220 licensees sold alcohol to underage youths before the intervention. During the intervention, 10.2% of 383 licensees sold alcohol to underage youths (relative risk [RR] = 0.4; 95% confidence interval [CI] = 0.3-0.5). Additionally, young people reported less binge drinking following the pilot programme. In the control area, 30.5% of 1,007 licensees sold alcohol to underage youths in compliance checks between October 1999 and February 2002. Between March 2002 and February 2004, 27.7% of 832 licensees made sales of alcohol to underage people (RR = 0.9; 95% CI = 0.8-1.1). No differences in binge drinking were reported by young people.	New Hampshire, USA
Pratten, 2005	Qualitative study, +	To determine the views of licensees on their legal responsibilities relating to the service of alcohol in a market town in the North West of England.	Market town in the North West of England	Pubwatch scheme	All participants interviewed were part of the local Pubwatch scheme. All were positive of the principles of the scheme and supportive of the imposition of bans where required. However, reported attitudes towards legal responsibilities were variable, with some licensees carefully adhering to laws relating to the prevention of sales to underage people, other participants appeared to be less stringent, and also suggesting that economic factors may be considered more important than legal limits.	Market town in the North West of England
Preusser <i>et al.</i> , 1994	Before and after study, +	To assess the effectiveness of a sting or decoy operation in which underage police cadets attempted to buy packaged beer at randomly selected grocery, convenience, liquor, and drug stores in Denver, Colorado	Grocery, convenience , liquor, and drug stores in Denver, Colorado, USA	A sting/decoy operation in which underage police cadets attempted to buy packaged beer at randomly selected grocery, convenience, liquor, and drug stores in Denver, Colorado.	During the first round of purchase attempts (June 26, 1992), 59% of premises sold beer to the underage police cadet. During the second round, 32% of premises sold beer to the underage cadet. Offending stores received a 30-day licence suspension. All were eligible to pay a fine in lieu of suspension (\$200 to \$3,000 based on volume and sales of establishment). The third round of purchase attempts (October 23, 1993) included the stores selected for the second random list. Just over a quarter of premises (26%) of premises completed the underage sale. This proportion (26%) was also observed during the fourth round of attempts (April 23 1993). The licence type, clerk, number of registers and number of customers had little apparent effect on the overall rate of sales. Therefore, cadets were able to buy beer on 59% of attempts at baseline, whilst underage sales decreased to 28% (summed across the subsequent rounds of purchase attempts), indicating the success of the operation in reducing underage alcohol sales.	Denver, Colorado, USA

Rehman <i>et al.</i> , 2005	Controlled before and after study, ++	To assess the effects of an enforcement campaign	Inner-city Stockholm, Sweden	<p>A campaign was conducted in inner-city Stockholm, Sweden to reduce underage sales of beer, consisting of a series of activities over 2 years using information/training, media advocacy, and monitoring. The programme involved the establishment of a steering group, meetings with parents, merchants, and visits to shops. Postcards were sent to teenagers. Additional components included parental monitoring of shops, issuing of letters to outlet owners, training of sales staff, purchase attempts, and media advocacy. An inner-city with a similar composition to the intervention city, but without the implementation of the intervention programme, was included as a control.</p>	<p>At baseline, 66% (intervention site) and 60% (comparison site) of underage purchase attempts resulted in a successful sale. One year following the programme, increases in the purchase success rate for purchase attempts were seen at both sites (73%, intervention site (NS), 86% control site). The increase in the intervention site was not significant, but the increase in the comparison site was significant. In the second follow up study, decreases were seen (29% intervention site, 42% control site (decreases from first follow-up study)). Purchase attempts were apparently more successful if fewer people were in the shop at the time of purchase and if the clerk was under 25 yrs of age</p> <p>A survey of students suggested no significant differences in underage alcohol sales from baseline to follow-up as a result of the intervention, with the same proportion of students reporting that it was easy to purchase alcohol (46% at baseline vs 47% at second follow-up).</p> <p>Both parents (75% to 74%) and shopkeepers (95%) were aware of the campaign. A large proportion (86%) of shopkeepers stated that the campaign led to discussions with sales staff on preventing underage sales and undertaking ID checks.</p> <p>Overall reductions in underage beer purchases were observed in both intervention and control areas. Students still described being able to purchase alcohol with ease. Therefore this intervention would not in itself be sufficient to prevent underage sales.</p>	Stockholm, Sweden
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Scottish Centre for Social Research, 2007	Evaluation	To assess the effects of a pilot programme to improve the prevention of underage alcohol sales.	Fife, Scotland	The pilot consisted of trial test purchasing attempts in Fife and interviews with stakeholders on views and feasibility of the pilot.	Knowledge of test purchasing was found to have increased between baseline and follow-up, with a larger proportion licensees reporting that they knew a lot about test purchasing at follow-up (51% vs 26%, $P<0.001$). About 48% of respondents who failed the initial test purchase visit reported that the pilot would have an impact on their retail practice. 36% of licensees stated that they made changes to their premises following the test phase, claiming to have increased vigilance and following of procedures. However, 31% (n=13) of those that represented premises that failed the test also said that their retail behaviour would not change. 38% of those licensees who failed the test at follow-up felt that proof of age card schemes which were already in existence were not a good idea. Over 83% of licensees who failed the initial test now reported giving at least 'quite a lot of training' to staff. At follow-up, 99% of licensees stated that they would ask for proof of age information (cards, driving licences, passports etc) if they had doubts about age. Even given the fact that the percentage of licensees giving a similar response at baseline was relatively high (92%) this difference was statistically significant ($P<0.05$), suggesting that the pilot had affected reported behaviour. The most popular response at baseline and follow-up relating to the most effective means of preventing underage drinking was for test purchasing to be utilised in combination with a nationally-accepted proof of age card scheme (i.e. one not already in existence), with over half (54%) of licensees holding this view.	Fife, Scotland
Scottish Executive Social Research, 2003	Literature review	To review evidence regarding alcohol licensing, including evidence relating to the use of information gathering and dissemination in enforcement of the licensing responsibilities.	Relevant work was conducted in Canada and Wales	The use of information gathering and dissemination in enforcement of the licensing responsibilities.	Work in Canada was described whereby apprehended drunk drivers were asked to state the site of their last drink and the resulting licensed establishments were reported to the licensing authorities and was linked to the issuing of warnings and risk of licence suspension. The evidence suggested that this activity contributed to reductions in the number of arrests in the location of the named bars. Furthermore, work in Cardiff included the publication of a league table of pubs and clubs where violent incidents had occurred, where data were provided to the local media and police. Findings suggested that such an approach may have played a role in reducing assault-related A&E attendances associated with named premises. Whilst no hard effectiveness evidence can be identified relating to these activities, such reports are applicable to the consideration of interventions for use in the enforcement of the legal minimum age and the management of the sale of alcohol to intoxicated people.	Relevant work was conducted in Canada and Wales

Toomey <i>et al.</i> , 2001	Controlled before and after study, ++	To describe an evaluation of the effectiveness of Project ARM in the enforcement of underage alcohol sales	USA	Project ARM (Alcohol Risk Management) was a US-specific programme consisting of 5 tailored one-on-one consultation sessions for owners and managers relating to sales of alcohol to underage and/or intoxicated individuals. Each consultation session lasted 1 to 2 hours. Sessions were implemented once a week during a 5-week period. The project focused on the implementation of policies to prevent illegal sales. The evaluation was performed in 5 bars (and 9 control bars), where pre and post-intervention rounds of purchase attempts were made.	<p>Purchase rates for underage sales were similar across experimental and control sites at baseline (intervention 46.0%, control 48.0%). Following the intervention, the purchase rate increased slightly for the control condition (to 49.4%) and decreased marginally (but not significantly) in the intervention condition (to 42.0%). The lack of significance may be due to the relatively small sample size of the study (requiring the participation of 830 bars per condition to demonstrate statistical significance).</p> <p>Owners and managers reported having enjoyed and valued participation in Project ARM. Outlet employees were also positive of Project ARM, indicating the benefit of establishing clear rules for beverage service.</p>	USA
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Toomey <i>et al.</i> , 2008	RCT, ++	To investigate the effectiveness of a training programme to increase enforcement of the minimum legal age of alcohol purchase	USA	The objective of training was to help owners/managers to select and implement alcohol control policies in their establishments. The full-ARM training consisted of four one-to-one sessions, whilst the ARM Express was a single session.	Just over a quarter (27%) of the 104 included establishments implemented the recommended policy of confiscating false IDs, whilst 19% revised policy, and 54% rejected the policy.	USA
Wagenaar <i>et al.</i> , 2000	RCT, ++	To present the findings of the USA-based Communities Mobilising for Change on Alcohol (CMCA) trial	USA	The trial was an evaluation of a community organising intervention designed with the aim of reducing the availability of alcohol to underage young people.	On-licensed and off-licensed alcohol outlets in the intervention group experienced 17% and 15% increases respectively in ID checks. Sales to underage buyers decreased by 24% and 8% for on-licensed and off-licensed premises respectively. 'Checking all ID for people who look under 30' did not appear to be an effective approach. Intervention communities demonstrated a 5% and 12% increase in perceived likelihood of being cited/caught for making underage sales for on-licensed and off-licensed outlets. Stores that reported that they would serve alcohol to a 21 yr old accompanied by an underage person decreased by 17% for on-licensed and 25% for off-licensed premises. The student survey showed a 25% reduction in young people who tried to buy alcohol, whilst students also reported increased difficulty in obtaining alcohol post-intervention. The supply of alcohol to young people by adults also decreased by 17%. However, high school seniors demonstrated a 30% increase in alcohol purchases.	USA
Wagenaar <i>et al.</i> , 2005	Literature review	To review findings relating to alcohol control policies for the reduction of underage drinking.	Studies originated from a range of countries, including some evidence from the UK.	Relevant studies in the area of underage enforcement reviewed the effects of server and management training, advertising restrictions, and compliance checks.	One study demonstrated that trained servers were more knowledgeable about underage enforcement. A further three studies showed that training had no apparent effect in reducing underage drinking. However, study sample sizes were small and server training was inconsistent and highly variable across programmes Six out of 10 studies found that advertising age restrictions was associated with reductions in alcohol consumption. Three studies demonstrated that compliance checks were effective in reducing underage drinking versus control groups. A further two uncontrolled studies supported this result.	Studies originated from a range of countries, including some evidence from the UK.

<p>Wagenaar <i>et al.</i>, 2005</p>	<p>Multi-community time-series quasi-experimental trial with a nested cohort design</p>	<p>To assess the effectiveness of two interventions designed to reduce underage alcohol sales</p>	<p>Alcohol premises included on and off-premise outlets. The study was undertaken in 20 cities across 4 geographic areas in the Midwest of the USA between 1999 and 2001. Intervention sites included 1 large urban city and 10 surrounding suburban incorporated cities; whilst comparison sites included 1 large urban city and 8 surrounding suburban incorporated cities.</p>	<p>The Complying with the Minimum Drinking Age (CMDA) project was performed in order to assess the effectiveness of two interventions designed to reduce underage alcohol sales: 1) training for management of retail alcohol establishments 2) enforcement checks of alcohol establishments.</p>	<p>The effects of the training intervention were described as mixed. The training and booster variables were not found to be significant for off-premise outlets (demonstrating that training had no effect on the likelihood of successful underage alcohol sales). On-premise outlets showed an effect of training, but not of the expected pattern. Participation in training was associated with a short-term, albeit non-significant reduction in the likelihood of underage alcohol sales, with a significant long-term increase in sales of approximately 7%. Specific deterrent effects for enforcement checks were observed, with a 17% reduction in the likelihood of underage sales at off-licence outlets, immediately following a law enforcement check (having controlled for buyer age, seller age, presence of signs warning against sales to minors or entrance to minors, number of customers in line and linear trend). This effect decayed to an 11% decrease in likelihood of successful sales at 2 weeks following the check and to a 3% decrease in likelihood of sales at 2 months following the enforcement check. The effects of the enforcement intervention in on-premise outlets had significant immediately and long-term effects. The authors reported a 17% decrease in the likelihood of selling following an enforcement check, decaying over time to a 14% reduction at 2 weeks and a 10% decrease at 2 months. The long-term decrease in likelihood of underage alcohol sales was 8.2%. Media coverage did not appear to have a significant impact on the effectiveness of the intervention programme.</p>	<p>USA</p>
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Wallin <i>et al.</i> , 2004	Controlled before and after study,++	To evaluate the impacts of a community alcohol prevention programme on underage alcohol sales at licensed premises in Stockholm, Sweden.	Stockholm, Sweden	The intervention consisted of training for serving staff in responsible beverage service, policy initiative, and enforcement of existing alcohol regulations.	A decrease in alcohol service to adolescents was observed within the whole study area, as well as in the intervention and the control areas. The reduction in frequency of alcohol service in the 2001 study from the baseline in 1996 was statistically significant for both the intervention and the control area, and for both areas combined. One third of the licensed premises visited had doormen (42% in the intervention area, compared to 32% in the control area), and the majority of study adolescents were denied entrance (77 of 88). Neither the number, nor estimated average age of the patrons, nor the time of the visits had any effect on the serving rate. The only secondary factor that had a statistically significant impact odds of being served was whether the licensed premises had a doorman (estimated odds ratio [OR], 0.18; 95% confidence interval [CI], 0.09–0.38). Therefore it appears that fewer adolescents were served beer in licensed premises in the central parts of Stockholm in 2001 than in 1996 but no difference was found between the intervention and control areas.	Stockholm, Sweden
Willner, <i>et al.</i> , 2000	Before and after study, +	To assess the ability of adolescents to buy alcohol, obtain information concerning vendors' views regarding underage alcohol sales and to evaluate a police intervention with the goal of reducing underage alcohol sales.	The study was performed in two University cities, one located in the South-East and one in the North-East of England.	Police intervention with the goal of reducing underage alcohol sales	<p><i>Vendor telephone survey</i></p> <p>Only 12.5% of respondents perceived that they had a problem with underage adolescents attempting alcohol purchases (this group did not differ significantly from other respondents with respect to any other questions asked by the research team). In terms of perceptions relating to the consequences of approving underage sales, 57% of questioned vendors thought they might receive a fine if caught and 6% that they might lose their licence, whilst 39% did not know of the likely consequences. Only 2 vendors believed that adverse consequences would arise in actual fact if they sold alcohol to underage customers.</p> <p><i>Phase 2 (Post-intervention evaluation):</i></p> <p>In phase 1, successful sales to 16 year old girls were slightly lower in the control site than the intervention site (P<0.05, no further data) but the 2 groups of 16 year old boys and 13 year old girls were well matched. In phase 2, sales to 16 year old girls in the control site increased to a level comparable with that in the intervention site (P<0.05, no further data). The intervention did not appear to decrease sales in any of the 3 groups of adolescent confederates, with sales approved to both the 16 year old boys and 13 year old girls actually increasing significantly post-intervention (P<0.001, no further data).</p>	UK
Wolfson <i>et al.</i> , 1996	Regression analysis	To examine the policies, practices and characteristics of alcohol outlets and likelihood of sales to underage individuals	USA	Policies, practices and characteristics of alcohol outlets	Outlets reported employing the following strategies against underage sales: warning signs for minors (77%), had a manager onsite at all times (64%), restricting entry to 21 years+ (60%) and asking everyone for ID (54%). Of the interventions, the authors reported that the presence of a manager on site at all times led to a 15% reduction in the purchase success rate; whilst formal training resulted in a 19% reduction in the purchase success rate in bars.	USA
Management of the sale of alcohol to intoxicated individuals						

Gehan, 1999	Qualitative study, +	To explore perceptions and practices concerning service of underage and intoxicated customers in order to develop a training programme	USA	Service of underage and intoxicated customers	Managers, bartenders, waiting staff and security personnel working in bars and restaurants were invited to discuss their perceptions and practices concerning service of underage and intoxicated customers in order to develop a training programme. Previous training varied widely. Waiting staff commented that training had been informative, that it increased the sense of teamwork, created more awareness of a server's possible liability, and helped them to train other staff. Bartenders and security staff were more inclined toward negative comments, stating that the information was common knowledge and could contradict practices, as well as that training was carried out for insurance purposes and was repetitive. There was a lack of standardised policies and procedures on how to cut off service to intoxicated customers. Bar tenders and wait staff reported that cutting off of service was reported to occur less with 'regulars' providing that they are not creating problems. There was a fear that cutting off such patrons might limit tips as well as cause bad feeling, and might not be supported by management. Some staff were concerned that they might lose their job or create problems for the establishment should they be found to have served intoxicated patrons. Level of support from managers varied, with some reported as not wanting to deal with such situations. Suggestions for future policy included financial incentives, increased management support, implementing training for managers, increasing the promotion of non-alcoholic drinks, installation of breathalysers, and standardised, enforced rules. In terms of external policies, increased public awareness and personal responsibility were cited, as well as enforcement of laws. Focus groups with owners / managers largely confirmed the portrait of management that was given by employees. They largely refused to accept any primary responsibility for the drinking behaviours of customers or the service behaviours of employees; rarely had a written internal service policy and depended more on intuition for making decisions. They rarely had internal systems in place for motivating staff and enforcing prohibitions; and were confused about the wording and requirements of state and local alcohol laws.	USA
Ker & Chinnock, 2008	Systematic review, ++	To investigate the effectiveness of interventions implemented in the server setting that attempted to modify the conditions under which alcohol was served, with the goal of reducing alcohol consumption and/or alcohol-related harm.	International evidence	The studies investigated a range of interventions relevant to this assessment, including server training. Legislative interventions (including server liability, licensing hours, advertising restrictions) were not eligible.	Server training appeared to reduce single vehicle night-time crashes and police-reported violence, promote desirable server behaviour, but no definitive impact on alcohol consumption by patrons could be observed.	International

McKnight & Streff, 1994	Controlled before and after study, ++	To assess the effects of enforcing laws prohibiting the service of alcohol to intoxicated patrons of bars and restaurants	USA	Enforcement of laws prohibiting the service of alcohol to intoxicated patrons of bars and restaurants	A total of 457 visits were made. Refusals in the intervention county rose from 17.5% prior to the initiation of effort to 54.3% after the first 3 months. Over the next 3 months, refusals dropped to 47.4%, and after 1 year to 41% (P<0.001). Results in the comparison county showed a similar pattern but the rates were consistently lower. Whilst each of the first two post-intervention refusal rates significantly exceeded that of baseline (P<0.05), the third did not (P=0.07). This shows that steps to discourage drinking declined in both cases as refusals rose. There was a decrease in Driving Whilst Intoxicated arrests in the intervention county from 31.7% to 23.3% (p<0.01). No interactions were found between the characteristics of establishments and either refusals or DWI arrests. Server intervention was more likely to occur when business volume was moderate than at either extreme. Intervention was more likely when observers saw no truly intoxicated patrons than when they saw one or more (P=0.01). Refusals of service were unrelated to whether the clientele was primarily white collar or blue-collar (P=0.76) or whether establishment was classified as 'upscale' (lounges and expensive restaurants) or 'downscale' (tavern, college hang-out) (P=0.19). Establishments that were sources of one or more drunk drivers during the 18 months prior to and following initiation of program were characterised by: 1) selling special drinks containing >0.52-0.60 ml absolute ethanol (P=0.04); 2) selling doubles and triples (P<0.001); 3) collecting for drinks after every round (P<0.01); 4) using tent cards to explain alcohol policies (P=0.05); 5) providing free coffee late at night (P=0.03); 6) not requiring that instances of questionable age be referred to manager (P<0.01); 7) requesting patrons to attest in writing that their ID was checked (P=0.03); 8) having received a report of visit enforcement agency (P=0.03); 9) requiring immediate termination of service to impaired patrons (P<0.01); 10) offering alternative non-alcoholic beverages (P=0.03). Refusals were mainly spread equally across various types of establishments. The 3-fold increase in refusals to intoxicated patrons immediately following implementation represents a large change in server behaviour, particularly in comparison with changes resulting from efforts solely through training.	USA
Geller, 1987	Controlled before and after study, ++	To evaluate the effectiveness of a programme Training for Intervention Procedures by Servers of Alcohol (TIPS) on driving under the influence of alcohol and customer satisfaction	USA	Training for Intervention Procedures by Servers of Alcohol (TIPS)	Pseudo-patrons showed more signs of intoxication after their third drink with untrained servers. By the sixth drink, these patrons had displayed at least 8 signs of intoxication, whilst those with trained servers displayed on average 5. The anonymity of servers made it difficult to separate tips for trained and untrained servers and some staff would not give this information. For those amounts that could be measured, the mean gratuities in Bar 1 increased from \$24.48 per report before training to \$28.75 (14%), and in Bar 2 the mean increased from \$22.57 per report before training to \$25.62 (12%).	USA

Stockwell, 2001	Literature review	To review the evidence for the potential effectiveness of responsible beverage service (RBS) and law enforcement initiatives	International	Responsible beverage service (RBS) and law enforcement initiatives	<p>An early study by Saltz (1987) involved the participation of 2 Navy clubs that served as intervention and control, the former of which introduced changes to club policy. Changes included the introduction of 18 hours training for detecting intoxication, slowing down service and refusing service if necessary. Beer was no longer served in pitchers, and food was made more available. In addition, staff monitored alcohol consumption within the premises. There was a significant reduction in BAC in the intervention site (33% to 15%), with little change in the control site.</p> <p>Russ & Geller (1987) evaluated a training programme (TIPS) in 2 bars where half the staff had attended and passed a training course with similar objectives to the Navy training course. Researchers posed as customers and attempted to buy a drink every 20 minutes for 2 hours. Trained staff intervened more frequently to slow or stop consumption (mean 3.24 times per performance compared to 0.75 for untrained staff). Lower BACs were achieved by patrons served by trained staff (0.059% compared to 0.103%).</p> <p>A modest but significant change in server behaviour towards RBS ideals was shown in intervention sites in a study by Gliksmann <i>et al.</i> (1993). These early studies led to the development of larger programmes, but the early promise was not realised in these studies. Stockwell proposes that to some extent this is explained by dilution of effect when RBS is applied at community level compared to the demonstration projects. There seems to be an effect of management support that cannot always be guaranteed in larger scale studies.</p>	International
Toomey <i>et al.</i> , 1998	Qualitative review	To assess the available training programs for employees and managers in a qualitative review of server training packages commonly used throughout the US	USA	Server training packages	<p>There was great variation across programmes in terms of coverage of content, use of behaviour change techniques and communication methods. Only a few scored highly across all categories and components. No single program was outstanding in all respects. The 2 scoring highest covered all content areas, good production values, and used behaviour change techniques, but focused solely on bartenders and waiting staff, with no attention to owners and managers. Existing server training programs need further refinement.</p>	USA

Toomey <i>et al.</i> , 2008	RCT, ++	To evaluate the effectiveness of a training intervention (full-ARM) and delayed intervention/control (ARM Express) conditions	USA	Training intervention	Intervention and control groups had similar baseline sales rates (74% and 70% respectively). At the first follow-up, rates were 61% in the intervention establishments and 74% in controls, but this improvement was not maintained over time, with rates 75% in intervention and 82% in controls by the second follow up. Time x condition was marginally significant (P=0.06) at first follow-up, but not at second (P=0.21), indicating that over time the intervention did not have an effect on likelihood of sales to obviously intoxicated patrons. Establishments in Full-ARM adopted on average 13-18 of the recommended policies for implementation. Prohibiting sales to intoxicated customers and providing copies of policies to staff, monitoring for suspicious behaviour were most likely to be adopted. Least likely were prohibiting last call and measuring all drinks. There was no effect over time on reported policies and practices between baseline and follow-up management practices. One month after ARM training there was a 23% relative reduction in likelihood of illegal sales to obviously intoxicated patrons at bars and restaurants in the 4 session Full-ARM programme. However, the effects dissipated within 3 months indicating that this programme is not sufficient to create sustained changes in likelihood of illegal alcohol sales. It is not certain what happened following the training programmes – many of the managers had left the establishments in the delayed ARM Express arm on contact to begin training. If new managers are not supportive it is unlikely that reductions in illegal sales will be sustained.	USA
Turrisi <i>et al.</i> (1999a) and Turrisi <i>et al.</i> (1999b)	Survey, ++	To identify policies that are favourably or unfavourably viewed by owners, servers and students that might assist in future policymaking decisions	USA	Server intervention policies	<p>The overall findings suggested that owner and server attitudes varied considerably and that there were some interventions that could potentially be adopted without negative reactions by either party. Statistically significant unique effects were observed between the perception of policy that reduces Driving Under the Influence (DUI), and attitudes toward posting information in bars about consequences of drunk-driving arrest and serving beer by glass or bottle. As the perception of reducing DUI increased, attitude towards those policies improved.</p> <p>The more individuals thought that policies would attract customers, those policies became more favourable. Policies encouraging the sponsoring of non-alcoholic promotions and posting information about the consequences of drunk driving were associated significantly with the perception that customers might be offended, and attitudes toward these policies were more negative. Offering to call a taxi and training in alcohol awareness had statistically significant unique effects observed for perceptions about customer affect and social atmosphere. As perceptions that customers would be offended or that policies create a less social atmosphere increased, attitude toward server training decreased. In general, policies perceived to create a less social atmosphere, being a hassle, or offending customers were perceived as more negative. Those perceived to attract more customers and reduce drink driving were perceived more favourably.</p>	USA

Warner-Smith <i>et al.</i> , 2000	Evaluation	To determine the acceptability of intervention strategies that increase the responsible service of alcohol by non-metropolitan rugby league clubs	Australia	The intervention strategy included use of a Responsible and Safe Drinking Information Kit with training for local public health workers to deliver the intervention. Workers mailed the information kits to the clubs and contacted each club twice to offer support.	71% of participating clubs reported being contacted by a Public Health worker; 61% of participating clubs reported being contacted by local police, 96 (59%) clubs found PH worker contact useful, 82 (96%) clubs found police contact useful, 135 (88%) clubs found the information kit useful, 133 (96%) clubs found the information kit easy to use, 134 (98%) clubs found the information in the kit credible, and 134 (99%) clubs found the information kit easy to understand. The 12 public health workers all felt that their role was sufficiently clear; none felt anything should be added to training, 11 found the workload reasonable; 10 found it a worthwhile use of time; 8 thought PH workers were the most suitable for the role, and 5 worked with rugby league outside the project. All 12 found the training day useful; 11 found information kit useful; 12 found the information in the kit to be credible; 12 found the information in the kit user friendly; 7 found police contact useful; 11 found police important to the project, and 3 felt a sense of ownership.	Australia
Wyllie, 1997	Evaluation	A multi-method campaign was evaluated in terms of the acceptability of a national mass-media campaign to discourage intoxication and encourage host responsibility practices.	New Zealand	A multi-method campaign to discourage intoxication and encourage host responsibility practices	Surveys following the campaign showed a large increase in public and drinker awareness that bar staff can be fined for serving someone who is drunk. The campaign was well received and thought to be making a useful contribution.	New Zealand
Hughes & Anderson, 2008	Questionnaire survey, ++	To identify perceptions and practices in alcohol service	Manchester, UK	Initiatives to improve management of alcohol-related activities	The majority reported that they had received training (61.4%) with 12% having undertaken an external course. 26.5% reported having received no training. Those in more senior roles were more likely to have undergone training. Content of training varied widely; 50.6% had been instructed not to serve intoxicated customers, while 41.0% had received specific information on refusals. The remainder had not received either, with completed training not significantly related to length of service. 19.8% reported seeing drunken customers on all shifts. More than half (59.8%) were aware of the illegality of serving alcohol to intoxicated patrons, while 6.1% were not aware of this. Awareness of the illegality of this practice increased with the level of training and advice received on this topic. Over half (51.2%) reported that they would never serve alcohol to a customer that they believed to be drunk; 9.3% stated that they would usually or always serve them. Managers and supervisors were significantly more likely than bar tenders to report that they would never serve drunken customers (61.0% compared to 22.2% $p<0.005$). Managing sales to intoxicated individuals needs to be worked on in partnership between managers, bar staff and the police, combining practices that are jointly understood.	Manchester, UK

University of Bath & Avon & Wiltshire Mental Health Partnership NHS Trust, 2007	Evaluation	To evaluate 3 UK Community Alcohol Prevention Programmes	UK	Community Alcohol Prevention Programmes	UK Community Alcohol Prevention Programmes were evaluated. In conclusion, it is difficult to relate any particular intervention to associated changes in crime and emergency department figures but the teams in the 3 sites are reported to have had an impact on the environment, including increasing awareness, co-operation and collaboration, instigating positive community responses to alcohol-related harm.	UK
Licensed hours and days of alcohol sale						
Department for Culture, Media and Sport, 2008	Evaluation	To evaluate the impact of the Licensing Act (2003) in order to assess the extent to which the objectives of the legislative reform had been subsequently fulfilled.	UK	Licensing Act 2003	The evaluation presented the findings that, whilst crime and alcohol consumption appeared to have remained stable overall, one notable observation was a temporal displacement of violent crime, with an increase in alcohol-related violence occurring during the early hours of the morning and some local increases in disorder. The Department evaluation also concluded that, whilst it was apparent that the freedoms facilitating by the Act were being implemented, a requirement existed for increased enforcement and use of regulatory powers.	UK
Durnford <i>et al.</i> , 2008	Before and after study, ++	To assess the impact of the Licensing Act on alcohol-related attendances at an inner city emergency department in Birmingham, UK	An inner city emergency department in Birmingham, UK	Licensing Act 2003	The authors found that total weekly attendances showed a slight increase from 1912 in 2005 to 2146 in 2006. There was a non-significant reduction in the proportion of alcohol-related attendances between 2005 (3.6%) and 2006 (2.9%). A significantly larger proportion of alcohol-related attendances occurred at the weekend between 6pm and 11.59pm in 2005 (61.4%) than in 2006 (17.2%). There was a significant increase in the weekend proportion of attendances presenting between 3am and 5.59am in 2006 (34.5%) than in 2005 (10.2%) (P=0.015). A significantly greater proportion of alcohol-related presentations were made on weekdays between 3am and 5.59am in 2006 (18.2%) than 2005 (0.0%) (P=0.025).	UK
El-Maaytah <i>et al.</i> , 2008	Before and after study, +	To investigate whether presentations at A&E due to head and neck trauma resulting from alcohol-associated assault had changed since the introduction of the UK Licensing Act	London, UK	Licensing Act 2003	In the first study period (24th November 2004 to 30th April 2005) there were 1102 attendances for head and neck trauma secondary to alcohol-associated assaults; whilst between 24th November 2005 to 30th April 2006 there were 730 reported similar attendances, equating to a reduction of 34% (95%CI 31 to 37%). These attendances were similar in terms of gender across both study periods (77% and 79% male in 2004-2005 and 2005-2006 respectively). More cases presented during weekends than on weekdays during both study periods (P=0.04). The authors stated that there was no effect of rainfall or temperature on findings.	UK

Foster <i>et al.</i> , 2007	Questionnaire survey, ++	To investigate views on the early implementation and impact of the Licensing Act from key respondents across a wide range of Licensing Authority areas in England.	England	Licensing Act 2003	This survey indicated that key informants from Local Authorities viewed the Licensing Act as having had a relatively mixed impact, with the establishment of very few Cumulative Impact Areas at the time of survey.	UK
Herring <i>et al.</i> , 2008	Qualitative study, ++	To conduct a preliminary investigation of the local implementation of initial local implementation of the Licensing Act 2003 in Greater London	London, UK	Licensing Act 2003	Variation was evident between licensing authorities in their level of engagement with licensing issues. The majority of respondents were supportive of the changes in administration and procedures and increased control over local licensing. Respondents did not report any significant problems associated with the new arrangements and the extension of hours resulting from the Act at the time of study. Respondents typically had exercised caution in the preparation of their policy statements, producing policies that would stand up to any legal challenge. In addition, a tendency to produce basic policy statements resulted from a stated lack of time or expertise. Respondents reported a requirement for a strong evidence base to support decisions relating to Cumulative Impact Areas and possible related challenges. Issues raised included the collection of evidence, associated costs, and definitions of what information would be classed as evidence. Some respondents also requested further training for Chairs. The engagement of senior council members was viewed as being important for the integration of a successful local licensing policy into council strategies.	UK
Hough <i>et al.</i> , 2008	Evaluation	To review key findings from the multiple component evaluation by the Home Office of the impact of the Licensing Act (2003) on levels of crime and disorder in England and Wales, with a key focus on 5 case study areas.	England and Wales	Licensing Act 2003	The report concluded that there were no discernable changes in overall crime levels as a consequence of the implementation of the Licensing Act, but that some incidents of crime had been displaced into the early hours of the morning.	England and Wales

Local Government Association/TNS UK, 2008	Questionnaire survey, +	To investigate the effects of the Licensing Act (2003) on Local Authorities, PCTs, A&Es and police authorities in England and Wales.	England and Wales	Licensing Act 2003	<p>Just under a third (29%) of respondents from PCTs were of the opinion that the licensing reform had increased alcohol-related incidents in their area (vs 10% from Police Authorities and 4% from Local Authorities). Over two thirds of local authority respondents (69%) perceived no change at all (vs. 55% from police authorities and 45% from PCTs). A quarter (25%) of police authority respondents felt that alcohol-related incidents/disorders had decreased (vs. 18% from PCTs and 16% from local authorities). All PCT and police authority respondents who felt that the Licensing Act had increased incidents were also asked whether this had impacted on resources. The majority (86%) of PCT respondents pressure on resources had been created, of which 43% cited increased pressure on A&E and hospital admissions and having spread problems over wider time frame (21%), increased pressure on police and other agencies (21%) and also increased pressure on ambulances (21%) (based on a sample of 14 respondents). The majority (94% of 51) of local authority respondents also felt they were more stretched in terms of workload and resources since the implementation of the Act. Half (50%) of a total of 20 police authority respondents stated that incidents were occurring later. 10% reported a perception of resources being stretched. Views were also captured on partnership working, with 96% of those from local authorities reporting closer working with police and 49% reporting no impact on working with PCTs. Whilst the majority (80%) of police authority respondents stated that the implementation of the Act had no effect on their working with PCTs, 70% viewed themselves as working more closely with local authorities. However, 73% and 61% of respondents from PCTs felt there was closer working with local authorities and police authorities respectively. Local authority respondents (n=51) were also asked whether they anticipated using alcohol disorder zones following implementation of legislation. Views were variable, with 33% answering yes, 33% no and 33% stated they were unsure. Where the response was negative, the main reasons cited for not using zones were the views that they would be ineffective (47%), a perception of no need (29%) or of them being too complicated/bureaucratic to implement (12%). Of the respondents who proposed developing alcohol disorder zones, anticipated effects included the reduction of alcohol-related incidents (41%), the passing of more control to police/authorities (24%), helping combat bad behaviour (18%), whilst 6% anticipated the zones to have no effect and 18% were unsure of outcomes.</p>	England and Wales
Morleo <i>et al.</i> , 2007	Qualitative study, +	To explore the implementation and impact of the Licensing Act 2003 in Lancashire	Lancashire, UK	Licensing Act 2003	<p>The authors described the implementation of licensing legislation as having been successful according to respondents, facilitating a quicker, more streamlined process with increased partnership, flexible ways of trading for licensees, and allowing more local input. Reviews were also reported to be a credible deterrent against infringement of licensing conditions. However, barriers were discussed, including the capacity for a venue to remain open during appeal against licence revoke, and a lack of a register for personal licensees.</p> <p>None of the study areas appeared to have experienced an increase in night-time violence or disorder, with a decrease or no change in overall levels typically reported. Some areas felt that incidents were easier to manage, since they were spread over an increased timeframe since the reform. At least one authority had undergone a clear decrease in noise complaints since the introduction of the Licensing Act. Key recommendations made in the report included the development of a national database for personal licence holders, the consideration of whether a venue can continue to trade during appeal against a licence removal, and the revisiting of the decision of whether to include public health as a licensing objective in the Licensing Act.</p>	Lancashire, UK

Newton <i>et al.</i> , 2007	Before and after study, ++	To determine the effect of the introduction of UK Licensing Act (2003) in November 2005 on overnight attendances to the emergency department of St Thomas' Hospital, London, UK	London, UK	Licensing Act 2003	<p>The total number of attendances at the emergency department in March 2005 was 10,290, and 9978 in March 2006 (a reduction of 3%, statistical significance not reported). The total number of overnight attendances in March 2005 was 2736, with 3135 recorded in March (an increase of 15%, statistical significance not reported). Of these, 2.9% (n=79) and 8.0% (n=250) were classed as alcohol-related attendances, representing a statistically significant increase (P<0.001).</p> <p>Statistically significant increases in the presentation of alcohol-related attendances as a result of injury (March 2005 n=44 (1.61%), March 2006 n=129 (4.11%), P<0.001) and assault (March 2005 n=27 (0.99%), March 2006 n=62 (1.98%), P=0.002) were observed between the 2 study periods. In addition, admission rates for alcohol-related attendances also significantly rose (March 2005 n=24 (0.88%), March 2006 n=71 (2.46%), P<0.001) between the 2 study periods.</p>	UK
Pike <i>et al.</i> , 2008	Evaluation	To explore the opinions and experiences of key stakeholders (including the police, licensees, licensing officers, crime and disorder reduction partnership representatives); to examine the degree of use of extended trading hours; and to investigate trends in alcohol-related crime and disorder following the implementation of the Act.	East of England and the Yorkshire and Humber regions	Licensing Act 2003	Evidence supported the observation of a temporal displacement of criminal activity as a result of the Act, with some towns finding that offences were more spread out across the evening in the 6 months post-reform. Other towns experienced a shift in activity, with peak times for offences being later in the evening. Changes in criminal activity patterns were observed in 6 of the 9 towns for which data were available, whilst the remaining 3 showed little or no change in timing of incidents.	East of England and the Yorkshire and Humber regions
Sivarajasingham <i>et al.</i> , 2008	Survey, ++	To assess the impact of the Licensing Act 2003 on A&E departments in England and Wales	A&E departments in England and Wales	Licensing Act 2003	There was an overall decrease of 12% in England and Wales in 2007 vs 2006, with approximately 43,000 fewer presentations at A&E as a result of violence-related injury. Violence-related injury was described as being most frequent on Saturday and Sunday.	England and Wales

Duffy & Pinot de Moira, 1996	Regression analysis	To explore trends in alcohol-related problems subsequent to the 1988 amendments to Licensing Act in England and Wales	England and Wales	1988 amendments to Licensing Act	Levels of absenteeism were stable throughout the period of study, with no evidence of increase in absenteeism due to the licensing amendments. A significant increase in the occurrence of slight accidents (over 3 days absence) in the workplace was evident, with an employee based in England and Wales being 1.134 times more likely than a Scottish employee to have a slight accident in 1989. No increases in drunk driving were observed in England and Wales, with no increase in positive breath tests occurring during extra permitted licensing hours. No changes were found in the number of people in England and Wales who were cautioned or convicted for drunkenness. Duffy & Pinot de Moira reported that, in the short-term, recorded crimes of violence increased by about 15.5% in England and Wales relative to Scotland, but that the increase tailed off slightly, being 8.8% in 1989.	England and Wales
Duffy & Plant, 1986	Analysis of longitudinal ecological data	To assess the impact of changes in Scotland's liquor licensing laws by comparing Scottish trends in alcohol-related problems with those in England and Wales.	Home population of Scotland aged 15 years and above	The licensing laws in Scotland were changed in December 1976 to allow public bars to open for an extra hour in the evenings (changing from a previous requirement to close at 10pm). Public houses were subsequently permitted to open on Sundays. Some 'all day licences' (regular extensions of permitted opening hours) were also issued by licensing courts, which were introduced during 1977.	This evidence would indicate no apparent effect of the licensing changes on level of alcohol-related morbidity and mortality in the Scottish population. Public order offences in the Scottish population appeared to have declined (but this was potentially attributable to policing policies). The licensing changes introduced since 1976 appeared to be neutral in impact and were popular amongst the surveyed members of the general public.	Scotland

Graham <i>et al.</i> , 1998	Before and after study, ++	To determine the effect of restricting extensions to permitted licensing hours on the numbers of alcohol or assault-related attendances at an inner city A&E department in Edinburgh	An inner city A&E department in Edinburgh, Scotland	Following the Licensing (Scotland) Act (1976), flexible licensing arrangements were implemented, with extensions granted to trading hours. However, this system led to the movement of large numbers of people between premises and subsequent public disorder. Therefore, a uniform closing time was introduced. As of 25 th March 1996 in Edinburgh, all public houses, hotels and restaurants were permitted to close by 01:00, clubs and public places with entertainments licences to close by 03:00 and casinos by 04:00.	<p>Of the 2836 patients taking the breath test (pre-period=1033, postperiod 1=838, postperiod 2=965), the majority (71.7%, n=2017) had no alcohol detected, 7.8% (n=222) were positive within the legal driving limit (80mg/100ml) and 21.1% (n=597) were positive over the legal driving limit. Overall, 56.5% (n=2836) of patients provided a breath sample, and 28.9% of these (n=819) were positive. There were no statistically significant differences in the proportion of patients testing positive across the 3 study periods (pre-period=30.9%, postperiod 1=27.3%, postperiod 2=28.1%). The proportion of patients with positive tests peaked between 02:00 and 04:00, which followed closure of public houses, hotels and restaurants at 01:00. There were no significant differences in the proportion of patients testing positive attending before 20:00, between 20:00-24:00, between 24:00-04:00 or after 04:00 hours. Patients aged 40 to 49 years were more likely than any other age group to test positively (38.5%) and had the highest mean blood alcohol concentration (205mg/100ml). Patients who tested positively were more likely to have been drinking in a pub/hotel or restaurant (42.8%) than in a club or other place with a public entertainment licence (6.6%) or at home (21.9%) (no breakdown by location of drinking presented across the 3 study periods).</p> <p>A total of 444 attendees (8.8%) were involved in incidents of assault. A third of these involved a weapon (n=133). No statistically significant difference was observed in the proportion of assault-related cases attending over the 3 study periods (pre-period=8.1%, postperiod 1=10.5%, postperiod 2=8.0%, NS).</p> <p>During time periods identical to those in this study, operational staff in the police divisional control rooms covering the city recorded numbers of incidents of 16 classifications of crimes of violence and public disorder (no further information presented) (personal communication to study authors by Lothian and Borders Police). During the study pre-period, 866 incidents were logged, with 1053 and 786 incidents recorded during postperiods 1 and 2 respectively. Overall, 43.4% were coded as 'drink-related' and the authors reported no significant differences between time periods (no further data presented).</p>	Edinburgh, Scotland
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Northridge <i>et al.</i> , 1986	Before and after study, +	To determine the frequency of alcohol intake associated with admissions for self poisoning by overdose before and after the liberalisation of Scotland's liquor licensing laws	Data relating to all patients aged 12 years and over admitted to the acute medical unit of Milesmark Hospital, West Fife, Scotland between 1971 and 1982 for self-poisoning by overdose were analysed.	Scotland's liquor licensing laws were relaxed in December 1976, to allow bars to trade for an extra hour in the evenings. The following year, public houses were permitted to open on Sundays and some 'all day licences' were granted.	<p>The frequency of alcohol taken in association with self poisoning overdose showed a considerable increase during the first two years after the liberalisation of the licensing laws. Between 1971 and 1976, 29.0% (114/393) of men took alcohol with their overdose. This proportion increased to 51.6% (306/593) between 1977 and 1982, representing a 23% increase (95%CI 17% to 29%). Between 1971 and 1976, 14.3% (117/821) of women consumed alcohol with their overdose, with this value increasing to 34.7% (368/1061) between 1977 to 1982, equating to an increase of 21% (95%CI 17% to 25%).</p> <p>Whilst the total yearly admission rate for self poisoning had been rising before 1976 (>160 admissions in 1971 to >220 admissions in 1976) this rate of increase subsequently rose markedly following change in licensing laws (to a maximum of >300 yearly admissions in 1978 for all overdoses) before decreasing to subsequent levels (>220 yearly admissions in 1985) (data presented graphically only). This increase did not appear to affect the severity of overdoses or outcome. In recent years, the authors noted there had been a decrease in the incidence of overdoses associated with benzodiazepines, barbiturates and dextropropoxyphene (drugs which react adversely with alcohol).</p>	West Fife, Scotland
Rhodes <i>et al.</i> , 1990	Before and after study, ++	To assess the impact of the 1988 changes in licensing laws in England (described above) on health-related outcomes in patients attending the Accident & Emergency Department, of Newcastle General Hospital	Patients aged 16 yrs and over attending the Accident & Emergency Department, of Newcastle General Hospital.	1988 changes in licensing laws in England and Wales	In 1986, a blood alcohol level of greater than 50mg/100ml was observed in 13% (n=99) of all attendees. In 1988, a proportion of 14% (n=56) of all attendees had a blood alcohol level of greater than 50mg/100ml, representing a non-statistically significant difference between the two time periods. Across both years, males made up the majority of patients who presented at A&E with excess blood alcohol levels (no further data presented). The authors stated that the patterns of presentation to A&E were very similar in 1986 and 1988, despite change in alcohol availability. The conditions most strongly associated with alcohol consumption were tablet overdose and fifth metacarpal fracture (no further data). Over two thirds (69%) patients with tablet overdoses in 1986 had >50mg/100ml alcohol in blood, compared with 60% in 1988. Over half (59%) of fifth metacarpal fractures occurred in presence of >50mg/100ml alcohol in 1986 vs. 30% in 1988. A non-significant trend towards increased frequency of alcohol consumption in patients attending at night-time was also observed.	Newcastle, UK

Chikritzhs & Stockwell, 2002	Interrupted time series analysis, ++	To determine the impact of later trading hours for licensed hotels (public houses) in Perth, Western Australia on violent assault levels on or located close to these premises.	Perth, Western Australia	Following the Liquor Act 1988, hotels (public houses) in Western Australia were permitted to trade for additional hours via an Extended Trading Permit (ETP). The term 'hotel' was used to refer to business establishments, primary function of which is to serve alcohol on the premises, including public houses, taverns, bars, ale houses and saloons.	When the general trend in assaults among Perth hotels was controlled for, there was a significant increase in monthly assault rates associated with ETP hotels, largely attributable to higher volumes of high alcohol content beer, wine and distilled spirits bought by ETP hotels. The authors concluded that greater violence was associated with hotels that were granted an extension in trading hours, and that greater numbers of customers and/or increased levels of drunkenness may be contributory factors to the increase in violence associated with these premises.	Perth, Western Australia
Chikritzhs & Stockwell, 2006	Interrupted time series analysis, ++	To ascertain the impact of later trading hours for some licensed hotels after mid-1993 in Perth, Western Australia on levels of impaired driver road crashes and driver breath alcohol levels.	Perth, Western Australia	Following the Liquor Act 1988, hotels (public houses) in Western Australia were permitted to trade for additional hours via an Extended Trading Permit (ETP).	Having controlled for non-ETP crash rates and the introduction of mobile police breath testing units to Perth freeways, a significant increase in monthly crash rates for hotels that had been granted ETPs was observed. This relationship was largely attributable to the higher volumes of high alcohol content beer wine and spirits purchases by ETP hotels. The authors concluded that later trading was associated with increased levels of impaired driver road crashes and alcohol consumption (particularly high alcohol content beverages), but that characteristics of the patrons of later trading hotels may have influenced the findings.	Perth, Western Australia
Chikritzhs & Stockwell, 2007	Interrupted time series analysis, ++	To determine the impact of extended trading permits (ETPs) for licensed hotels in Perth, Western Australia on impaired driver breath levels (BALs) between July 1993 and June 1997.	Perth, Western Australia	Following the Liquor Act 1988, hotels (public houses) in Western Australia were permitted to trade for additional hours via an Extended Trading Permit (ETP).	This study showed that impaired female drivers apprehended between 10.01 pm and 12 midnight (before closing time) had significantly lower BALs after drinking at ETP hotels. Male drivers aged 18-25 years apprehended between 12.01 and 2.00am after drinking at ETP hotels had significantly higher BALs than drivers who drank at non-ETP hotels. The authors concluded that at a peak time for alcohol-related offences, extended trading was association with higher BALs in those groups most at risk of alcohol-related harm.	Perth, Western Australia

d'Abbs & Togni, 1999	Literature review	To review of the effectiveness of various community-based initiatives with a focus on restrictions on alcohol availability in remote and regional areas of Australia	Remote and regional areas of Australia	Restrictions on alcohol availability, including limitations on hours and days of licensed sales, were implemented in the communities of Tennant Creek, Derby, Halls Creek, Elliott and Curtin Springs.	The evaluations were suggestive of a modest, positive impact on alcohol consumption and indicators of alcohol-related harm.	Remote and regional areas of Australia
Hoadley <i>et al.</i> , 1984	Cross-sectional time series analysis	To determine the significance of associations between regulation of spirits and per capita consumption for 48 states of the USA	48 states of the USA	Independent variables included weekday closing hours for on-premise sale of spirits; sale of spirits for on-premise consumption on Sundays; total density of outlets for purchase of spirits in number of licences per 1000 population.	Restrictions on Sunday sales had no apparent impact, whilst earlier closing hours in bars appeared to result in increased sales. Data were not available for off-premise sales. The presence of more on- and off-licensed outlets was associated with higher consumption levels.	USA
Hogan <i>et al.</i> , 2006	Literature review	To present findings from evaluations of a trial of alcohol restrictions that was implemented in Alice Springs, Northern Territory, Australia from April 2002 to June 2003	Alice Springs, Northern Territory, Australia	The trial included restrictions on take-away trading hours for all outlets to between 2pm and 8pm on weekdays (reduction of 2 hours per day) and removal of alcohol of any type from the market in containers greater than 2 litres, and a provision that only light beer could be sold in bars before noon.	<p>Incidents of drunkenness and protective custodies decreased by a third. Alcohol-related assaults decreased by 13%. However, alcohol-related offences were reported to have risen by 20%, particularly relating to criminal damage and disturbances (although Hogan acknowledged that this finding may be due to wide fluctuations in monthly police data). The ambulance service received around a quarter fewer alcohol-related call-outs, whilst selection presentations the emergency department of the local hospital were seen to fall by 19%. Admissions of patients with acute conditions to the local hospital were reported to have increased.</p> <p>No significant reduction was observed in the quarterly wholesale sales of pure alcohol over the trial period. However, consumers made a shift to the cheapest form of alcohol (2 litre port), with sales of this type of beverage increasing by 1000%. By time of the trial, the price of port had been lowered by approximately 25% and was also being heavily promoted by liquor outlets, a situation that would have been likely to have contributed towards the increase in sales of this beverage. It was therefore apparent that consumers shifted to a beverage with a lower volume (in order to meet the restrictions on off-sales volume) but having equal alcohol content.</p>	Alice Springs, Northern Territory, Australia

Mäkelä <i>et al.</i> , 2002	Literature review	To perform an extensive literature review of evaluation studies of changes in alcohol availability from the previous 50 yrs in Nordic countries	Scandinavia	Interventions affecting the availability of alcohol	Evidence was presented regarding interventions affecting the availability of alcohol, with restrictions in licensing hours or days typically associated with decreased alcohol consumption.	Scandinavia
McMillan <i>et al.</i> , 2007	Regression analysis	To investigate alcohol-related motor vehicle crash rates in New Mexico, USA	New Mexico, USA	As of July 1st 1995, the ban on Sunday packaged alcohol sales was lifted in the state of New Mexico, with legislation including a local option for individual communities to re-implement the restrictions on Sunday packaged alcohol sales.	The analysis showed that alcohol-related crash rates across New Mexico were 1.32 times greater subsequent to the relaxation of licensing than pre-reform (RR=1.32, 95%CI 1.07 to 1.64). Variability in relative risks was apparent across states, with values ranging from 1.04 to 1.90. Counties that promptly made the local re-implementation of the ban on Sunday packaged alcohol sales were described as being able to limit the negative impact on alcohol-related motor vehicle crashes.	New Mexico, USA
Norström & Skog, 2003	Interrupted time series analysis, ++	To model the estimated size of effect of the Saturday opening of alcohol retail outlets in Sweden.	Sweden	Saturday opening of alcohol retail outlets	A statistically significant increase in total alcohol sales of 3.3% was observed (beer 7%, wine 2%, spirits 3%).	Sweden
Norström & Skog, 2005	Controlled before and after study, ++	To assess the impact of Saturday opening of alcohol retail shops on alcohol sales and indicators of assaults and drink driving	Sweden	Saturday opening of alcohol retail shops	Increased accessibility to alcohol facilitated by Saturday opening of alcohol outlets increased sales of alcohol. However, no increase in alcohol-related harm could be detected. The authors acknowledged that the lack of an intervention effect on harm indicators may have been attributable to insufficient statistical power.	Sweden

Ragnarsdottir <i>et al.</i> , 2002	Before and after study, +	To determine the effects of a trial involving the unrestricted alcohol serving hours in Reykjavik, Iceland.	Reykjavik, Iceland	Unrestricted alcohol serving hours	The number of calls or working episodes of police in the city centre was described as increasing from 251 in 1999 to 286 in 2000 (14%). In comparison, the number of police working episodes across the whole town underwent a smaller increase from 573 cases in 1999 to 610 in 2000 (6%). Whilst being based on a crude estimate, fewer people were reported by police as being present in the city centre between 3am and 5 am in 2000 than 1999 (-36%), whilst considerably more people were in the city centre at 6am (+267%). A telephone survey of 30 of the 33 barkeepers (91%) who could serve alcohol round the clock showed variability in the use of extended hours. The mean closing time following the liberalisation was 4.30am on Saturdays and 5am on Sundays. Half (50%) of establishments remained open after 4am. An increase of 31% in the total number of cases admitted to emergency wards during weekend nights was experienced. The number of cases admitted on Saturdays and Sundays increased by 20% but decreased by 2% on other days of the week. Increased admissions for potentially alcohol-related incidents, including accidents and fighting were observed, particularly among men. No changes were observed in suicide attempts subsequent to the relaxation in licensing. A clear increase in the number cases of suspected drink driving was seen (29 in 1999 vs 52 in 2000, +80%). Some residents and merchants reported increased disturbance due to nightlife and a lack of receptivity of police to complaints. Street cleaning workload also increased. Half (50%) of barkeepers reported extended hours as having yielded financial benefits. 48% reported more consumers in bars, 43% did not perceive an increase in alcohol consumption among guests, whilst 68% said guests stayed longer despite their later arrival. Serving hours were subsequently restricted in response to growing concerns over the problems associated with the unrestricted hours.	Reykjavik, Iceland
Outlet density						
Gruenewald <i>et al.</i> , 1993	Time-series cross-sectional analysis	An objective of the study was the exploration of the potential simultaneous relationship between per capita alcohol outlet density and alcohol sales.	USA	Physical availability of alcohol	Physical availability of alcohol was directly related to levels of sales of spirits and wine, independent of effects of prices. The direction of the simultaneous relationship was shown to be strongest from outlets to consumption, with increased outlet density driving increased sales.	USA

Huckle <i>et al.</i> , 2008	Multi-level modelling	To analyse the relationship between on- and off-licensed alcohol outlet density and measures of drinking activity including typical occasion quantity of alcohol consumption, frequency of consumption and drunkenness among young people	Young people aged 12 to 17 yrs in Auckland, New Zealand.	On- and off-licensed alcohol outlet density	Alcohol outlet density was significantly associated with typical-occasion quantity of alcohol consumption ($b=0.004$, $p<0.05$), whilst other covariates proved non-significant. No covariates demonstrated a significant relationship with frequency of drinking among young people. Only the relationship between alcohol outlets and frequency of drunkenness among young people was marginally significant ($b=0.005$, $P=0.058$). No other covariates displayed a significant relationship with this dependent variable. This study therefore showed that typical-occasion quantity of alcohol consumption is predicted by alcohol outlet density.	Auckland, New Zealand
Kuntsche <i>et al.</i> , 2005	Regression analysis	To investigate the relationships between alcohol outlet density, perception of adolescent drinking in public (at a school level), and adolescent drinking and drunkenness at an individual level.	9th grade students from 68 classes across 61 schools in Switzerland	Alcohol outlet density	Over half (51.3%) of pupils consumed beer, wine, spirits, or premixed drinks or alcopops and around a third (32.1%) were repeatedly drunk. Alcohol outlet density was a significant predictor of adolescent alcohol use (unstandardised regression coefficient = 0.17 (SE 0.07), $p<0.05$).	Switzerland
Kuntsche <i>et al.</i> , 2008	Multi-level modelling	To assess the relationship between alcohol outlet density and alcohol-related measures including perceived availability and adolescent alcohol use.	12 to 17 yr old adolescents from the 8th and 9th grades of school (mean age 14.8 yrs, 49.7% male) from 254 communities in Switzerland	Alcohol outlet density	The study found that the density of on-premises ($b=0.13$, $p<0.05$) but not off-premises alcohol outlets was related to perceived availability. The density of on-premises ($b=0.19$, $p<0.05$) but not off-premises outlets was also related to volume drinking but not to the frequency of risky drinking occasions among young people.	Switzerland

Kypri <i>et al.</i> , 2008	Analysis of correlation	To model the relationship at campus-level and individual-level between outlet numbers within 1km and 3 km of student residences and individual drinking levels or problems	University campuses in New Zealand; included the analysis of data from a large sample of students (mean age 20.2 yrs, 60% female, 41% New Zealand European, 31% New Zealand Maori, 15% Chinese, 13% other, 42% frequent binge drinking in high school).	Alcohol density outlet	<p>For each additional 10 off-licensed outlets within 3 km of respondents' residences, respondents consumed on average 1.017 (95%CI 1.001, 1.033, P=0.0317) times as many drinks per drinking day; had 1.032 (95%CI 1.023, 1.042, P<0.0001) times as many alcohol-related problems and experienced 1.057 (95%CI 1.022, 1.092, P=0.0011) times as many second hand effects.</p> <p>For each additional 10 on-licensed outlets within 3 km of respondents' residences, respondents consumed on average 1.005 (95%CI 0.999, 1.010, P=0.0910) times as many drinks per drinking day; had 1.008 (95%CI 1.005, 1.010, P<0.0001) times as many alcohol-related problems and experienced 1.013 (95%CI 1.005, 1.022, P=0.0020) times as many second hand effects.</p> <p>For each additional 10 off-licensed outlets within 1km of respondents' residences, respondents consumed on average 1.047 (95%CI 0.978, 1.121, P=0.1855) times as many drinks per drinking day; had 1.069 (95%CI 1.044, 1.095, P<0.0001) times as many alcohol-related problems and experienced 1.133 (95%CI 1.025, 1.207) times as many second hand effects.</p> <p>For each additional 10 on-licensed outlets within 1km of respondents' residences, respondents consumed on average 1.005 (95%CI 0.999, 1.012, P=0.1235) times as many drinks per drinking day; had 1.011 (95%CI 1.006, 1.016, P<0.0001) times as many alcohol-related problems and experienced 1.018 (95%CI 1.006, 1.031, P=0.045) times as many second hand effects.</p>	New Zealand
Livingston <i>et al.</i> , 2008	Multi-level modelling	To explore individual and community-level correlates of regular very-high risk drinking (more than 21 drinks at least 12 times a year for males and more than 11 drinks at least 12 times a year for females) among young drinkers (aged 16 to 24 yrs) in Victoria, Australia	Victoria, Australia	Alcohol density outlet	Approximately 20% (2167) of the sample reported regular (at least once per month) very high risk drinking (more than 20 drinks at least 12 times a year for males and more than 11 drinks at least 12 times a year for females). The density of packaged liquor outlets was found to be significantly associated (p<0.01) with very high-risk drinking in young people.	Victoria, Australia

Pollack <i>et al.</i> , 2005	Multi-level modelling	To investigate the relationships between neighbourhood-level deprivation, alcohol availability and individual-level alcohol consumption.	USA	Alcohol density outlet	Multi-level analyses showed that the least deprived neighbourhoods were associated with the highest levels of alcohol consumption, even when individual-level sociodemographic factors controlled for (OR=1.30, 1.08 to 1.56). The density of alcohol outlets (high vs low) (OR=1.12 (0.96 to 1.31) was not significantly associated with heavy drinking in this study.	USA
Schonlau <i>et al.</i> , 2008	Regression analysis	To explore the relationship between alcohol outlet density and alcohol consumption	Louisiana and Los Angeles County, USA	Alcohol density outlet	Off-premise alcohol outlet density was associated with the quantity of alcohol consumption among respondents in Louisiana but not Los Angeles County, with a stronger association between alcohol consumption and outlet density within a one mile buffer of the respondent's home than for outlet density within the census tract of the respondent's residence.	Louisiana and Los Angeles County, USA
Scribner <i>et al.</i> 2000	Multi-level analysis	To assess the relationship between off-sales alcohol outlet density and alcohol consumption.	New Orleans, Louisiana, USA	Alcohol density outlet	The analysis demonstrated that, whilst individual distance to closest alcohol outlet was not related to alcohol consumption, the mean distance to the closest alcohol outlet was negatively related to drinking norms (-5.50, SE=2.37) and alcohol consumption (-0.447 SE=0.195), meaning that the lower mean distance to the closest alcohol outlets, the greater the mean drinking norms score (indicating a greater acceptability of drinking activity) and mean level of alcohol consumption. This study therefore showed that, in this case, the effect of alcohol outlet density on alcohol measures appeared to function at a neighbourhood rather than individual level, in that all individuals living in a neighbourhood of high alcohol outlet density are affected by the exposure.	New Orleans, Louisiana, USA
Treno <i>et al.</i> , 2008	Regression analysis	To investigate the effect of alcohol outlet density on perceived and actual informal and formal adolescent alcohol access in California, USA	California, USA	Alcohol density outlet	Off-premise outlet density was found to be positively associated with both actual use of (b=0.391, p<0.01) and perceived ease of access (b=0.081, p<0.001) to formal sources of alcohol among young people. Off-premise alcohol outlet density was negatively associated with actual use of informal sources (b= - 0.228, p ≤ 0.05).	California, USA

Trolldal, 2005a	Interrupted time-series analysis, ++	To determine the effects of the privatisation of retail sale of alcohol in Alberta, Canada (primarily between end of 1980s and early 1990s) on alcohol-related measures including annual sales of alcohol (1950 to 2000) and fatal traffic crashes among people aged ≥ 15 yrs.	Alberta, Canada	Privatisation of retail sale of alcohol	It was reported that privatisation had a significant and permanent effect on the sale of spirits (estimate 0.12, $p < 0.01$) (but not wine or beer sales). However, this effect was not large enough to influence total sales. No significant impact was observed in terms of the number of fatal motor vehicle traffic accidents.	Alberta, Canada
Trolldal, 2005b	Interrupted time-series analysis, ++	To assess the effects of privatisation on wine sales, total sales and sales of spirits and beer in Quebec, Canada	Quebec, Canada	Grocery stores were permitted to sell domestically produced wine and wine imported and bottled by the Liquor Board from 1978. This liberalisation was extended in 1983, allowing the sale of wine bottled by privately owned manufacturers in Quebec.	Trolldal observed a significant and permanent effect of policy change in 1978, whereby sales of wine increasing by 10% (but no significant effect on spirits or beer sales) ($p < 0.01$). However, as previously, the beverage-specific increase was not sufficient to have an influence on total sales. There was no apparent increase in the sales of wine observed between 1983 and 1984. Change in prices of beverages had a significant negative effect on wine sales ($p < 0.01$), with evidence indicating that, when price increased by 1%, sales decreased by 0.40%.	Quebec, Canada
Wagenaar & Holder, 1995	Interrupted time series analysis, ++	To investigate the results of the privatisation of wine sales in 5 states of the USA between 1968 and 1991 that had not undergone previous investigation (Alabama, Idaho, Maine, Montana and New Hampshire).	Alabama, Idaho, Maine, Montana and New Hampshire, USA	Privatisation of wine sales	Significant increases in sales of wine were observed after the privatisation of retail wine monopolies of 42% for Alabama, 150% in Idaho, 137% in Maine, 75% in Montana and 15% in New Hampshire (representing increases in litres of pure ethanol per year in the form of wine of 621,000, 432,000, 364,000, 363,000 and 171,000 respectively). No significant decreases in wine sales were observed in states adjacent to focal states. Furthermore, no significant increases in the sales of beer or spirits occurred alongside sales of wine, suggesting no general contemporaneous trend in increased sales.	Alabama, Idaho, Maine, Montana and New Hampshire, USA

Weitzman <i>et al.</i> , 2003	Analysis of correlation	To determine the correlations between on and off-premise alcohol outlet density and heavy and frequent drinking among college students	8 Universities across the USA	Alcohol outlet density	A significant correlation was observed for all drinkers between outlet density and heavy drinking ($r=0.82$, $p=0.01$), which held for subgroups, including men ($r=0.73$, $p=0.04$) and students who acquired binge drinking in college ($r=0.75$, $p=0.03$). In addition, a significant correlation was found between outlet density and frequent drinking among all drinkers, ($r=0.73$, $p=0.04$), women ($r=0.72$, $p=0.02$), underage students ($r=0.79$, $p=0.02$) and students who picked up binge drinking in college ($r=0.84$, $p=0.01$). Outlet density and drinking-related problems were also significantly correlated among all drinkers ($r=0.79$, $p=0.02$), women ($r=0.90$, $p=0.002$), underage students ($r=0.73$, $p=0.04$), overage students ($r=0.79$, $p=0.02$) and students who acquired binge drinking in college ($r=0.76$, $p=0.03$).	8 Universities across the USA
Xie <i>et al.</i> , 2000	Cross-sectional time series analysis	To assess the relationships between alcohol availability measures (rate of licensed premises, year in which legal drinking age was reduced) and per capita consumption of alcohol in adults aged 15 yrs and over in Canada	Adults aged 15 yrs and over in Canada	Alcohol outlet density	Alcohol outlet density was described as having had a significant positive relationship with alcohol consumption ($p \leq 0.05$).	Canada

Cohen <i>et al.</i> , 2006	Analysis of longitudinal ecological data	To examine the effect of neighbourhood changes, including alcohol outlet density, on rates of gonorrhoea	Los Angeles, USA	The Civil Unrest that occurred in Los Angeles in 1992 resulted in the closure of 270 alcohol outlets due to arson and vandalism. A community mobilisation effort, in conjunction with new conditional use zoning laws that restricted the opening of alcohol outlets, led to the 270 alcohol outlets surrendering their licences.	The primary outcome of the analysis was the annual age and sex-adjusted gonorrhoea rate (1988-1996) at census tract level. The mean proportion of off-premise outlets that surrendered their licence in 1992 was 3% (SD=12). The mean pre-post Civil Unrest change in number of off-premise outlets per road mile was 0.01 (SD=0.09). Four individual growth models were used to predict age-sex adjusted gonorrhoea rates. The first three models investigated separately the hypothesised association of a riot-related key predictor (including the proportion of off-premise alcohol outlets surrendered, physical damage due to the Unrest, and alcohol outlet density) with gonorrhoea rates, after controlling for other time-varying and tract level covariates and an overall time trend. A fourth model included all three riot-related predictors. All models controlled for baseline gonorrhoea rates, proportions of the population who were Black, Hispanic, and male, and socioeconomic status. The final model explained 92% of between-tract variance and 93% of within-tract variation. All predictors except for socioeconomic status were statistically significant $P<0.01$). The average gonorrhoea rate in 1992 for census tracts with no damage was 110 per 100,000. In 1992, a tract with damage had 56 additional cases of gonorrhoea per 100,000 than a tract without damage. The overall temporal trend was for a decline of 11 gonorrhoea cases per 100,000 for a non-damaged, 'average' tract and a more rapid decline of 33 cases per 100,000 annually for damaged tracts. Tracts with more off-premise liquor outlets surrendered in 1992 had higher gonorrhoea rates ($P<0.001$) at baseline than tracts with fewer licences surrendered. However, the rate of decline over time for tracts with more surrendered licences was more rapid than in tracts with fewer surrendered licences. For a typical tract in LA with 5 off-premise outlets, the effect size of closure of one of the outlets equated to 42 fewer gonorrhoea cases per 100,000 (with other census tract characteristics set at an average value). Having controlled for the effect of property damage and surrendered licences, there was a positive association between alcohol outlets and gonorrhoea rates. The median number of off-premise outlets per roadway mile was 0.36, with an average number of 16 roadway miles per census tract. Therefore, for a census tract with a median outlet density and average characteristics, there would be 62 additional gonorrhoea cases per 100,000 compared to a tract with zero outlet density. Following the Civil Unrest, a unit decrease in the number of alcohol outlets per mile of roadway was associated in 21 fewer gonorrhoea cases per 100,000 ($P<0.01$) in tracts affected by the Unrest compared to those areas not affected. Thus, this study demonstrated that alcohol outlets appear to be significantly associated with changes in gonorrhoea rates. However, it is unclear whether other social changes that occurred following the Unrest and were not controlled for in the analysis may have contributed to the increase in gonorrhoea.	Los Angeles, USA
Her <i>et al.</i> , 1999	Literature review	To perform a review of the research evidence relating to the effects of the privatisation of alcohol retail monopolies in the USA, Canada and Scandinavia	USA, Canada and Scandinavia	Privatisation of alcohol retail monopolies	The authors found that the privatisation of alcohol retail monopolies tended to result in higher outlet densities, longer hours or more days of sale, and changes in price and promotion, typically resulting in increased per capita rates of alcohol consumption.	USA, Canada and Scandinavia

Mäkelä <i>et al.</i> , 2002	Literature review	To undertake a literature review of evaluation studies of changes in alcohol availability from the previous 50 yrs in Nordic countries	Scandinavia	Alcohol outlet density	This review therefore provided evidence of the variable impact of changes in alcohol outlet density.	Scandinavia
<i>Interaction between off-licence and on-licence availability of alcohol</i>						
Holloway <i>et al.</i> , 2008	Case studies	To explore domestic drinking practices, the meaning of home and alcohol policy in England.	England	Pre-drinking activity	40% reported being likely to have drink before going out for the night, whilst 23% were likely to have drink after returning home from a night out. Quantitative data demonstrated that the likelihood to drink before a night out did not vary by gender but varied significantly by age, religion and social class (no data reported). Young people were over-represented among those very likely to drink before a night out; whilst those aged over 55 were over-represented among those very unlikely to do so. 47% of religious people reported being very unlikely to drink before going out vs 32% of their secular counterparts. Those from a higher social class were over-represented among those who drink before a night out (although the authors stated that 'all social groups were represented to some degree') (no further data presented). However, qualitative data indicated that young people of low income drank to intoxication before going out in order to save money. The findings from the interviews also suggested that motives for drinking before a night out included winding down with friends and socialising whilst preparing for the night. The authors argue that the increased availability of alcohol via supermarkets has facilitated home drinking, with one respondent stating that 'Sainsbury's is my local.'	England
Hughes <i>et al.</i> , 2008	Cross-sectional questionnaire survey	To investigate the potential differences in alcohol consumption and negative nightlife experiences between young people who drink before attending city night-life venues and those who do not drink until reaching bars and nightclubs.	England	Pre-drinking activity	This evidence therefore that demonstrates people who drink before visiting nightlife venues consume more alcohol over the course of the evening and are at greater risk of being involved in violent incidents. The authors suggested that prevailing differences in pricing and policing of alcohol between on and off licensed premises may promote at-home drinking before nights out. No evidence was presented relating to alcohol consumption after returning home.	England

Wells <i>et al.</i> , 2009	Literature review	To report the research, policy and prevention implications of pre-drinking or pre-gaming, defined by the authors as planned heavy drinking prior to going to a public drinking establishment.	International evidence	Pre-drinking activity	<p>Heavy pre-drinking before going out was described as being a common and popular practice among young adults internationally. Apparent motivations for pre-drinking included: avoiding paying for high priced drinks at commercial drinking establishments; achieving drunkenness and the enhancement and extension of leisure time; socialising with friends, reducing social anxiety or enhancing male group bonding before night out. Wells noted that private drinking sometimes occurs in preparation for event where alcohol not available, particularly among young drinkers (Pedersen and LaBrie, 2007) and is popular and celebrated activity among young adults (especially in college/university drinking culture). Pedersen and LaBrie (2007) found 64% of students at US college setting engaged in pre-drinking before attending a bar, party or concert, with increased negative consequences. Of those students who had been referred for mandatory intervention at private liberal arts university in USA following alcohol-related violation, 31% had been pre-drinking on that night, with higher consumption than non-pre-drinkers (Borsari <i>et al.</i>, 2007). An economic motive for pre-drinking was shown in studies in the USA (DeJong & DeRicco, 2005) and Glasgow, UK (Forsyth, 2006). Becoming intoxicated was also a deliberate motive for pre-drinking in the USA (DeJong & DeRicco, 2005) and UK, where intoxication was described as being a strategic goal (Parker & Williams, 2003). Some individuals favour pre-drinking as an option for socialising with friends in quieter pre-nightlife setting, as reported in studies from the USA (DeJong & DeRicco, 2005) and Glasgow, UK (Forsyth, 2006). Grazian (2007) also found use of pre-drinking in male bonding in male college students. Pre-drinking also is used to relieve social anxiety at the individual's intended destination (Pedersen and LaBrie, 2007, DeJong & DeRicco, 2005, Forsyth, 2006). Limited existing evidence indicated that pre-drinking is linked with uncontrolled, heavy drinking and harmful consequences. Two studies described young people passing out or becoming too intoxicated to go out through pre-drinking (DeJong & DeRicco, 2005; Kellner, 2008). Pre-drinking also has been observed to result in participants consuming increased amounts of alcohol over the course of the evening, above planned levels (DeJong&Ricco, 2005; Pedersen & LaBrie, 2007; Glindemann et al., 2006; LaBrie & Pedersen, 2008). The authors argued that alcohol policies restricting the availability of alcohol licensed premises may lead to the displacement of drinking to pre-drinking in private settings, possibly resulting in greater harm to individuals. Suggested approaches included making on- and off-licence alcohol prices more balanced (with Wells stating that the differential in prices between on- and off-licence premises potentially supporting pre-drinking), and attempting to attract young people back to licensed premises for early drinking, where this activity could be under more control.</p>	International evidence
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APPENDIX 5: Characteristics and main findings from studies included in the review of alcohol promotion

First author and date and country	Study Design & Quality (++/+/+)	Research Objective	Setting & Study Population	Intervention(s) & Comparator(s)	Main findings
Booth <i>et al.</i> , 2008 UK	Systematic review, ++	To investigate the relationships between advertising/promotion and alcohol consumption or directly to harm.	Booth <i>et al.</i> carried out additional syntheses of findings relating to underage drinkers (under the age of 18 yrs), young adult binge drinkers (aged 18-25 yrs, drinking more than the equivalent of 6 UK units (women)/8 UK units (men) on a single occasion), harmful drinkers, (individuals regularly drinking more than the equivalent of 35 UK units per week for women/50 UK units per week for men), and those on low incomes.	Promotion: <ul style="list-style-type: none"> • Advertising interventions • Promotion interventions 	Seventy studies including 2 meta-analyses met inclusion criteria. The meta-analysis performed by Gallet (2007) included 132 studies. Studies were published between 1945 and 2003, with the majority of studies originating in the USA. Smith & Foxcroft (2007) undertook a systematic review of the effect of advertising on alcohol consumption among young people and identified 7 cohort studies from a range of settings including the USA, Belgium and New Zealand. Booth <i>et al.</i> presented the median advertising elasticities calculated by Gallet (2007) as follows: beer (0.020); wine (0.007); spirits (0.070) and alcohol (0.032), and described an advertising elasticity for beer of 0.020, representing that for every 10% increase in advertising expenditure, the expenditure on beer increased by 0.2%. Findings from the systematic review by Smith and Foxcroft (2007) were also described, which demonstrated the relationship between exposure to alcohol advertising and subsequent alcohol consumption. Booth noted that the form of analysis employed by Gallet used high-level aggregates of advertising expenditure and that such an approach was not able to differentiate between different forms of advertising or types of consumers. Furthermore, it was noted that the cohort studies, as identified by Smith and Foxcroft (2007), can be prone to confounding and that residual confounding may have influenced the analysis. Booth <i>et al.</i> described the evidence as demonstrative of a small but consistent relationship between advertising and alcohol consumption at a population level and among young people at an individual level. In addition, the evidence was considered to be supported by consumer studies, which show alcohol advertisements to result in positive expectancies and attitudes related to alcohol. Twelve studies were included by Booth <i>et al.</i> , the earliest of which was published in 2000, with the majority being published in the USA (with isolated evidence emerging from the UK, Australia and New Zealand). Studies were typically longitudinal in design. The evidence base was described by the authors as being moderately but consistently suggestive of the likely influence of point of purchase promotions on the overall alcohol consumption of underage drinkers, binge drinkers and regular drinkers. The evidence consistently suggested that exposure to billboard and print media may serve to increase initiation of alcohol consumption, and also frequency and quantity of consumption among young people. Booth <i>et al.</i> reported that the evidence from cross-sectional studies was consistently demonstrative of high levels of ownership of such merchandise among young people, especially among underage drinkers and binge drinkers. Some inconclusive evidence was identified that ownership of alcohol-related merchandise was linked with initiation of or current alcohol consumption. Evidence from longitudinal studies consistently demonstrated that exposure to television and other forms of broadcast media were related to initiation of and levels of alcohol consumption, but that evidence relating to the impact of the home-viewing videos was inconclusive. The evidence base was inconclusive but suggested that bans on advertising may reduce consumption and that bans might be most effective alongside other restrictive measures. No studies were identified by the review authors relating to the impact of industry self-regulation of alcohol advertising standards.

Anderson <i>et al.</i> , 2009	Systematic review, ++	To examine the effects of alcohol advertising and media exposure on future alcohol use among adolescents.	Participants aged ≤18 yrs (with the exception of studies conducted in the USA, where legal drinking age of 21 yrs was taken as the cut-off).	The intervention reviewed was alcohol mass media advertising by the alcohol industry (including the portrayal of alcohol in the mass media, alcohol promotion and media exposure containing alcohol advertisements. Mass media routes included advertising delivered via television, radio, newspapers, outdoor advertising, posters and so on. Alcohol promotion included give-aways and items bearing alcohol industry branding.	Thirteen longitudinal studies were included that followed up a total of >38,000 young people, with sample sizes in individual studies ranging from 630 to 6522. These studies included differing age groupings that ranged between 10 and 21 yrs at baseline. Ten studies were performed in the USA, one in Belgium, one in Germany and one in New Zealand, with data collection periods ranging between 1985 and 2005. Two studies assessed the effects of media exposure (television and music videos) on alcohol use; three studies focused on alcohol use in motion pictures; two studies covered a range of marketing exposure (including television, magazines, concession stands at sports or music events, and in store advertisements; two studies tested ownership of alcohol branded merchandise; one study looked at TV alcohol commercials alone; one study, recall and liking of advertisements; one study, outdoor advertising; one study, brand recognition, recall and receptivity to alcohol marketing; and one study, volume of and expenditure on advertisements. Drinking activity was reported by included studies as follows: seven studies described initiation of alcohol use amongst non-drinkers, three studies reported on maintenance and frequency of drinking amongst baseline drinkers, and seven studies presented alcohol use of the total sample of non-drinkers and drinkers at baseline. In 10 studies, participants were followed up once. Data were collected at time points ranging from a few months to several years. Twelve of the thirteen studies reported that exposure had an impact on subsequent alcohol use among adolescents, including initiation of drinking and heavier drinking amongst existing drinkers, when potentially confounding variables (including family and peer drinking and relevant demographic variables) were controlled for. A single study (testing the effects of outdoor advertising located near school settings) did not observe an impact on alcohol use. However, an impact on intentions to use alcohol in the next month was found. Seven studies demonstrated a dose-response relationship between exposure and alcohol use. However, the review authors stated that it is not possible to determine whether all potentially confounding variables were controlled for.
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