The Use of Existing Data Sources to Evaluate the Impact of Alcohol Control Policies or Contextual Factors Affecting Alcohol Consumption in the UK and in Sri Lanka

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BSc(Hons) MSc

Thesis submitted to the University of Nottingham

for the degree of Doctor of Philosophy

May 2017

ABSTRACT

Background

Harmful use of alcohol is the fifth leading risk factor for global burden of disease, disability and death. While the level of alcohol consumption varies around the world, it causes numerous preventable health and social issues in many countries and around 3.3 million deaths per year globally. In the UK alcohol consumption is decreasing; by contrast, alcohol consumption in Sri Lanka has been rapidly increasing over recent years. However, in both settings alcohol misuse represents a major public health concern. Therefore, it is important to evaluate existing alcohol control policies or contextual factors affecting alcohol consumption in these settings and to identify existing data sources that can be used for alcohol control policy evaluation.

This thesis aimed to investigate the suitability of existing data sources in the UK, identify potentially suitable measures and use those measures to evaluate the impact of Licensing Act 2003 in England, which allowed flexible opening hours including 24-hour drinking at on-trade premises in England and Wales from November 2005 onwards. This thesis further aimed to apply the lessons learned from the UK to Sri Lankan context, identifying potential data sources and using these to evaluate the effect the end of conflict in 2009 on alcohol consumption in Sri Lanka.

Methods

A range of sources of data on alcohol consumption and consequences in the UK were reviewed to identify those appropriate for alcohol control policy evaluation, and in particular for time series analysis which requires consistent data collected at regular intervals for a long period of time. The suitability of UK primary care data on alcohol consumption was assessed by

identifying the proportion of patients with a record of alcohol consumption status in the last year, as well as ever since their registration with a practice. The quality of alcohol consumption measures collected by English national surveys was assessed by comparing them with the international guidelines for measuring alcohol consumption in population surveys. Existing data sources on alcohol consumption and consequence in Sri Lanka were also identified and reviewed to identify their suitability for alcohol control policy evaluation. Interrupted time series analysis was then conducted on these measures to establish the effect of the Licensing Act 2003 on alcohol consumption among adults (age≥16) in England, and the end of the conflict on recorded alcohol consumption among adults (age≥15) living in the areas that were not directly affected by the conflict in Sri Lanka.

Findings

In the UK, there are numerous sources of alcohol consumption and consequence data. However, few provide frequently collected data from large samples over long time periods for time series analysis. The recording of alcohol consumption in primary care remains low, particularly when recent recording within a given year is considered. Moreover, alcohol consumption recording in primary care is higher among at-risk groups such as women in child bearing age, older men and women who are likely to have an illness linked to alcohol. Therefore, primary care data are currently unsuitable for alcohol control policy evaluation. Comparison of the alcohol data collected in English national surveys with recommendations from international guidelines showed that they have failed to maintain the consistency of data collection over time and to collect information on some of the key alcohol consumption measures such as the frequency of binge drinking. However, Health Survey for England (HSE) measured alcohol consumption on the heaviest drinking day of the last week consistently over

time and this measure was available on a quarterly basis for a nationally representative sample.

Interrupted time series analysis of HSE heaviest drinking day data from 2001 to 2013 showed that prior to the implementation of the Act alcohol consumption among adult male and female drinkers remained constant at around 8.3 units and 5.5 units of alcohol respectively. After the Act, there has been a gradual decline (less than 0.03 units per quarter) in the heaviest drinking day consumption among both male and female drinkers in England. However, it is difficult to attribute this decline in consumption to the Licensing Act as there was no step change in the consumption soon after the Act and the decline in heaviest drinking day consumption was small and gradual over a period of seven years.

When compared with the UK, Sri Lanka has a limited number of data sources on alcohol consumption and alcohol consequences. The Department of Excise alcohol sales database was identified as the only data source that can be used for alcohol control policy evaluation in Sri Lanka. However, these population-level data cannot be used to identify the characteristics of people who drink and patterns of drinking such as binge drinking.

Interrupted time series analysis showed that recorded alcohol consumption among Sri Lankans living in areas that were not directly affected by the armed conflict increased markedly after the end of the conflict in 2009, with a dramatic acceleration in the trend of adult per capita consumption. Annual adult per capita alcohol consumption among Sri Lankans increased from 1.59 litres of pure alcohol in 1998 to 2.56 litres of pure alcohol in 2013. Prior to the end of war in 2009 adult per capita alcohol consumption was increasing by 0.051 litres of pure alcohol per year (95% CI 0.029-0.074, $p<0.001$). After 2009, it increased by 0.154 litres per year (95% CI 0.082-0.226, $p=0.001$). it increased by 0.166 litres of pure alcohol per year (95% CI 0.095-0.236, $p<0.001$), almost a three-fold increment in

the increase per year compared to the trend prior to the end of the conflict. Beer consumption showed the highest per capita growth compared with other beverages.

Conclusions

This thesis identified the existing data sources that can be used for alcohol control policy evaluation purposes in two settings; UK and Sri Lanka. It has highlighted the further improvements required in existing alcohol consumption related data sources in both countries and discussed the potential of applying lessons learned from the UK context to Sri Lankan context. Despite the current trend in alcohol consumption, both countries experience a significant public health burden due to alcohol misuse. Therefore, both countries will require formulation and implementation of new policy measures. However, Sri Lanka does not have high-quality individual level alcohol consumption data to support the monitoring and evaluation of alcohol control policies. Therefore, this thesis has emphasised the need to generate high-quality alcohol consumption data in Sri Lanka and carry out monitoring and evaluation of alcohol control policies to tackle the alcohol-related burden.

PEER-REVIEWED PUBLICATIONS AND PRESENTATIONS ARISING FROM THE WORK PRESENTED IN THIS THESIS

Nugawela M, Langley T, Lewis S, Szatkowski L. 2014. Availability of alcohol consumption data for patients registered in primary care. British Journal of General Practice 2014; eLetter. 1st August 2014.

Nugawela M, Langley T, Szatkowski L, Lewis S. Measuring Alcohol Consumption in Population Surveys: A Review of International Guidelines and Comparison with Surveys in England. Oral Presentation at 10th Annual Meeting of UK Society for Behavioural Medicine, Nottingham, 4th December 2014.

Nugawela M, Langley T, Szatkowski L, Lewis S. Measuring Alcohol Consumption in Population Surveys: A Review of International Guidelines and Comparison with Surveys in England. Alcohol and Alcohol 2016; 51 (1): 84-92. doi: 10.1093/alcalc/agv073

Nugawela M, Lewis S, Langley T, Szatkowski L. How has alcohol consumption in England changed since the 2003 Licensing Act? Poster Presentation, Global Alcohol Policy Conference 2015, Edinburgh, 7-9th October 2015.

Nugawela M, Szatkowski L, Lewis S. Langley T. The Epidemic of Alcohol Consumption in Sri Lanka, Poster Presentation, Global Alcohol Policy Conference 2015, Edinburgh, 7-9th October 2015.

Nugawela M, Lewis S, Langley T, Szatkowski L. How has alcohol consumption in England changed since the 2003 Licensing Act?, Poster Presentation at the Alcohol Research UK Postgraduate and Early Career Symposium 2016, Birmingham, 15-16th March 2016.

Nugawela M, Lewis S, Szatkowski L, Langley T. Rapidly Increasing Trend of Recorded Alcohol Consumption Since the End of the Armed Conflict in Sri Lanka. Alcohol and Alcohol. 2017; 1-7. doi: 10.1093/alcalc/agx044

ACKNOWLEDGEMENTS

The work in this thesis was supervised by Dr Tessa Langley, Dr Lisa Szatkowski and Professor Sarah Lewis. I would like to express my gratitude to my supervisors for all the support and guidance they have provided me towards the completion of this work as well as towards the goal of becoming an independent researcher. I would also like to thank my assessors, Dr Jack Gibson and Professor Petra Meier for their constructive comments and suggestions that have been very helpful in refining this work.

The work involved in this thesis was funded by a scholarship (the Vice Chancellor's Scholarship for Research Excellence – International) from the University of Nottingham and the UK Centre for Tobacco and Alcohol Studies (UKCTAS), a UKCRC Public Health Research: Centre of Excellence. Funding to the UKCTAS from the British Heart Foundation, Cancer Research UK, the Economic and Social Research Council, the Medical Research Council and the National Institute of Health Research, under the auspices of the UK Clinical Research Collaboration is gratefully acknowledged.

Next, I would like to thank Dr Yue Huang for her support in extracting THIN data. My thanks also go to Mr Kala Rasika Wijesinghe, from the Department of Excise, Sri Lanka and Mrs I.R. Bandara, from the Department of Census and Statistics, Sri Lanka for their support in providing relevant data. I would also like to thank my friends and relatives for their encouragement, love and support over the past few years.

This thesis is dedicated to my parents and my husband with a wholehearted thank you. It would not have been possible to complete this work without their unwavering encouragement and support.

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ABBREVIATIONS

ABV	Alcohol by Volume
ACF	Autocorrelation Function
ADIC	Alcohol and Drug Information Centre
AUDIT	Alcohol Use Disorder Identification Test
ARIMA	Autoregressive Integrated Moving Average
BAC	Blood Alcohol Concentration
BSQF	Beverage Specific Quantity Frequency
CDC	Centre for Disease Control and Prevention
CI	Confidence Interval
CVD	Cardiovascular Disease
EU	European Union
FAS	Fetal Alcohol Syndrome
FAST	Fast Alcohol Screening Test
GHS	General Household Survey
GLF	General Lifestyle Survey
GP	General Practitioner
GQF	Graduated Quantity Frequency
HED	Heavy Episodic Drinking
HES	Hospital Episode Statistics
HSE	Health Survey for England
IAC	International Alcohol Control Study
ICD	International Classification of Diseases
ITS	Interrupted Time Series Design
NATA	National Authority on Tobacco and Alcohol
NIAAA	National Institute on Alcohol Abuse and Alcoholism

NICE	National Institute for Health and Clinical Excellence
NHS	National Health Service
PHRD	Public Health Responsibility Deal
QOF	Quality Outcomes Framework
QF	Quantity Frequency
RCT	Randomised Controlled Trial
SES	Socioeconomic Status
UK	United Kingdom
US	United States
WHO	World Health Organization

1 INTRODUCTION

Alcohol consumption is among the top five risk factors for the global burden of diseases, disability and death.[1, 2] Although light drinking (no more than 1-2 units per day) appears to reduce the risk of coronary heart disease, stroke and diabetes mellitus,[3, 4] higher levels of alcohol consumption cause many preventable diseases, injuries, violence, serious social issues and around 3.3 million deaths per year globally.[1]

Harmful alcohol consumption is a causal factor for diseases such as liver cirrhosis, cancers, mental health problems, tuberculosis and fetal alcohol syndrome.[4] It is also associated with a range of acute health consequences including alcohol poisoning, injuries, and drink-drive accidents.[4, 5] Alcohol misuse harms society through family disruption, child maltreatment and reduced industrial productivity.[6, 7] Even though alcohol consumption and related problems vary widely around the world, the public health burden remains significant in most countries. For example, in the United Kingdom (UK) alcohol consumption is the leading risk factor for ill health, disability and death among people aged 15 to 49 and it is the fifth leading risk factor for ill health among the whole UK population.[8] Healthcare costs, antisocial behaviours, and crimes due to alcohol misuse in the UK drain around £21 billion of public funds per year.[9, 10] In Sri Lanka, a South Asian low and middle-income country, 75% of deaths are due to non-communicable diseases and alcohol consumption is one of the top five risk factors (smoking, alcohol use, unhealthy diet, physical inactivity) contributing to this non-communicable disease burden.[11]

The World Health Organization (WHO), defines harmful use of alcohol as "drinking that causes detrimental health and social consequences for the drinker, the people around the drinker and society at large, as well as the

patterns of drinking that are associated with increased risk of adverse health outcomes".[1, 12] The level of alcohol misuse is mainly determined by the average volume of consumption, pattern of consumption such as binge drinking and the quality of alcohol.[13] In relation to the quality of alcohol, the home-made or illegally produced alcoholic beverages are considered to be more harmful than legally produced alcohol as they can contain toxic substances.[1]

Several individual-level and population-level factors also influence the degree of alcohol consumption and related harm among individuals. These individual level factors include age, gender, socioeconomic status, weight, physical fitness, race, religion, and ethnicity, whereas the population level factors include economic development, alcohol control policies, cultural norms and beliefs in different settings.[1, 14-16] Moreover, the level of alcohol consumption and alcohol-related consequences can also be moderated by the drinking context. For example, drinking without meals,[17] in public drinking places,[18] with many others[19] has been associated with higher rates of alcohol consequences.

Of these factors affecting alcohol consumption and consequences, the current work of this thesis will focus on population-level factors, particularly the impact of alcohol control policies and contextual factors on alcohol consumption in different settings.

1.1 Alcohol control policies and contextual factors affecting alcohol consumption

Alcohol control policies can be defined as "any purposeful effort or authoritative decision on the part of governments to minimise or prevent alcohol-related consequences".[20] Scientific literature from around the world provides evidence on the effectiveness of alcohol control policies in

tackling alcohol misuse as well as alcohol-related consequences.[21-23] The impact of common alcohol control policies in different settings will be discussed in detail in the following section.

Contextual factors such as natural disasters, conflicts and end of conflicts can also have significant impact on the level of alcohol consumption among individuals in different settings.[24-26] For example, exposure to Hurricanes Katrina and Rita in 2005 has been associated with increased alcohol consumption and binge drinking among individuals living in Mississippi, Louisiana and Alabama.[27] Similarly, other natural disasters such as tsunami, earthquakes, floods and eruption of volcanoes has also resulted in changes in the level of alcohol consumption among individuals in different settings.[28-30] In addition to these natural disasters, conflicts such as civil wars are a growing concern around the world. By the end of the year 2015, the total headcount of the displaced conflict-affected population was 40.8 million, of them 8.5 million were affected by conflicts during the year 2015.[31, 32] Though it has been identified that conflict exposure can result in alcohol and substance abuse,[33] there is a lack of scientific evidence around this relationship, particularly among low and middle-income countries where the vast majority of on-going and previous conflicts have taken place.

Therefore, out of the different contextual factors affecting alcohol consumption, the work in this thesis will further focus on the effect of conflict exposure on alcohol consumption and a detailed review of existing literature on this relationship is provided later in this chapter (section 1.3).

1.2 Effect of common policies on alcohol consumption in different settings

Successful policy options are informed by evidence and based on sound theoretical assumptions.[20] Therefore, they are likely to be effective across diverse settings. The following section describes the key national level policy options that have been recommended by the World Health Organization.[12]

1.2.1 Alcohol availability

Policies on alcohol availability aim to restrict the physical availability of alcohol. These policies are based on the theory that if alcohol is less easy to obtain it will lead to a reduction in the level of consumption and alcohol-related consequences.[20] One of the evidence-based policy approaches used to restrict the availability of alcohol in many countries is the use of government monopolies or licensing systems.[1, 34] Government monopolies on alcohol production or sales remove the private profit motive for sales of alcohol. In many countries (126 countries) alcohol licensing systems are being used to restrict alcohol production and sales, whereas in some countries (32 countries) government monopolies are being used to control alcohol production.[1] Some countries also use a combination of monopoly and licensing systems.

Managing Alcohol Outlet Density (AOD) is another policy option that is being used in different settings to restrict the alcohol availability. By restricting the number of alcohol outlets in an area, management of AOD aims to increase the travelling time and effort drinkers have to take to obtain alcohol and thereby to reduce the consumption. Several systematic reviews have attempted to synthesise the evidence on the relationship between AOD and alcohol consumption.[35-39] Despite the large number of primary studies

and systematic reviews, the evidence on the relationship between AOD and alcohol consumption is inconclusive, with mixed results showing strong, weak or no relationship.[35-39] One of the major limitations of the current evidence in relation to AOD is the lack of understanding of the causal relationship between AOD and alcohol consumption. It is not yet clear whether increased alcohol consumption (demand) leads to an increased number of AOD or vice versa.[40, 41]

In addition to above policy measures, age limits on drinking or purchasing alcohol are also being used in many countries to restrict alcohol availability, particularly to children.[42] Moreover, restricting the hours or days of alcohol sales has been identified as an effective alcohol control policy whereas there is evidence to support that extended or relaxed trading hours can increase consumption and related harm.[43, 44] A systematic review of studies assessing the effect of increasing hours of sale in on-licensed premises in high-income countries showed that an increment of hours of alcohol sales by more than 2 hours can lead to excessive alcohol consumption and related harm.[44] In contrast to this evidence, the Licensing Act 2003 in the UK allowed flexible and longer opening hours for licensed premises including the option of opening up to 24 hours a day.[45] Existing evidence on the implementation of this Act and its effect on adult alcohol consumption will be discussed in detail in the section 1-8 and in Chapter 5 respectively.

1.2.2 Alcohol pricing and taxation

Alcohol taxation and other price controls aim to increase the economic cost of alcohol and thereby to reduce the demand for alcohol [20]. A large number of studies conducted in both developed and developing countries demonstrate that alcohol taxation and pricing policies are effective

measures in tackling alcohol misuse and related harm.[1, 20, 22, 46-53] The current evidence suggests that alcohol prices and taxes are inversely related to the level of drinking,[22] though the strength of this relationship has been found to vary according to the setting. However, the effectiveness of these policies can depend on concurrent changes in income among populations.[52] For example, a price increase of alcohol may not be effective in a community experiencing an income rise due to economic development as the policy may not have an impact on the level of alcohol affordability among individuals.

Alcohol taxes broadly fall into three categories: excise duties, value added taxes (VAT) and customs tax, and the tax levels for different alcohol products/beverages can vary. The impact of these taxes on beverage specific alcohol consumption can depend on substitutes that drinkers make into other types of drinks or substances.[23]

Minimum unit pricing (MUP) is another pricing policy options. When implementing MUP policies a direct price control is set by the government on the volume of liquid, the alcohol content or on both.[23] This policy option has proven to be effective in reducing alcohol consumption in Canada [54]. Several modelling studies conducted in England have also shown that MUP policies would be an effective measure in reducing alcohol consumption irrespective of the socioeconomic status of drinkers. [55, 56] Similarly, another modelling study conducted using Australian data showed that a minimum unit price of $2 on off-trade alcohol purchases will have a significant impact on households purchasing higher levels of alcohol (at risk drinking levels) but not on households purchasing alcohol light to moderate drinking levels.[57]

Banning the sales of alcohol below the cost is another pricing policy option that has been used to control alcohol misuse.[46, 58] The costs considered under this policy option can vary according to its definition of costs; usually considered costs are the production, warehousing,

distribution and retail costs, excise duty and VAT. However, a modelling study comparing the MUP and banning the sale of alcohol below cost policies has shown that the latter policy option would have insignificant impact on reducing alcohol consumption compared to MUP.[59] Banning price promotions is another policy that can influence alcohol purchasing patterns among individuals.[60-63] There is moderate level evidence on effectiveness banning price promotions towards reducing alcohol consumption in different settings.[23, 64, 65]

1.2.3 Restrictions on alcohol marketing

The alcohol industry uses various marketing strategies to recruit new drinkers and to retain current drinkers. These marketing strategies include advertisements on television, radio, print media, the internet, and other methods such as sponsorships and promotional campaigns including point of sale promotions. Alcohol marketing aims to normalise drinking within society and exposure to these marketing strategies have shown to increase consumption among adults[48, 66] as well as among young people.[67-70]

Advertising bans are being used in many countries as an effective policy option in reducing alcohol consumption and related harm. For example, European countries with stricter advertising bans have reported lower levels of hazardous drinking when compared with other European countries having less strict alcohol advertising regulations.[71] Several modelling studies conducted using UK [65], US[72], Australian[73] and Danish[74] data have shown the beneficial effect of alcohol advertising bans in reducing consumption and related harm. However, a recent Cochrane review published in 2014 did not find strong evidence to support this relationship due to the poor quality of existing studies.[75]

Industry self-regulation is another policy option used to regulate alcohol marketing in different settings. Current evidence shows that industry self-regulation is ineffective and frequently does not meet the intended aims of reducing alcohol consumption and consequences.[51, 76]

Moreover, there are policies specifically aimed at protecting children from alcohol marketing and these include age verification filters, bans on alcohol advertising prior to 9pm, bans on alcohol advertising in films and banning alcohol sports sponsorships.[23]

1.2.4 Drink-drive policies

Studies have shown a direct relationship between alcohol and road traffic accidents, and current evidence reveals that even a small amount of alcohol increases the risk of road traffic accidents compared to a zero level of alcohol consumption.[77, 78] Drink drive policies aim to reduce alcohol-related drink drive accidents by establishing policies such as limits on Blood Alcohol Concentration (BAC) level, breath testing and taking legal action or introducing punishments against drunk drivers.[20] The use of these drink-drive policies has been identified as a cost-effective measure for reducing alcohol consumption as well as road traffic accidents.[51] In theory, it is assumed that these policies will reduce drink-drive accidents through punishment and social pressure.

One of the most commonly used policy options to control drink driving is using a legal BAC level. The legally acceptable level of BAC varies around the world and the most commonly used BAC levels vary from 0.05% to 0.15 %.[79] In the UK, the introduction of a BAC level in 1965 resulted in a 23% reduction of road traffic accidents.[80] Similarly, in the US, the lowering of the permitted BAC level from 100mg to 80 mg of alcohol per 100ml of blood resulted in a 15% of reduction in road traffic accidents.[81]

Further reduction of BAC level from 80mg to 50mg of alcohol per 100ml of blood has also proven to be more effective in reducing drink-drive accidents.[77, 82]

In the best practice of implementing policies related to BAC levels, it is expected to have sobriety checkpoints and random breath testing conducted by police to identify drink drivers.[20, 83] There is strong evidence to suggest that breath testing is an effective measure in reducing drink drive accidents, and three systematic reviews have provided evidence in favour of this policy option. [84-86] Graduated driver licensing, immediate licence revocation, alcohol ignition interlock devices are other effective policy options being used to reduce drink-drive accidents in different settings around the world.[23]

1.2.5 Other policy options

In addition to the above-mentioned most commonly used alcohol control policies, ensuring "broad access to information and effective education and public awareness programmes among all levels of society about the full range of alcohol-related harm" has also been recommended by the WHO as an important policy option to be implemented in member states.[12] Mass media campaigns have been used in many countries to inform people about alcohol-related consequences as well as to change public attitude towards drinking.[87] However, the current evidence on the effectiveness of mass media campaigns in reducing alcohol consumption remains inconclusive.[21] Alcohol education programmes have also been used to increase the awareness of alcohol-related health risks among adolescents, to delay the onset of their drinking and to change attitudes towards drinking, but evidence on school-based alcohol education programmes also remains inconclusive due to the poor quality of existing

studies.[21, 88] Alcohol warning labels, information labels, content labels, and alcohol drinking guidelines are other forms of interventions that have been used to increase the awareness of responsible drinking among populations.[89-91] However, the current evidence on these interventions also remains weak.[23]

Having relevant policies to address the social consequences of drinking in pubs, bars and restaurants is another policy area to be considered.[12] Violence and antisocial behaviours in and around on-trade premises is a significant social issue in many countries.[92] It has been identified that factors related to the drinking environment have an effect on the level of intoxication among drinkers. For example, a study conducted in 60 bars in four European countries (Netherlands, Slovenia, Spain, and the UK) identified higher levels of intoxications in permissive late night venues.[93] Therefore, having relevant policies to manage drinking environments is important.

Server training and strict enforcement of alcohol laws have been used as interventions to manage drinking environments in Stockholm and an evaluation of this intervention showed that there was a significant reduction in assaults as well as in the instances of bar staff selling alcohol to intoxicated customers.[94] The same intervention was found to be highly cost-effective, as it could save around €31 million public funds through the reduced number of violent crimes in Stockholm.[95] Similar multicomponent approaches in Finland and England have also shown that managing the drinking environment through community mobilisation, law enforcement and server training are effective approaches towards reducing alcohol-related harm in on trade premises.[96, 97]

Another intervention used to alter the drinking environment is replacing glassware with safer alternatives such as polycarbonate glassware.[98-100] Evaluations of this policy approach in Lancashire and

Glasgow showed that there were fewer injuries and customers felt safer since the introduction of polycarbonate glassware [98, 99]. Removing the sale of drinks with high alcohol content,[101] banning public drinking or drinking in specific locations[102] are other policy approaches used in managing drinking environments in different settings.

1.3 Effect of conflict exposure on alcohol consumption in different settings

This section will provide an overview of the current evidence on conflict exposure and alcohol consumption in different settings and discuss the factors linked to conflict which may influence alcohol consumption among individuals in these settings. Finally, it will provide a conceptual framework on these factors and their impact on alcohol misuse in post-conflict settings.

1.3.1 Alcohol consumption among militants

The scientific literature provides evidence of high rates of drinking and heavy drinking among military personnel.[103] Conflict and trauma exposure have been identified as risk factors associated with alcohol misuse in armed forces.[103-106] A study showed that after controlling for key demographic factors such as age, education, race/ethnicity and sex, military personnel were twice as likely to be heavy drinkers when compared with civilians.[107] Generally, military men reported having a high risk of heavy drinking compared to military women and civilians. [103, 107] By contrast, military women reported to have no clear difference in heavy drinking compared with civilians.[106]

Several studies have shown this high-risk drinking among combatants is associated with conflict exposure. For example, a cohort study of UK

military forces showed that military personnel who were deployed to Iraq and Afghanistan during 2003 to 2009 were 30% (OR: 1.30; 95% CI 1.01-1.67; p=0.03) more likely to misuse alcohol compared to those who were not deployed.[104] A number of systematic reviews have synthesised the evidence on alcohol consumption among military personnel [103, 105, 106] and these reviews confirm the association between conflict exposure and high-risk drinking among combatants. A recent systematic review of eighteen studies focused on veterans who were deployed to Gulf war, Afghanistan or Iraq war showed that they were at increased risk of alcohol misuse when compared with non-deployed military personnel.[105]

1.3.2 Conflict exposure and alcohol consumption among civilians

Despite the extensive amount of evidence for excessive alcohol consumption among military personnel, [103, 105, 106] evidence on alcohol misuse among civilians during post-conflict periods is extremely limited due to a small number of studies, particularly in low and middle-income countries. Moreover, existing studies have mainly focused on populations directly exposed to conflicts, such as refugees or internally displaced persons.[25, 26] The following sections discuss existing literature on alcohol consumption among conflict-affected displaced and non-displaced populations separately.

1.3.2.1 Among displaced populations

Two systematic reviews have synthesised the evidence on alcohol consumption among displaced populations; the first review published in 2010 aimed to identify the factors associated with alcohol misuse among displaced populations.[26] It identified age, gender, exposure to traumatic events, prior alcohol use disorders, year of immigration, the location of residence, social relations, and post-migration trauma and stress as factors associated with alcohol misuse among conflict affected populations.[26] The other most recent systematic review aimed to summarize findings from studies on substance use among populations displaced by conflict and considered substances that included alcohol, cannabis, opiates, pharmaceuticals and psychostimulants.[25] It identified 17 studies conducted on populations in or recovering from conflicts. Only three studies included in this review identified the risk factors for substance use among displaced and they were gender, trauma-related conditions, pre-displacement substance use and socio-economic status.[25] Other studies included in this review provided estimates on prevalence of substance use, described harmful consequences of substances, examined gender based violence in these settings. In conclusion, this review emphasized that current evidence on substance use among conflict affected displaced populations is weak.[25]

According to the limited evidence base, heavy drinking is particularly a problem among men compared to women in conflict-affected displaced populations.[25, 26] However, the prevalence of heavy drinking has varied from setting to setting. For example, the prevalence of alcohol dependence among a group of Internally Displaced People (IDPs) in Croatia (157 men and 211 women) was 60.5% and 8.1% for men and women respectively.[108] The prevalence of alcohol use disorders among Northern Ugandan IDPs who were affected by a civil war for more than 20 years were 32% and 7% for men and women respectively.[109] Another study questioned 636 pregnant

women in Thailand Mae Le refugee camp about their own alcohol consumption and their male partners' alcohol consumption.[110] This study found that alcohol misuse is mainly a male issue in this setting as the prevalence of risky alcohol consumption among men and women was about 24.4% and 0.2% respectively.[110] However, the findings of these studies have been limited due to a lack of comparison populations and failure to use standardised and validated alcohol consumption measurement methods. [25, 26, 111]

1.3.2.2 Among non-displaced populations

Alcohol consumption among non-displaced or indirectly affected populations in post-conflict settings may also increase due to population-level factors such as rapid urbanisation, lack of alcohol control strategies and alcohol producers and distributors taking advantage of weakened trading systems.[111-113] A few studies have identified increased alcohol consumption among non-displaced populations,[114] but these were based on high-income countries and their results have also been limited due to methodological issues. For example, a study conducted after the terrorist attack on September 11th, 2001 in the United States, identified an increase in alcohol consumption among residents living in Manhattan.[115] However, its response rate was only around 64% and it used the most basic quasi-experimental study design comparing a single measure before and after the attack.[115] Therefore, its results may have been affected by secular trends or sudden fluctuations in the outcome measure.[116] After considering this limited evidence base, the importance of conducting adequate research on alcohol consumption and related disorders among conflict-affected populations particularly in low and middle-income countries was emphasised by Roberts et al in 2015.[117]

1.3.3 Individual and population level risk factors caused by conflict and influencing alcohol consumption in post-conflict settings

1.3.3.1 Mental health problems

Mental health disorders have been identified as a major risk factor contributing toward increased alcohol consumption and initiation of drinking among people in different post-conflict settings around the world. For example, a study conducted among 3048 respondents from post-conflict communities in Algeria, Cambodia, Ethiopia and Palestine identified PTSD as the most common mental health disorder among individuals exposed to violence and anxiety as the most common disorder among individuals who were not directly exposed to violence in these settings.[118] Participants with experience of violence associated with armed conflict in Algeria had a risk ratio of 2.10 (95% CI 1.38 – 2.85) for anxiety, whereas participants with violence experience in Palestine had a risk ratio of 10.03 (95% CI 5.26 – 16.65) for PTSD.[118] A systematic review and meta-regression on prevalence rates of PTSD and depression among conflict-affected populations synthesised the results from 161 studies, which included a total of 81,866 conflict-affected persons from 40 countries.[119] According to this review rates of PTSD and depression in different settings showed large variability from 0%-99% and 3%-85.5% respectively.[119] However, after adjustment for methodological issues related to sampling and choice of diagnostic instrument, exposure to torture and traumatic events have been identified as the strongest substantive factors associated with PTSD and depression among people in these settings.[119] Another systematic review on the behavioural and psychological consequences of terrorist incidents included 113 studies. According to this review, the prevalence of PTSD among people directly exposed to terrorist incidents varied from 12% to

16% but this prevalence may decrease over time.[120] Moreover, there was a slight difference in the prevalence of PTSD among people who lived within 100 miles of terrorist events (7.9%, 95% CI= 3.3% to 17.6%) and who lived beyond 100 miles (9.5%, 95% CI= 7.5% to 12%).[120]

These commonly reported mental health disorders such as PTSD, anxiety and depression among conflict-affected populations are found to be associated with increased risk of alcohol consumption.[24] Scientific literature shows that the co-occurring relationship between anxiety disorders and alcohol abuse is greater than that would be expected by chance alone.[24, 121] For example, a recent study conducted among a group of patients with alcohol use disorders has identified that anxiety was associated with an increased risk of alcohol dependence.[122] Therefore, mental health disorders among conflict-affected populations can be considered as one of the key factors contributing towards increased alcohol consumption in these settings.

1.3.3.2 Unemployment and Poverty

Conflict-affected populations experience high levels of unemployment due to a lack of potential employers, unstable governments, absence of savings and investments in these settings.[123, 124] The groups of people who are more likely to be affected by unemployment in post-conflict settings include military combatants, others involved in conflict-related employments, displaced persons, women and disabled people. [123, 124] For example, it is estimated that around 50,000 military personnel were decommissioned in Sri Lanka after the end of its 26 year long war and these combatants may have spent more than a decade in the armed forces.[123] Therefore, it can be difficult for them to find other job opportunities as they may not have gained the relevant skills.

Lack of employment opportunities, damaged infrastructure, destruction of assets, forced displacement, death and injury to people, as well as the breakup of social networks, leads conflict-affected populations into poverty.[125, 126] During the period from 1981 to 2005, on average a country that experienced major violence had a poverty rate 21% higher than the countries that did not experience violence.[127] Moreover, for every three years of major violence, the poverty reduction of a country that experienced major violence lagged behind 2.7% compared with other countries.[127] Conflict-affected countries can take at least 14 years to recover from economic downfall and get back to pre-war economic growth rates,[128] and least developed countries find it most difficult to recover from extreme poverty levels caused by conflicts.[129] In countries affected by conflicts, the most conflict-affected areas (districts or provinces) have the highest poverty levels. For example, Columbia,[130] Syria,[131] Rwanda,[132] Uganda,[133] and Sri Lanka [134-136] reported having the highest poverty levels in the most conflict-affected areas of these countries.

Alcohol consumption among conflict-affected populations can be increased as a result of this high level of unemployment and poverty.[137] A comprehensive systematic review focused on the relationship between unemployment and substance abuse identified that risky alcohol consumption is more prevalent among unemployed and unemployment is a significant risk factor for hazardous alcohol consumption.[137] Moreover, it has been identified that people who experience poverty and unemployment for longer periods are likely to become heavy drinkers or more frequent drinkers at the age of 27-35. [138]

1.3.3.3 Lack of alcohol control strategies

Due to political instability and prioritisation of other critical public health concerns such as malnutrition, sanitation, and spread of infectious diseases in post-conflict settings,[113, 139] the implementation and enforcement of alcohol control policies have a low priority. Formulation and implementation of alcohol control policies also become a challenge in these settings due to lack of expertise, resources and capacity.[113] The governments and health ministries often do not perform well during post-conflict periods.[113] Even if there were alcohol control policies in place, enforcement of those policies would be difficult due to a lack of resources and commitment from relevant authorities such as the police.

1.3.3.4 Legal and illegal alcohol industry involvement

The alcohol industry has been recognised as playing a harmful role in developing countries where the vast majority of conflicts have taken place. For example, the alcohol industry's involvement in alcohol control policy development has been identified in Lesotho, Malawi, Uganda and Botswana.[140] Alcohol policy initiatives in these four countries were sponsored by alcohol producer SAB Miller and the International Centre on Alcohol Policies which is an organisation funded by the alcohol industry.[140]

Post-conflict settings are particularly being targeted by the alcohol industry due to their weak regulatory frameworks, greater ability to interfere with the development of alcohol policies and marketing opportunities due to populations who are more vulnerable to misuse alcohol.[113] In addition to the legal alcohol industry, the illegal alcohol producers also take advantage in post-conflict settings. The alcohol products produced by illicit alcohol producers have a low price compared to legal alcohol products and illicit brewers are capable of producing cheap alcohol

as their production costs are lower than legal brewers.[139, 141] Moreover, it has been identified that females in post-conflict settings also involve themselves in the illicit alcohol industry as an easy income generation method.[142, 143] This situation leads to increased availability of alcohol and increased consumption in post-conflict settings.

1.3.3.5 Rapid socio-economic changes

Countries-affected by conflicts normally require both financial aid and policy advice to reconstruct their extremely fragile societies. Therefore, these countries normally receive foreign aid during post-conflict periods. [144, 145] Moreover, rebuilding the conflict-affected settings becomes a priority for governments in these settings and other parties such as non-state actors, private sector, donors will also contribute towards this process in many ways such as providing financial support and creating employment opportunities.[144-148] A study conducted using data from 17 conflict-affected societies highlighted that the conflict affected settings can experience rapid improvement of economic conditions solely or partially depend upon foreign aid.[149] On the other hand, people who flee from conflict zones will return during post-conflict periods. During the post conflict periods, conflict-affected settings are therefore likely to undergo rapid socio-economic development and urbanisation,[113] and alcohol consumption in these settings can increase as a result of these changes.[34, 150]

1.3.4 Conceptual framework on alcohol consumption among displaced and non-displaced settings

As discussed in section 1.4.2, conflict exposure can be direct or indirect, and populations may be displaced or non-displaced due to conflicts. Conflicts can cause several individual and population level factors that have the potential to influence alcohol consumption in post conflict settings. According to current evidence provided in the above section, it is clear that alcohol consumption among populations displaced or directly affected by conflicts are likely to affect from both individual and population level risk factors caused by the conflicts whereas alcohol consumption among non-displaced or indirectly affected populations are more likely to affected from population level risk factors caused by the conflict.

However, in addition to these factors caused by the conflicts there are several other factors which are known to influence alcohol consumption among individuals in general as mentioned in the introduction to this thesis. These include individual level factors such as age, gender, socioeconomic status, religion, and ethnicity, and population level factors such as cultural norms and beliefs in different settings.[1, 14-16] All these factors have found to mediate the effect of conflict exposure on alcohol consumption.[25, 26, 110]

Based on this evidence, the following conceptual framework (Figure 1-1) aims to show the individual and population level risk factors caused by the conflict that have the potential to influence alcohol consumption in displaced and non-displaced settings, while considering other factors which mediate alcohol consumption in post-conflict settings.

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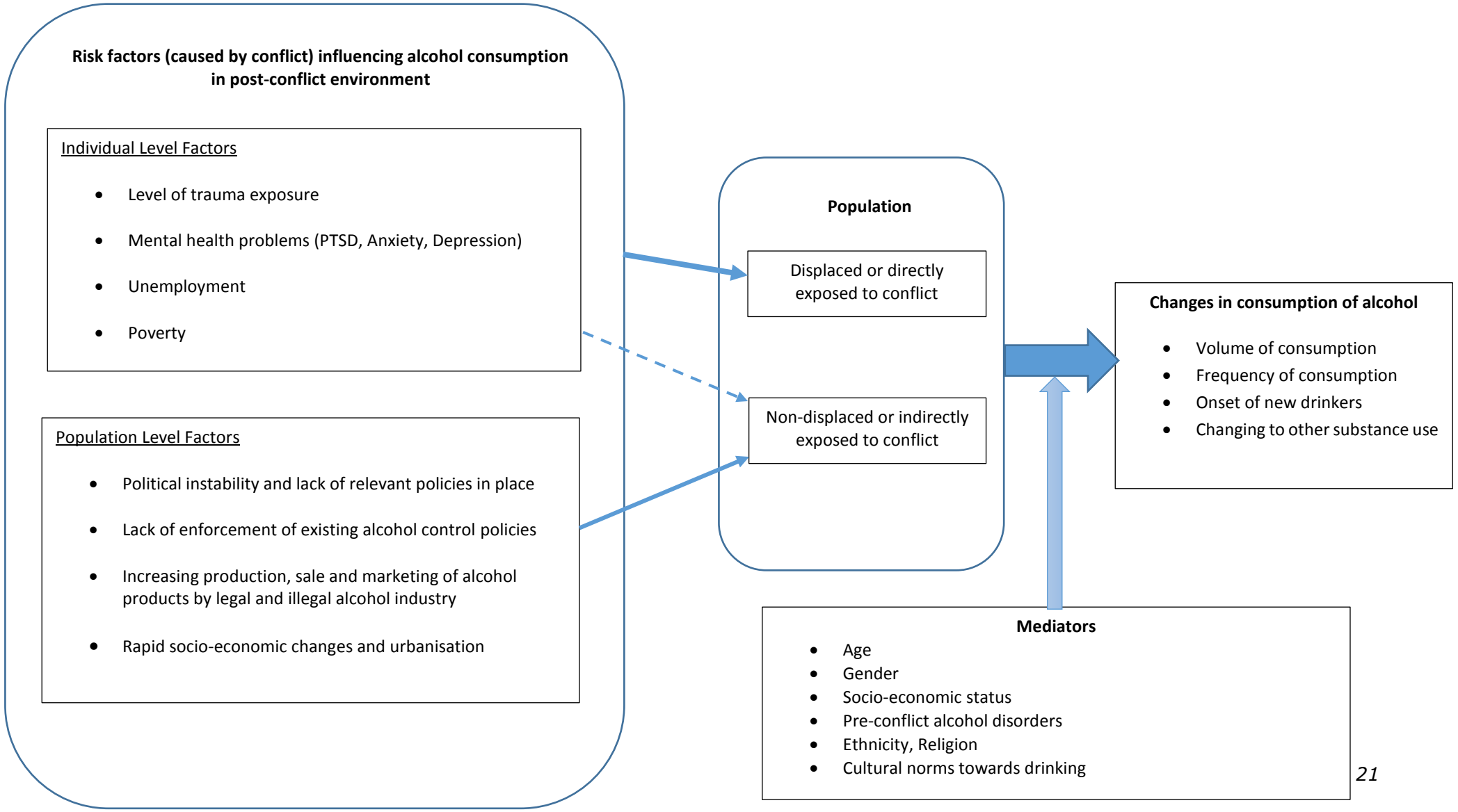
Figure 1-1: Conceptual framework for risk factors associated with changes in alcohol consumption in post-conflict displaced or non-displaced populations



1.4 Why evaluate the impact of alcohol control policies and conflict exposure on alcohol consumption?

Considering the significant burden of harmful alcohol consumption on global health, the World Health Organization has prioritised continuous monitoring and evaluation of alcohol harm reduction strategies.[12] The global strategy to reduce harmful alcohol consumption has recommended ten target areas for policy options and interventions on the national level.[12] Monitoring and surveillance is the tenth policy area to be considered as it creates the basis for the successful delivery of each of the other nine policy options which include leadership, health service response, drink-driving policies and pricing policies. The Global Strategy, European Action Plan, as well as national level strategies, will be more effective if their implementation and impacts are monitored and evaluated.

Evaluation of alcohol control policies is essential in identifying the effectiveness of different policy options and to generate a better understanding of how policies work, who they reach and what effects they have on different groups of people. Furthermore, evaluation of policies is important to identify whether the policies have any unintended outcomes or whether they generate any health inequalities. Therefore, the learning from alcohol control policy evaluation will be important in identifying any necessary adjustments or improvements for current policies and better ways of implementing future policies. Another important reason to evaluate alcohol control policies is to improve the global and regional comparability of actions taken towards reducing harmful alcohol consumption and for research purposes.[7]

Similarly, it is important to evaluate the impact of conflict exposure on alcohol consumption as relevant findings can inform the global alcohol control community including researchers, policymakers, and advocates about this important public health problem in post-conflict settings. In due course, this evidence can be used to guide and support countries around the world with on-going conflicts enabling the rapid implementation of alcohol control strategies during post-conflict periods. This will reduce the risk of additional public health burden in post-conflict settings.

The following section of this chapter will discuss the study designs that are suitable for evaluating alcohol control policies or contextual factors affecting alcohol consumption in different settings.

1.5 Study designs for evaluating alcohol control policies and contextual factors affecting alcohol consumption

1.5.1 Similarities of alcohol policies and contextual factors

The work involved in this thesis focused on alcohol control policies and contextual factors delivered/occurred at population level. They are often not undertaken for the purpose of research and the exposure to the intervention is not manipulated for the purpose of research.[151, 152]

Moreover, alcohol control polices (e.g. pricing policies, drink drive policies and policies on alcohol availability) and contextual factors (e.g. natural disasters and conflicts) affecting alcohol consumption can be considered as complex interventions as they are usually built up from several components which may act independently or interdependently.[153] These components can include the method of intervention delivery, the location/setting of intervention, or other parameters of the intervention itself such as the frequency and timing of intervention delivery.[153-156]

Due to the above-mentioned similarities between population level alcohol control policies and contextual factors affecting alcohol consumption the challenges to evaluating them and the study designs suitable for evaluating them are likely to be similar.

1.5.2 Challenges to evaluating them

As mentioned above these interventions are delivered at population level and they are often out of the hands of researchers/evaluators. Therefore, applying experimental methods or randomising the study population to the intervention and non-intervention groups are often difficult or impossible when evaluating the effect of alcohol control policies or contextual factors such as the end of conflicts. Hence, the use of experimental study designs such as randomised controlled trials, cluster randomised trials or stepped wedge designs are often inappropriate.[153, 157] Due to these reasons, natural experimental study designs have been recommended for evaluating population level policies or other similar events[151, 152] and these study designs are discussed in the next section of this chapter.

Moreover, the evaluations of natural experiments are often done retrospectively using existing data sources such as routinely collected data. Finding a data set which provide appropriate data for the exposed and unexposed groups can be a challenge for researchers. The delivery of these interventions may be different from one setting to another. For example, the level of enforcement of national alcohol control policies such as drink-drive policies may not be the same in all areas of a country and when evaluating

the effect of such policy that will be important to consider the program fidelity and its impact on outcome measures.

Another challenge in evaluating population-level complex interventions is measuring the outcome of interest. The length and complexity of causal chains in these interventions make it more difficult to identify the intended and unintended outcomes and measure them.[156] Moreover, the effects of alcohol policies and contextual factors affecting alcohol consumption are likely to be entangled with other policies/interventions that occur concurrently. Then it becomes problematic to disentangle the effect of the intervention/event of interest from others. In addition, these can also be affected by underlying trends such as the seasonality which is particularly important when evaluating alcohol control policies or contextual factors as alcohol consumption is likely to have natural seasonal variations. Due to this nature of policies and contextual factors occurring at population level, their evaluation is often challenging and complicated.[151, 156]

1.5.3 Outcome evaluation

Outcome/effectiveness evaluations of an intervention measure its effects in the target population by assessing the changes in the outcome and attempts to make to make causal inferences by assessing the variation in exposure and outcome measures. Natural experimental study designs have been recommended[152] and successfully used in outcome evaluation of population level interventions that are out of the control of researchers.

1.5.3.1 Natural experiments

Natural experiments are defined as interventions where populations' exposure to the intervention has not been manipulated by the evaluator or researcher.[151, 152] Even though these interventions/policies/events are not undertaken for the purpose of research natural experimental approaches attempt to make causal inferences by assessing the variation in exposure and outcome measures.

Natural experimental study designs have been used in many different settings and in contexts such as evaluating the effect of legislation to prevent suicidal attempts,[158] policies on smoking in public places,[159-161] and policies aiming to prevent air pollution.[162, 163] Similarly, natural experimental study designs can be used for evaluating the effect of alcohol control policies and contextual factors affecting alcohol consumption. Natural experiments may be the only option to evaluate effect of contextual factors such as the end of conflicts and when compared with planned experiments natural experiments enable studying the effect of an intervention/event on the whole population. Despite these advantages of natural experiments they are more susceptible to bias and confounding.[152]

Therefore, natural experimental study designs are recommended only when existing evidence suggest that the intervention/policy/event will have a significant impact on the outcome of interest but there is scientific uncertainty about the size or nature of the effects; when the intervention cannot be introduced as a true experiment; when it is possible to obtain data from an appropriate study population in which data are available for exposed and unexposed groups or groups with different levels of exposure to the intervention; and when the intervention has potential for replication or generalisability.[151]

In scientific literature, several study designs have been used to evaluate the effects of natural experiments and among them pre and post intervention study design and interrupted time series study design are the most commonly used study designs,[151] and therefore, this section focuses on the use of these two study design for evaluating the effect of alcohol control policies or contextual factors affecting alcohol consumption.

1.5.3.2 Pre-and-Post study designs

Pre-and-post intervention study design can be divided into two categories; uncontrolled and controlled studies. In an uncontrolled pre and post study design, the outcome is measured in a given study setting before and after the intervention.[164] This study design is relatively easy to conduct and can be used with a minimum of one group and a single data collection point before and after implementation of a policy. However, internal validity of this design can be jeopardised by secular trends or sudden fluctuations in the outcome measure.[164, 165] Therefore, it is difficult to attribute the changes observed in the outcome to the intervention.

In a controlled pre and post study design, a control population with similar characteristics is used for comparison with the study population, and the changes between pre and post intervention are compared between the intervention group and control group to assess the changes in the intervention population over and above the changes in control population.[164] In this method at least one pre- and post-intervention outcome measure is compared between the study population and the control population. Even though the use of controlled group helps to minimise certain threats to validity, identifying an appropriate control group with

similar characteristics can be difficult.[164] This design can also be affected by secular trends and sudden changes.[164, 165]

1.5.3.3 Interrupted Time Series analysis

The other most commonly used non-experimental study design is the Interrupted Time Series (ITS) design. This study design is suitable when the outcome can be measured reliably and repeatedly before and after an intervention. Data collected at multiple time points at regular intervals are used in ITS study designs to detect whether the intervention had a significant effect on the outcome while accounting for any underlying secular trend that may have existed prior to the intervention.[164] In addition, having short intervals between data points is important in this study design as it enables identification of small transient effects of the outcome measure. For example, monthly data or quarterly data can be used to identify short term effects of an intervention better than annual data. Shorter data intervals are also supportive towards detecting the effects due to other concurrently occurring interventions, though separating these effects is often not possible. To apply an ITS design, there must be a clearly defined point in time when the intervention came into effect.[165, 166] A detailed description of this study design and how it can be used in the data analysis will be provided Chapter 5.2.4.

1.5.4 Process evaluation

Assessing the effectiveness of a complex intervention using the outcome evaluation methods discussed above have limited capability in explaining why and how the identified effects occurred. Process evaluation of an intervention aims to answer these questions by assessing the quality

and fidelity in its implementation, identifying causal mechanisms and identifying contextual factors associated with relevant outcomes.[153, 167-169]

As mentioned in the Section 1.5.2 the implementation of an alcohol control policy can vary from setting to setting or over time. Process evaluation can be used to identify any changes to the fidelity of a policy implementation and its impact on outcome of interest. For example, during the process evaluation of a drink-drive policy, its fidelity can be assessed by identifying whether each component of the policy was implemented as planned, whether the frequency and duration of intervention (dose) were the same as planned (e.g. number of sobriety checkpoints and random breath testing).[157, 170]

In addition, process evaluation also aims to identify causal mechanisms and to answer the questions why and how an intervention works. This understanding of causal mechanism contributes towards developing effective interventions and informing how findings can be transferred across different settings and populations.[153, 157]

Moreover, process evaluation also focuses on the context and how it shapes the implementation of an intervention/event as well as the causal mechanisms of the intervention. Therefore, this stage of process evaluation refers back to the previous stages (implementation fidelity and mechanisms of impact) and aim to identify the contextual impact on them.[157, 170]

1.5.5 The value of mixed methods

Comprehensive outcome and process evaluations tend to use mixed methods to generate a complete picture of the impact of an intervention. Mixed methods are characterised by the use of both quantitative and qualitative methods, and mixed methods have the ability to generate an optimum answer to a research question.[171]

One of the key advantages of mixed methods research is the complementary role it can play by reducing the limitations in qualitative analyses using quantitative methods and vice versa.[172] Moreover, the evaluation of complex interventions demands the use of practical and methodological tools that can address the complexity of the intervention itself and the mix of quantitative and qualitative methods has been better able to provide this in practice than any one method alone.[172, 173] In addition to the above advantages, mixed methods are considered to strengthen credibility/trustworthiness of research findings.[172, 173] Another key advantage of mixed methods is their ability to answer both explanatory and exploratory research questions.[172, 173]

Existing literature recommend using a combination of quantitative and qualitative methods particularly for process evaluations.[157] In process evaluations, quantitative methods can be used to test pre-hypothesized causal pathways whereas qualitative methods can be used to explore participant responses, intervention fidelity, contextual influence on the outcome and any unintended causal pathways.

The data sources that can be used for process evaluation include routinely collected data sources, self-reported diaries/questionnaires, observations (photographs, videos, or audio recordings) and qualitative interviews and focus group discussions.[157] For example, a recent study used a mix of quantitative and qualitative methods to evaluate the impact of The

Alcohol Improvement Programme (AIP) which was implemented by the UK Department of Health during April 2008-March 2011.[174] The AIP programme aimed to reduce the alcohol-related hospital admissions in the UK and it was a complex multi-component intervention. This study conducted both process and outcome evaluation of the AIP using a combination of data sources and these included in-depth interviews with national level policy makers and regional level informants, structured telephone interviews with relevant officials, case studies, alcohol related hospital admissions data collected by North West Public Health Observatory.[174]

Longitudinal data spanning the life of an intervention are ideal for process evaluation as it can help to identify any changes to the intervention through its lifetime. However, this might not be practical in some situations. For example, the above mentioned study evaluating the AIP programme started two years after the implementation of the programme and ended 6 months after the end of programme due to funding constraints.[174] Retrospective and cross-sectional data can be used as alternative study designs but when it comes to retrospective study designs researchers need to be careful about relevant biases such as recall bias.

1.5.6 Focus of the work involved in this thesis

The work in this thesis focused on alcohol control policies and contextual factors affecting alcohol consumption and as discussed in this section natural experimental study designs are suitable for evaluating the effect of these population level interventions that are not undertaken for research purposes. When compared with outcome evaluations, process evaluations require newly collected qualitative data that are difficult to find

when evaluating the effect of alcohol control policies or contextual factors such as the end of conflicts.

However, outcome evaluations can be conducted using existing data sources such as routinely collected data. Therefore, the work in this thesis aimed to use existing data sources for outcome evaluations of alcohol control policies or contextual factors affecting alcohol consumption in two different settings as discussed in the below section in detail.

1.6 Evaluation of alcohol control policies or contextual factors using existing data sources in the UK and Sri Lanka

1.6.1 Why existing data sources?

The use of existing data sources in health research has become increasingly popular when compared with the use of primary data. The main advantage of using existing data sources is the low cost.[175, 176] Even though sometimes there is a fee to access to existing data sources, it is much less expensive than conducting an original study. Use of these already available data can answer many research questions relatively quickly and efficiently.

In developed countries, much data collection occurs routinely and government surveys are often carried out, with some of them specifically designed for research purposes. Most of the time these data are cleaned, come with a data dictionary and survey weights, therefore saving time for researchers.[175, 176] For example, the National Health and Nutrition Examination Survey (NHANES) is a high-quality data source on diseases, medical conditions and health indicators of adults and children in the United States.[177] In the UK the largest data collection of social, economic and population data is hold by the UK Data Service and this service provides access to high-quality data, support for relevant research, as well as

guidance and training on data use.[178] Increasing the availability of better quality existing data sources encourages researchers to carry out more research using these data sources and also to conduct international comparisons. Moreover, when existing data have been collected over time repeatedly these data can be used for longitudinal research purposes such as for time series analysis.

On the other hand, there are several disadvantages to using existing data sources. The existing data may not have been collected targeting a specific research question. Therefore, researchers may find a lack of data on key variables or key confounding variables required for the study. Another issue could be that sampling frame or the region of data collected may not match the research question which researchers aim to answer. When using data for longitudinal studies, it is important to identify the frequency of data that have been collected over time and whether they are suitable for answering the research question. For example, if a study is aiming to identify seasonal variation of sales or changes in weather, that study will require monthly or quarterly data but not annual data. Missing data is another critical issue of existing data sources. Moreover, the investigator has little or no control over what data have been collected and how they have been recorded. Therefore, when conducting secondary analyses using existing data sources it is important to select the most suitable data source that fulfils the key requirements of a study.

1.6.2 Why the UK and Sri Lanka?

Why the UK?

As discussed in detail in section 1.7 below, the UK has a significant public health burden due to alcohol misuse, and it is the fifth leading risk factor for ill health among people in the UK.[8] Therefore, evaluation of existing alcohol control policies affecting alcohol consumption will inform future policy measures aimed at tackling alcohol misuse.

Compared to many other countries around the world, the UK has an abundant amount of healthcare data sources that are specifically developed for research purposes. In particular, alcohol consumption measures in the UK can be obtained from several data sources such as large-scale population surveys, HMRC Revenue and Customs data, alcohol sales data and from primary care records. The UK also has experience of collecting healthcare data for a long period of time using different methods which include maintaining routinely data sources and conducting annual health surveys. For example, the Office for National Statistics has conducted population surveys including alcohol consumption questions since the 1980s.[179] Therefore, this thesis aimed to use existing data sources in the UK and to identify their appropriateness for alcohol control policy evaluation.

UK also has a history of using different policy options to tackle alcohol misuse as discussed in section 1.7.3 below and hence the lessons learned from evaluating the effect of different policy measures implemented in the UK can contribute to the development of alcohol control policies in other settings.

Why Sri Lanka?

Sri Lanka suffered from a civil war for about three decades and it ended in 2009. As discussed in detail in section 1.9 below, alcohol misuse is a significant public health burden in Sri Lanka, and since the end of the war alcohol consumption is reported to have increased notably. However, the effect of the end of conflict on alcohol consumption among Sri Lankans has not yet been formally evaluated or quantified. Therefore, its evaluation would be important in generating better understandings about the effect of the end of the war on alcohol consumption in Sri Lanka and in formulating and implementing future alcohol control policies to tackle the burden of alcohol misuse.

As a low to middle-income country, Sri Lanka has few existing data sources on general health as well on alcohol consumption. These include hospital mortality and morbidity records, government health surveys and Department of Excise alcohol sales data. However, Sri Lanka is currently undergoing a transition period in relation to healthcare data management and moving from paper-based healthcare records to electronic health records database which is called as electronic Indoor Morbidity and Mortality Record (eIMMR)[180, 181]. The National eHealth Policy which is waiting to be implemented in Sri Lanka will further support development and maintenance of healthcare data sources.[182] Sri Lanka also aims to implement a new National Alcohol Control Policy in the near future and these policies aim to make significant improvements in the healthcare data management as well as in tackling alcohol burden.[183] For example, as part of the National Alcohol Policy, the government intends to conduct longitudinal surveys on alcohol consumption once every three years.[183] Moreover, it aims to strengthen the existing policies in Sri Lankan and to implement new alcohol control policies.

Therefore, it is timely to evaluate the existing data sources on alcohol consumption, use suitable data sources to evaluate the impact of the end of

war in Sri Lanka and compare them with a country having experience collecting alcohol consumption data for a long period of time as well as in implementing alcohol control policies to tackle the increasing consumption.

1.6.3 Benefits of applying the lessons learned from the UK context to Sri Lankan context

Evaluation of existing data sources on alcohol consumption in the UK will provide information about different methods used to measure and record consumption, the quality of existing alcohol consumption measures, and the advantages and disadvantages/limitations of using them for alcohol control policy evaluation. The lessons learned from above step can then be used as an starting point for identifying potential data sources for alcohol control policy evaluation in Sri Lanka or in providing relevant recommendations to improve existing data sources or development of new data sources such as national surveys or routine data sources. For example, the new alcohol control policy document in Sri Lanka emphasize the importance of monitoring alcohol consumption and hence the lessons learned from the UK context in relation to alcohol surveys will particularly be beneficial for developing and conducting national surveys on alcohol consumption.

Sri Lanka has limited experience in implementing comprehensive alcohol control policies compared to the UK and Sri Lanka's first National Policy on Alcohol Control is still at the discussion stage and waiting to be implemented soon.[184] Therefore, the lessons learned by evaluating alcohol control policy options in the UK will particularly be beneficial for consideration in Sri Lanka at this stage.[184] Though these lessons will need to be taken into account while considering the socio-economic and cultural differences in the two countries.

Moreover, the natural experimental study designs such as time series methods have been underused in public health research[185] as they were initially developed for econometrics. Hence, using these methods for two different contexts will provide an opportunity to refine how these methods should be applied and to understand their strengths and limitations.

1.7 Alcohol in the UK context

Alcohol has played an integral part in social and family life in the UK for centuries. Despite the positive contribution of alcohol towards society such as providing employment, encouraging sociability and enhancing the UK economy, its negative consequences have been significant. This section provides an overview of alcohol consumption, consequences, and alcohol control policies in the UK.

1.7.1 Alcohol consumption in the UK

In relation to the pattern of drinking three types of drinking behaviours have been defined in the UK as sensible drinking, harmful drinking and binge drinking.[186] Sensible drinking is drinking within the low-risk drinking limits set by the government that is unlikely to cause significant risk of harm to the drinker or to others.[186] Harmful drinking is "drinking at levels that lead to significant harm to physical and mental health and at levels that may be causing substantial harm to others".[186] Binge drinking is essentially drinking a large amount of alcohol over a short period of time and is defined as drinking twice or more than the low-risk drinking limits which are summarised below.[186]

MEN[186]

Regular consumption of between 3 and 4 units (alcohol unit = 8g or 10 ml of pure ethanol) a day by men of all ages will not accrue significant health risk

Consistently drinking 4 or more units a day is not advised as a sensible drinking level because of the progressive health risks it carries

WOMEN[186]

Regular consumption of between 2 and 3 units a day by women of all ages will not accrue significant health risk

Consistently drinking 3 or more units a day is not advised as a sensible drinking level because of the progressive health risks it carries

The above mentioned low-risk drinking guidelines were revised by the Department of Health in January 2016, and according to these new guidelines, both men and women should not regularly drink more than 14 units of alcohol per week.[187] However, these guidelines are relatively new and the evidence available to date on alcohol consumption in the UK is based on the previous drinking guidelines. Therefore, the following sections of this thesis will use the previous low-risk drinking guidelines to discuss the alcohol consumption in the UK.

1.7.1.1 Per Capita Alcohol Consumption

According to the WHO data on adult per capita alcohol consumption, the UK has a considerably higher consumption level when compared with many other countries around the world as well as in Europe.[1] UK adult (age 15+) average per capita alcohol consumption during 2008-2010 equalled 11.6 litres of pure alcohol.[1] The same statistic for the European region was

10.9 litres of pure alcohol and globally it was only 6.2 litres of pure alcohol.[1, 188] During the same period, per capita consumption among UK males and females was 16.5 and 6.9 litres of pure alcohol respectively.[188] However, the drinkers' only per capita alcohol consumption level among UK male and female drinkers was high at 18.9 and 8.5 litres of pure alcohol per year respectively.[188]

According to the recorded pure alcohol consumption data in 2010, beer (37%) and wine (34%) represent the most popular types of drinks in the UK. Spirits (22%) and other types of drinks consumption were relatively low (7%) when compared with above two types of drinks. In addition, the proportion of unrecorded (illicit) alcohol consumption during 2008-2010 in the UK was around 10%.[188]

Alcohol consumption in the UK has been increasing gradually over the past few decades[5] and alcohol sales in England and Wales reached a peak value of 567 million litres in 2008.[189, 190] This increase in consumption is likely to be influenced by the increased affordability of alcohol, consumption by women, and shifting to higher strength alcoholic products.[191] Though alcohol consumption started to decline from 2008 onwards, the abstinence rates have increased over time.[23, 192] Therefore, the decline in alcohol consumption in the UK likely to be due to people abstaining from alcohol as well as drinkers consuming less alcohol. In recent years new types of drinks such as alcopops have been introduced to the market and the proportion of drinkers consuming products such as wine and strong beer have increased significantly.[193]

1.7.1.2 Adult drinking habits in different population sub groups

In 2016, the prevalence of drinking in the last week in Great Britain was 56.9% and that was the lowest prevalence of drinking in the last week reported since 2005.[194] However, alcohol consumption habits among drinkers in the UK vary substantially according to their age, gender and socio-economic status.

Gender

In the UK, a considerable proportion of both men and women drink alcohol. The proportion of men and women drank alcohol in the previous week in Great Britain in 2016 was 62.8% and 51.3% respectively.[194] However, the prevalence of binge drinking among men and women were 28.2% and 25.3% respectively.[194] In 2014, in England there were more than 10 million drinkers who drank more than 14 units of alcohol per week, and 7.3 million men and women involved in binge drinking (more than 8 units/6 units for men and women) on their heaviest drinking day of the last week.[192]

Age

In Great Britain, young people are less likely to be drinkers when compared with people in other age groups. In 2016, the prevalence of drinking in the last week among the 16-24 age group was 46.0% whereas it was 64.2% among those aged 45 to 64 years.[194] However, young drinkers are more likely to be binge drinkers than drinkers in other age groups. In 2016, the prevalence of binge drinking among those aged 16-24 and aged above 65 years was 37.3% and 10.3% respectively.

Income Level

People with higher income levels in the Great Britain are more likely to be drinkers when compared with people having low income. In 2016, the prevalence of drinking in the last week among people with the highest income (annual income £40,000 or more) and the lowest income (annual income up to £10,000) was 77% and 46% respectively.[194] The highest earners in Great Britain also report having higher binge drinking prevalence (21.8%) when compared with the lowest earners (10.7%).[194]

Ethnicity and Geographic Location

In the UK, white people reported having higher prevalence of drinking when compared with other ethnicities.[194] However, the ethnic composition in the UK doesn't vary considerably according to the geographic location which has a white majority population in most areas. In 2016, the prevalence of drinking in England, Wales and Scotland was 57.4%, 54.7% and 53% respectively.[194] However, in England, in 2016, the highest prevalence of drinking was reported in South West (70.1%) and the lowest prevalence was reported in London (47%).[194] This difference is likely to be due the ethnic composition of London which is one of the most ethnically diverse areas in the UK.

1.7.1.3 Further variation in adult drinking habits

In addition to above mentioned differences in drinking habits among adults in the UK, there can be further differences by population subgroups in terms of their high-risk drinking, location of drinking and beverage preferences as discussed below.

High-risk drinking

In England, in 2006 around 66% of alcohol was consumed by the heaviest 20% of drinkers and this proportion varied substantially according to the gender. The heaviest 20% male drinkers consumed 72.7% of alcohol drunk by all men whereas the heaviest 20% of female drinkers consumed 53.1% of alcohol drunk by all women in that year. This proportion was even higher among young men and women (aged 16-24) at 76.5% and 57.3% respectively.[195]

In addition, a recent study suggests that drinkers having the lowest socio-economic status are more likely to engage in extreme drinking after adjusting the results for age, sex, ethnicity and year of survey.[196] This study showed that long-term unemployed drinkers were 4.5 (95% CI: 1.52 – 13. 43, p=0.007) times more likely to exceed the highest heavy weekly drinking threshold (85/110 units per week among men and women) when compared with drinkers in higher managerial occupations.[196]

Another recent study has found that high risk drinking occasions in England are likely to occur when drinking with friends, duration of drinking was around 4-6 hours, reason for occasion was a sociable get-together, when drinking in mixed locations and when the motivation for the occasion was to have a laugh.[197]

Beverage preferences

In relation to beverage preferences in England, beer is the most popular drink among men whereas wine is the most popular drink among women.[195, 197, 198] A recent study which was specifically focused on heavy drinkers identified four stable beverage specific clusters of heavy drinking in Great Britain during the period from 1978 to 2010; beer and spirit combination, all beverage, high volume beer and wine and spirit only clusters.[198] 'Beer and spirit combination' represent the largest cluster (45%) of heavy drinkers and it is male dominated.[198] Drinkers in 'all beverage' cluster prefer having all three types of drinks (beer, wine and spirit) and include 35% of heavier drinkers. Drinkers in 'high volume beer' cluster (14%) is also male dominated and shows a strong preference for beer and weak preference for wine whereas drinkers in the fourth cluster of wine and spirit (6%) show a strong preference for wine and weak preference for spirit. Though these clusters have remained stable over time the prevalence of heavy drinking has increased mainly due to the 5-fold increase (0.8%-4.3%) in the female dominated 'wine and spirit' drinking cluster.

Location of drinking

The location of drinking in England also varies considerably according to the gender and age of the drinker. Male drinkers have a strong preference for drinking in on-trade whereas female drinkers prefer off-trade drinking.[195, 197] Furthermore, on-trade drinking is more common among younger drinkers. For example, in 2006, 76% and 60% of alcohol consumed by young (18-24) hazardous male and female drinkers were in on-trade premises respectively.[195]

1.7.2 Alcohol consequences in the UK

Alcohol misuse has become one of the key public health concerns in the UK and currently it is the fifth leading lifestyle risk factor for disease and death in the UK after smoking, obesity, blood pressure and high fasting plasma glucose.[8] This section provides an overview of alcohol consequences in the UK.

Alcohol harm to the drinkers' health

The average age of death in England and Wales in 2014 was 77.6 years whereas the average age of death from alcohol-related causes were 54.3 years.[23] Alcohol-related deaths normally occur at a younger age and it is estimated that in 2015 in England around 301,000 years of life were lost due to alcohol among persons under age 75. [23] According to WHO estimates in 2012, the age-standardised death rates due to liver cirrhosis in the UK were 16 for men and 8 for women per 100,000 adults.[188] Moreover, liver cirrhosis was responsible for 63% of all alcohol related death in England in 2014/15.[193]

In 2014/15, in England there were 1.1 million hospital admissions that were directly or indirectly related to alcohol misuse. These included alcohol-related disease, injury or condition where alcohol misuse was the primary reason or secondary diagnosis.[193] Alcohol misuse causes a significant public health burden through health problems related to the cardiovascular system and these include hypertension, stroke, and heart disease in England.[23] In addition to these health concerns, brain damage, injury and mental health problems due to alcohol misuse are other significant health problems in England.[23]

Alcohol harm to others around the drinker

Alcohol consumption has resulted in detrimental effects not only to individuals who drink but also to others around the drinker through violence and irresponsible behaviours. Harmful alcohol consumption among parents can harm children's physical and psychological health. According to the Health Survey for England and General Lifestyle Survey in 2004, around 30% (3.4 million) and 8% of children under age 16 in the UK lived with at least one binge drinking parent or two binge drinkers respectively.[199] In England, children living with one to three or more drinkers were 1.7–3.6 times more likely to consume alcohol compared to other children who do not live with drinkers. Alcohol misuse also contributes towards relationship breakdowns and intimate partner violence in the UK.[200]

Alcohol and employment

Alcohol misuse can also result in unemployment, reduced productivity and absenteeism among workers. In the UK the data on loss of work productivity due to alcohol misuse haven't been monitored routinely and therefore, there are no recent statistics on alcohol and its effect on employment.[23] According to a survey conducted among British workers in 2007, 77% of employers of believed that alcohol misuse negatively impacts their employees' wellbeing and reduces their productivity.[201] Moreover, a significant number of employees reported alcohol consumption affected their performance negatively in several ways which include difficulty in concentrating, being less productive, feeling tired and making mistakes at work.[201]

Crime and disorder

Alcohol-related crimes also influence the night time economy in the UK. Alcohol plays an important role contributing to the night time economy through the sale of alcohol in nightclubs, restaurants, and pubs. However, the fear of crime and violence due to alcohol misuse at night time can keep people away from city centres.[202] Alcohol-related crimes include homicide, physical assault, sexual assault, robbery and burglary. According to the crime surveys conducted in England and Wales, victims of all violent incidents in 2013/14 believed that more than half of (53%) offenders were drunk.[203] Alcohol-related violence is more frequent on weekend nights and around 70% of all violent incidents are related to alcohol during weekends whereas during weekdays the same is around 35%. In relation to timing, more alcohol related violence is reported between midnight and 6 am.[203] Alcohol bottles and glasses are commonly used as weapons in these violent incidents.[204] Alcohol misuse is also associated with antisocial behaviours such as vomiting, urinating and littering in public places.[205]

Economic burden

Alcohol misuse is not only a public health and social burden but also an economic burden for the UK. In England, the health care costs due to alcohol use disorders were £2.9 billion in the 2008/09.[10] The estimated cost due to crime and antisocial behaviour was about 8 billion per year.[10] Furthermore, the estimated cost of employee absenteeism related to alcohol misuse was £1.7 billion. Altogether alcohol consumption drains about £21-billion of public funds per year in the UK.[9]

1.7.3 Government strategies to reduce alcohol misuse in the UK

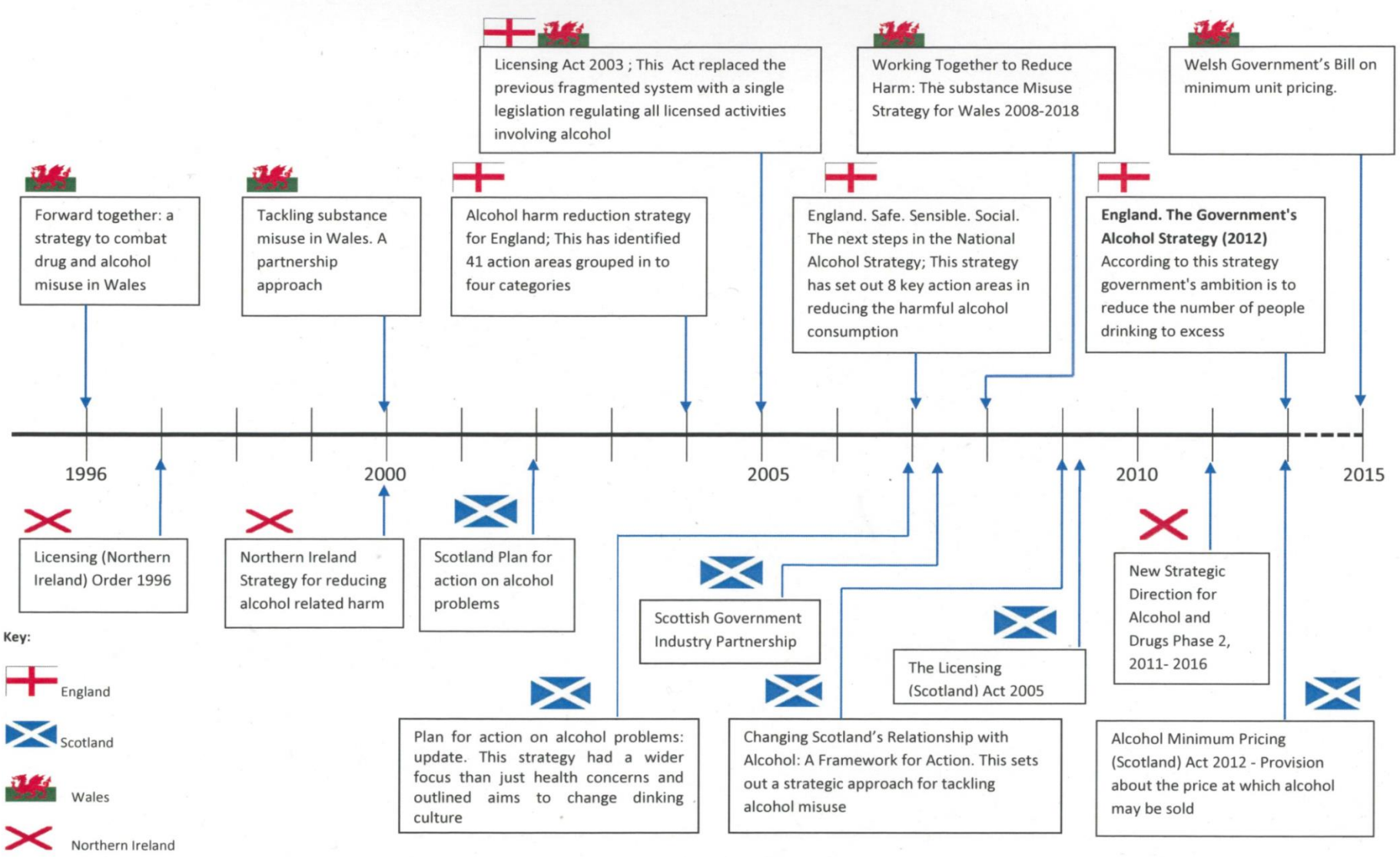
As shown in Figure 1-2, over the past two decades several harm reduction strategies were implemented in the UK to prevent alcohol-related harm. Due to the burden of harmful alcohol consumption on the population, the UK government published its latest strategy to deal with this major public health problem in March 2012. According to this strategy, the government plans to take action mainly in helping individuals to change their drinking behaviour, giving more powers to local councils, improving treatments for alcohol dependence, sharing responsibility with industry, making cheap alcohol less available, and stopping advertising appealing to young people.[9] It promised to ensure that local areas are able to tackle local problems, reduce violence due to alcohol misuse, and reduce health inequalities. This strategy also aimed to give strong powers to local areas to control the density of licensed premises.[9] Securing the alcohol industry's support in changing harmful alcohol consumption among individuals was another main action of this strategy. Finally, the government strategy aimed to support individuals to make informed choices about responsible and healthier drinking.[9] Of these actions, four weeks of nationwide TV advertising took place through the Change4Life campaign in February 2013.[206] This campaign raised awareness of health consequences due to alcohol misuse and tried to help individuals to change their drinking behaviour.[206] It used resources such as an online drinks checker to help people to check units, costs and calorie intake, and a smartphone application to help track drinks.[206]

On the other hand, in July 2013 the Government declared that it would not be proceeding with minimum unit pricing policy in England and Wales, which was a major action emphasised in the Government Strategy to deal with harmful alcohol consumption.[207] Furthermore, in relation to minimum unit pricing, the UK government announced that "The policy would

remain under consideration, but at present, there was not enough concrete evidence that it would be effective in reducing the harms associated with problem drinking without penalising people who drink responsibly".[207]

However, the Scotland, Wales and Northern Ireland Governments act differently towards the minimum unit pricing policy. In 2012, Scottish Government legislated to introduce a minimum unit price of 50 pence and it is currently under consideration by the European Court of Justices as the legality of this policy was challenged by the alcohol industry.[208] Both the Welsh Government and Northern Ireland Government announced their support for minimum unit pricing and the Welsh Government's bill on minimum unit pricing was passed in July 2015.[208] A consultation on this was carried out between July 2015 and December 2015.[209] According to the results of this consultation, the majority of respondents (68%) supported the proposal to introduce legislation.[210]

Figure 1-2: Alcohol harm reduction strategies and key Acts in the UK[5, 9, 186, 208, 211-218]



As discussed above, over the past two decades, the UK Government and the Governments of the four nations have introduced several strategies to reduce alcohol misuse.[9] Of them, the recent alcohol harm reduction strategies affecting England are the Licensing Act 2003 and Public Health Responsibility Deal (PHRD).

The PHRD was launched in March 2011 and it aimed to use the potential of businesses and other organisations to reduce alcohol misuse.[219] According to the PHRD, the alcohol companies who have taken part in this programme will foster a culture of responsible drinking by addressing several alcohol pledges put forward by the Department of Health.[219] For example, alcohol industry partners who signed up for the first alcohol pledge had to ensure that over 80% of products on the shelves are labelled with clear unit content by December 2013.[219] However, signing up for these pledges is voluntary and therefore it has come under widespread criticism from public health advocates and others, who have suggested that it will be ineffective.[220]

In 2013, a study developed a detailed logic model of the responsibility deal to help understand how such a complex public health policy should be evaluated.[221] This study showed the possibility of evaluating two alcohol-related pledges that are specific, measurable and time-bound.[221] The first is ensuring that "over 80% of products on shelves will have labels with clear unit content, NHS guidelines, and a warning about drinking when pregnant" by December 2013.[219] The second is removing "one billion units of alcohol sold annually from the market by December 2015 through improving the choice of lower alcoholic products".[219] The timescales for the implementation of the PHRD overlapped with the current PhD, therefore its evaluation was beyond the scope of this work. However, the Institute of Alcohol Studies has recently evaluated the effect of PHRD and published their

report in November 2015.[222] According to this report, PHRD has been ineffective and in relation to the billion unit pledge and alcohol labelling pledge, the industry has generally failed to meet its targets.[222]

1.8 Licensing Act 2003

The Licensing Act 2003 was implemented in England and Wales on the 24th of November 2005 with four specific objectives: prevention of crime and disorder; public safety; prevention of public nuisance; and the protection of children from harm.[213] According to the Act, these objectives must be addressed when issuing premises licence, personal licence or while carrying out other licensable activities.[213] The premises requesting new licenses or licensed premises can fulfil these objectives in several ways and a brief overview of these methods are mentioned below.[213]

Prevention of Crime and Disorder

The Act encourages licensing authorities to seek advice from local police in relation to crime and disorder, co-operate with Local Community Safety Partnership and Security Industry Authority (SIA), and consider adding extra conditions to the licenses if required. Inclusion of radio links and ring round phone systems were also recommended by the Act to assure that the licensing premises can contact local police instantly to tackle any disorder.

Public Safety

In relation to ensuring public safety, licensed premises can take several actions such as having access to ambulance services, having trained staff to provide first aid if required and having fire safety equipment. The safe departure of people who entered the licensed premise is also a responsibility of the licence holder. Therefore, providing appropriate lighting around the

premises and providing relevant information such as taxi contact details to their customers is also a responsibility of the license holder.

Prevention of Public Nuisance

According to the third objective of the 2003 Act, licensed premises should take appropriate actions to prevent public nuisance which include issues such as noise nuisance, garbage, and light pollution. In relation to noise nuisance, licensed premises can consider closing doors and windows of the venue or use acoustic curtains to control the level of noise.

Protection of Children from Harm

The fourth objective of the Licensing Act is the protection of children from moral, psychological and physical harm, which may or may not be directly related to alcohol. Under this objective it is unacceptable to sell alcohol to children, allowing the sale of alcohol to children, and delivering alcohol to children. In addition, it also aims to protect children from other incidents such as exposure to strong language or exposure to certain films such as adult movies.

1.8.1 Changes introduced by the Act and intended outcomes

The Licensing Act 2003 allowed flexible and longer opening hours for licensed premises including the option of opening up to 24 hours a day, seven days a week.[45] This replaced the previous English and Welsh law, with the standard closing time of 2300h for licensed premises.[212, 223] By allowing flexible opening times it intended to lead to a more liberalized and relaxed drinking culture called café culture, which in turn was expected to lead to fewer alcohol-related crimes, health issues and violence.[224, 225] The Act

emphasised that standard closing times encourage drunkenness as some drinkers tend to drink as much as they can prior to the closure of pubs and night clubs.[45, 224] Furthermore, it emphasised that a standard closing time could cause a higher level of alcohol-related consequences as it released all drunk people into public space at the same time.[45]

The Act also replaced a number of separate licensing regimes into one with the aim of introducing a simple system involving a single premise license.[226] It moved the responsibility of licensing alcohol outlets from local magistrates to "responsible authorities". These "responsible authorities" are formed by a group of representatives such as local fire and rescue authority, children's services and the chief officer of police. In 2011, local public health teams were added to these "responsible authorities". Through these changes the government aimed to encourage the identification of most appropriate licensing strategies for local areas through a regulatory framework, supporting the responsible licensed premises through minimising regulatory burden on business and encouraging community involvement in making licensing decisions.[213]

However, the Act introduced "cumulative impact" policies which could be considered by the local authorities when developing their licensing policy statement. The cumulative impact was defined as the potential impact on the promotion of licensing objectives of a significant number of licensed premises concentrated in one area. These cumulative impact policies could be used to address issues such as public nuisance and disorder that generally occur because of large number of drinkers being concentrated in one area.[213] In addition, the Act also provided more powers to the police to effectively manage and take actions against irresponsible licensed premises and encouraged involvement in tackling alcohol misuse at the local authority level.[223, 226] For example, the Act provides police with powers to close down

irresponsible premises that are causing public nuisance instantly for up to 24 hours.[226]

1.8.2 Potential unintended consequences of extended opening hours and alcohol consumption

Despite the explanation of café culture emphasized by the Government in relation to the provision of flexible opening hours,[45, 213, 223] there was a debate on the effectiveness of this liberalised approach suggesting that it could increase the burden of alcohol misuse and alcohol-related consequences in the country.[227-232] Critics of the Act assumed that there would be an increase in the overall availability of alcohol in England and Wales as it allowed flexible and longer opening hours and hence they suggested that it would lead to an increased level of consumption and consequences.[227-232]

The alcohol availability theory suggests that greater availability of alcohol is associated with an increased level of average alcohol consumption in the population, increased numbers of excessive drinkers, and increased numbers of alcohol-related consequences.[233] In other words, the alcohol availability theory suggests that if alcohol is less easy to obtain it will lead to a reduction in the level of consumption and alcohol-related consequences.[20, 233] This theory has been extensively supported by the scientific literature and the section 1.2.1 provided an overview of the current evidence available on policies aimed at restricting alcohol availability and their effectiveness. As mentioned in the section 1.2.1 there are several policy options being used to restrict alcohol availability in different settings and restricting the hours of sale is one policy option and it has also been extensively supported by existing literature. For example, a systematic review of studies assessing the impact of changes to liquor trading hours included a total of 49 studies

conducted in different countries between 1965 to 2009 and concluded that extended night-time trading hours can lead to excessive alcohol consumption and related consequences.[234] Two other systematic reviews of more recent studies evaluating the effect of alcohol control policies on maintaining or restricting days and hours of alcohol sales also support the alcohol availability theory.[43, 44] Those two studies found that increasing the number of days of alcohol sale, or the hours of alcohol sale by more than two hours can lead to excessive consumption levels and related harm.[43, 44]

However, the option to extend opening hours permitted by the Government was not utilised by most licensed premises. A telephone survey of police officers responsible for licensing on-trade premises in 26 of the 43 police forces in the UK showed that only a few premises requested 24 hour licensing.[223] It also showed that on-trade premises which applied for longer opening hours generally applied for one or two extra hours, and these extra hours were often only used occasionally such as during weekends, parties, and bank holidays.[223] Another data analysis conducted by the Department of Culture, Media and Sports in 2007 showed that after the implementation of the Licensing Act, the average closing time was extended by only 21 minutes among all on-trade premises in England and Wales, and almost 80% of them closed at or before midnight.[45] Though there is evidence to suggest that the effect of increasing hours of sale in on-licensed premises in high-income countries by more than 2 hours can lead to excessive alcohol consumption and related harm,[44] there was no sufficient evidence to prove the same for an increment of hours of alcohol sales less than 2 hours.[44] During 2006/07, there were 5100 premises with 24 hour license (3,320 hotel bars and 470 bars and night clubs) and it also included 920 off-trade premises.[45] However, most of these off-trade stores reported that do not actually open their stores for 24 hours or they choose not to open their

alcohol aisles for 24 hours following discussions with the police about issues within the local area.[45] Hence, the actual extensions to opening hours introduced by the Licensing Act may not have had a large effect on adults' alcohol consumption in England.

Therefore, it is unlikely to expect sharp changes in adult alcohol consumption in England. Hence, the work involve in this thesis will be based on the hypothesis that there may have been gradual changes in adult alcohol consumption since the implementation of the Licensing Act.

1.8.3 Effect of the Act on alcohol consumption

Even though the focus of this thesis will particularly be on the effect of the extended opening hours granted by the Act and increased availability of alcohol in England, within the Act there were several other pathways that could influence alcohol consumption among individuals. Hence, it is important to identify these other effects and consider how they may have influenced the alcohol consumption among individuals in England.

In addition to the extended opening hours, the Act relaxed the regulatory burden on alcohol licensing,[226] and used a nationally set licensing fee rather than a locally-set licensing fee.[235] This could have led to an increased number of alcohol outlets and thereby increased the availability of alcohol. Having a nationally set licensing fee has been criticized by the Local Government Association as it does not cover the cost of administering and enforcing the licensing system and this has been seen as another step encouraging the industry through a favourable regulatory scheme.[235, 236] This action as well as the reduced regulatory burden could have contributed towards the increased number of alcohol outlets in England over time. During the period between 2004 and 2014 the total number of licensed premises

(on and off trade) increased by 2.1% (from 179,865 to a total of 183,600).[190] The increase in off-trade premises during this period was twice as many as the on-trade premises.[236] Therefore, the increased number of alcohol outlets since the Act is likely to have increased the availability of alcohol and may have also had an effect on alcohol consumption.[35-39]

Moreover, the promotion of café culture though flexible opening hours, relaxed regulatory framework, increased safety in licensed premises, and measures taken to protect children in licensed premises may have had an influence on drinkers' perceptions towards drinking, drinking location (on-trade, off-trade) and choice of beverage type. On the other hand, increased police powers to deal with disorderly premises may have also influenced drinkers' perceptions and alcohol consumption behaviours in licensed premises.

1.8.3.1 Conceptual framework

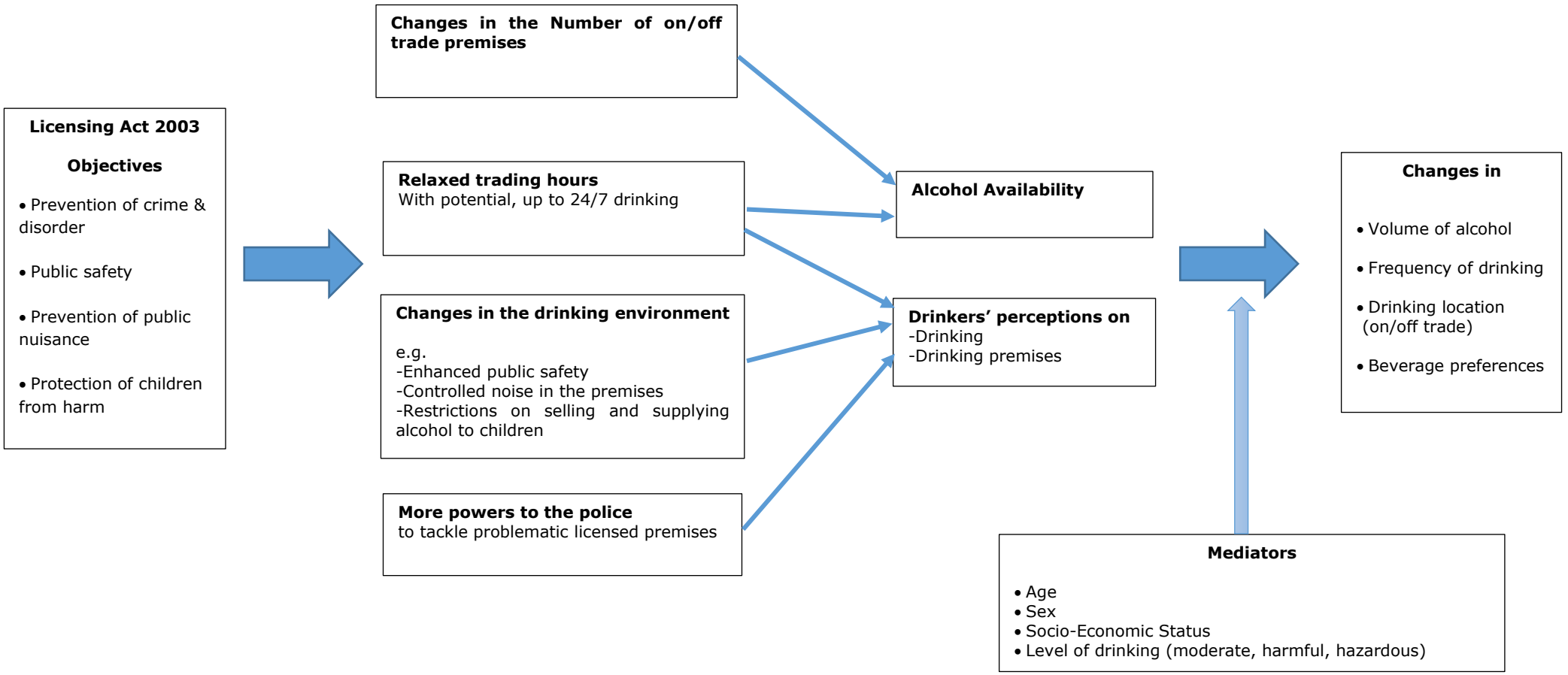
Based on the evidence discussed in the sections above, this section provides a conceptual framework (Figure 1-3) on the effect of Licensing Act 2003 on adult alcohol consumption. This shows the potential link between the changes introduced by the Act on adult alcohol consumption in England. These changes introduced by the Act include extended opening hours, reduced licensing regulatory burden, changes in drinking environments (e.g increased public safety, reduced noise levels, protecting children from harm), and increased police powers on adult alcohol consumption in England.

Of these changes the slight increment in average closing time in on-trade premises in England and Wales[45] and reduced regulatory burden leading to changes in number of alcohol outlets are likely to have changed the level of alcohol availability in England. According to the alcohol availability theory this can have an influence on the alcohol consumption

among individuals. Changes to the drinking environment and increased police powers as well as flexible opening hours introduced by the Act may have had an influence on drinkers' perceptions on drinking and drinking locations. According to the Theory of Planned Behaviour, behaviour such as alcohol consumption is driven by the extent to which an individual positively values that behaviour (attitude), their perception of other people's approval or disapproval of that behaviour (subjective norms), and the individual's perceived ability to perform that behaviour and perception of their own level of control over engaging in that behaviour (perceived behaviour control),[237] and this theory has been used to predict alcohol consumption among individuals.[238, 239] Therefore, any changes in drinkers' perceptions about drinking and drinking locations occurred due to the Act may have also had an influence on alcohol consumption.

As discussed in the previous sections of this thesis, the alcohol consumption habits among drinkers vary substantially according to their age, gender and socio-economic status. Moreover, the level of drinking (moderate, hazardous and harmful) can affect drinker's beverage preferences, drinking location, and the motivation to substitute for other beverage types.[195] Therefore, these factors likely to mediate the impact of the Act on adult alcohol consumption as shown in the conceptual framework below.

Figure 1-3: Conceptual framework for Licensing Act 2003's effect on alcohol consumption among adults in England



1.8.3.2 Groups most likely to be affected by the Act

As shown in the above conceptual framework, the Licensing Act is likely to have influenced the alcohol consumption among adults in England. However, the effect of a population level policy measure is unlikely to affect all drinkers in the same way and this has been shown by the mediators in the above conceptual framework.

Based on the above conceptual framework and evidence in relation to the Acts implementation (Section 1.8.2), variation in drinking in different population subgroups (Section 1.7.1) particularly in terms of beverage preferences and location of drinking it was hypothesized that the Licensing Act could have led to a slight but gradual increase in alcohol consumption among adults in England, particularly among heavy drinkers and young (16-24) drinkers who are more likely to drink in on-trade.[195, 197] Moreover, men have a strong preference for drinking beer in on-trade,[195, 197, 198] therefore, a slight increase in beer consumption among men could have also expected due to extended opening hours in on-trade.

1.8.4 Existing literature on the impact of the Act

Several studies have evaluated the effect of the England and Wales Licensing Act, mainly by focussing on acute alcohol-related consequences such as incidents of violence and alcohol-related attendances at emergency departments. Their results have been inconclusive, with increases,[240-242] decreases[243-245] and no significant changes[246-251] in alcohol consequences after the implementation of the Licensing Act. Despite the number of studies evaluating the effect of the Licensing Act on alcohol-related consequences, only a few studies have evaluated its effect on alcohol consumption.

The first study to assess the impact of the Licensing Act on alcohol consumption mainly focused on changes in crime and disorder due to the Act.[223] However, it compared the average weekly alcohol consumption measure generated by the General Household Survey (GHS) in 2005 with the same in 2006 and reported that there was 6% fall in average weekly alcohol consumption in Great Britain. This study used the most basic quasi-experimental study design which compares a single measure before the Act with another single measure after the Act. Therefore, its results may have been affected by secular trends or sudden fluctuations in the outcome measure over time.[164, 165] Furthermore, the average weekly alcohol consumption estimates used in this study to compare alcohol consumption before and after the Act were derived from GHS questions that asked about alcohol consumption in the last year.[252, 253] Therefore, the alcohol consumption estimate used to represent respondents' consumption level after the Act may have overlapped with their alcohol consumption level prior to the implementation of the Act. The next study to assess the effect of the Licensing Act on adult alcohol consumption is a recent study published by the Institute of Economic Affairs.[254] This study showed that between 2005 and 2013 there has been a 17% decline in per capita alcohol consumption in the UK.[254] Furthermore, it described a decline in the prevalence of binge drinking from 2005 onwards using results produced by an Office for National Statistics report.[179] However, the Institute of Economic Affairs used only a descriptive analysis to produce these results and no information was available on the statistical significance of the results presented. Moreover, it only discusses the trend of alcohol consumption after the Act but there was no statistical analysis to compare it with the trend prior to the implementation of the Licensing Act in 2005. Another recent study used a qualitative approach in evaluating the effect of the Licensing Act by

conducting interviews with 36 participants from all key groups involved in licensing such as police, licensing officers, licensing lawyers, and trade associations.[236] This study synthesised the evidence on the Licensing Act's effect on alcohol consumption and concluded that the decreasing trend in alcohol consumption among adults is unlikely to be due to the Act. However, it did not conduct any further analysis to address the limitations in the existing studies.[236]

Therefore, to date, there are no studies that have employed more robust quasi-experimental study design on a nationally representative sample to evaluate changes in alcohol consumption after the implementation of the Licensing Act. Hence the Chapter 5 of this thesis will aim to fill this gap by evaluating the effect of extended opening hours and increased availability of alcohol on adult alcohol consumption in England by using interrupted time series analysis on a nationally representative data set.

1.9 Alcohol in Sri Lankan context

Sri Lanka is a South East Asian, lower-middle income country with around 20 million people. When compared with the UK, Sri Lanka is at a different stage in terms of its alcohol consumption, consequences and implementation of alcohol control policies. This section provides an overview of alcohol consumption, consequences, and alcohol control policies in Sri Lanka.

1.9.1 Alcohol consumption in Sri Lanka

1.9.1.1 History of alcohol consumption in Sri Lanka

Alcohol consumption in Sri Lanka has a long history, and it has been documented that ancient Sri Lankan Kings who ruled the country more than a thousand years ago consumed toddy,[255-257] which is a fermented beverage with low alcohol content (5% ABV) produced from the sugary sap obtained by tapping flowers of coconut (Cocos nucifera), Palmyra (Borassus flabellifer) or Kithul (Caryota urens) trees. In ancient Sri Lanka, villages produced toddy only for their own consumption but not for commercial purposes. During those times, alcohol drinking was not promoted in the country, mainly due to religious and cultural reasons as the majority of Sri Lanka's religion is Buddhism, which discourages alcohol consumption.[258]

However, these habits among Sri Lankans changed from the sixteenth century onwards due to invasions by Europeans: the Portuguese, Dutch and British respectively.[255, 258] The Western cultural influence promoted drinking habits among Sri Lankans and the production of toddy and arrack for commercial purposes began. Arrack, a form of spirits with high alcoholic content around 30%-40% and made by distillation of naturally fermented toddy, became the most popular alcoholic beverage among Sri Lankans.[259] Over time, various other types of drinks were introduced to Sri Lankans by Western powers who ruled the country, starting with Portuguese introducing wine in 1505. The first Excise Ordinance in Sri Lanka was implemented by British as the "Toddy Act of 1912".[259] Thereafter, British rulers promoted the drinking habit among Sri Lankans by liberally providing licenses to open taverns in most parts of the country with the intention to increase revenue.[258, 259]

After independence in 1948, the Sri Lankan Government transferred alcohol production from the Department of Excise to a newly formed State Distilleries Corporation in 1974, and the Department of Excise continued to monitor and control authority of the industry.[259] However, instead of consuming legal alcohol produced by the Distilleries Corporation, many low-income groups started producing and consuming illicit alcohol with very high alcohol content around 50% ABV named "Kasippu" and "Moonshine".[259] Due to lack of revenue from the alcohol industry, mainly due to the illicit alcohol industry, the State Distilleries Corporation was privatised in 1992.[259] Since then alcohol consumption in Sri Lanka has increased rapidly.

1.9.1.2 Per capita consumption

According to the World Health Organization, average per capita (15+) alcohol consumption in Sri Lanka, for the period from 2008-2010 was 3.7 litres of pure alcohol. This estimate included both recorded and unrecorded alcohol.[1] Recorded alcohol consumption during this period of time was only around 2.2 litres of pure alcohol. By 2010, the per capita alcohol consumption level in Sri Lanka was higher than the average alcohol consumption level within the South East Asian Region, which was 3.5 litres of pure alcohol.[1] During the same period per capita consumption among Sri Lankan males was 7.3 litres of pure alcohol, whereas among females it was only 0.3 litres of pure alcohol.[1] However, the drinkers' only per capita alcohol consumption level among Sri Lankan male drinkers in 2010 was very high at 26.7 litres of pure alcohol per year, which is equivalent to drinking 51 units of alcohol per week (10ml=1 unit).[1]

The most commonly consumed types of alcoholic beverages in Sri Lanka are spirits and beer. According to recorded alcohol consumption data

in 2010, spirits and beer consumption accounts for 85% and 13% of the total alcohol consumption in Sri Lanka.[260] Wine and other types of drinks consumption including toddy were relatively low when compared with spirits and beer.[260]

In addition to the recorded alcohol consumption estimates discussed above, Sri Lanka has a high proportion of unrecorded (illicit) alcohol consumption. Even though the WHO estimated that unrecorded per capita consumption was only 1.5 litres of pure alcohol, which is around 40% of total consumption,[1] it is estimated that unrecorded alcohol accounts for about 50% of total alcohol consumption in Sri Lanka.[141, 261, 262]

1.9.1.3 Prevalence of drinking in Sri Lanka by socio-demographic group and setting

Prevalence of drinking among Sri Lankans varies considerably according to several factors such as gender, age, religion, ethnicity, the level of education and level of income. This section provides a summary of prevalence statistics according to key demographic factors. However, there are only a handful of studies that have studied alcohol epidemiology in Sri Lanka, therefore, it is currently not possible to describe timely and detailed statistics on alcohol consumption among different subgroups in Sri Lanka.

Gender

Alcohol consumption in Sri Lanka is common among men but rare in women. According to the National Non Communicable Disease Risk Factor survey conducted in 2008 the prevalence of current drinking among men and women was 26% and 1.2% respectively.[263] However, the National Alcohol Use Prevalence Survey conducted in 2012 showed higher current drinking rates of 39.6% in men and 2.4% in women.[264] Several other surveys conducted in different regions of the country have confirmed that alcohol consumption is predominantly a habit among men in Sri Lanka.[265-267]

Age

Alcohol consumption among Sri Lankans varies substantially by age. When compared with middle-aged men younger men tend to report lower levels of current drinking and heavy drinking. For example, according to a study conducted in 2004 in Southern province, the prevalence of current drinking among men aged 15-19 was 10.6%.[268] Another cross-sectional study conducted in seven of the nine provinces in Sri Lanka found the highest prevalence of current drinking (58.9%) among men aged 30-39.[266] The same study reported men aged 30-39 were twice as likely to be current drinkers and engage in hazardous drinking when compared with men aged 18-29.[266] Similarly, in Colombo district the highest rate of current drinking (75.4%) was reported among older adults aged 35-46 when compared to younger adults (36.9%) aged 16-24 in 2006.[267] However, according to the National Alcohol Prevalence Survey conducted in 2012, current drinking was highest among men aged 45-54 years (47.7%).[264] Men aged 35-44 had the second highest current drinking rate (45.2) and it was lowest (14.5%)

among men aged 15-24. In the same survey, current drinking in females was highest (3.4%) in the 25-34 year age group and lowest (1.0%) in the 15-25 age group.[264]

Ethnicity and Religion

Ethnicity and religion are highly correlated with drinking habits in Sri Lanka. Sri Lanka is home to four ethnic groups; Sinhalese, Tamils, Burghers and Muslims who believe in Buddhism, Hinduism, Christianity, and Islam respectively. In some studies Tamils are further divided as Sri Lankan Tamils and Indian/Plantation Tamils. When compared with Sinhalese, Tamils and Burghers have relatively higher current drinking rates whereas Muslims have relatively lower levels current drinking rates.[255, 265, 266] For example, the prevalence of current drinking among Sinhalese, Sri Lankan Tamil, Plantation Tamil, Burgher and Muslim male populations during 2005 and 2006 was 49.4%, 67.1%, 65.6%, 64% and 7.3% respectively. The same study reported that Tamils were 70% more likely to be current drinkers and twice as likely to be hazardous drinkers when compared with Sinhalese.[266] On the other hand, Muslims were 60% less likely to be current drinkers when compared with Sinhalese during 2005 and 2006.[266]

Income and Education Level

Drinking in Sri Lanka is more common among people with higher levels of income.[255, 266] For example, during 2005-2006 the prevalence of current drinking among males with an income over Rs:50,000 (£250.00) per month was 60%, whereas the prevalence of current drinking among males in the lowest income group (less than Rs:7000 per month) was 43%.[266] Similarly, drinking is more common among females with higher income.[255, 266] In Sri Lanka the prevalence of current drinking among unemployed people are relatively low (36%) as they cannot afford alcohol due to the lack of unemployment benefits or insurance.[255, 266]

The highest prevalence of current drinking and hazardous drinking is seen among men with medium to the lowest level of education.[266] In contrast, the highest prevalence of drinking among women is reported in the group with the highest educational qualifications.[266]

Area (Urban or Rural)

In addition to above the mentioned factors, alcohol consumption among Sri Lankans has been found to vary according to the level of urbanisation in the area in which they live. People in urban areas are more likely to be current drinkers when compared with people living in rural areas.[269, 270] For example, a study conducted in 2009 compared the prevalence of current drinking among men in Colombo (urban district) and Polonnaruwa (rural district). According to this study the rates of current drinking among men in urban and rural areas were 33% and 20.8% respectively.[270] The levels of alcohol consumption in urban areas were also significantly higher than the rural areas with 33.1 units per week and 20.9

units per week respectively.[270] According to Katulanda et al the rates of current drinking among men and women in urban and rural areas are 29.5% and 22.2% respectively.[266]

1.9.2 Alcohol consequences in Sri Lanka

1.9.2.1 Non-communicable disease burden

Non-communicable diseases in Sri Lanka are on the rise.[271, 272] Cardiovascular disease, diabetes, cancers, and chronic respiratory diseases are the prevalent non-communicable diseases in Sri Lanka that account for about 75% of the total deaths in the country.[11, 273] Alcohol misuse has been identified as one of the main four risk factors (smoking, alcohol use, unhealthy diet, physical inactivity) contributing to this non-communicable disease burden in Sri Lanka.[11]

Sri Lanka has a comparatively high mortality rate for liver cirrhosis, of 37.3 per 100,000 males; in the UK it is 16.0 per 100,000 males.[1] Mental health disorders due to alcohol misuse also contribute to the significant non-communicable disease burden in Sri Lanka. Furthermore, hospital admissions and deaths due to alcohol-related non-communicable diseases such as hypertension and ischemic heart disease are increasing over time.[274]

1.9.2.2 Drink-drive accidents

Accidents and injuries due to alcohol intoxication are other major aspects of alcohol consequences in Sri Lanka. There is an upward trend in deaths due to road traffic accidents in Sri Lanka,[275] of which a considerable proportion are likely to be due to alcohol misuse. According to the WHO in 2012, the age-standardized death rate (per 100,000 of the population) for road traffic accidents among males and females was 26.8 and 8.0 respectively.[1] The alcohol-attributable fraction for road traffic accidents in the same year was around 20% for men and 0.8% for women in Sri Lanka.[1]

1.9.2.3 Public nuisance and domestic violence

Public nuisance and domestic violence due to alcohol misuse are clear issues in the Sri Lankan rural community.[276] Most of the drinkers in rural areas drink locally brewed illicit arrack, known as kassippu, which has a high level of alcohol content of around 50% ABV. These drinkers are often responsible for public nuisance, domestic violence, and negligence of their family responsibilities. In Trincomalee District, among a random sample of 417 women aged 18-49 years, 30% reported that they were beaten by their husband and alcohol misuse among these men was a key factor associated with wife beating incidents.[277] A recent study (n=156) conducted in two villages from Central Province showed the significant suffering of Sri Lankan women by investigating the prevalence of major depressive disorder. This study was conducted among spouses of men who use alcohol and in this sample of women, 33.3% were identified to have a major depressive disorder.[278]

1.9.2.4 Worsening poverty

Most of the families in rural areas of Sri Lanka experience exacerbations in poverty due to unaffordable alcohol consumption habits.[276] Alcohol expenditure accounts for a considerable proportion of expenditure from households in rural areas, whose incomes are barely sufficient to satisfy their basic needs. It has been estimated that in the poorest families, around 30%-50% of family income is spent on alcohol consumption.[279, 280] This situation leads to domestic violence, family disruption, health consequences, and disruption of education among children, which perpetuates the cycle of poverty in these families.[281]

1.9.2.5 Suicide and self-harm

Suicide among Sri Lankans has been a major public health burden for a long period of time, and according to the most recent statistics by the WHO in 2012, Sri Lanka had the fourth highest suicide rates worldwide.[282] In 1991, the female suicide rate in Sri Lanka was 16.8 per 100,000 and it was second only to the female suicide rate in China (17.9 per 100,000).[283] Alcohol misuse has been identified as a major factor associated with suicide and self-harm attempts in Sri Lanka.[283, 284] A study conducted in Ratnapura District, around 110km from the capital Colombo, found that alcohol misuse was associated with around 40% of self-harm cases in this area.[285] Sri Lankan women's and youth's self-harm attempts also have a strong relationship with their male family members' alcohol misuse.[283, 286] During 1998-1999 in Ratnapura District self-poisoning attempts among women and youths were mainly due to the alcohol-related domestic violence or irresponsible behaviour of their husband or father.[285]

1.9.3 Recent alcohol control policies in Sri Lanka

In 2006, the National Authority on Tobacco and Alcohol (NATA) was established in Sri Lanka to implement the NATA Act that came into action in the same year.[287] This act prohibits the sale and distribution of alcohol to people under the age of 21, advertisements and free distribution of alcoholic products and smoking cigarettes in public places.[287] However, the full implementation of this act has not yet been achieved.

For example, studies conducted by the Foundation for Innovative Social Development (FISD) and Health Alliance for Development (HALD) in nine districts of Sri Lanka in 2012 showed how the alcohol industry undermines the implementation of NATA Act. The percentage of alcohol outlets selling alcohol to persons under the age of 21 years was 98.7% and 93.3% according to FISD study and HALD study respectively.[288] The Institute for Policy Studies in Sri Lanka also emphasises concerns regarding existing alcohol policy. These include issues such as the weak law enforcement, influence from the alcohol industry, political influence and unaffordable prices of legal liquor that can lead to more illicit alcohol consumption in Sri Lanka.[289, 290]

In contrast to previous governments, the current government and President of Sri Lanka (Mr Maithripala Sirisena) who came into power in January 2015 are keen on tackling the alcohol-related burden. Moreover, the current government aims to implement a comprehensive National Alcohol Control Policy in the near future, which was developed in 2014 with the direction from President Maithripala while he was in his previous office as the Minister of Health.[183] The new national policy on alcohol control in Sri Lanka aims to achieve best practice in alcohol control by formulating and implementing new legislation while enforcing the existing alcohol control policies in the country.[183] This has ten target areas of policy improvements

including changes in policies related to alcohol marketing, pricing, availability, accessibility of alcohol products from any source, and drink driving. However, these key changes to the alcohol control policies have not yet taken place.[184]

1.10 End of civil war in Sri Lanka

Sri Lanka suffered from an armed conflict for over three decades (1976-2009).[291] The conflict was between the Sri Lankan military forces and Liberation Tigers of Tamil Eelam (LTTE) who fought for a separate mono-ethnic Tamil state under its control based in Northern and Eastern Provinces of Sri Lanka.[291] This conflict mainly took place in the Northern and Eastern Province but people in the whole country suffered from the terror of LTTE's bomb blasts that could take place anytime, and anywhere in the country, killing hundreds of people.[291] This armed conflict left the whole country in terror for almost three decades.[291-294] It is estimated that around 100,000 people were killed during this period.[295] Finally, on the 18th May 2009 this conflict came to an end, having caused significant hardship for Sri Lanka by affecting its population, environment and economy.[296]

The effect of the end of the conflict on adult alcohol consumption in Sri Lanka has not yet been formally quantified and evaluated. Therefore, the work involved in this thesis aimed to evaluate the effect of the end of conflict on adult alcohol consumption in Sri Lanka.

1.10.1 Factors caused by the conflict influencing alcohol consumption

As discussed in detail in Section 1.4, conflicts can cause several individual and population level factors influencing alcohol consumption in post conflict settings and their effect can vary among displaced/directly affected populations and non-displaced/indirectly affected populations.

In Sri Lanka the armed conflict mainly took place in two (Northern and Eastern) out of the country's 9 provinces; the majority of Sri Lankans (87%) [297] who were living in the rest of the country (seven provinces) were not displaced or directly exposed to this conflict.[291, 298] Up to now only a few studies have focused on the impact of the end of conflict in Sri Lanka. However, the results of these studies have been consistent with international evidence given in Section 1.3, with higher rates of mental health issues,[295, 299] unemployment,[295, 300] poverty[295, 300] and alcohol industry penetration[301] identified in the areas that were directly affected by the conflict in Sri Lanka. Similarly, in line with international literature, the areas that were not directly affected by the conflict in Sri Lanka experienced population level factors influencing alcohol consumption in post conflict settings, and these include rapid economic development,[300, 302, 303] urbanisation[304] and alcohol industry penetration.[301]

Based on the existing evidence from international and local studies on the impact of conflict exposure on alcohol consumption, it was hypothesised that alcohol consumption among Sri Lankans living in both areas that were directly and indirectly exposed to the conflict is likely to have increased notably during the post conflict period with a greater increase in the directly affected areas.

However, the effect of the end of conflict in both directly and indirectly affected areas is likely to vary further according other factors that were not caused by the conflict such as age, sex, and ethnicity. The above-mentioned hypothesis will be further specified after considering the effect of socio-demographic factors and their geographical distribution in the section below.

1.10.2 Other factors influencing alcohol consumption

As shown in the conceptual framework in section 1.4.4, the effect of conflict-caused factors influencing alcohol consumption in post conflict settings can be mediated by other factors such as age, gender, socio-economic status, and cultural beliefs. Moreover, section 1.9 discussed variations in alcohol consumption according to different subpopulations in Sri Lanka and identified that current drinking is more common among men, particularly among men in middle age (30-50), having Tamil ethnicity, living in urban areas and having higher income levels.

Of these other factors affecting alcohol consumption among individuals in Sri Lanka, three factors vary considerably according to the geographical area: ethnicity, proportion of population in urban and rural areas, and income level.[297, 305] Therefore, when evaluating the effect of the end of conflict on adult alcohol consumption in Sri Lanka it is important to consider these variations. That will enable the identification of the effect of the end of conflict on different areas and subpopulations.

Provincial level ethnic composition

The Figure 1-4 shows the variations in provincial level ethnic composition in Sri Lanka. Most of the provinces have a majority of Sinhalese, except from the Northern and Eastern provinces with 3% and 23% Sinhalese population respectively. Most of the Tamil populations are clustered in the Northern, Eastern and Central provinces whereas the largest proportion of Muslims are clustered in Eastern province.[297, 306]

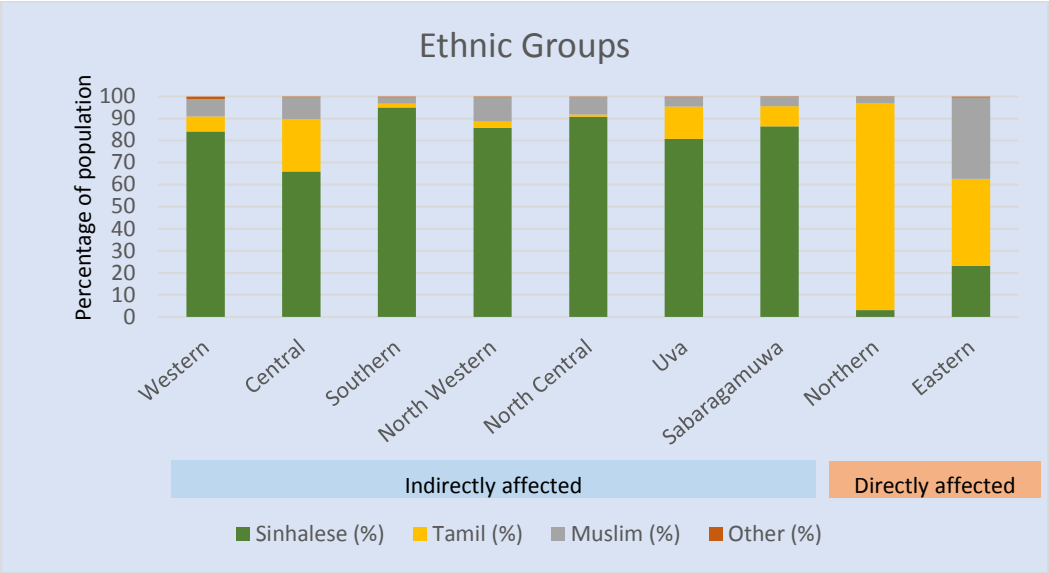
Urban and rural areas

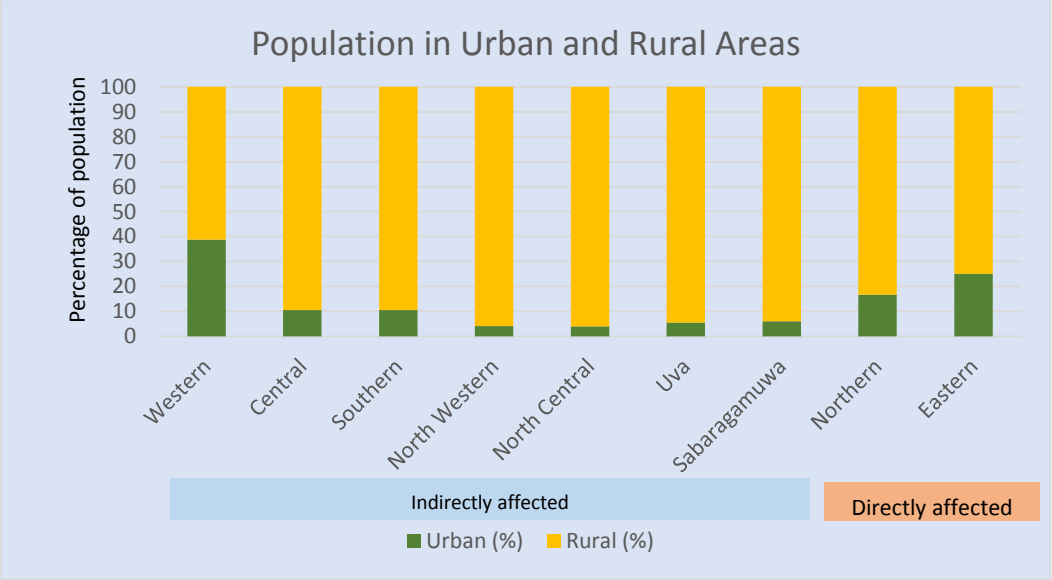
As shown in Figure 1-4, there is a notable gap in the proportion of the population living in urban and rural areas in different provinces. The Western province has the highest proportion of the population (39%) living in urban areas followed by Eastern (25%) and Northern (17%) provinces. In all other provinces, more than 85% of the population are living in rural areas.[297, 306]

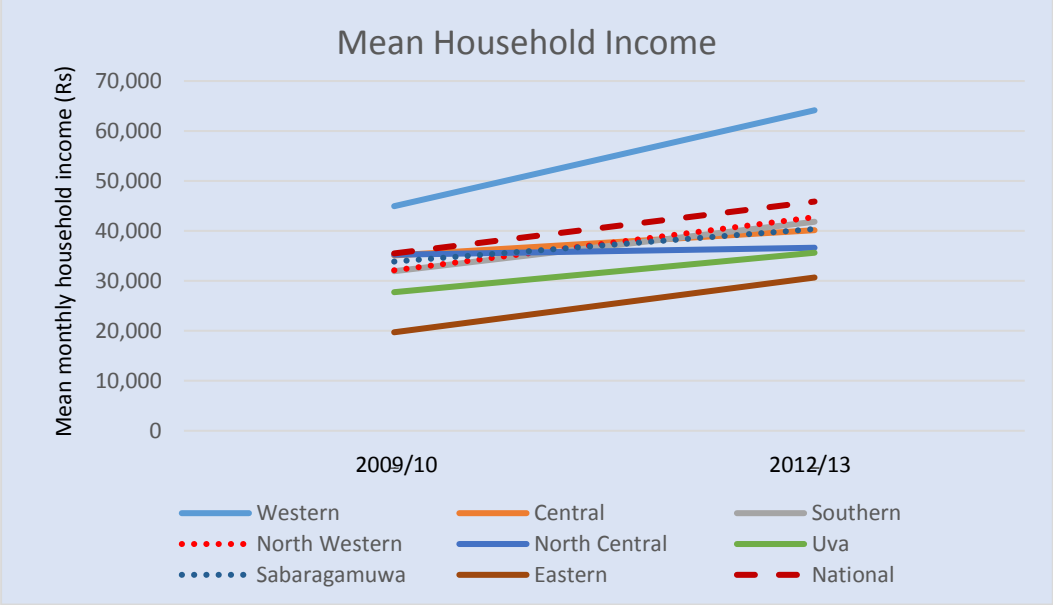
Mean household income levels

There are also substantial variations in household income levels in different regions in Sri Lanka (Figure 1-4). The Western province is the only province which has a mean household income level (2009/10: Rs.44,955 and 2012/13: 64,152) that is greater than the national average (2009/10: Rs.35,495 and 2012/13: 45,878).[305, 307] However, over time mean household income levels have increased in all provinces.

Figure 1-4: Provincial level ethnic group, urban rural areas, and mean household income variation







Data Source: Census of Population and Housing Survey, 2012 and Household Income and Expenditure Surveys (2009/10 and 2012/2013). Department of Census and Statistics
**Data not available for Northern province mean household income level*

1.10.3 Potential variations in adult alcohol consumption since the end of conflict

In section 1.10.1, it was hypothesised that alcohol consumption among Sri Lankans living in both areas that were directly and indirectly exposed to the conflict is likely to have increased notably during the post conflict period with a greater increase in the directly affected areas. These hypotheses can be further specified by considering the above mentioned geographical variations in terms of ethnicity, level of urbanisation, and mean income level are likely to influence the effect of the end of conflict on alcohol consumption among adults in Sri Lanka.

Hence it was further hypothesised that of the two provinces (Northern and Eastern) directly affected by the conflict, the Northern province is likely to have experienced a higher increase in alcohol consumption during the post conflict period, due to its greater proportion of Tamil (94%) who are more likely to drink than Muslims (36%) in the Eastern province, who are more likely to abstain from alcohol. Furthermore, within the areas that were not directly exposed to the conflict it was hypothesised that end of the conflict likely to have had a higher influence on alcohol consumption in Western and Central provinces due to highest income level and urbanization level in Western province and higher level of Tamil proportion in Central province respectively.

This thesis aims to review and identify potentially suitable data sources for evaluating the effect of the end of conflict on adult alcohol consumption in Sri Lanka and then to test the above the mentioned hypotheses (all of them or some of them depending on the availability of appropriate data) in Chapter 6. Moreover, as mentioned in Section 1.6, it will apply the lessons

learned from the UK context to the Sri Lankan context when evaluating the effect of the end of conflict.

1.11 Summary

Harmful alcohol consumption causes many preventable health and social issues around the world. The level of alcohol consumption and related harm can be influenced by alcohol control policies and other contextual factors. It is important to evaluate the effect of these policies/contextual factors to identify their effectiveness and generate a better understanding of their effect on alcohol consumption.

The UK has introduced several alcohol control strategies over time and the Licensing Act 2003 is one of the recent policies implemented in England and Wales. Even though there are some studies that have evaluated the Licensing Act 2003, their results have been inconclusive, showing both increased and decreased levels of attendances to Emergency Departments after the Licensing Act 2003.[241, 242, 245] These studies have also focused on very specific study populations with small sample sizes from different Emergency Departments in the UK. Hence, the results of these studies are not largely generalizable to the UK population and may not fully capture the extent of changes in alcohol-related attendances. Therefore, it is important to evaluate the effect of the Licensing Act 2003 by using a nationally representative dataset.

On the other hand, in Sri Lanka, in recent years there have not been any alcohol control policy implementations but there is increasing recognition of alcohol misuse as a public health burden since the end of the war in 2009. The effect of the end of the war on adult alcohol consumption has not yet been formally quantified and evaluated. Evaluation of the effect of the end

of conflict is important in identifying the current trend of alcohol consumption and next steps towards reducing the alcohol-related burden in Sri Lanka.

However, alcohol control policies/ contextual factors evaluation requires high quality and timely data. Hence, it is important to identify the suitability of different data sources in both settings while considering their advantages and disadvantages for alcohol control policy evaluation purposes. This can be done by validating potentially suitable alcohol consumption measures. Therefore, the work in this thesis will focus not only on identifying suitable data sources for alcohol control policy or contextual factor evaluation in the UK and in Sri Lanka but also using those data to evaluate the effect of the Licensing Act 2003 and the end of the war in 2009. Moreover, applying the lessons learned from evaluating alcohol control policies in the UK into Sri Lankan context will be beneficial in identifying potentially suitable existing data sources for policy evaluation, developing future data sources such as national surveys and in identifying potentially suitable policy options.

1.12 Aim and Objectives

The aims of this PhD thesis are to investigate the suitability of existing data sources in the UK and in Sri Lanka for evaluation of alcohol control policies/contextual factors, validate potentially suitable measures, and use validated measures to evaluate the impact of Licensing Act 2003 in the UK and the end of conflict in Sri Lanka using time series analysis.

It has four specific objectives:

- To analyze and describe a range of existing data sources that provide information on alcohol consumption in terms of their adequacy for evaluating alcohol control policies/contextual factors in England (Chapter 2) and in Sri Lanka (Chapter 6).
- To validate previously unvalidated alcohol consumption measures identified in Chapter 2 as potentially valuable measures in the evaluation of population-level alcohol control policies in England (Chapter 3 & Chapter 4).
- To utilize validated measures of alcohol consumption to evaluate the impact of the Licensing Act 2003 using the most appropriate time series methods (Chapter 5).
- To utilize existing data sources in Sri Lanka to evaluate the effect of the end of the war on adult alcohol consumption using the most appropriate time series methods (Chapter 6).

2 EXISTING DATA SOURCES ON ALCOHOL CONSUMPTION IN THE UK

This chapter describes a range of existing data sources on alcohol consumption in the UK while aiming to identify potentially suitable data sources for evaluating the effect of the Licensing Act 2003 on alcohol consumption among adults in England. The potentially suitable data sources identified from this chapter will then be further assessed for their quality, completeness and suitability for evaluating the effect of Licensing Act in Chapter 3 and Chapter 4 of this thesis.

Even though there are several data sources on alcohol consumption, they are likely to be affected by different sources of bias. Moreover, alcohol control policy evaluation requires high quality, timely data for a long period of time. Hence the following sections of this chapter discuss the general sources of bias separately for population level and individual level data. It then further discusses the unique strengths and limitations of each data source with the aim of identifying potentially suitable data sources for evaluating the effect of the Licensing Act 2003 on adult alcohol consumption in England.

2.1 Population level data and potential biases

Population level alcohol consumption measures can usually be obtained from alcohol excise duty returns and alcohol sales/production records. These data sources are considered as the most accurate means of producing estimates of per capita alcohol consumption, particularly in developed countries where unrecorded consumption is relatively low.[7] These data also

produce higher estimates for alcohol consumption when compared with individual level data sources such as the general population survey data.

However, population-level data can only be used to estimate the average volume of alcohol consumption in a population. Even though these data can be used to generate estimates of alcohol consumption at the national level, they cannot be used to generate estimates on the amount of alcohol consumed by individuals. Therefore, population level data fail to provide information on patterns of drinking such as the frequency of heavy episodic drinking which is considered as a key indicator in alcohol epidemiology.[7] Moreover, population-level data cannot be used to compare the drinking behaviours among different groups of people, examine drinking behaviours according to types of drink, and to identify people who drink above the sensible drinking limits or binge drinking limits.

In addition to the above-mentioned limitations, population-level data may overestimate or underestimate alcohol consumption. Overestimation of alcohol consumption can occur due to underestimation of the denominator population. For example, the UK has a considerable non-UK resident student population; during the year 2012/13, there were 425,265 non-UK students.[308] These non-UK resident students represented 18% of the UK total student population and their alcohol consumption also contributes towards the total alcohol sales;[308] however they are not included in national population estimates. According to the Smoking, Drinking and Drug Use Among Young People in England survey data, 10% of pupils aged 11-15 drank alcohol in the last week, with an average consumption of 12.5 units.[309] Likewise, the denominator population used to calculate per capita consumption measures can be underestimated when it does not account for visitors to a country and individuals below 16 years of age who consume alcohol.[310, 311] However, this is likely to have only a small effect on the

estimate of per capita consumption. For example, the amount of alcohol consumed by young people (aged 13-15) in Scotland has not been large enough to change the adult per capita consumption estimates.[312] Another study adjusting HMRC sales data for potential sources of bias showed that children's consumption in the UK had a minor influence on the per capita consumption estimates.[310] The other minor factors that can contribute towards the overestimation of adult per capita consumption estimates derived from population-level data are personal exports, stockpiling of alcohol after purchase, alcohol wastage or spillage and alcohol used in food.[310, 312]

In contrast to overestimation, underestimation of population-level alcohol consumption measures can occur due to unrecorded alcohol consumption such as home-brewed alcohol, cross-border purchases and illegally produced alcohol.[310] In developed countries such as in the UK, most of the alcohol consumed is legal and recorded.[1, 313-315] However, a large amount of alcohol consumed by populations in low and middle-income countries is unrecorded.[141, 313, 314, 316] Therefore, per capita alcohol consumption measures calculated from official statistics on alcohol production or sales may not provide a complete picture of total per capita consumption. For example, during 2008-2010 in the UK 10.3% of alcohol consumed was unrecorded, whereas in Sri Lanka this proportion was estimated to be 40.5%.[1] This estimate of unrecorded consumption can vary between 40%-60% in different settings.[1, 313] Moreover, the drinkers only per capita consumption can substantially vary from the adult per capita consumption in some countries. For example, in Sri Lanka adult per capita consumption during 2008-2010 was 3.7 litres of pure alcohol.[317] However, drinkers only consumption for male and female drinkers was 26.7 and 2.9 litres of pure alcohol per year. [317]

In addition, the exclusion of certain alcohol sales outlets in retail sales data can also contribute towards the underestimation of population level alcohol consumption figures. For example, Nielson and CGA, market research organisations who collect alcohol sales data in the UK, exclude several elements of alcohol sales such as mail orders, off-trade sales on military bases and duty-free sales.[312] Nielson also excludes off-trade sales data from alcohol outlets selling alcohol to the Ministry of Defence including the Navy, Army and Air Force.[312]

A number of studies have considered adjusting population level alcohol figures in the UK for all the above-mentioned factors.[310, 311, 318] A study conducted using Scottish retail sales data showed that underestimation outweighs the overestimation of adult per capita consumption measure by 2.1 litres of pure alcohol in 2010.[312] However, an update to the same study showed that underestimation of alcohol consumption in alcohol retail sales data for Scotland has increased from 4% in 2010 to 7% by 2013.[318] Another study using British alcohol sales data showed that adjustment for potential biases discussed above increased the original HMRC alcohol clearance figure for Britain by 7.6%.[310] The factors that had a large impact on this change in HMRC figure were tourism (+2.9%), spillage (-6.7%) and illicit alcohol (+9.3%).[310]

2.2 Population level data sources in the UK

The following section discusses the key population level alcohol consumption measures available in the UK and their potential strengths and limitations in terms of evaluating the Licensing Act 2003. A summary of these data sources is provided at the end of this section in Table 2-1.

2.2.1 HMRC clearance data

Summary

HM Revenue & Customs, the UK's tax authority, provides figures on all alcohol that has been cleared after excise duty for consumption in the UK for each year.[319] Alcohol Excise Duty is a tax for alcohol produced or processed in the UK or brought into the UK for consumption.[319] Excise duties vary according to the type of alcohol, and there are four categories of alcohol duties: Wine of fresh Grape, Made Wine, Spirits, and Beer and Cider.[319] HMRC data on alcohol clearance provides an overall picture of the alcohol consumed in the UK for each year. These data are available from 1899 onwards and over the recent decades data from HMRC on alcohol clearance have been released on a monthly basis.[319, 320] HMRC data for the period from 1980-2010 show that drinking patterns changed over time with a significant increment in wine and cider consumption, and a steady decline in beer clearances.[321]

Strengths

HMRC data have the ability to provide an indication of national level alcohol consumption in the UK. These data can be obtained by type of beverage.[189] HMRC data are available for more than a century and they can be used to identify seasonal trends in alcohol clearance since the data are released on a monthly basis.[189, 312] Therefore, HMRC data can be used in the interrupted time series analysis to identify the effect of alcohol control policies. Moreover, these data are freely available for researchers, unlike the market research data in the UK (discussed in the Section 2.2.2 below).

Limitations

Aside from the general limitations of population-level alcohol consumption data mentioned above, HMRC alcohol clearance data are only available for the whole UK but not for each individual nation or regional level.[312] Hence, it is difficult to use these data to identify the effectiveness of alcohol control policies implemented in different nations separately and therefore, HMRC data cannot be used to evaluate the effect of Licensing Act 2003 which was implemented in England and Wales. Furthermore, HMRC alcohol clearance data may not necessarily reflect the amount of alcohol consumed in the same period due to stockpiling of alcohol after purchase.[311]

2.2.2 Alcohol retail sales data

In the UK, population level alcohol consumption data can also be obtained from market research organizations and this section provides details of two of the most commonly used market research data sources; CGA and Nielsen.

2.2.2.1 CGA Strategy data

Summary

CGA Strategy is a market research organisation that collects on trade alcohol sales data in Great Britain.[312] CGA maintains a database of all on trade alcohol outlets in Great Britain. According to this database in 2010, there were 133,801 alcohol outlets and these include all types of on-trade premises such as restaurants, pubs, bars, casinos, cinemas, nightclubs, hotels, conference suites and guest houses. CGA database keeps a record of

basic information for each outlet such as the name, ownership details, address, and outlet type.[312]

CGA divides alcohol outlets in Great Britain into 109 outlet types and then further stratifies them according to the postcode. Stratified random sampling is then used to identify a nationally representative sample of alcohol outlets.[312] CGA collects data on alcohol brands at stock in these outlets by conducting detailed interviews with the publican via telephone or in person. The volume of different alcohol sold by outlets is collected from CGA's partners who provide detailed information on daily or weekly alcohol sales for each outlet once a month.[312]

Strengths

CGA provides detailed information on the volume and type of alcohol sold at on-trade premises. The beverage-specific alcohol sales information is available on a weekly basis and can be used to identify seasonal trends in alcohol sales. On the other hand, CGA data are based on a large nationally representative sample, therefore those data can be used to monitor regional level alcohol sales.[322] Due to the above reasons, CGA data can be considered as a potential data source for evaluating the effect of the Licensing Act 2003 on adult alcohol consumption in England. However, there are several limitations in using these data as discussed below.

Limitations

A key limitation of retail sales data is their cost, which makes them unaffordable for most researchers. Furthermore, alcohol consumption measures obtained from CGA are likely to be underestimated when compared with the HMRC clearance data as they do not include alcohol sold at temporary venues such as music festivals, sports events and outdoor

concerts, and private clubs. CGA sales data also do not include sales in Northern Ireland.[312, 323] Moreover, in relation to evaluating the effect of the Licensing Act 2003, CGA data can only produce population-level estimates such as per capita consumption measures. The data cannot be used to identify the Licensing Act's effect on alcohol consumption among men/women or on different age groups.

2.2.2.2 Nielsen alcohol sales data

Summary

The Nielsen market research organisation collects off-trade alcohol sales data in Great Britain. Nielsen maintains a database of all off-trade alcohol outlets in Great Britain and it records basic information of each outlet such as the outlet's name, address, outlet size, and the sales area. According to this database in 2010, there were 43,681 off-trade alcohol outlets in Great Britain. Nielsen collects weekly store census data from a nationally representative sample of outlets selected from its database. These data represent around 75% of all alcohol sold in off-trade alcohol outlets.[312] The key data collected from these alcohol outlets include type and volume of each item sold, retail price and information on special offers.[312]

Strengths

Nielsen data are available on a weekly basis, therefore, those data can be used to identify seasonal trends in off-trade alcohol sales. Furthermore, Nielsen data are based on a large nationally representative sample that can also be used to monitor regional level alcohol sales.[322] Moreover, Nielsen conduct market research in 106 countries,[324] and therefore, alcohol sales data obtained from other countries can be used as

control data sets in alcohol control policy evaluation. However, in relation to evaluating the effect of Licensing Act 2003, these data have several limitations which are discussed below.

Limitations

Similar to CGA data, a key limitation of using Nielsen data is their cost. Moreover, Nielsen data do not take into account alcohol sales from "duty-free" products, caterers, embassies, wine warehouses, mail orders and personal imports.[323] Nielsen also do not include sales in Northern Ireland, and sales from two key supermarkets Aldi and Lidl which account for about 5% of off-trade sales in the UK.[312, 323] In relation to evaluating the effect of the Licensing Act 2003, Nielsen data cannot be used to identify changes in consumption among men/women and in different age groups.

Table 2-1: Summary of **population level** alcohol consumption data in the UK

Data type	**Data source**	**Key alcohol consumption measures**	**Geographic area covered**	**Method of data collection**	**Sampling method**	**Sample size**	**Shortest time interval suitable for time series analysis**
Routine Data	**HMRC data**	Alcohol clearances data -Alcohol brand and volume of alcohol	UK (Data cannot be divided up to country level)	Routinely collected data on alcohol cleared after excise duty in the UK	Not applicable	Not Applicable	Monthly
Retail Sales Data	**CGA data**	On-trade alcohol sales data on -Alcohol brand -Volume of alcohol	Great Britain (Data can be divided up to regional level)	-Face to face or telephone interviews conducted every 3 months and -Daily or weekly data from CGA partners at least once a month	Stratified random sampling used on the database of all on-trade alcohol outlets	In 2010: -5600 outlets to obtain brand data -57,000 outlets to obtain volume data	Weekly
	Nielsen data	Off-trade alcohol sales data -Alcohol brand -Volume of alcohol	Great Britain (Data can be divided up to regional level)	Weekly store census data are collected from large multiple retailers and several small retailer groups	Stratified random sampling used on the database of all off-trade alcohol outlets	In 2010: -8096 large multiple retailers -669 smaller retailer groups	Weekly

2.3 Individual level data and potential biases

Individual level alcohol consumption data have unique advantages over population level data. They can be used to identify not only the volume of alcohol consumption but also patterns of alcohol consumption among individuals.[7] Individual level data also allow researchers to link alcohol consumption with alcohol-related consequences as well as to adjust for individual-level characteristics.[325] In contrast to population-level data, these data can be used to compare patterns of alcohol consumption between different groups of people and to examine who drinks what types of alcoholic drinks. Furthermore, these data can be used to identify risk factors for particular drinking behaviours such as heavy episodic drinking.

In the UK, individual level alcohol consumption data can mainly be obtained from alcohol surveys, market research surveys and patient records. These data sources use different data collections mechanisms and they have vastly different biases from one another as discussed in detail below. A summary of these data sources is provided at the end of this section in Table 2-3.

2.3.1 Patient records

Almost 100% of the residential population in the UK are registered with a general practice.[326] In 2015, there were 7674 practices in England, 454 practices in Wales, 981 practices in Scotland and 349 practices in Northern Ireland.[326] Primary care data provide information on patients' morbidity, any treatments provided and information on healthcare utilisation.[327] Over 80% of general practitioners (GPs) in the UK use computers to record patient information, and as a result of the new GP contract, GPs are required to

record detailed information on clinical management.[328] Hence, primary care is considered as an ideal setting to monitor patients' lifestyle information such as smoking and alcohol consumption status. Currently, there are several alcohol care pathways in primary care in which alcohol consumption status of a patient can be recorded and these include new patient registration, general health checks, specific disease clinics (e.g. hypertension, diabetes) and other health screening procedures.[329] However, there are several biases that can affect how routine data in general and alcohol consumption data in particular are recorded at primary care. The following section discusses the general issues related to primary care data recording and then the next section (Section 2.3.1.2) will discuss the specific issues related to alcohol consumption data recording in primary care.

2.3.1.1 General issues related to patient records at primary care

2.3.1.1.1 Variation in patient consultations

Even though patients registered in primary care are broadly representative of the UK general population in terms of age, sex, and geographic distribution,[328, 330] patient consultations vary by gender, age and deprivation status.[331, 332] Women and older people are reported to have a higher rate of general practice consultations compared to men and younger people.[331, 332] The gap between primary care consultation among men and women is particularly high when they are aged 16 to 60 years.[331, 332] This gap widens during the reproductive age; for example, in 2008 women aged 16-44 years were twice as likely to consult their general practitioner when compared with men.[332] According to another study in 2010, women aged

21-39 were 2.5 times more likely to use primary care services than men.[331] The same study explored whether gender differences in health care consultations remain after exclusion of reproductive health consultations and found that there was a considerable gap even after this adjustment.[331] Reluctance among men in seeking healthcare services has been identified as a factor contributing to this gap in consultations between men and women.[333, 334] This variation in consultations between men and women and between age groups can affect the representativeness of alcohol consumption data collected in primary care.

2.3.1.1.2 Factors influencing physicians' routine data recording behaviours

There is a wide spectrum of factors that can influence the routine data recording behaviours among physicians and other clinical staff members in primary care and this section provides an overview of them. These factors can contribute towards increased or decreased routine data recording in different settings. Hence, it is important to consider these factors and how they may have had an effect on the alcohol consumption data when primary care data are being used for research purposes.

Role of the doctor

Physicians' views on the doctor-patient relationship can also influence their recording practices. Current evidence suggests that sometimes physicians view coding as a barrier to an effective consultation process and the use of coding systems with 'diagnostic labels' can have negative impacts on the doctor-patient relationship.[335] Clinicians may also be reluctant to use coding systems as they believe it can potentially stigmatise patients.[336]

Influence of the patient

Patients with a history of disease conditions are likely to have higher levels of routine data for particular risk factors than other patients. For example, a study conducted using electronic medical records from 14 practices during December 2008 and January 2009 showed that patients with hypertension had better recording of data for blood pressure, body mass index and cholesterol.[337] Another factor that can contribute towards differences in routine data recording in general practices is the socio-demographic characteristics of patients. Women and older people tend to have a higher level of healthcare data recording in primary care.[337, 338] Patients' level of deprivation also seems to have an effect on the physicians' recording of health care data, however, current evidence on this relationship is mixed with positive and neutral results.[339, 340]

Technological factors

Technological factors are found to be associated with the way how practitioners enter data. One of these technological aspects is the use of prompts and reminders.[338, 341, 342] For example, the use of prompts and electronic reminders on specific health issues such as on cardiovascular risk factors and epilepsy have increased the level and adequacy of clinical information recording in several primary care settings.[341, 342] In addition, different coding systems are being used in general practices and some of them are found to be associated with better quality data recording compared to other clinical coding schemes.[343-345] A comparison between Read Version 3 and an earlier version of this clinical coding scheme (Read Version 2) found higher level of accuracy and consistency of data recording when using Read Version 3.[343] Moreover, it has been identified that the number of Read codes available for specific conditions can also influence the quality and

completeness of data recording at primary care.[335, 346] Coding inconsistencies can occur when there are a large number of Read codes available to record a specific condition but only a proportion of them are being used by physicians.[335]

Resource factors

Routine data recording in primary care can also depend on financial incentives and other resource factors.[339, 347] For example, smoking status recording in primary care markedly increased since the introduction of Quality Outcomes Framework (QOF),[339] which is a voluntary pay-for-performance general practice contract that came into effect in 2004.[348] Similarly, another study showed that introduction of QOF increased diabetes recording from 46.5% in 2000/2001 to 81.0% in 2006/2007.[340] In addition, other resources available for physicians particularly the time they can spend on patient consultations has been identified as a factor that can determine physicians' recording practices.[349]

Education and training factors

Several studies have suggested that providing training and feedback on data recording has the ability to improve the quality of primary care health records.[350-352] For example, a before and after study conducted using data from around 85 general practices in England showed that a training program which aimed to improve the recording of ischemic heart disease data had a significant impact on the recorded prevalence of ischemic heart disease data.[352] After this training, there was a 10% increment in recorded ischemic heart disease data.[352] In contrast, lack of IT skills and inadequate training for physicians and clinical staff can contribute towards poor quality data recording in primary care.[335, 349]

2.3.1.2 Specific issues related to alcohol consumption recording

Alcohol consumption screening and brief intervention have been used in primary care for a long period of time in identifying patients drinking at high-risk levels and in providing them with the necessary support to reduce alcohol consumption. Screening tests are used to identify the level of alcohol consumption and consequences of a drinker, whereas in brief interventions patients are offered information, guidance and advice to reduce the high risk of drinking.[329] There are a wide variety of alcohol consumption screening tests as discussed below, and variation or inadequate use of these tests can also contribute towards the lack of consistency and completeness of alcohol consumption data in primary care.

AUDIT

The Alcohol Use Disorders Identification Test (AUDIT) was first introduced in 1989 by the WHO. It consists of ten questions on the level of alcohol consumption, drinking behavior, and alcohol-related problems or reactions as shown in Table 2-2 .[353, 354] The first three questions in the AUDIT questionnaire ask about the frequency of drinking, typical quantity of drinking, and frequency of heavy drinking. AUDIT has been reported as performing well in identifying high-risk drinkers and hence currently it is considered to be the gold standard for screening for high-risk drinking.[355] AUDIT allocates points from 0-4 for each question and the final score of AUDIT can range from 0-40. An AUDIT score greater than or equal to 8 has been identified as having a high level of sensitivity (92%) and specificity (94%) in identifying high-risk drinkers.[354] Hence AUDIT is considered as a highly accurate tool for detecting hazardous and harmful drinking in primary care patients.

Shortened versions of AUDIT have also been developed for use in primary care settings and these include AUDIT-C and AUDIT-PC. AUDIT-C only use the first three questions of full AUDIT questionnaire which asks about the level of alcohol consumption.[356] AUDIT-PC uses five questions from full AUDIT questionnaire and these include question number 1, 2, 4, 5, and 10.

FAST

The Fast Alcohol Screening Test (FAST) is another shortened version of AUDIT designed for use in busy primary care settings or in emergency departments.[357] It is a two staged screening procedure: in the first stage, it asks about the level of consumption (AUDIT Question 3), and then moves on to the remaining questions (AUDIT Questions 5,8 and 10) if the score for the first stage question is 0, 1 or 2. Due to this limited number of questions FAST has only one question on the level of alcohol consumption, which is about the frequency of heavy episodic drinking.

CAGE

CAGE has four screening questions that ask whether the respondent has ever felt the need to cut down drinking, people have annoyed the respondent by criticizing his/her drinking, the respondent ever felt bad or guilty about his/her drinking and whether the respondent has ever had a drink as the first thing in the morning to steady nerves or to get rid of a hangover.[358] This tool has been shown to be effective in identifying lifetime alcohol dependence;[359] however, it has a low sensitivity in identifying heavy drinkers and in differentiating between current and past heavy drinkers.[360, 361]

Table 2-2: Alcohol Use Disorder Identification Test (AUDIT)[353]

	AUDIT	Scoring system					Your score
		0	1	2	3	4	
1	How often do you have a drink containing alcohol?	Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week	
2	How many units of alcohol do you drink on a typical day when you are drinking?	0 -2	3 - 4	5 - 6	7 - 9	10+	
3	How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
4	How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
5	How often during the last year have you failed to do what was normally expected from you because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
6	How often during the last year have you needed an alcoholic drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
7	How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
8	How often during the last year have you been unable to remember what happened the night before because you had been drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
9	Have you or somebody else been injured as a result of your drinking?	No		Yes, but not in the last year		Yes, during the last year	
10	Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down?	No		Yes, but not in the last year		Yes, during the last year	

Other Screening Tools

In addition to the above-mentioned screening tools, there are several other alcohol consumption screening tools, including the Single Alcohol Screening

Questionnaire (SASQ),[362] Five-shot Screening Tool,[363] The Michigan Alcoholism Screening Test (MAST),[364] and Paddington Alcohol Test (PAT).[365] These tools differ from each other slightly and some of them have alcohol consumption questions but some of them do not have questions on consumption. Therefore, the use of different screening tools in different primary care settings can also affect the consistency of routine data on alcohol consumption.

2.3.2 Survey data

Alcohol survey data is the other main source of data for individual level alcohol consumption in the UK. Alcohol surveys can be cohort, repeated cross sectional or strictly (i.e. one-off) cross-sectional surveys. Cross-sectional surveys on alcohol consumption can be used to obtain a snapshot of the level of alcohol consumption in a population. For example, cross-sectional data can be used to identify the prevalence of drinking or volume of average alcohol consumption in different age groups at a certain time point. However, strictly cross-sectional surveys cannot be used to identify patterns of drinking or to establish causal attributions.[366] Therefore, strictly-cross sectional survey data cannot be used to evaluate the effect of policy measures on alcohol consumption among individuals, whereas repeated cross-sectional surveys, or cohort surveys can be used to identify the patterns of consumption among individuals as well as for alcohol control policy evaluation purposes.

In addition to the above mentioned concerns related to the study design (cohort, repeated cross section or strictly cross sectional), there are many methodological issues that can influence how accurately alcohol consumption is measured in surveys.[7] Self-reported alcohol consumption in

surveys typically accounts for 40-60% of total alcohol sales.[367-369] This underestimation of self-reported alcohol consumption is likely to occur mainly due to sampling frame issues,[310, 370] non-response bias[371-374] and under-reporting bias.[375-377] These major issues affecting alcohol surveys are discussed in detail below.

2.3.2.1 General sources of bias in alcohol surveys

Under-representation of heavy drinkers

Household surveys do not include people living in institutions and people who do not have a fixed address. These groups of people may be more likely to drink heavily than the people who live in households.[7] Household surveys also exclude groups of young single adults such as students who live in university accommodation and military personnel.[310] These groups of people are also more likely to drink heavily.[7] Therefore, household surveys may underrepresent people who tend to drink more than the average amount of alcohol.[378]

Non-Response Bias & Mode of Interview

Even if heavy drinkers are included in the survey sample it may be more difficult to contact them and they may refuse to answer the questions.[378] Therefore, non-response bias is another serious issue that can contribute towards the inaccurate results of alcohol surveys.[371-374] Guaranteeing the confidentiality of responses in order to increase the response rates in alcohol surveys is recommended.[7] It has also been found that the response rates depend on the type of interview. For example, face-to-face household interviews generally have a higher response rate of 60-80%, compared with a response rate of 50%-60% in telephone interviews.[7]

Recall and Reporting Bias

People tend to underreport their alcohol consumption intentionally and unintentionally.[7, 375-377] Due to wider social influences such as publicity on the harmful effects of alcohol, drinkers may intentionally under-report their consumption.[7] On the other hand, people may unintentionally tend to underestimate the amount of alcohol consumed due to lack of awareness of unit measures.[7] This can also happen as they have forgotten the actual amount they drank, which is more likely to happen due to the effect of alcohol.[378]

Fieldwork period

Another factor that can contribute towards the difference between alcohol sales data and survey data is the period to which data refer. Surveys are not usually conducted during holiday periods and at Christmas, when alcohol consumption is relatively high, whereas sales data are based on annual consumption. Therefore, the fieldwork period can be another reason for survey underestimation. To maintain the comparability of survey data over time, conducting repeated surveys at the same time of year is recommended.[379]

Survey assumptions on drink sizes and strength

The accuracy of survey estimates on alcohol consumption depends on assumptions of usual drink sizes and pure alcohol content in each drink.[379] If there were wide variations in the drink sizes and pure alcohol content defined in the survey when compared with the real types of drinks available in the market, that can derive misleading estimates for alcohol consumption.[379]

Assumed-size of self-poured drinks

Furthermore, it has been found self-defined drink sizes usually underestimate the actual alcohol consumption.[380] When people drink at home or pour a glass of alcohol themselves, they usually pour more than one unit or standard drink as their usual glass of alcohol.[380, 381] Therefore, all these discrepancies can contribute towards the survey underestimation of alcohol consumption.

Survey fatigue and attrition

Respondents or households participating in longitudinal or panel surveys may become less interested in the survey participation in later surveys when compared with the initial surveys. This can happen as participants become tired of answering survey questions repeatedly and they may decide to skip questions or provide incomplete information. This phenomenon is called 'survey fatigue' and it could be a major problem particularly in market research panel surveys. For example, participants of Kantar Worldpanel market research organisation's survey provide weekly information on alcohol products they brought into their homes by using hand-held scanners to scan the bar codes of all products.[382-384] Participants are asked to send these data electronically to Kantar Worldpanel, along with the till receipts once a week. This procedure can put a considerable amount of burden on the survey participant compared to participating an annual survey where participants have to take part only once a year. Therefore, survey fatigue is likely to be a key issue experienced in panel surveys. Survey fatigue can also result in the drop out of participants which will then result in 'survey attrition'. Both these phenomena can affect alcohol consumption estimates not only in market research panel surveys but also in other longitudinal surveys.

2.3.2.2 Survey instruments and framing of questions

There are several alcohol survey instruments or in other words sets of questions being used to measure alcohol consumption in surveys. The most frequently used alcohol survey questions include Quantity Frequency (QF), Beverage Specific Quantity Frequency (BSQF), Graduated Quantity Frequency (GQF) and the Last Seven Day questions.[7] In relation to these survey questions, the length of the reference period is considered as a critical factor that can affect measurements of alcohol consumption.[7] Here, the reference period relates to the time period for which the respondents are asked to describe their alcohol consumption.

The selection of the survey instrument and the reference period depends on the overall purpose of data collection.[385] For example, QF and GQF methods with a longer reference period of the last 12 months allow researchers to identify the long-term pattern of alcohol consumption and then to link it with relevant chronic consequences. On the other hand, the last seven-day method provides more detailed and accurate information on recent alcohol consumption, but it cannot be used to represent the overall drinking pattern of the drinker.[7] An overview of these survey instruments is provided below.

Quantity Frequency (QF)

This method measures the usual amount of alcohol drunk by respondents by asking two main questions. The first is "how much alcohol do you usually drink" and the second is "how often do you drink?".[7] When used with longer reference periods such as 12 months, this method produces more reliable estimates for average weekly alcohol consumption.[379]

Beverage Specific Quantity Frequency questions (BSQF)

In the BSQF method respondents are asked about the frequency of drinking of different types of alcoholic drinks and then the usual quantity of alcohol consumption for each type of drink.[386] These questions are considered to be easily understood by survey participants as they can refer to the beverage types they usually drink. BSQF questions can also be used to compare consumption across different cultures and settings as it can measure alcohol consumption according to different types of beverages. Moreover, participants do not have to calculate standard units/drinks when they answer BSQF questions. This method has the ability to generate higher volumes of alcohol consumption when compared with the QF method.[387]

Graduated Quantity Frequency (GQF)

GQF questions ask how often people drink specific amounts of alcohol in one day giving options for them to select. Usually, these options start with large amounts of alcohol (e.g. more than 12 drinks) and then move down to smaller quantities (e.g. 1-2 drinks) to encourage complete reporting.[7] GQF questions used with a longer reference period such as the last 12 months is considered as the best method for estimating levels of binge drinking.[7]

Last 7 Days

This method asks respondents to complete a retrospective 'diary' that shows the amount of alcohol they drank during the last 7 days.[7] Even though this method can provide detailed and accurate information on drinking during the last 7 days, estimates may not be representative of an individual's usual drinking behaviour due to its short reference period.[7, 379] Moreover, survey questions based on alcohol consumption during the last 7 days likely to miss

infrequent drinkers and greatly underestimate the proportion of people binge drinking.[7, 379]

Location and Beverage Specific Questions

In this method, respondents are asked whether they had consumed alcohol at different locations over a selected reference period (past 12 months or 6 months) and these locations include home, pubs/hotel/taverns, workplaces, special events and outdoor public places.[388] For each location, respondents are then asked beverage specific quantity frequency questions. Similar to BSQF method, respondents report their usual frequency and volume of beverage specific consumption.[388] For example, these questions are used in New Zealand National Alcohol Survey where there have been nine container options for beer, six for wine, and seven for spirits.[389] In 2000, this survey produced a per capita alcohol consumption estimate which accounted for 94% of alcohol sold in New Zealand.[389]

Within-location beverage-specific questions are considered as the gold standard in measuring alcohol consumption due to its ability to generate relatively higher individual level alcohol consumption estimates that are closely comparable with alcohol sales data. The use of very detailed questions on the location of drinking and beverage types is likely to generate higher alcohol consumption estimates. Detailed questions have the ability to remind drinkers of the place where they drank and their average level of consumption in each location. Previous studies have shown that increasing the number of questions on alcohol consumption likely to generate higher estimates on volume of alcohol consumption.[390-392] However, this detailed survey instrument is likely to be time and resource consuming and may not be suitable for multi-purpose general population surveys.

Yesterday method

This method can be divided into two methods: "The simple Yesterday method" and "The detailed Yesterday method".[393, 394] In the simple method, respondents are asked about their yesterday alcohol consumption using standard drinks and in the detailed method, respondents are asked about yesterday consumption using beverage specific questions.[393, 394] Estimates of annual alcohol consumption are then generated using the responses received for yesterday consumption. The Yesterday method, particularly the detailed Yesterday method has proven to generate higher volumes of alcohol consumption when compared with QF and GQF method.[393, 394]

2.4 Individual level data sources in the UK

2.4.1 Primary care data

There are various databases which collect primary care data in the UK, mainly for administrative work, quality improvement and health service planning purposes.[395] These include Primary Care Information Services (PRIMIS), QResearch, Clinical Practice Research Datalink (CPRD) and The Health Improvement Network (THIN). Of them, CPRD and THIN are the most frequently used primary care research databases and this section provides an overview of them.[396]

2.4.1.1 Clinical Practice Research Datalink (CPRD)

Summary

CPRD (previously the General Practice Research Database (GPRD) has been collecting primary care data since 1987.[397] CPRD data are available for all four countries in the UK and provides information on a nationally representative sample that is around 8% of the total population.[398] This dataset can also be linked to other data sources including Hospital Episode data, Office for National Statistics Mortality data, and Cancer Registry data. Quality assurance procedures carried out on CPRD data ensures that users are able to make most appropriate use of data by identifying patients labelled as "acceptable".[398] This label is not provided to patient records if they do not meet several quality standards, for example if they do not have a record for a year of birth, gender (male/female/indeterminate), a first registration date, or if someone's age is recorded as older than 115 years.[398] Routinely collected alcohol consumption data in general practices care can be obtained from CPRD data.

Strengths

Primary care data provide a unique opportunity to study real life data because the data are collected in a non-interventional way. CPRD data provides access to a large nationally representative data set that can also be linked to other data sources and researchers can use these linkages to obtain a comprehensive picture of patient journeys within healthcare services.[397, 398] CPRD quality assurance procedures ensure that data are up to an acceptable research standard. CPRD releases a new version of the dataset each month, and each build of the dataset contains patient follow-up data which can be used in most epidemiological study designs such as cross-

sectional, cohort and case-control study designs. As mentioned in section 2.3.1, there are currently several alcohol care pathways in primary care and hence these data can potentially be useful to monitor alcohol consumption trends over time and for evaluating the effect of the Licensing Act 2003 on alcohol consumption.

Limitations

In addition to the common limitations of primary care data discussed in section 2.3, CPRD data are not freely available for its users, and the cost for each data set can depend on the size of the requested data and whether it requires any linkages to other data sources. Moreover, researchers have to request approval for each research project from the Independent Scientific Advisory Committee (ISAC approval) which slows down access to these data. Moreover, the GP practices that have been volunteered to provide data in primary care datasets are often larger and more organised when compared with the average practices.[327, 328] Therefore, the quality and completeness of data obtained from CPRD can be higher than that from average practices.

2.4.1.2 The Health Improvement Network (THIN)

Summary

THIN was developed from 2003 onwards and currently, it includes data from 562 practices covering 6.2% of the total population in the UK.[330, 399] The THIN database contains around 11.1 million patient records with 3.7 million active patient records which are equivalent to 75.6 million patient years of data. Similar to CPRD data set, THIN conducts comprehensive data quality checks on patient records and identifies patients who satisfy acceptable research quality.[399] THIN records alcohol consumption data

using Read codes and Additional Health Data (AHD) codes. Read codes and AHD codes are used to record information on various aspects of alcohol consumption such as units of alcohol consumed in last week and average level of consumption.

Strengths

THIN data are broadly representative of the UK general population in terms of age, sex, and geographic distribution.[328, 330] These data provide the opportunity to conduct studies using most of the main epidemiological study designs including cohort, case-control, or cross-sectional studies. Furthermore, THIN data allow the researcher to assess changes in an outcome measure at regional level due to its large sample size. Currently, there are several alcohol care pathways in primary care and therefore, THIN data can potentially be useful for monitoring trends in consumption over time and for evaluating the effect of the Licensing Act 2003 on alcohol consumption.

Limitations

In addition to the common limitations of primary care data discussed in section 2.3 the quality and completeness of primary care data can vary between different practices in the UK.[327, 328] Similar to CPRD data, THIN data are not freely available for researchers. The quality and completeness of data obtained from THIN can be higher than that from average practices as the practices volunteered to provide data in primary care databases are often larger and more organised when compared with the average practices.[327, 328] Quality and completeness of THIN data will be further assessed in Chapter 3.

2.4.2 Survey data

In the UK there are several surveys that collect alcohol consumption measures. However, alcohol control policy evaluation requires high quality, timely data collected for a long period of time. Moreover, to evaluate the effect of the Licensing Act 2003 there needs to be alcohol consumption data collected for a reasonable period of time prior to 2005 and after 2005. Even though there are a large number of surveys that have collected alcohol consumption measures in the UK some of them were initiated after the year 2005 or have not collected data at least once a year. These surveys include National Diet and Nutrition Survey,[400] Understanding Society or the UK Household Longitudinal Study (UKHLS),[401], Adult Psychiatric Morbidity Survey,[402] Alcohol Policy Interventions in Scotland and England (APISE),[403] and Alcohol Toolkit Study (ATS).[404] They are less suitable for Licensing Act 2003 evaluation purposes which require before and after data collected on regular and frequent time intervals and therefore, not considered here.

The following section focuses on annual surveys that started collecting alcohol consumption data prior to 2005. The three major general population surveys in England fulfil these requirements:[253] the General Lifestyle survey (GLF), Health Survey for England (HSE) and Opinions and Lifestyle survey. These are also the key surveys that have been used to provide estimates on adults alcohol consumption level in national reports.[405-407]

2.4.2.1 General Lifestyle Survey

Summary

The General Lifestyle Survey previously known as the General Household Survey (GHS), was carried out for 40 years from 1971-2011 and ceased in January 2012.[408] It is a face to face survey and included survey participants from private households in Great Britain. It used a probability, stratified two staged cluster sampling design in selecting the survey sample during 1971 to 2004. From then onwards the GLF's survey design changed from a cross-sectional design to longitudinal survey design and only 25% of the sample were replaced each year.[409] The sample was drawn from a list of all postcodes maintained by the UK post office. The primary sampling units of this survey were postcodes and the secondary sampling units were household addresses within those postcodes. An approximate sample of around 9000 households were included in this survey. Survey weights were applied to adjust the sample according to Great Britain's population in terms of region, age group and sex.[409]

This survey was conducted with the aim of collecting data on a range of topics related to household, family and individual.[410] These included employment, education, smoking, drinking, health, and demographic information.[410] Questions on drinking were included in the survey from 1978 onwards, and the GLF produced two main alcohol consumption measures over time: average weekly alcohol consumption and the maximum amount of alcohol drunk on any day in the previous seven days.[408, 411] It used BSQF questions with a reference period of the past 12 months to generate average weekly alcohol consumption measure and another set of BSQF questions focused on heaviest drinking day of the last week to generate binge drinking estimates.[253]

Strengths

The GLF comprised a large nationally representative sample of respondents in Great Britain. In its last survey conducted in 2011, the GLF included data for 18,367 respondents from 7,937 households.[410] GLF/GHS can be considered as a unique and powerful data source in identifying the long-term trends of alcohol consumption which can be used in alcohol control policy evaluation.[411] GLF data can be used to monitor trends in beverage specific consumption over the past 12 months. Its heaviest drinking day alcohol consumption questions provide a measure of the short-term alcohol consumption that can specifically be used to evaluate the effect of Licensing Act 2003. However, it has several limitations as discussed below.

Limitations

One of the main limitations in using GLF data for alcohol control policy evaluation is its change in alcohol unit assumptions over time.[408, 411] In 2006, the number of alcohol units assumed to be in beer and wine drinks were changed. This made a large impact on the unit assumptions for wine, as the revised method changed not only the ABV assumption from wine from 9% to 12% but also the glass size assumption for wine. Prior to 2006, a glass of wine assumed to 125 ml but afterwards, respondents were provided with different glass size options (125ml, 175ml or 250ml). Even though GLF has collected alcohol consumption data for almost 30 years, because of this change in survey methodology those data are not directly comparable over the whole 30-year period.

Furthermore, the lapse of time between data collection and data dissemination of GLF is around 11-15 months.[409] Even though the GLF had a large sample size, it does not seem to be suitable for regional level data analysis.[412] Moreover, GLF's sampling method is designed to produce a

nationally representative sample annually but not at monthly or quarterly intervals,[409] hence it is difficult to use GLF data to identify small or temporary behavioural changes when evaluating the Licensing Act 2003. This survey cannot be used to obtain recent alcohol consumption measures as it was ceased in January 2012.

2.4.2.2 Opinions and Lifestyle Survey

Summary

The Opinions and Lifestyle Survey is a monthly survey carried out with the aim of offering required data to government departments, academics and charities on various topics.[413] This survey was formerly known as the ONS Opinions Survey or ONS Omnibus Survey and began in 1990.[413] It incorporates a core set of questions covering demographic information and a non-core set of questions which vary from month to month.[413]

This survey uses multistage stratified random sampling in selecting the survey sample of adults (aged 16+) in Great Britain. It selects around 67 postcodes each month after stratifying them according to the region, the socio-economic status of the household reference person, the proportion of households without a car and the proportion of people aged over 65. Households within each postcode are then selected using probability proportional to the size. Survey weights are used to ensure the sample distribution matches with the Great Britain population across regions, age and sex.[414]

The inclusion of alcohol consumption questions in this survey has been inconsistent over time and in 2009 it included questions on drinking in the last week, consumption of different types of drinks, awareness of unit

labelling, and frequency of purchasing alcohol.[395] After 2009, the Opinions and Lifestyle Survey did not include alcohol consumption questions, but in 2012, some of the GLF's alcohol consumption questions were transferred into it as GLF was ceased in that year.[409]

Strengths

The Opinions and Lifestyle survey collects data on a nationally representative sample of Great Britain and this survey data can be obtained more quickly when compared with the other annual surveys since it is a monthly survey with a lag of 14 weeks to the publication.[414] Therefore, it allows its clients to have survey data in a short period of time.

Limitations

Due to the inconsistent inclusion of alcohol consumption questions, this survey data cannot be used for formal time series analysis to identify trends of alcohol consumption and to evaluate the effect of the Licensing Act 2003. These data might be able to be used with alternative study designs such as pre and post study designs depending on the time of the intervention and availability of pre and post survey data accordingly. The sample size for each month is relatively small in this survey. However, these monthly surveys can be combined together if clients require a larger sample size on any specific topic.[414]

2.4.2.3 Health Survey for England

Summary

The Health Survey for England (HSE) has been carried out annually since 1991.[415] It includes a core set of questions, with another set of questions that can be changed according to the focus of the survey each year, such as a specific disease or a specific subpopulation.[415] The core set of questions of this survey is based on general health and psychosocial indicators, smoking, alcohol consumption, demographic and socio-economic indicators, physical measures of height, weight and blood pressure, questions on health services and prescribed medicines.[415]

HSE monitors health among adults (aged 16+) and children (aged 0-15) living in private households in England and uses a multistage stratified random sampling for selecting a nationally representative sample.[416] HSE selects a random sample of around 600 postcodes (primary sampling units) after stratifying them according to the region (government boundaries) and the socio-economic status of the household reference person. These primary sampling units are then randomly allocated to the 12 months of the year, enabling each quarter to provide a nationally representative sample.[416]

HSE included alcohol consumption questions since it began in 1991. Similarly to the GLF, the HSE collects alcohol consumption data on two measures: the heaviest drinking day consumption in the last week and average consumption over the past 12 months.[253] It used BSQF questions with a reference period of past 12 months to generate average weekly alcohol consumption estimate and another set of BSQF questions focused on heaviest drinking day of the last week to generate binge drinking estimates.[253]

Strengths

HSE is considered to be one of the longest running surveys in Europe.[417] Due to its longevity, HSE data can be used to monitor alcohol consumption trends over time. HSE provides nationally representative data at each quarter.[415] When compared with annual data, quarterly data are more sensitive in identifying short-term changes and seasonal effects in an outcome measure over time. HSE heaviest drinking day alcohol consumption questions provide a measure of the short-term alcohol consumption that can specifically be used to evaluate the effect of Licensing Act 2003.

Limitations

Similar to GLF, the alcohol unit assumptions in HSE also changed in 2006.[253] In addition to the beer and wine unit assumptions, the alcopops unit assumptions were also changed in HSE in 2006. Because of these changes in alcohol unit assumptions consumption measures obtained from HSE cannot be used directly used to observe trends over time or in policy evaluation. Another key limitation of using HSE data is its small sample size when compared with other national surveys.

2.4.3 Kantar Worldpanel data

Summary

Kantar Worldpanel is a market research organisation collecting information on shopping and consumption behaviours within the alcohol market across Great Britain using three different data collection methods. The first is the Kantar purchase panel which consists of 30,000 nationally representative households.[384] The participating households provide information on products purchased by using hand-held scanners to scan the

bar codes of all products brought into their homes including alcohol.[382-384] This data, along with images of corresponding till receipts, is sent electronically to Kantar Worldpanel where weights are applied to create a aggregated read of the GB take home alcohol market. This data is available on a monthly basis. Second is the Worldpanel Alcovision service which is an online diary survey which monitors alcohol consumption across the on and the off trade among a large nationally representative sample of individuals in Great Britain.[384] It collects data from 30,000 individual adults in a given year (age 18+), every week a subset of this group report on their drinking occasions over the past 7 days.[384] These data include information on the product consumed, who drinks what, where, when and why – this data is available quarterly.[384] The third method used by Kantar Worldpanel is Alcoshop. This combines behavioural data with an insight into drivers behind this behaviour - linking a shoppers' off-trade alcohol purchasing to the decisions affecting their purchasing. Combined Kantar Worldpanel's data sources provide a comprehensive level of information on alcohol consumption patterns among adults in Great Britain.

Strengths

Kantar Worldpanel data provides detailed information on alcohol purchasing by household on a monthly basis and alcohol consumption by individuals on a quarterly basis, therefore can be used to identify any seasonal trends in different types of alcohol consumption and purchasing at a granular level. Hence this data can be considered as a good source of data for evaluating the effect of Licensing Act 2003. Moreover, Kantar Worldpanel conducts market research in 60 countries.[418] Therefore, alcohol consumption data obtained from other countries can be used as control data sets in alcohol control policy evaluation. Further to the regularly collected

data Kanta Worldpand have the possibility to field a bespoke questionnaire to individuals using the Alcoshop service.

Limitations

The Alcovision survey is designed as a market research survey rather than a health survey and it has more response options for survey questions than in health surveys. However, in relation to questions on drinking context, Alcovision does not have detailed information on drinking with a meal which is an important option to consider in alcohol epidemiology.[197] Moreover, Kantar Worldpanel respondents' survey fatigue for reporting alcohol products is relatively high compared with other products such as fish, fruit, sweets and chocolates.[419]

Table 2-3: Summary of **individual level** alcohol consumption data in the UK

Data type	Data source	Key measures of alcohol consumption	Method of alcohol consumption data collection	Geographical coverage	Eligibility criteria of the sample (Sample size)	Sampling method/ Weighting	Shortest time interval suitable for time series analysis	Setup Year
Patient Records	**THIN**	-Units per week -Level of average consumption -AUDIT score	Patient Records from Primary Care	UK	Patients registered with a GP practice and active within the given data collection period	Patients included in each release of THIN data are nationally representative	Monthly	2003
	CPRD	-Units per week -Level of average consumption -AUDIT score	Patient Records from Primary Care	UK	Patients registered with a GP practice and active within the given data collection period	Patients included in each release of CPRD data are nationally representative	Monthly	1987
Survey Data	**GLF**	-Average weekly alcohol consumption -Heaviest drinking day consumption	Face to face interview	Great Britain	Individuals living in private households of Great Britain (Around 20,000 individuals)	Stratified two staged clustered sample design Nationally representative annual sample of data	Annual	1971 -2011
	HSE	-Average weekly alcohol consumption -Heaviest drinking day consumption	Face to face interviews and diaries	England	Adults (aged 16 and over) and children (aged 0-15) in the general population, living in private households (10,000-20,000 individuals)	Multistage stratified random sampling The survey design ensures that population sampled in each quarter is nationally representative	Quarterly	1991
	Opinions and Lifestyle Survey	-Heaviest drinking day consumption	Face to face interviews	Great Britain	Adults (aged 16 or over) in private households (Around 1200 individuals per month)	Multistage stratified random sampling	Monthly	1990
Market Research Data	**Kantar Worldpanel – Purchase Panel**	-Grocery purchasing across FMCG – including Alcohol - shopper behaviours - demographics - trends in purchasing	Take home panel	Great Britain	Adults (aged 18+) (30,000 households)	Panel is representative of GB population	Monthly	*1997 before then it was TNS UK*
	Kantar Worldpanel - Alcovision Survey	-Alcohol product purchased, -Drinking context, -Reasons for drinking	Online Survey	Great Britain	Adults (aged 18+) (30,000 individuals)	Survey is nationally representative	Quarterly	2001 – (moved to online surveys in 2009)

2.5 Summary

This chapter has shown that there are a number of different alcohol consumption data sources in the UK. However, it was identified that none of them is without limitations. Despite these limitations, individual level data have unique advantages over population level data in alcohol control policy evaluation. These advantages include the ability to identify not only the volume of alcohol consumption but also the patterns of alcohol consumption among individuals, ability to link alcohol consumption with alcohol-related consequences as well as to adjust for individual-level characteristics, and ability to compare patterns of alcohol consumption between different groups of people and to examine who drinks what types of alcoholic drinks.

Therefore, the next phases of this thesis will further investigate the suitability of individual level alcohol consumption data sources to evaluate the effect of Licensing Act 2003 on adults' alcohol consumption level in England. Of the individual level data sources discussed in this chapter, the market research data and primary care data are not freely available to further investigate their suitability for Licensing Act's evaluation. Therefore, the next phases of this thesis (Chapter 3 and Chapter 4) will limit this further investigation of data sources to one primary care data source (THIN) and other freely available individual level data sources discussed in this chapter which include HSE, GLE and Opinions and Lifestyle Survey.

3 SUITABILITY OF PRIMARY CARE DATA FOR ALCOHOL CONTROL POLICY EVALUATION

3.1 Introduction

From the overview of alcohol consumption data sources presented in Chapter 2, primary care data were identified as one of the key data sources providing individual level alcohol consumption data in the UK. However, evaluation of the Licensing Act 2003 requires complete and consistent measures on alcohol consumption collected from a nationally representative sample for a reasonable amount of time before and after the Act. Hence this chapter aims to assess the suitability of primary care data for evaluating alcohol control policy in general while focusing on the Licensing Act 2003. This chapter will identify how alcohol consumption data are recorded in primary care, the proportion of people having an alcohol consumption recording in each year (before and after the act), and the characteristics of patients having alcohol consumption records.

3.1.1 Why THIN data?

As mentioned in Chapter 2 (Section 2.4), there are various primary care databases in the UK but most of them are designed mainly for administrative work, quality improvement and health service planning purposes.[395] Of them, CPRD and THIN are the most frequently used research oriented primary care databases.[396] Section 2.4 discussed these two research oriented databases in terms of their suitability for policy evaluation and identified that CPRD and THIN both have mostly similar advantages and disadvantages with regard to evaluating the Licensing Act

2003 in terms of sample size, ability to conduct regional data analysis, availability of demographic factors and other related confounding factors.

However, both data sources require a relevant license to use the data. For example, an institutional academic license to access the CPRD data would cost around £150,000 per annum.[398] In addition to having the CPRD license, the institution will have to appoint a researcher(s) as a CPRD fob holder(s) who will then receive a mandatory training from CPRD and a fob that grant access to the CPRD GOLD online database. As a result of these security measures and terms and conditions in relation to the license, research using these databases are restricted to researchers who have the relevant license.

The Division of Epidemiology and Public Health, University of Nottingham has the relevant license to use THIN data and during the work of this thesis the research group involved in this work (supervisors and the thesis candidate) had access to use the THIN data. Therefore, THIN data were used in this study. Ethical approval for this work was provided by the THIN independent scientific review committee.

3.1.2 Information contained in THIN

The THIN database has seven data files, namely the Patient, Medical, Therapy, Additional Health Data (AHD), Postcode Indicators, Consultations, and Staff. The Patient file contains information related to the patient such as age, sex, and registration date. As part of the anonymization process THIN data does not provide the date of birth, name or address for each patient. Instead, it provides the birth year and a unique patient identifier for each patient.

The Medical file contains information related to medical events such as medical diagnoses, date and location of diagnosis. These are recorded using Read Codes, which is a comprehensive hierarchical clinical classification system.[420, 421] Read Codes have been used in the NHS since 1985 and they provide a common standard vocabulary for clinicians to record medical event related information.[420]

Information about prescriptions such as the date issued, quantity, dosing instructions and events leading to withdrawal of drugs can be found in the Therapy file. GP prescribing is supported by the GP practice computer systems which uses the Multilex coding system for drug prescriptions,[422] and it provides a pick up list of drugs with information on market brands, their flavor, colour and 'sugar free' status if appropriate.[422]

The additional health data file provides information related to vaccination, prescription of contraceptives, laboratory test results, height and weight, and information on lifestyle events such as smoking and drinking,. The remaining three data files record information on postcode indicators, consultations and staff. A summary of information recorded under each file is given in Table 3-1 below.

Table 3-1: Separate data files included in THIN Database[330]

File	Description
Patient	Age, sex, registration date when entering the practice, and date upon leaving the practice
Medical	Medical diagnoses including alcohol consumption related diagnoses, date of diagnosis, and location (e.g. GP's office, hospital, consultant) of the event and an option for adding free text; Referrals to hospitals and specialists.
Therapy	All prescriptions along with the date issued, formulation, strength, quantity, and dosing instructions, indication for treatment for all new prescriptions (inferred from cross reference to medical events on the same date), and events leading to withdrawal of a drug of treatment.
Additional Health Data (AHD)	Vaccinations and prescriptions for contraceptives, miscellaneous information such as alcohol consumption, smoking, height, weight, immunizations, pregnancy, birth, death, and laboratory results.
Postcode Indicators (PVI)	Postcode linked area, socio-economic, ethnicity and environmental indices
Consultations	Date, time and duration of consultation
Staff	Gender and roles of staff who entered the data

3.1.3 Alcohol consumption data in THIN

In THIN data, alcohol consumption related information is recorded in two files; the AHD file and the Medical file.

3.1.3.1 AHD file

In the AHD file, AHD codes are used to record the additional health details and there are two AHD codes available to record information on alcohol consumption. The first is "Alcohol" and the second is "Alcohol test". These codes have up to 6 data fields that can be used to report further information. For example, the alcohol consumption related AHD code with the description of "Alcohol" has fields to enter patients' drinking status (yes/no) and number of units per week. The "Alcohol test" code uses two data fields to record information on the test and test results. In addition to

these two AHD codes, the AHD file has another potentially relevant code with the description of "advice given" which can provide information on any advice given. Alcohol consumption related information in AHD file has the potential to be particularly useful in identifying not only the status of drinking but also the level of alcohol consumption.

3.1.3.2 Medical file

In contrast to the number of AHD codes available on alcohol consumption, there are a large number of Read codes available to record alcohol related information in Medical file. These can broadly be separated into two categories: Read codes with a description related to levels of drinking, and Read codes related to alcohol consumption screening tests. However, sometimes it can be difficult to identify the actual unit consumption from these read records as they only provide a description of the level of alcohol consumption but not a unit measure such as the units per week measure. For example, some Read codes provide an indication of the level of consumption and these include codes with descriptions such as "Moderate drinker - 3-6u/day" and "Trivial drinker - <1 u/day". However, most of the Read codes do not provide an indication of the level of alcohol consumption. These include Read code descriptions such as "Light drinker", "Beer drinker", "Alcohol consumption", "Alcohol screen – AUDIT completed" do not provide information on the level of consumption. A subset of alcohol consumption related Read codes are presented in Table 3-2.

Table 3-2: Subset of Read codes on alcohol consumption

	Read code	Read Code Description
Read codes related to alcohol consumption	136N.00	Light drinker
	136O.00	Moderate drinker
	136P.00	Heavy drinker
	136..00	Alcohol consumption
	1364.00	Moderate drinker - 3-6u/day
	1363.00	Light drinker - 1-2u/day
	1362.11	Drinks rarely
	136a.00	Increasing risk drinking
Read codes related to alcohol screening tests	9k15.00	Alcohol screen - AUDIT completed
	9k16.00	Alcohol screen - fast alcohol screening test completed
	ZRa1.11	MAST - Michigan alcoholism screening test
	ZRa1100	Brief Michigan alcoholism screening test
	ZRk6.11	SADQ - Severity of alcohol dependence questionnaire

3.1.4 Alcohol consumption recording in primary care

Only a limited amount of research has explored how well alcohol consumption is recorded in primary care databases. In 2013, Khadjesari et al published a study which aimed to determine how alcohol screening is recorded in primary care, particularly among newly registered patients. This study used THIN data to identify adult patients (≥18 years) who registered with a general practice during 2007, 2008 and 2009. According to this study a total of 292,376 (76%) of 382,609 newly registered patients in 2007-2009 had entries for alcohol consumption.[423] It further explained how alcohol consumption is recorded in primary care using Read codes, unit measures and type of alcohol screening test used. Moreover, this study showed how alcohol consumption recording varies according to patient characteristics such as age, sex, region, and social deprivation. However, newly registered patients included in this study represented only about 15% of the patients registered within a practice and they are relatively younger than the total

practice population.[424] Therefore, the results reported in Khadjesari et al study may not be broadly generalizable to the UK population and may not fully capture the magnitude of the change in recording over time.[424]

Two further publications based on THIN data examined alcohol consumption recording in primary care particularly among patients with severe mental illness.[425, 426] These studies showed that there has been a marked increase in alcohol consumption recording among patients with bipolar disorder[425] and schizophrenia[426] since 2011, when financial incentives were introduced via QOF to screen for alcohol consumption in patients with severe mental illness.[427] The percentage of alcohol consumption recording among bipolar disorder patients was 83.7% during the period April 2011-March 2013.[425] This percentage was 78% among patients with schizophrenia during the same period of time.[426] However, the results of these studies are not generalizable to the UK general population as they focused on alcohol consumption recording among patients with severe mental illness.

The current study aimed to identify how alcohol consumption data are recorded in primary care, the proportion of people having an alcohol consumption recording in each year (before and after the Licensing Act), and the characteristics of patients having alcohol consumption records using all patients registered and active in THIN, which provides a nationally representative sample of the UK population.

However, during the progression of this study Khadjesari et al published their study on alcohol consumption screening of newly registered patients in primary care in the UK.[423] Due to the overlap between the content of the current study and the Khadjesari study particularly in relation to how alcohol consumption data are recorded in primary care, the findings were not published as a stand-alone paper. Instead. additional information

about the proportion of patients having an alcohol consumption recording in each year as well as ever since they registered with a practice was published as an e letter in response to the Khadjesari et al study.[428] A copy of this letter is attached in Appendix 8.2.

3.2 Methods

For each year from 2003 to 2012, all patients older than 16 years of age who were registered with a THIN practice for the whole of the year were identified. Patients were defined as having an alcohol consumption record if they had a relevant AHD code OR a Read code.

Initially the data were extracted using the three AHD codes described in section 3.1.3.1. However, records under "Advice given" category did not provide information related to alcohol consumption. Therefore, the data extraction was limited to the remaining two AHD codes with descriptions of "Alcohol" and "Alcohol test". Read codes dictionary was used to identify the alcohol consumption related Read codes by using relevant key words such as "alcohol", "drink" and "beer" in a Stata command (searchrc) which finds all Read Terms in the same section of Read code hierarchy. Read terms identified from this step were manually checked afterward to identify the final list of Read codes on alcohol consumption. This final list which was used to identify patients with an alcohol consumption recording is given in Appendix 8.1.

After identifying patients with an alcohol consumption recording, those records were used to generate the proportion of patients with an alcohol consumption status recording in each year as well as ever since they registered with their practice.

Further analysis was carried out on alcohol consumption records documented in 2012 to assess their completeness and meaningfulness. This

was done by investigating the additional data from the AHD data file and identifying any non-meaningful or incomplete alcohol consumption records. For example, Read codes related to alcohol consumption but with no further information in relation to the level of drinking or unit measures were identified as incomplete records. Read codes indicating a patient as a drinker with a specific level of consumption (e.g. 1-2 units per day) but having an associated recording of alcohol unit measures which does not comply with this description (i.e. more than 14 units per week for this example) were also identified as non-meaningful codes. Details of all combinations used in identifying meaningful and non-meaningful codes are given in Table 3-3.

Characteristics of men and women who received an alcohol consumption recording in 2012 were compared in terms of their age, deprivation category and health authority. The chi-squared test was used to identify whether there were significant differences in alcohol consumption recording according to patient characteristics. The number of alcohol consumption records per patient and the level of alcohol consumption recording were further investigated using box plots. The level of alcohol consumption recording was investigated among patients having a valid figure (greater than 0 and less than or equal to 420) in the AHD file for the number of units per week. The maximum number of units per week assumed to be 420 units, based the Office for National Statistics figure for maximum number of units per day which is 60 units (60*7=420).[405] Where individuals received more than one record, the most recent record was selected in generating box plots for the levels of alcohol consumption recorded in 2012.

Table 3-3: Identification of meaningful and non-meaningful recodes and assumptions used

	Read code Category according to Read code description	**AHD file further information (Drinking status and weekly unit measure)**	**Meaningful OR Non-Meaningful record (Assumptions Used)**
1	Read codes with an indication of alcohol consumption	Drinker with unit measures which comply with the read code description	**Meaningful record**
2	Read codes classify patient as a Non-drinker	Do not include any unit measures	**Meaningful record**
3	Read codes with a specific level of alcohol consumption Ex: Light drinker 1-2units/day Heavy drinker 7-9units/day	Drinker with no unit measures per week	**Meaningful record** (Read code description has a unit range, therefore it was assumed that weekly unit measure was not included in AHD file)
4	Read codes with a low frequency of drinking e.g. Drinks occasionally Drinks rarely	Drinker with no units per week	**Meaningful record** (It was assumed that a weekly alcohol consumption level has not been entered for these patients as they drink occasionally or rarely but not weekly)
		Drinker with high level of consumption (e.g. more than 21 units per week)	**Meaningful record** (It was assumed that these are records of patients who may drink occasionally but drink heavily when they drink. Therefore considered as a meaningful records)
5	Read codes with an indication of alcohol consumption without any unit measures or specific level of consumption e.g. Alcohol consumption, Social drinker Beer drinker, Spirit drinker	Drinker without any unit measures	**Non-Meaningful record**
		Drinker with implausibly high level of consumption	**Non-Meaningful record** (Records of patients with more than 200 units per week were considered as non-meaningful records as they may have been entered incorrectly)
6	Read codes with a specific level of alcohol consumption e.g. Light drinker 1-2units/day	Drinker with unit measures which does not comply with the read code description (e.g. Having unit measures more than 21 units per week)	**Non-Meaningful record** (Records may have not entered correctly therefore a non-meaningful record)
7	Records of screening tests e.g. AUDIT / FAST	Invalid test results	**Non-Meaningful record** (Records may have not entered correctly therefore a non-meaningful record)
		Missing test results	**Non-Meaningful record** (Records may have not entered completely therefore a non-meaningful record)

3.3 Results

3.3.1 Percentage of patients with alcohol consumption records

Approximately three million patients aged ≥ 16 years were alive and registered with a THIN practice during each year of the study, as shown in Table 3-4 below. In 2003, only 29% of patients had a record of alcohol consumption since their registration with a practice, and only 4% of patients had their consumption recorded during that year. However, the completeness of recording has improved over time. In 2011, the proportion of patients ever having an alcohol consumption recording since registration with their practice rose above 50% and this increased to approximately 65% in 2012.

Table 3-4**:** Alcohol consumption recording in primary care

Year	Number of patients active in each year	Number of patients having a record since registration	Number of patients having a record in this year	Percentage of patients having a record since registration	Percentage of patients having a record in this year
2003	3,016,220	875,846	120,839	29.04	4.01
2004	3,051,224	984,251	151,513	32.26	4.97
2005	3,104,865	1,075,307	129,801	34.63	4.18
2006	3,123,560	1,154,826	138,119	36.97	4.42
2007	3,143,188	1,238,856	144,601	39.41	4.60
2008	3,159,658	1,330,802	151,702	42.12	4.80
2009	3,099,390	1,401,125	171,661	45.21	5.54
2010	3,034,089	1,484,432	188,627	48.93	6.22
2011	2,987,201	1,622,675	234,633	54.32	7.85
2012	2,918,231	1,888,454	365,632	64.71	12.53

Alcohol consumption recording in each year increased considerably since 2008. From 2003 to 2008, the increment in number of patients having an alcohol consumption record was 25%, whereas from 2008 to 2012, it was 141%. However, alcohol consumption recording in each year remained low and in 2012 just 12.5% of patients had their consumption recorded during that year.

The total number of alcohol consumption records for patients registered in THIN in 2012 was 622,187. In these records the most frequently used AHD codes and Read code are given in Table 3-5 and Table 3-6. Teetotaler, Drinks rarely and Drinks occasionally were the other main Read code categories used in alcohol consumption recording. However, the use of standard screening tests seems to be minimal in primary care; even in 2012 out of the all alcohol consumption related records less than 1% of records were available under screening test related Read codes and AHD codes. On the other hand, not all of these records were meaningful, due to their incompleteness. Therefore, only 11.7% of patients had a complete and meaningful alcohol consumption recording in their records in 2012.

Table 3-5: AHD codes used to record alcohol consumption in 2012

AHD code	AHD code description	Number of codes	Percentage
1001400003	Alcohol test	190	0.03
1003050000	Alcohol	621,997	99.97
	Total	622,187	100.00

Table 3-6: Read codes used to record alcohol consumption in 2012

Read code	Read Code Description	Number of records	Percentage of records
136..00	Alcohol consumption	268474	43.15
1361.00	Teetotaller	114522	18.41
1362.11	Drinks rarely	63879	10.27
1362.12	Drinks occasionally	60013	9.65
1367.00	Stopped drinking alcohol	29793	4.79
1362.00	Trivial drinker - <1u/day	14652	2.35
1363.00	Light drinker - 1-2u/day	13519	2.17
136L.00	Alcohol intake within recommended limits	11917	1.92
136O.00	Moderate drinker - 3-6u/day	7785	1.25
136V.00	Alcohol units per week	5349	0.86
1361.12	Non-drinker alcohol	5146	0.83
68S..00	Alcohol consumption screen	4620	0.74
9k17.00	Alcohol screen - AUDIT C completed	1214	0.20
38D3.00	Alcohol use disorders identification test	58	0.01
9k15.00	Alcohol screen - AUDIT completed	74	0.01
9k16.00	Alcohol screen - fast screening test completed	22	0.00
	All other	21150	3.40
	Total	622187	100.00

3.3.2 Characteristics of patients with alcohol consumption records

As shown in Table 3-7, alcohol consumption recording in primary care was higher among women (13.6%) compared to men (11.39%). There was significant variation in alcohol consumption recording ($P<0.001$) according to age in both genders and the percentage of patients having a record increased with age. Women of reproductive age (16-44) had almost twice as high rates of alcohol consumption recording when compared to men.

Alcohol consumption recording also varied according to the deprivation quintile; recording was highest in the most deprived group of men and women. Statistically significant regional variation in alcohol consumption recordings were also noted among men and women (p<0.001). Recording rates appeared to be highest in Scotland, London and North East in 2012.

Table 3-7: Characteristics of patients having alcohol consumption records in 2012

	Men			Women		
	Records/N	**%**	**P***	**Records/N**	**%**	**P***
All	163,725/1,437,453	11.39		201,907/1,480,778	13.64	
Age –years						
16-24	6,096/151,967	4.01		11,987/141,102	8.50	
25-44	30,161/477,510	6.32		52,534/472,132	11.13	
45-64	66,347/495,303	13.40		70,541/489,871	14.40	
65+	61,121/312,673	19.55	<0.001	66,845/377,673	17.70	<0.001
Deprivation quintile						
1 (least deprived)	39,720/348,422	11.40		47,968/358,488	13.38	
2	34,430/294,739	11.68		42,286/305,927	13.82	
3	32,213/286.275	11.25		39,852/296,192	13.45	
4	28,478/255,736	11.14		35,693/263,505	13.55	
5 (most deprived)	22,204/181,742	12.22		26,504/180,584	14.68	
Missing	6680/70,539	9.46	<0.001	9604/76,082	12.60	<0.001
UK regions						
(B) Northern Ireland	3,596/28,030	12.83		3,679/28,278	13.01	
(C) South West	10,202/81,712	12.49		12,759/84,063	15.18	
(A) South East Coast	16,398/163,177	10.05		21,064/172,587	12.20	
(E) Scotland	5,255/34,378	15.29		6,682/35,329	18.91	
(F) South Central	19,091/143,158	13.34		21,314/146,564	14.54	
(H) Yorkshire and Humber	5,020/59,284	9.98		6,850/51,821	13.22	
(I) East Midlands	24,911/215,223	11.57		33,713/219,394	15.37	
(J) West Midlands	17,313/178,030	9.72		20,839/182,417	11.42	
(K) North West	13,360/137,845	9.69		17,469/145,327	12.02	
(L) East of England	13,929/136,171	10.23		16,284/141,804	11.48	
(M) Wales	11,890/110,888	10.72		14,456/112,318	12.87	
(D) London	19,859/139,389	14.25		23,540/140,695	16.73	
(G) North East	2,901/19,168	15.13	<0.001	3,258/20,181	16.14	<0.001

*P value from Chi-squared test

3.3.3 Number of alcohol consumption recordings per person

The Figure 3-1 and Table 3-8 present results for the number of alcohol consumption recordings per person for those who had an alcohol consumption recording in 2012. The oldest age group of men and women had the highest mean number of records per person. For younger age groups (16-44), women had higher mean number records per person when compared with men. In contrast, for older age groups (45-64, 65+), men had higher mean number of records per person when compared with women.

Figure 3-1: Number of alcohol consumption recordings per person according to gender and age group in 2012 (excluding outliers)

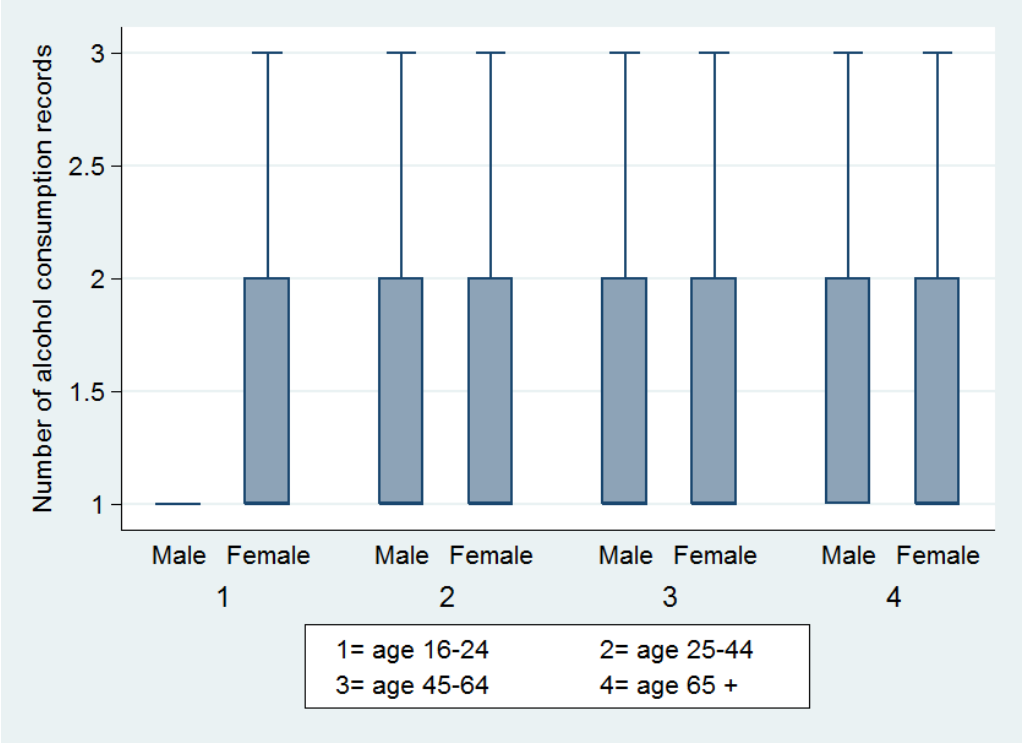


Table 3-8: Number of alcohol consumption recording per person in 2012

Age group	Male			Female		
	Median (Lower Quartile, Upper Quartile)	Mean (Standard Deviation)	Range including outliers	Median (Lower Quartile, Upper Quartile)	Mean (Standard Deviation)	Range including outliers
16-24	1.0 (1, 1)	1.20 (0.51)	1 to 8	1.0 (1, 2)	1.41 (0.76)	1 to 9
25-44	1.0 (1, 2)	1.38 (0.76)	1 to 13	1.0 (1, 2)	1.40 (0.76)	1 to 18
45-64	1.0 (1, 2)	1.61 (0.94)	1 to 16	1.0 (1, 2)	1.50 (0.81)	1 to 13
65+	1.0 (1, 2)	1.77 (0.97)	1 to 16	1.0 (1, 2)	1.66 (0.87)	1 to 17

3.3.4 Levels of alcohol consumption recording

The Figure 3-2 and Table 3-9 present results for the level of alcohol consumption recording and among men, the age groups 25-44 and 45-64 reported a mean consumption of 18.44 and 18.12 units per week. The youngest and oldest men reported consuming 13.0 and 13.9 units per week. Among women, the mean number of units per week increased with age up to the age group of 45-64 years. Women in the age groups of 16-24, 25-44, 45-64 reported consuming a mean of 6.86, 8.13, and 10.10 units per week respectively. The oldest age group of women reported consuming a mean of 7.48 units per week.

Figure 3-2: Levels of alcohol consumption recorded according to gender and age in 2012 (excluding outliers and using cut off level of 420 units per week)

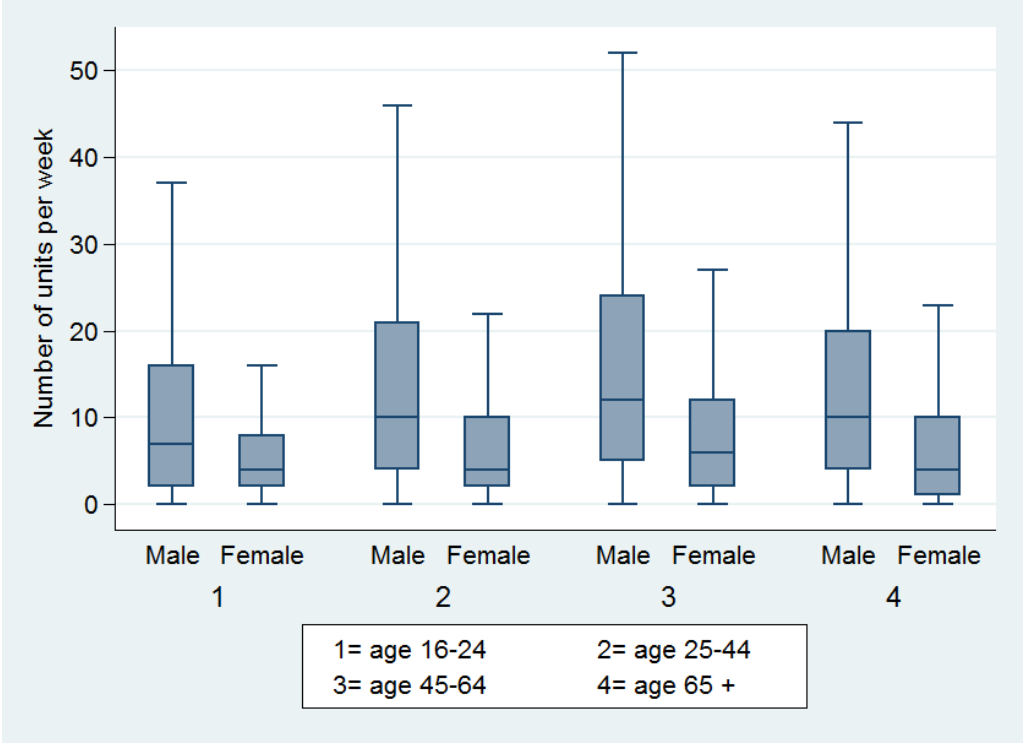


Table 3-9: Levels of alcohol consumption recorded according to gender and age in 2012 (using cut off level of 420 units per week)

Age group	**Male**			**Female**		
	Median (Lower Quartile, Upper Quartile)	Mean (Standard Deviation)	Range including outliers	Median (Lower Quartile, Upper Quartile)	Mean (Standard Deviation)	Range including outliers
16-24	7 (2, 16)	13.01 (20.76)	1 to 420	4 (2, 8)	6.86 (12.75)	1 to 420
25-44	10 (4, 21)	18.44 (27.05)	1 to 400	4 (2, 10)	8.13 (12.36)	1 to 300
45-64	12 (5, 24)	18.12 (21.25)	1 to 350	6 (2, 12)	10.00 (13.68)	1 to 420
65+	10 (4, 20)	13.91 (14.98)	1 to 350	4 (1, 10)	7.48 (8.88)	1 to 221

3.4 Discussion

Alcohol consumption recording in primary care has improved over time. In 2003, only 29% of patients had a record of alcohol consumption ever since their registration in primary care and this had improved to 65% in 2012. However, alcohol consumption recording among all patients registered and active in THIN remains low, particularly when recent recording within a given year is considered. In 2012, only 12.5% of patients registered in THIN had their consumption recorded during that year. The use of validated screening tests was rarely documented in primary care data. Moreover, the alcohol consumption recording among men and women varied significantly by age, deprivation and region. The highest and lowest levels of recording were observed among the oldest age group (65+) and youngest age group (16-24) respectively. This trend was observed in both men and women, however, women of child bearing age (16-44) reported almost twice as high a level of recording when compared with men in the same age group. Patients in the highest deprivation group and in the regions of Scotland, London and North East reported having higher rates of alcohol consumption recordings.

These findings are in line with previous studies showing higher rates of patient consultations in primary care among older age groups and women in reproductive age when compared to men and younger people.[331, 332] Moreover, there is evidence to suggest that patient consultations vary by gender, age and deprivation status.[331, 332] These variations in consultations between men and women, in different age groups and deprivation levels likely to have influenced the alcohol consumption recording in primary care.

The financial incentives provided through Directed Enhanced Services (DES) from 2008 onwards for screening newly registered patients may have contributed towards the slight increase in alcohol consumption recording in each year, especially towards the noticeable increment of recording (141%) identified in the current study from 2008 to 2012. However, it has been reported that the financial incentive provided by DES might not be effective as QOF because of the low level of payment and poor monitoring of outcomes.[329, 429] In addition to DES, the "Making Every Contact Count" strategy may have also contributed towards this slight increment in alcohol consumption recording in primary care.[430-432]

Despite the increment in recording over time, the proportion of patients having a record of their alcohol consumption within a given year is relatively low. This seems likely to be due to several barriers. A systematic review of 47 papers identified a number of barriers towards implementation of alcohol screening in primary care, including organizational factors such as lack a of financial incentives; staff factors such as attitudes towards health promotion activity and availability of training facilities; and patient factors such as patient characteristics and their participation in screening.[433]

Even though most GPs in the UK believe that primary care is a suitable setting for alcohol consumption screening,[434] they do not regularly question patients about alcohol consumption.[435] Reasons for this include

include a lack of training, lack of financial incentives and everyday time pressures.[329, 433, 435] In addition, general practitioners' ambivalence about their role in giving advice about alcohol consumption has also been identified as another barrier for alcohol consumption screening.[433, 436] In a society where most people drink alcohol moderately, physicians find it hard to provide advice on alcohol consumption.[436] Patient factors such as a negative reaction when questioning about alcohol consumption has also found to be associated with low level of alcohol consumption recording in primary care.[433]

The current study results in relation to the recording of alcohol consumption screening tests are consistent with Khadjesari et al, who found rarely documented alcohol consumption screening test results in primary care data.[423] This low level of alcohol consumption screening tests could be due to a unstandardized and highly personalised approach to recording of screening and brief intervention in primary care.[329] As shown in the current study there is a wide selection of Read codes for recording alcohol consumption, and GPs have to select the most appropriate code. Practitioners have reported experiencing difficulties in locating the correct Read code and in translating information of a diagnosis into Read codes.[329] Furthermore, GPs reported using free text in reporting patients' alcohol consumption rather than using relevant read codes due to difficulties in identifying the most suitable Read code.[329]

Due to the above reasons, alcohol consumption recording in primary care is likely to remain relatively low. Having better recording of alcohol consumption in primary care will be beneficial in identifying and supporting problem drinkers as well as for research purposes. Hence, it is important to take measures to increase recording. These can include providing financial incentives, training and support for primary care. For example, QOF+, which

is a local version of QOF was used to incentivise alcohol screening and brief intervention in Hammersmith & Fulham from July 2008 to March 2011.[429] As a result of this financial incentivising scheme in Hammersmith & Fulham, during this period of time the proportion of alcohol consumption recording among patients with cardiovascular and mental health conditions showed a significant increment from 4.8% to 65.7%.[437] Therefore, it is important to consider incentivising recording of alcohol consumption nationally and including it in QOF. The importance of including alcohol consumption recording in QOF has also been emphasized by the Alcohol Health Alliance,[438] which is an alliance of more than 40 non-governmental organizations with the aim of promoting evidence-based policies to reduce the damage caused by alcohol misuse.[439] In addition, universal screening of alcohol consumption which is screening all adults registered in primary care is recommended,[437, 440, 441] rather than the current approach of targeted screening of people who are at high risk of alcohol consequences.[442]

In general, people tend to under report their alcohol consumption;[7, 369] therefore, it is important to use standard screening tests such as AUDIT in primary care. The use of standard screening tests will minimise limitations in relation to the screening method by making them uniform over time or between different patients. This will enable the comparison of alcohol consumption measures over time and among different groups of people. Furthermore, alcohol consumption recording in primary care can be improved by providing the necessary support and training for practitioners in selecting relevant Read codes for alcohol consumption and encouraging them to use Read codes rather than free texts.[329]

This study was strengthened by the use of nationally representative sample of patients registered in primary care. Therefore, the results are

largely generalizable to the UK population. However, the data analysis of this study did not include free text data in which practitioners may have entered alcohol consumption related information. The effect of omitting any free text data on the quality of alcohol consumption measures are likely to be minimal as it is expected to have these records recorded using Read codes in good practice of data reporting.[348, 443]

3.5 Conclusion

In conclusion, this study showed that alcohol consumption recording in primary care remains low, particularly when recent recording within a given year is considered. Alcohol consumption recording in primary care is higher among at-risk groups such as women in child bearing age, older men and women who are likely to have an illness linked to alcohol, and patients in lower socio economic group.

Due to the above described variations and due to the low level of alcohol consumption recording in each year, primary care data cannot be reliably used for evaluating the effect of Licensing Act 2003 on adult alcohol consumption. Making efforts to improve the proportion of patients having an alcohol consumption recording in primary care will, at an individual level, be beneficial in identifying and supporting problem drinkers. At a population level, such measures may provide useful data to monitor trends in consumption and evaluate the effectiveness of alcohol harm reduction strategies.

4 QUALITY OF ALCOHOL CONSUMPTION MEASURES FROM GENERAL POPULATION SURVEYS AND THEIR SUITABILITY FOR ALCOHOL CONTROL POLICY EVALUTION

From Chapter 2, primary care data and general population survey data were identified as key sources of individual level alcohol consumption data available in the UK. However, Chapter 3 showed that primary care data are not suitable for evaluating the Licensing Act 2003 for a number of reasons. The remaining key source of individual level alcohol consumption data in the UK is the survey data, and this chapter aims to identify the suitability of survey data for Licensing Act 2003 evaluation purposes.

There are a number of potential biases that affect alcohol consumption estimates generated from alcohol surveys as discussed in detail in section 2.3.2, however, as long as these biases remain consistent over time, those data can be used for alcohol control policy evaluation which focuses on the changes in the trends of consumption. In the UK alcohol survey data substantially underestimates alcohol consumption extrapolated from sales data and this underestimation has increased over time.[379] For example, the General Lifestyle Survey for 2008 was found to underestimate alcohol consumption by around 40% when compared with sales data,[369] and the difference between GLF measure and alcohol sales was equivalent to 430 million units a week.[368] In other words, a bottle of wine per adult (16 years and over) per week is unaccounted for due to survey underestimation.[368]

Adjusting GLF survey data to account for several issues such as underestimation of self-poured drinks and sampling frame issues increased the GLF's annual per capita alcohol consumption estimate, but it still remained 22% lower than the estimate obtained from equivalent alcohol sales data.[310] In addition to the potential biases taken into account in the above study, the survey instruments themselves and the framing of the questions is likely to influence the adequacy of survey measures of alcohol consumption.[325, 444-447] Therefore, the use of inappropriate survey instruments may have contributed towards this residual underestimation.

Hence, the Section 4.1 will identify the quality, completeness and consistency of survey questions in English surveys by investigating the survey questions over time and comparing them with the international guidelines for measuring alcohol consumption in national surveys. However, alcohol control policy evaluation likely to require more detailed information and adherence of survey data to the international epidemiological guidelines may not fulfil all those requirements. Therefore, the Section 4.2 discuss these further requirements of data suitable for alcohol control policy evaluation.

4.1 Comparison with international guidelines

Multiple guidelines on the use of alcohol survey instruments and framing of survey questions have been proposed, but whether they are consistent in their recommendations and whether the English national surveys meet those recommendations have not been considered to date. Hence this section aims to compare the recommendations on alcohol survey instruments from international guidelines and to establish whether national surveys in England are adequately measuring the key aspects of alcohol

consumption. This study has been published in Alcohol and Alcoholism[448] and a copy of this paper is given in Appendix 8.3.

4.1.1 Methods

A literature search for international guidelines for measuring alcohol consumption in general population surveys was carried out. It was conducted within the websites of the WHO, National Institutes of Health (NIH), Centres for Disease Control and Prevention (CDC), European Commission, UK Department of Health (DH) and the UK Office for National Statistics, as well as the PubMed database, by using the following search strategy: (recommendations OR standards OR guidelines OR agreement) AND (measuring OR monitoring OR reporting OR questions) AND (alcohol consumption OR ethanol consumption OR drinking alcohol OR drinking pattern). From the results of these searches, the publications that provide international guidelines for measuring alcohol consumption among adults (age≥16) in general population surveys were identified. The references cited by identified guidelines were also scrutinized in order to identify any other existing international guidelines.

The alcohol consumption measures, recommended survey instruments or questions, and the process used to establish them were extracted from each guideline. When guidelines had both a minimum set of questions and a recommended set of questions for alcohol research, the recommended set of questions was extracted. The analysis was limited to the recommendations on alcohol survey instruments that measure levels and patterns of alcohol consumption. Therefore, the recommendations for measuring alcohol consequences or minimising other limitations of national surveys, such as sampling frame issues, under-reporting and non-response bias, were not included in the analysis.

The common core recommendations between the guidelines in terms of recommended measures and survey instruments were identified. For example, all four guidelines recommend measuring frequency and volume of heavy episodic drinking and using Graduated Quantity Frequency (GQF) questions as the survey instrument.

Finally, the three major general population surveys that have been collecting alcohol consumption data using detailed questions on average volume of consumption and heavy episodic drinking among adults (age≥16) in England,[253] and have been used to provide national level estimates on adults alcohol consumption were identified.[309, 405, 407] These are the Health Survey for England (HSE), General Lifestyle Survey (previously called the General Household Survey, GHS) which ceased in 2012, and the Opinions and Lifestyle Survey (previously called the Omnibus Survey). Each of these surveys provides national data for England though the GLF and Opinions and Lifestyle survey in fact cover the whole of Great Britain. The alcohol consumption questions in these surveys were compared with the common core recommended alcohol consumption measures and survey instruments identified from the international guidelines. Different colours are used to highlight any changes in wordings or questions of these surveys over time.

For each survey the most recently-available version of the questionnaire with alcohol consumption related questions was used for initial comparison; for the HSE this was 2013, for the GLF 2011 and for the Opinions and Lifestyle survey this was 2008/2009.[410, 413, 415] After 2009 the Opinions and Lifestyle Survey did not include alcohol consumption questions but in 2012 some of the GLF's alcohol consumption questions were transferred into it.[449] The consistency of the alcohol related questions in each survey over time, from the year 2000 onwards until its most recently published survey were assessed afterward.

4.1.2 Results

4.1.2.1 Guidelines for measuring alcohol consumption

Four sets of international guidelines that provide recommendations for measuring alcohol consumption in general population surveys were identified: the International Guide for Monitoring Alcohol Consumption and Related Harm by the WHO; the Agreement on ways to measure alcohol consumption by the Kettil Bruun Society (KBS), an international organization of scientists engaged in research on alcohol use and alcohol problems; the Recommended Alcohol Questions by the National Institute on Alcohol Abuse and Alcoholism (NIAAA); and the Standardizing Measurement of Alcohol Related Troubles (SMART) Project Guidelines by the European Commission.[7, 385, 386, 450]

In 2000, the WHO published the International Guide for Monitoring Alcohol Consumption and Related Harm aiming to provide guidance on epidemiological monitoring of alcohol consumption and to improve the global and regional comparability of alcohol-related data.[7] It was drafted by a large number of leading experts in alcohol research with reference to the relevant evidence at that time. An agreement on ways to measure and report drinking patterns and alcohol-related problems in adult general population surveys was developed at the thematic conference of KBS held on April 2000, with participation of over 40 researchers from 12 countries.[385] This thematic conference used 26 research papers plus the WHO guidance document mentioned above to draw their conclusions.

In 2003, a task force of the National Institute on Alcohol Abuse and Alcoholism (NIAAA) developed four recommended sets of alcohol questions for surveys that can include only a limited number of alcohol questions.[450] They developed these using the recent epidemiological studies at that time and the WHO guide.

The European Commission's Standardised Measurement of Alcohol-Related Troubles (SMART) project published its guidance and recommended alcohol questions for European countries in 2010. This project developed standardized comparative survey methodologies on heavy drinking, binge drinking, context of drinking, alcohol dependence, and alcohol related problems as well as public support for alcohol policy measures for use in the European Union (EU).[386] The methodology, developed on the basis of a review of European survey experiences from over 20 countries as well as a literature review, was tested in 10 countries with different socio-cultural backgrounds and patterns of alcohol consumption.

All four guidelines emphasise that surveys measuring alcohol consumption need to contain items on alcohol drinking status, average volume of alcohol consumption, and frequency and volume of heavy episodic drinking, where the volume of alcohol is calculated by multiplying the quantity and frequency of relevant drinking occasions over the past year. A minimum set of three questions (that can be used to obtain all of the above-mentioned alcohol consumption measures) has also been provided by the guidelines as shown in Table 4-1. In addition to this minimum set, all four guidelines give recommended items for surveys that are able to include a larger number of questions. These include more detailed questions on volume of average alcohol consumption, frequency and volume of binge drinking and an optional section on drinking context. For measuring average volume of alcohol consumption, Beverage Specific Quantity Frequency (BSQF) questions were identified as the most appropriate survey instrument, whereas Quantity Frequency (QF) questions were identified as adequate when surveys have limited resources and space for alcohol questions. QF questions measure how often alcohol was consumed and how much on each occasion whereas BSQF questions do the equivalent for different types of

alcohol beverage separately. All guidelines recommend Graduated Quantity Frequency (GQF) questions to assess heavy episodic drinking. GQF questions start by asking for the highest level of consumption on any occasion during the past year and then, based on the answer, ask a series of follow-up questions on the frequency of consuming lesser quantities (e.g. frequency of consuming more than 144g, 96g, 60g, 36g, or 24g).[7, 385, 386]

In addition to the above questions on essential alcohol consumption measures, questions on drinking context were also recommended by all four guidelines. Commonly recommended drinking context questions ask whether participants drank with or without a meal, alone or with others, and the place of drinking.

Some other additional alcohol consumption measures were also recommended by individual guidelines. For example, the WHO and SMART guidelines recommended including questions on unrecorded consumption (home brewed or purchased abroad) and duration of heavy drinking occasions. However, these additional questions were recommended for surveys that can include a large number of questions and they were not commonly recommended by all four guidelines.

Table 4-1: Common core categories of alcohol consumption measures and the associated questions recommended by international guidelines (M: Minimum set of questions for surveys with limited resources)

Required Measures	Recommended Survey Instrument	WHO Guidelines in 2000	KBS Conference Guidelines in 2000	NIAAA Guidelines in 2003	EU Commission (SMART) Guidelines -2010
1) Alcohol Drinking status (Past year & Lifetime) - **CORE ITEM**	Questions on Abstention	Derived from the Question 1 below when Respondents haven't drunk in past year Abstention - past 12 months Abstention-lifetime	Derived from the Question 1 below when Respondents haven't drunk in past year Abstention - past 12 months Abstention-lifetime	Derived from the Question 1 below when Respondents haven't drunk in past year Abstention - past 12 months Abstention-lifetime	Derived from the Question 1 below when Respondents haven't drunk in past year Abstention - past 12 months Abstention-lifetime
2) Volume of alcohol Consumption (Past year) - **CORE ITEM**	**Quantity Frequency Questions - QF** (Past year)	1. In the past year, how often did you drink any alcoholic beverage? **(M)** 2.How many drinks did you usually have on days you drank in the past year? **(M)**	1. Overall frequency of drinking considering all types of alcoholic beverages **(M)** 2. Usual quantity of drinking, all alcoholic beverages together **(M)**	1.During the last 12 months, how often did you usually have any kind of alcoholic drink ? **(M)** 2.During the last 12 months, how many alcoholic drinks did you have on a typical day you drank alcohol ? **(M)**	1. How often did you drink beer, wine, spirits or any other alcoholic drink in past 12 months ? (Recommendations for usual quantity - not included)
	Beverage Specific Quantity & Frequency - BSQF (Past year)	3. After a filter question that determines whether or not specific type of beverage was consumed, ask for the largest as well as usual quantity of drinks and size of the drink.	3.Beverage-specific frequencies of drinking usual quantities of drinking, size of usual drink maximum quantity and Frequency	3. Beverage specific consumption	2. How often did you drink beer in the past year? 3. How much did you drink on average on a when you drank beer over the past 12 months? Repeat Q2, 3 for wine, sprits & for another type
3) Frequency & Volume of Heavy Episodic Drinking (Past Year)- **CORE ITEM**	**Graduated Quantity Frequency Questions** Starting with The largest Number of Drinks (past year)	4. Counting all types of beverages combined, what was the largest number of drinks that you drank in a single day in the past year?	4.Largest amount drunk in last 12 months, all beverages together ? 5. How often above amount was consumed?	4. Largest number of drinks containing alcohol you drank within 24 hours during the past year? 5. How often above amount was consumed? Repeat Q5 for lifetime	Recommendations not included
		5. In the past year, how often did you drink five or more drinks of any alcoholic beverage or combination of beverages in a single day? **(M)** (Preferably should obtain from questions with Cut-off values of 12 +, 8-11, 5-7, 3-4, 1-2 drinks, a drink is equivalent to 12g of pure alcohol)	6.Frequency of consuming >60g ethanol or if above , frequency of consuming>96g Ethanol in a single day ? **(M)** (Preferably should obtain from questions with cut-offs: 24, 36, 60, 96, 144, and 240g of pure alcohol)	6. During the last 12 months, how often did you have 5 or more (males) or 4 or more (females) drinks containing any kind of alcohol in within a two hour period ? **(M)** (A drink is equivalent to 12g of pure alcohol)	4. How often in the past 12 months, have you had 6 drinks or more on one occasion ? (Which is equivalent to 60 g of pure alcohol) 5. Repeat Q4 for 12 drinks

Table 4-1 Continued : Common core categories of alcohol consumption measures and the associated questions recommended by international guidelines (M: Minimum set of questions for surveys with limited resources)

Required Measures	Recommended Survey Instrument	WHO Guidelines in 2000	KBS Conference Guidelines in 2000	NIAAA Guidelines in 2003	EU Commission (SMART) Guidelines -2010
4) Drinking Context **OPTIONAL ITEM**	Questions on Drinking Context	6. During the past year where did you usually drink ? 7. What proportion of time you spent in different locations 8. How often did you drink in above mentioned locations?	7. Questions on whether the participant *Had drinks with meals or not *Had drinks on a weekday / weekend *Had drinks alone or with others *Had drinks in public (bar/restaurants) or not in public	7. Questions on drinking contexts (Specific questions not included)	6. When you drink alcohol do you usually drink * With a meal or at some other time? * Where? * With whom?

4.1.2.2 Comparison of English Survey Questions with Guidelines

Comparison of the most recently available questionnaire with guidelines

For all three surveys, the most recently available questionnaire with alcohol consumption-related questions covered only two essential alcohol consumption measures out of the three essential measures recommended by the international guidelines (Table 4-2). They are alcohol drinking status and the average volume of alcohol consumption. English surveys addressed these two essential alcohol consumption measures precisely according to the international guidelines by using questions on abstention and Beverage Specific Quantity Frequency questions with the past year as the reference period.

English surveys did not include questions on the frequency of heavy episodic drinking, the other essential measure recommended by the international guidelines. Instead, they used an alternative set of questions on binge drinking which focussed only on the volume of alcohol consumed on the heaviest drinking day of the last week. The guidelines, on the contrary, recommend using GQF questions which measure not only the volume of binge drinking but also the frequency of binge drinking with the past year as the reference period.

In addition to the above questions on essential alcohol consumption measures, questions on drinking context were not addressed at all by either HSE or GLF. However, the Opinions and Lifestyle survey included some of the recommended items on drinking context such as questions on place of drinking.

Table 4-2: Comparison of English survey questions with the common core categories of alcohol consumption measures recommended by international guidelines

Required Measures (Reference Period)	Recommended Survey Instrument	Health Survey for England (2013)	General Lifestyle Survey (2011)	ONS Opinions Survey (2008/2009)
1) Alcohol Drinking Status (Past year & Lifetime) - **CORE ITEM**	Questions on Abstention	1) Do you ever drink alcohol nowadays, including drinks you brew or make at home? 2) If Q1=No, does that mean you never have an alcoholic Drink nowadays, or do you have an alcoholic drink very occasionally?	1) Do you ever drink alcohol nowadays, including drinks you brew or make at home ? 2) If Q1=No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?	1) Do you ever drink alcohol nowadays, including drinks you brew or make at home? 2) If Q1=No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?
		3) If Q2=Never, have you always been a non-drinker or did you stop drinking for some reason?	3) If Q2=Never, have you always been a non-drinker or did you stop drinking for some reason?	Questions not included
2) Volume of alcohol Consumption (Past year) - **CORE ITEM**	**Quantity Frequency Questions - QF** (Past year)	4) If Q1=Yes OR Q2= Very Occasionally, Thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months? **Questions on usual quantity - not included**	4) If Q1=Yes OR Q2=Very occasionally, Would you say: hardly drink at all, drink a little, drink a moderate amount, drink quite a lot, drink heavily 5) Thinking now about all kinds of drinks, how often have you had an alcoholic drink of any kind during the last 12 months? **Questions on usual quantity - not included**	3) Thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months? **Questions on usual quantity - not included**
	Beverage Specific Quantity & Frequency - BSQF (Past year)	IF Q1=Yes or Q2= Very Occasionally **Type 1: Normal strength beer, lager, stout, cider, shandy** 5) How often have you had type 1 drink during thelast12 months? 6) How much type 1 drink have you usually drunk on any one day during the last 12 months? (half pint, small cans, large cans, bottles) 7) How many (Q6 size) type 1 drink have you usually drunk on any one day during the last 12 months? **Repeat above questions for other drink types** Repeat Q5-Q7 for Strong beer, lager, stout or cider Repeat Q5-Q6 for Sprits & Sherry Repeat Q5-Q6 for Wine with extra question on glass size Repeat Q5-Q7 for Alcopops	IF Q1=Yes or Q2= Very Occasionally **Type 1 :Normal Strength beer, lager, stout, cider or shandy** 6) How often have you had a drink of type 1 during the last 12 months? 7) How much type 1 drinks have you usually drunk on one day during the last 12 months? (half-pints, small cans, large cans, bottles) 8)How many (size Q7) of type 1 drinks have you usually drunk on any one day during last 12 months? **Repeat above questions for other drink types** Repeat Q6-Q8 for Strong beer, lager, stout or cider Repeat Q6-Q7 for Sprits & Sherry Repeat Q6-Q7 for Wine with extra question on glass size Repeat Q6-Q8 for Alcopops	IF Q1=Yes or Q2= Very Occasionally **Type 1: Strong beer, lager, stout, cider** 4) How often have you had a type 1 during the last 12 months? 5) How many half pints of type 1 have you usually drunk on any one day during the last 12 months? 6) Specify amount of type 1,usually drunk on any day during the last 12 months? (Specify no and type of units- if bottle or can - record size) **Repeat above questions for other drink types** Repeat Q4-Q6 for Normal Strength beer, lager, stout, cider shandy and for (Sprit and Sherry with singles & glasses on Q12) Repeat Q4-Q6 for wine with extra questions on wine glass size Repeat Q4-Q6 for Alcopops and other drinks

Table 4-2 Continued: Comparison of English survey questions with the common core categories of alcohol consumption measures recommended by international guidelines

Required Measures (Reference Period)	Recommended Survey Instrument	Health Survey for England (2013)	General Lifestyle Survey (2011)	ONS Opinions Survey (2008/2009)
3) Frequency & Volume of Heavy Episodic Drinking (Past Year) - **CORE ITEM**	**Graduated Quantity Frequency Questions** Starting with the Largest number of Drinks (Past year)	**Questions not included**	**Questions not included**	**Questions not included**
		Alternative method used : This only produce the volume of consumption in the heaviest drinking day last week 8) Did you have an alcoholic drink in the seven days ending yesterday? 9) On how many days out of the last week did you have an alcoholic drink? 10) If (Q9>1) Did you drink more on one of the days/ some days than others, or did you drink about the both/ same on each of those days ? 11) Which day last week did you(have an alcoholic drink / have the **most** to drink)? 12) What types of drinks did you have that day (Q11 day) ? **(Type 1:** Normal strength beer/ lager/ cider/shandy) 13) If(Q12= Type 1) How much of type 1 drinks did you drink that day (Q11 day)? (half pints, small cans, large cans , bottles) 14) How many (Q13 size) of type 1 drinks did you have that day? **If (Q12= Other drink types mentioned below)** Repeat Q13-14 for Strong beer, lager, stout, or cider Repeat Q13 for Spirits, Sherry, Repeat Q13-14 for alcopops& for wine with glass size Repeat Q13 for three other types of drinks	**Alternative method used : This only produce the volume of consumption in the heaviest drinking day last week** 9) Did you have an alcoholic drink in the seven days ending yesterday? 10) On how many days out of the last week did you have an alcoholic drink? 11) If (Q10>1) did you drink more on some days than others, or did you drink about the same on each of those days? 12) Which day (last week) did you last have the most to drink ? 13) What types of drink did you have that day (Q12 day) ? **(Type 1:** Normal strength beer/ lager/ cider/shandy) 14) If(Q13= Type 1) How much of type 1 drinks did you drink that day (Q12 day)? (half pints, small cans, large cans , bottles) 15) How many (Q14 size)of type 1 drinks did you have that day ? **If (Q10= Other drink types mentioned below)** Repeat Q14-15 for Strong beer, lager, stout, or cider Repeat Q14 for Spirits & Sherry Repeat Q14-15 for alcopops& for wine with glass size	**Alternative method used : This only produce the volume of consumption in the heaviest drinking day last week** 7) Did you have an alcoholic drink in the seven days ending yesterday ? 8) On how many days out of the last seven did you have a drink? 9) If (Q8>1) Did you drink more on some days than others, or did you drink about the same on each of those days? 10) If (Q8=1|Q9=varied) On which day did you have (a drink| most to drink) ? 11) If (Q9=varied| same)Thinking about (most to drink day| most recent drinking day) what types of drink did you have? (**Type 1**: Strong beer, larger, stout and cider) 12) If (Q11= Type 1) How many half pints of strong beer, lager, stout and cider did you drink that day? 13) Specify amount of type 1 you drunk that day **If (Q11= Other drink types mentioned below)** Repeat Q12-Q13 for Normal strength beer, lager, stout, cider, shandy Repeat Q12-13 for wine with extra questions on glass size Repeat Q12-13 for alcopops, sprit, sherry,
4) Drinking Context **OPTIONAL ITEM**	Questions on Drinking Context	**Questions not included**	**Questions not included**	Questions on alcohol drinking places & companion

Consistency of survey questions over time

Though the HSE has broadly maintained its structure over time, there has also been some inconsistency in the inclusion of the core recommended questions over time. The Beverage Specific Quantity Frequency (BSQF) question category has not been consistently included in HSE, being excluded for eight years, from 2003-2010 (Table 4-3). Furthermore, it was identified that the order of questions changed over time. Extra sections were included in HSE on pregnancy and drinking in the year 2002, questions on attitude towards drinking in the year 2007 and a Drink Diary in the year 2011.

The General Lifestyle Survey has also largely maintained its structure over time (Table 4-4). However, the GLF has also been inconsistent in including BSQF and overall frequency of drinking questions; BSQF questions were not included in the GLF in the 2003/2004, 2004/2005 and 2007 questionnaires. There have also been some changes in the total number of questions asked, the order of questions and the wording of questions as highlighted in different colours in Table 4-3 and Table 4-4.

The Opinions and Lifestyle survey did not include alcohol consumption questions annually. Therefore, it was not included in this phase of the analysis.

Table 4-3: Alcohol consumption questions of Health Survey for England over time

Required Measure	Recommended Survey Instrument	2000-2001	2002	2003--2010	2011
1) **Abstention** (Past year & Lifetime) **CORE ITEM**	Questions on Abstention	1) Do you ever drink alcohol nowadays, including drinks you brew or make at home?	1)same	1)same	1)same
		2) If Q1=No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?	2)same	2)same	2)same
		3) If Q2=Never, have you always been a non-drinker or did you stop drinking for some reason?	3)same	3)same	3)same
2) **Volume of alcohol Consumption** (Past Year) **CORE ITEM**	Quantity Frequency Questions- QF (Past Year)	4) If Q1=Yes OR Q2= Very Occasionally, Thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months?	4)same	4)same	4) same
		Questions on usual quantity – NOT included	**NOT included**	**NOT included**	**NOT included**
	OR **Beverage Specific Questions** (Past Year)	IF Q1=Yes or Q2= Very Occasionally **Type 1: Normal strength beer, lager, stout, cider, shandy** 5) How often have you had type 1 drink during the last 12 months?	5)same		5)same
		If (Q5= Almost every day.. Once or twice a year) 6) How much type 1 drink have you usually drunk on any one day during the last 12 months? (half pint, small cans, large cans, bottles)	6)same	BSQF Questions **NOT included**	6)same wine glass & bottle size
		7) How many (Q6 size) type 1 drink have you usually drunk on any one day during the last 12 months?	7)same		7)same
		Repeat Q5-Q7 for below categories: Strong beer or cider, Sprits, Sherry, Wine, Pops, Other types of drink (A,B,C)	Repeat 5-7 for other categories		Repeat 5-7 for other categories
3) **Prevalence & Volume of heavy Episodic drinking** (Past year) **CORE ITEM**	**Question on Largest Number of Drinks**	8) Did you have an alcoholic drink in the seven days ending yesterday?	8)same	5)same	8)same
		9) On how many days out of the last week did you have an alcoholic drink?	9)same	6)same	9)same
		10) If (Q8>1) Did you drink more on one of the days/ some days than others, or did you drink about the same on both/ each of those days ?	10)same	7)same	10)same
		11) If (Q10=same|varied) Which day last week did you last (have an alcoholic drink/ have the most to drink) ?	11)same	8)same	11) same
		12) What types of drinks did you have that day (Q11 day)? (Normal strength beer/lager..Strong beer/lager Sprits etc..)	12)same	9) same	12)same
	AND	**Repeat below question for drink types mentioned in Q9:** 13) On that day how much (Q12 drink type) did you drink ? (half pint, small cans, large cans, bottles)	13)same	10)same 2007onwards wine glass & bottle size	13)same wine glass & bottle size
		Repeat below question for drink sizes mentioned in Q11 14) How many (Q13 drink size) did you drink that day?	14)same	11) same	14)same
	Graduated Quantity Frequency (GQF)	GQF NOT Included	NOT included	NOT included	NOT included

Table 4-3 Continued: Alcohol consumption questions of Health Survey for England over time

Required Measure	Recommended Survey Instrument	2000-2001	2002	2003--2010	2011
4) **Drinking Context & Duration OPTIONAL Highly Desirable item**		15) If Q3=Used to drink & stopped, Did you stop drinking because of a particular health condition that you had at the time? 16) Compared to five years ago, would you say that on the whole you drink more, about the same or less nowadays?	15)same 16)same	12)same 13)same	15)same 16)same
			Questions on Pregnancy	**Only in 2007:** attitude of drinking	**Drink Diary** for all drank in last year

Table 4-4: Alcohol Consumption Questions of General Household Survey/General Lifestyle Survey over time

Required Measure	Recommended Survey Instrument	General Household Survey (2000/2001)	2001/02 -2002/03	2003/04 -2004/05	2005 -2006	2007	2008-2011
1) **Abstention** (Past year & Lifetime) **CORE ITEM**	Questions on Abstention	1) Do you ever drink alcohol nowadays, including drinks you brew or make at home?	1)same	1)same	1)same	1)same	1)same
		2) If Q1=No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?	2)same	2)same	2)same	2)same	2)same
		3) If Q2=Never, have you always been a non-drinker or did you stop drinking for some reason?	3)same	3)same	3)same	3)same	3)same
2) **Volume of Alcohol Consumption** (Past year) **CORE ITEM**	Quantity Frequency Questions- QF (Past year)	4) If Q1=Yes OR Q2=Very occasionally, Would you say: hardly drink at all, drink a little, drink a moderate amount, drink quite a lot, drink heavily	4)same	4)same	4)same	4)same	4)same
		5) Thinking now about all kinds of drinks, how often have you had an alcoholic drink of any kind during the last 12 months?	5)same	5)same	5)same	5)same	5)same
		Questions on usual quantity – NOT included	**NOT included**	**NOT included**	**NOT included**	**NOT included**	**NOT included**
	OR **Beverage Specific Questions (Past Year)**	**Category 1 :Normal beer, lager,stout,cider or Shandy**					
		6) How often have you had a drink of category 1 during the last 12 months?	6)same		6)same		6)same
		7) How much category 1 drinks have you usually drunk on one day during the last 12 months? (halfpints,small cans,..)	7)same	BSQF	7)same	BSQF	7)same
		8)How many (size Q7) of category 1 drinks have you usually drunk on any one day during last 12 months?	8)same	NOT included	8)same	NOT included	8)same
		9) If Q7=bottles, What make of category 1 drinks do you usually drink from bottles?	9)same		9)same		
		10) Code for Brand at Q8	10)same		10)same		
		Repeat Q6-10 for Strong Beer or Cider and	Same		Same		Repeat 6-8
		Repeat Q6-Q7 for Sprits, Sherry, Wine and Pops	Same		Same		Repeat 6-7
							Question on Wine glass size

Table 4-4 Continued: General Household Survey/General Lifestyle Survey over time

	Required Measure	Recommended Survey Instrument	General Household Survey (2000/2001)	2001/02 -2002/03	2003/04 -2004/05	2005 -2006	2007	2008-2011
3)	**Prevalence & Volume of Heavy Episodic Drinking** (Past year) **CORE ITEM**	Question on Largest Number of drinks	11) Did you have an alcoholic drink in the seven days ending yesterday?	11)same	6)same	11)same	6)same	9)same
			12) On how many days out of the last week did you have an alcoholic drink?	12)same		12)same		10)same
			13) If (Q12>1) did you drink more on some days than others, or did you drink about the same ?	13)same	7)same	13)same	7)same	11)same
			14) If (Q13=same|varied) Which day last week did you have an alcoholic drink / have the most to drink?	14)same	8)same	14)same	8)same	12) **08/09**- have an alcoholic drink? After 2010- the most
			15) What types of drink did you have that day (Q14 day) ? **(Category 1:** Normal strength beer, lager, stout, cider or shandy OR **other Categories**)	15)same	9)same	15)same	9)same	13)same
			16) If(Q15= Category 1) How much category 1 drinks did you drink that day (Q9 day)? (half pints, small cans, large cans , bottles)	16)same	10)same	16)same	10)same	14)same
			17) How many category 1 drinks did you usually drunk on "a day"?	17)that day	11)that day	17)that day	11)that day	15)that day
			18) If (Q15=bottles) which make of category 1 did you usually drink ?	18) same that day in 2002/03	12)that day	18)that day		
		AND	19) Code for brand at Q18	19)same	13)same	19)same		
			If (Q10= Other Categories) Repeat below accordingly					
		Graduated Quantity Frequency	Repeat Q16-18 for Strong beer, lager, stout, or Cider	Same	same	Same	Repeat 10,11	Repeat 14, 15
			Repeat Q16 for Spirits, Sherry, Wine and Alcopops	same	same	Same	Repeat 10	Repeat 14,15
		GQF Questions	**GQF NOT included**	**NOT included**	**NOT Included**	**NOT Included**	**NOT Included**	**NOT included**
4)	Drinking Context & Duration **OPTIONAL**	Questions on Drinking context And Duration	Questions NOT included	**NOT included**	**NOT Included**	**NOT Included**	**NOT Included**	**NOT included**

4.1.3 Discussion

4.1.3.1 Main findings

Alcohol consumption data from national surveys are essential for epidemiological and public health research purposes and existing international guidelines are broadly consistent in their recommendations for how alcohol consumption should be measured in these surveys. Alcohol consumption status, average volume of alcohol consumption, and frequency and volume of binge drinking are the key alcohol consumption measures recommended by all four guidelines, with another recommended item on drinking context for surveys that can include a large number of questions. English national surveys have collected data on only two core items, as they have not included questions on the frequency of binge drinking. The alternative method they have used, which focusses on volume of alcohol drunk in the heaviest drinking day of the last week, is likely to underestimate the scale of heavy drinking in England as explained below. Beverage specific questions which is the only source of information available in English surveys for measuring volume of average alcohol consumption, has been inconsistent over time.

4.1.3.2 Strengths and Limitations

To my knowledge this is the first study to evaluate survey instruments and faming of questions from general population surveys in England according to the international guidelines. The analysis of this study used the three main surveys that collected adult alcohol consumption measures in England and it evaluated each survey for more than 10 years by considering the recommendations from four international guidelines. However, the analysis was limited to the recommendations on survey

instruments measuring alcohol consumption. Hence, the recommendations for measuring alcohol consequences or minimising other limitations of national surveys, such as sampling frame issues, under-reporting and non-response bias, were not included in the analysis.

4.1.3.3 International guidelines for measuring alcohol consumption

It is perhaps not surprising that some of the international guidelines identified in this study are consistent, as they have been constructed by some of the same leading experts in the field and are based on their understanding of the available evidence. The recommendations from the SMART project stand alone in resulting from a full systematic review of the evidence, and from testing of these recommended questions across multiple European countries, including the UK. It is reassuring that the recommendations of the SMART project on essential alcohol consumption measures are similar to those of the other guidelines.

This study compared the international guidelines with national survey data for England. Welsh and Scottish Health Surveys containing similar, but not identical, alcohol questions to those in the HSE also exist, and the GLF and Opinions and Lifestyle survey provide data for other UK countries as well; however, in the interests of clarity, this study was focussed on surveys used in England. It used the guidelines as a means of assessing the quality of alcohol consumption data for England, but it should be recognised that consistency with the guidelines may still not constitute successful alcohol consumption measurement. Even surveys that have the 'best-case' measures according to the guidelines are likely to produce estimates that are lower than sales. This will be partly due to biases in who is surveyed in the national surveys, resulting from the sampling frame and non-response,

but problems with the survey instruments remain. For example, according to all four international guidelines, BSQF is the recommended survey instrument to measure volume of alcohol consumption according to all four international guidelines, but it is less reliable for measuring irregular drinking patterns since it is based on average measures and it does not capture the volume of alcohol taken as a combination of various types of drinks.[386]

There have been attempts to improve the recording of self-reported alcohol consumption by using the 'yesterday' method, which includes questions about the amount of alcohol consumed on the day before the interview.[394] The 'yesterday' method has proven to be effective in minimising under-reporting of overall alcohol consumption but it appears to be best used with other methods capable of describing longer-term alcohol drinking patterns such as the GQF.[394]

In addition, location and beverage specific alcohol consumption questions have been successful in accounting for high levels of alcohol consumption among individuals.[388, 389] These questions were used in the International Alcohol Control Policy Evaluation (IAC) study, which is the first ever international cohort study of alcohol use and alcohol policy relevant behaviours.[388] It generates high-quality individual level alcohol consumption measures using longitudinal cohort surveys and the location specific questions used in this survey, and the beverage and location specific survey question framework has also proven to be suitable for adaption to different country contexts.[388, 389] For Australia and New Zealand, this method of using location and beverage specific questions has generated alcohol consumption estimates that were equal to 86% and 94% of alcohol sales respectively.[377, 389] A study which compared the GQF questions and IAC survey questions identified that GQF questions underestimated consumption by 33% compared with beverage specific within location

locations used in IAC study.[377] However, these survey questions used in IAC study is a highly detailed survey instrument which is time-consuming and may not be suitable for multi-purpose general population surveys of the type discussed in this paper.[388]

4.1.3.4 Limitations of currently used binge drinking measures in English surveys

As discussed in Chapter 1, binge drinking refers to a drinking pattern of consuming an intensive volume of alcohol over a short period of time that is likely to lead to intoxication and acute consequences.[451, 452] To measure this drinking pattern, the English surveys use questions on the maximum amount of alcohol drunk on the heaviest drinking day of the previous week, rather than the recommended GQF questions on frequency of heavy drinking incidences over the last year. This is due to the English surveys aim of identifying people drinking above the sensible drinking limits and binge drinking limits,[253, 411] which uses daily benchmarks as discussed in Chapter 1. However, the shorter reference period of last week is likely to greatly underestimate the proportion of heavy drinkers and miss infrequent drinkers.[7, 386, 450] Even though it is difficult to estimate exactly by how much binge drinking is being underestimated in English surveys as a result of the current survey approach, a study from Canada which compared the GQF measure on last year alcohol consumption with a weekly drinking measure on previous week consumption found that the former gave 5 times higher prevalence estimate of binge drinking.[444] Therefore, the English survey binge drinking measure based on just one day of the previous week might be expected to miss even more binge drinkers because of the shorter time frame. It may also be affected by seasonality due to its shorter reference period, and may fail to represent respondents' overall pattern of binge

drinking. Therefore, the English surveys' heaviest drinking day measure on its own cannot be used for most epidemiological research purposes. A review of data from Scotland's routine national surveys has also reported similar findings on binge drinking measures based on the shorter reference period of last week.[379]

4.1.3.5 Importance of having beverage specific survey questions consistently over time

An individual's average volume of alcohol consumption is the other most important indicator used in alcohol epidemiology as it has a causal impact on chronic diseases such as cancers, diabetes mellitus, depressive disorder and liver cirrhosis.[4, 13] Despite its importance, the BSQF questions that provide the information on average volume of consumption in English surveys, have been inconsistently included over time so that this core measure is also unavailable for some years. This has resulted in gaps in time series data for the average volume of consumption and limits the potential of these data for formal time series analysis to identify trends in consumption and evaluate policy interventions.

According to the international guidelines, total alcohol consumption from surveys should be calculated by aggregating the average volume of consumption and consumption due to binge drinking occasions.[7, 386] This adjustment has also been proven to improve prevalence estimates for heavy drinking since respondents do not normally include heavy drinking occasions in estimates of their average consumption.[453] Therefore, using the average volume of alcohol consumption generated by BSQF questions on its own can contribute towards the survey underestimation of alcohol consumption in England when comparing with sales data.

4.1.3.6 Limited number of alcohol surveys with long-term data

In January 2012 the GLF was ceased[410] and this ended a unique and powerful time series of alcohol consumption data in its 35th year.[253] Even though alcohol consumption questions asked in the GLF have been transferred to the Opinions and Lifestyle Survey,[409] they do not include the detailed beverage-specific questions asked in the GLF,[449] and the Opinions and Lifestyle survey has a relatively small sample size due to its format of monthly surveys.[414] Out of the three major surveys that used to provide national estimates on alcohol consumption in England, HSE is currently the only survey which continues to measure alcohol consumption annually. However, HSE is also limited by inconsistent inclusion of questions for measuring average volume of alcohol consumption.

Some of the limitations of England's major national surveys in measuring alcohol consumption may be addressed by more recent additions to the spectrum of surveys in this country. The Alcohol Toolkit Study (ATS) includes all essential alcohol consumption indicators including the frequency of binge drinking in a large nationally-representative sample of adults in England.[404] This study uses the Alcohol Use Disorders Identification Test (AUDIT) to measure alcohol consumption, which includes the minimum recommended number of alcohol questions, but not the detailed survey instruments shown in Table 1. Alcohol Policy Interventions in Scotland and England (APISE), which is the other recent study, represents England and Scotland's arm of the International Alcohol Control study;[388] it covers all essential alcohol consumption measures but uses a small sample size of 3725 adults split evenly between England and Scotland.[403] However, both these studies are bounded by limited funding available only for a few years.[404, 454] Therefore, these surveys will not be able to provide data for a

long period of time to enable identification of trends in consumption or evaluation of future alcohol control policies.

4.1.3.7 Recommendations

Even though the heaviest drinking day questions of HSE remained consistent over time, the methodology used by Office for National Statistics in calculating alcohol unit measures changed over time.[253, 309] The revised method changed the assumed number of units in beer, lager, cider and wine. However, the main impact was on wine category since the revised method changed not only the assumed Alcohol By Volume (ABV) of wine from 9% to 12% but also the size of a glass of wine.[309] Until 2006 respondents had only one glass size option (125ml glass), which was assumed to contain 1 unit of alcohol.[309] According to the revised method, respondents were given three options for glass size as 125ml, 175ml, and 250ml and it was assumed that these glasses contain 1.5units, 2 units and 3 units of alcohol correspondingly.[309] Therefore, the implications of these methodological changes will have to be considered when using the HSE data for alcohol control policy evaluation in the next phase of this thesis.

Future surveys should strive to retain consistency of the core indicators of alcohol epidemiology that are essential for monitoring public health and evaluating alcohol control policies and other interventions. It is important that this includes a measure of the frequency of binge drinking. The integrated Household Survey is relatively a newer survey, which is carried out quarterly and has a much larger sample size than HSE.[455] However, this survey does not include any alcohol consumption questions yet. Therefore, including recommended survey instruments on all core alcohol consumption indicators in the newer Integrated Household will generate a valuable data source for future monitoring and evaluation purpose.

Including more detailed alcohol questions on drinking context would be helpful in identifying the associations between drinking and its consequences.[7, 386] For example, drinking without meals,[17] in public drinking places,[18] and with many others[19] have been associated with higher rates of alcohol consequences. Ensuring that measurement of alcohol consumption in all countries adheres to the guidelines would not only provide more reliable estimates for each country to evaluate its own level of public health risk and effectiveness of national policy, but also improve the global and regional comparability of data on alcohol use and health consequences in order to improve monitoring and to facilitate research, risk assessment and advocacy.

4.2 Suitability of data for alcohol control policy/contextual factor evaluation

4.2.1 Additional survey questions

The above section of this chapter concentrated on the degree to which survey questions in English surveys follow international guidelines that are particularly aimed providing guidance for national alcohol consumption monitoring purposes. However, alcohol control policy evaluations likely to require further detailed information on alcohol consumption as they aim to investigate whether and how the policy/contextual factors caused a change in alcohol behaviour.

The Licensing Act 2003, aimed to reduce the drunkenness by introducing a café culture. Hence HSE's heaviest drinking day alcohol consumption measure will be particular suitable for evaluating the Act's effect on binge drinking. However, as discussed in Section 1.2 of this thesis, there are different alcohol control policy options such as drink drive policies, pricing policies, policies aimed at alcohol marketing and availability. These different policy options are likely to require different measures due to the nature of the policy and outcome of interest.

Therefore, collecting data on topics such as social supply of alcohol (someone else buying alcohol for the drinker), preloading (drinking alcohol before going out to places such as bars and nightclubs), traveling times to buy alcohol, exposure to alcohol advertising, and alcohol purchasing information would also be important for evaluating different alcohol policy options such as pricing policies, policies aimed at reducing alcohol availability, and policies on alcohol marketing. For example, the detailed IAC study which is particularly aimed at collecting data for alcohol control policy evaluations collects information on above mentioned aspects of drinking.[388, 456]

Moreover, alcohol consumption among individuals is a complex behaviour which depends on several factors, including economic, demographic and physiological factors. Numerous studies have shown that the Theory of Planned Behaviour (TPB) can be used to predict alcohol consumption among individuals.[238, 239] According to this theory, behaviour such as alcohol consumption is driven by the extent to which an individual positively values that behaviour (attitude), perception of other peoples' approval or disapproval of that behaviour (subjective norms), and individual's perceived ability to perform that behaviour and perception of own level of control over engaging in that behaviour (perceived behaviour

control).[237] Therefore, including questions related to drinkers' attitudes, subjective norms and perceived behaviour control in UK surveys would also be beneficial for evaluating the effect of alcohol control policies and identifying their causal pathways towards changing drinking behaviour among individuals.

4.2.2 Reference time

Even though the international guidelines generally recommend using 12 months as the reference period for both average consumption measures and binge drinking, this may be less useful for identifying short term changes in consumption following the implementation of an intervention/policy. The alcohol consumption measures based on longer reference period such as 12 months require a whole year for that measure to become truly representative of the respondents' average level of consumption. When using alcohol consumption measures based on longer reference periods there can be an overlap between the pre and post policy implementation period. This can be overcome by having a shorter reference period. For example, the International Alcohol Control Policy Evaluation Study (IAC Study) uses a reference period of 6 months to minimise the overlap of measurement in pre-post policy implementation periods.[388]

Another problem with alcohol consumption measures based on long term reference period is that they are more likely to be affected by other interventions/policy measures. Therefore, it will be difficult to disentangle the effects of the specific policy under investigation. This problem as well as the issue in relation to overlap between pre and post policy implementation period can be minimised by using an alcohol consumption measure based on shorter reference period such as the last 7 days.

Hence, HSE's heaviest drinking day alcohol consumption measure based on last seven days will suitable for evaluating the effect of the Licensing Act not only because it provides a measure on binge drinking but also it is based on a shorter reference period of last 7 day. Therefore, it will allow the identification of short term changes in alcohol consumption without an overlap of measurement between the pre and post Act periods.

4.2.3 Other requirements

In addition to the above-mentioned requirements, alcohol control policy or contextual factor evaluation will require frequently collected data on regular time intervals (quarterly, monthly or weekly) on a nationally representative sample. This will allow identification of short term changes in the outcome measure of interest and will enable controlling for any seasonal variations in the outcome.

Moreover, when evaluating the effect of alcohol control policies or contextual factors affecting alcohol consumption it is important to take the population heterogeneity into account.[195] Therefore, having a sufficiently large nationally representative sample will allow identification of the policy's effect on different population subgroups in terms of the age, gender, socio-economic status and different drinking levels.

4.3 Conclusions

GLF and HSE have alcohol consumption measures on heaviest drinking day of the last week consistently over time but GLF data cannot be obtained on a monthly or quarterly basis, which is important for alcohol control policy evaluation. However, HSE's heaviest drinking day alcohol consumption measure is available on a quarterly basis for a nationally representative sample.[457] Therefore, HSE data on the heaviest drinking day measure will be used in the next phase (Chapter 5) of this thesis to evaluate the effect of the Licensing Act 2003 on adult alcohol consumption.

5 HOW HAS ALCOHOL CONSUMPTION IN ENGLAND CHANGED SINCE THE 2003 LICENSING ACT?

5.1 Introduction

The Licensing Act 2003 came into effect in England and Wales in November 2005 and made several changes to the previous licensing law with the intention of introducing a café culture.[212, 213] One of the key changes it introduced was the flexible and longer opening hours for licensed premises.[212, 213] Section 1.8 in chapter 1 provided a detailed description of the Act and its potential impact on adult alcohol consumption in England. Furthermore, it established the gap in existing literature in relation to the effect of the act on adult alcohol consumption.

As mentioned in Section 1.8, the Licensing Act's implementation led to a slight increase in average opening times across on-trade premises in England and it may have also had an influence on drinkers' perceptions of drinking and drinking premises. Hence it was hypothesised that there may have been a small/gradual increase in alcohol consumption among adults in England, particularly among heavy drinkers and young (16-24) drinkers who are more likely to drink in on-trade premises.[195, 197] Moreover, it was hypothesised that there may have been a slight increase in beer consumption among men as they are more likely to drink on-trade and have a strong preference for beer.

Evaluating the effect of the Licensing Act on adult alcohol consumption while testing above the mentioned hypotheses requires a dataset with detailed alcohol consumption related information (e.g. volume of drinking, location of drinking (on/off trade), and duration of drinking) and large sample size that allows stratification of drinkers into different subgroups.

Moreover, evaluation of the Act's effect using interrupted time series analysis, which is the strongest quasi-experimental study design requires more frequent alcohol consumption measures such as quarterly or monthly data to identify any seasonal effects or short term variations.

After reviewing a large number of data sources in Chapter 2, primary care data, alcohol survey data and market research data were identified as potentially suitable data sources for the work involve in this thesis. However, market research data were not further considered due to funding constraints. Chapter 3 showed that alcohol consumption recording among patients registered in primary care remains low, particularly when recent recording within a given year is considered. Finally, Chapter 4 identified the suitability of HSE data for alcohol control policy evaluation in England.

However, HSE data do not support testing some of the above-mentioned hypothesis due to lack of information on location of drinking and small sample size of quarterly data. Despite these limitations, it has several advantages in relation to evaluating the effect of the Licensing Act 2003. HSE's heaviest drinking day in last week measure been collected consistently over time and theses data are available quarterly basis on a nationally representative sample. Moreover, HSE's heaviest drinking day measure is based on a shorter reference period of last 7 day. Therefore, it will allow the identification of short term changes in alcohol consumption without an overlap of measurement between the pre and post Act periods.

Therefore, this chapter aimed to use HSE heaviest drinking day alcohol consumption measure to identify how alcohol consumption among adults in England changed since the 2003 Licensing Act and to explore Acts impact only on a limited number of subgroups.

5.2 Methods

5.2.1 Alcohol consumption data

HSE heaviest drinking day alcohol consumption data provide information on the amount of alcohol consumed by each person on their heaviest drinking day of the week prior to the interview. These data were used for in this study for the period from January 2001 to December 2013.

In line with the Office for National Statistics (ONS) reports, missing values were generated when participants refused to respond or were not able to answer the question.[458] When there were unrealistically high alcohol unit measures in the dataset, they were removed from the dataset using the cut-off level used by the ONS, which is consuming more than 60 units of alcohol on the heaviest drinking day.[405, 458]

The individual level observations for total alcohol units consumed on the heaviest drinking day in the last week were aggregated and averaged across each quarter while taking the sample weights into account. This step generated a total of 52 quarterly (20 pre and 32 post intervention) population-level observations for the mean number of alcohol units consumed by all adults (age≥16) on the heaviest drinking day of the last week. However, the main focus of this study was on the adult drinkers (i.e. excluding abstainers) and therefore, the quarterly mean number of alcohol units for adult drinkers were also generated for the whole study period.

In addition to the total alcohol consumption by all adults and adult drinkers on the heaviest drinking day (all alcoholic beverages together), beverage-specific consumption measures were also generated for adult drinkers. These measures were categorised into three categories: "beer", "wine" and "other type" of drinks. The "other type" of drinks category consisted of the total amount of any spirits, sherry, and alcopops consumed on the heaviest drinking day by each individual. Beverage-specific alcohol

unit measures were not directly available from the HSE dataset. Therefore, beverage-specific unit measures were computed for each type of beverage, by multiplying the number of drinks consumed on the heaviest drinking day by the number of units per drink. The number of units per drink was based on the ONS unit assumptions used in calculating alcohol unit measures.[253]

Alcohol consumption data for the following alcohol consumption related questions included in the HSE survey were used to generate the beverage-specific alcohol unit measures (Figure 5-1).

Figure 5-1: Health Survey for England – Alcohol Consumption Questions used for the data analysis

1) What types of drinks did you have on the heaviest drinking day last week?
   Type 1=Normal Strength beer
   Type 2=Strong Strength beer
   Type 3=Wine
   Type 4=Spirits
   Type 5=Sherry
   Type 6=Alcopops

2) If (Q1 = Type 1) How much of type 1 drinks did you drink that day?
   Half pints
   Small cans
   Large cans
   Bottles
   Glasses

3) How many (Q2 = half pints, small cans..) of type 1 drinks did you have that day?

4) If (Q1= Other drink types) Repeat Q2 and Q3 accordingly for other types of alcohol consumed on the heaviest drinking day.

5.2.2 Methodological issues related to data

HSE assumes an average pure alcohol content for each type of drink, rather than asking the respondent for the pure alcohol content for each drink consumed. The conversion of volumes of alcohol into units of alcohol depends on the assumptions made about the usual size of drinks (glass size, can size, half pint or pint) and pure alcohol content in specific drink types, which is also called the alcohol by volume (ABV) percentage. These assumptions made by the Office for National Statistics in calculating alcohol unit measures have changed over time.[253] Therefore, the number of alcohol units assumed to be in beer, alcopops and wine, and in different sized containers changed accordingly.

However, the alcohol unit assumption for spirits and sherry remained constant over time and it was assumed that 25ml of spirits or a glass of sherry (size unspecified) contained one unit of alcohol.

5.2.2.1 Changes in alcohol unit assumptions for beer and alcopops

The number of alcohol units assumed by the Office for National Statistics for beer and alcopops were revised in 2006 because of the introduction of new types of alcoholic drinks to the market over time with higher ABV percentages. With these changes the assumed number of alcohol units per drink of beer and alcopops changed as shown in Table 5-1. For example, prior to 2006 it was assumed that a pint of strong beer contained 3 units of alcohol but after 2006 it was revised to 4 units of alcohol. Prior to 2006 it was assumed that a bottle of alcopops (275ml) contained around 1 unit of alcohol but after 2006 this was revised to 1.5 units of alcohol.

Table 5-1: Changes to alcohol unit assumptions for beer and alcopops[253]

Type of drink and volume	Usual volume (ml)	Previous Unit Assumptions (Prior to 2006)	Revised Unit Assumptions (2006 onwards)
Normal strength beer, larger, cider			
Half	284	1.0	1.0
Pint	568	2.0	2.0
small can/bottle	330	1.0	1.5
large can/bottle	440	2.0	2.0
Bottle	500	1.0	2.5
Strong beer, larger, cider (ABV≥6)			
Half	284	1.5	2.0
Pint	568	3.0	4.0
small can/bottle	330	1.5	2.0
large can/bottle	440	3.0	3.0
Bottle	500	1.5	4.0
Alcopops/coolers			
Bottle	275	1.0	1.5

5.2.2.2 Changes in alcohol unit assumptions for wine

The unit assumptions for wine changed in 2006 and again in 2007. These changes were made to take into account the increases of pure alcohol content in wine, and glass size changes over time. Prior to 2006, wine glass size was unspecified in the HSE questionnaire and the assumption was that an average glass of wine (125ml) contained around one unit of alcohol. However, due to the availability of different glass sizes (125ml, 175ml, and 250ml) in licensed premises over time, it was decided to take the glass size changes into account when estimating wine units.

In generating the revised unit assumption, two approaches were suggested by the ONS. The first was to continue specifying wine glass size in the questionnaire but assuming an average wine glass is equal to 170ml and contains 2 units of alcohol. The second approach was to provide 125ml (small), 175ml (medium or standard) and 250ml (large) glass size options

to respondents while assuming a small glass of wine equates to 1.5 units, a medium glass to 2 units and a large glass to 3 units.

The first approach (which assumed an average glass of wine (170ml) contains 2 units of alcohol) was used in the HSE in 2006 to generate the revised alcohol unit measures. However, the wine glass size was found to vary between different groups of respondents.[253] For example, young people, professional and managerial workers were more likely to use large glasses whereas older people were less likely to use large glasses.[253] Therefore, from 2007 onwards the second approach with specific wine glass sizes was used in the HSE questionnaire as shown in Table 5-2 below.

Table 5-2: Changes to the wine unit assumptions over time[253]

Previous Unit Assumption **(Prior to 2006)**		Revised Unit Assumption **(In 2006)**		Revised Unit Assumption **(2007 onwards)**	
Average glass size	Unit Assumption	Average glass size	Unit Assumption	Average glass sizes	Unit Assumptions
125ml	1	170ml	2	125ml 175ml 250ml	1.5 2.0 3.0

Due to these changes in unit assumptions and wine glass sizes, the heaviest drinking day alcohol consumption data available from HSE were not directly comparable over time. There was an abrupt change in the heaviest drinking day alcohol consumption measure due to this change in the unit calculation methodology in 2006 and it overlapped with the implementation of the Licensing Act at the end of November 2005 as shown in Figure 5-2.

Figure 5-2: Adult drinkers' heaviest drinking day total alcohol consumption (all alcoholic beverages together) using originally available data from HSE (Using previous unit assumptions from 2001-2005 and revised unit assumptions from 2006-2013)

Note: Dashed line shows the Licensing Act implementation

5.2.3 Primary analysis and sensitivity analysis

To address the above-mentioned change in HSE alcohol unit calculation methodology, the data were analysed using both previous unit assumptions and revised unit assumptions. This was done by converting the data according to previous and revised unit assumptions for the whole study period. This allowed analysis of any changes in the outcome measure according to both previous and revised unit assumptions while retaining the consistency of unit assumptions over time. For clarity, from this point onwards the data analysis conducted using revised unit assumptions is referred to as the primary data analysis, and the data analysis conducted using previous unit assumptions is referred to as the sensitivity analysis. Primary analysis and sensitivity analysis was carried out on total consumption and beverage specific (beer, wine, and other alcoholic drinks) consumptions on the heaviest drinking day as discussed below.

5.2.3.1 Primary analysis of the total alcohol consumption on the heaviest drinking day

The total alcohol units based on the revised unit assumptions were available from HSE only for the period from 2006 - 2013. Therefore, to conduct the primary analysis, revised unit measures were generated for the period from 2001-2005 using revised unit assumptions for specific beverages given in section 5.2.2.1 and 5.2.2.2. In relation to wine glass size changes over time, it was assumed that an average glass of wine (170ml) equates to 2 units for the period from 2001-2005. This provided a time series of heaviest drinking day alcohol consumption data, calculated according to the revised unit calculation methodology for the whole time period considered (2001-2013) as shown in Figure 5-3. However, data were not completely

comparable over time due to the inclusion of specific wine glass size (125ml, 175ml, 250ml) options in the HSE survey from 2007 onwards. Therefore, in addition to the sensitivity analysis on total alcohol consumption given below, a further sensitivity analysis was carried out on beverage-specific consumption as given in section 5.2.3.3.

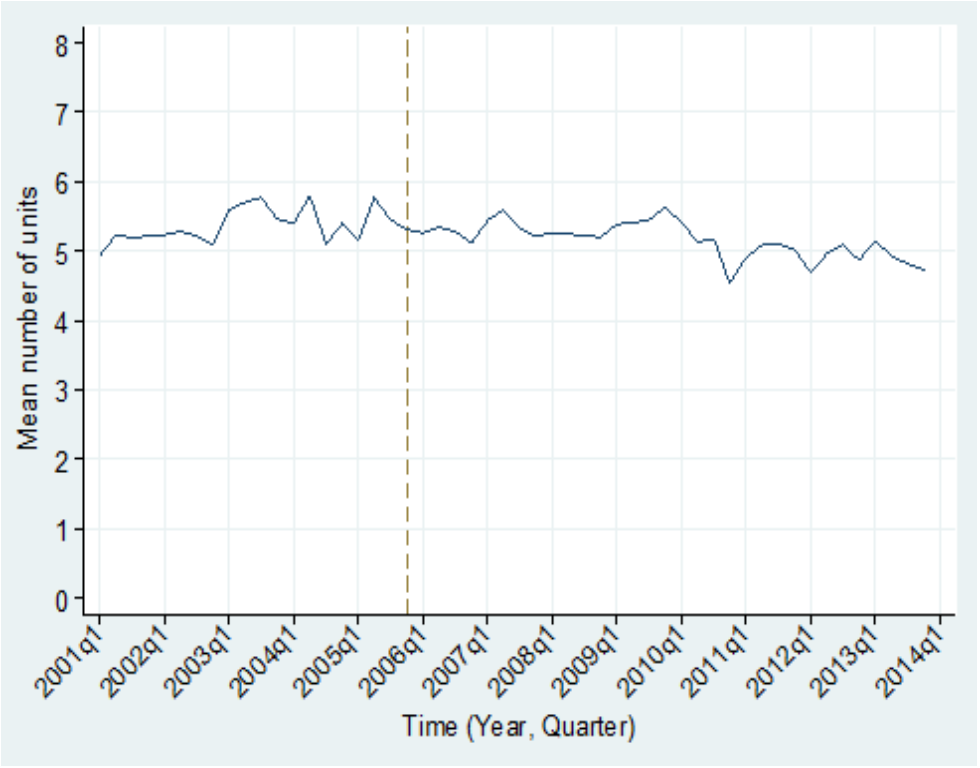
5.2.3.2 Sensitivity analysis of the total alcohol consumption on the heaviest drinking day

The total alcohol units based on the previous unit assumptions were available from HSE only for the period from 2001 - 2005. Therefore, to conduct the sensitivity analysis, previous unit measures were generated for the period from 2006-2013 using previous unit assumptions for specific beverages given in section 5.2.2. In relation to the wine glass sizes options introduced into the survey in 2007, which were not available prior to 2007, it was assumed that wine glass size was unspecified for the whole time period and an average glass of wine (125ml) was equal to one unit of alcohol, which is in line with the previous wine unit assumption. This step generated heaviest drinking day total alcohol consumption measures that were comparable over time as shown in Figure 5-3.

Figure 5-3: Adult drinkers' total alcohol consumption (all alcoholic beverages together) on the heaviest drinking day (2001-2013)

a) Data generated according to revised unit assumptions for Primary Analysis (Revised unit assumptions)

b) Data generated according to previous unit assumptions for Sensitivity Analysis (Previous unit assumptions)



Note: Dashed line shows the Licensing Act implementation

5.2.3.3 Primary and sensitivity analysis of beverage-specific alcohol consumption on the heaviest drinking day

The primary analysis of beer consumption on the heaviest drinking day used beer units generated according to the revised unit assumptions for the whole period considered in the study, whereas the sensitivity analysis used the previous beer unit assumptions. Similarly, data on the consumption of "other drinks" (spirits, sherry, and alcopops altogether) on the heaviest drinking day were also generated according to both revised and previous unit assumptions for the whole period considered (2001-2013) in the study. These data were then used in the primary analysis and sensitivity analysis to explore changes in other drinks consumption on the heaviest drinking day.

Wine consumption on the heaviest drinking day was evaluated using two models based on the revised unit assumptions. These were used to identify the effect of different wine glass sizes introduced in 2006 and 2007. As given in Table 5-3, the first model used the revised unit assumptions introduced in 2006 for the whole period of time which assume an average glass of wine (170ml) equals to 2 units of alcohol. The second model used revised unit assumptions which assume an average glass of wine (170 ml) equals to 2 units for the period from 2001-2006, and revised unit assumptions with specific glass sizes for the period from 2007-2013.

Table 5-3: Models for analysing the change in wine glass size over time

Model	Unit Assumption	Time Period	Average Wine Glass Size	Assumed number of units
(a) Primary Analysis	Revised Unit Assumptions	2001-2013	170 ml	2 units
(b) Sensitivity Analysis	Revised Unit Assumptions with specified glass sizes from 2007 onwards	2001-2006	170 ml	2 units
		2007-2013	125 ml 175 ml 250 ml	1.5 units 2.0 units 3.0 units

5.2.4 Interrupted Time Series analysis

This section will detail the interrupted time series (ITS) methods used in this Chapter and also in Chapter 6. The specific application of these time series methods to the analysis for the current study will be discussed in section 5.2.6.

As discussed in the introduction (section 1.6), interrupted time series analysis is arguably the most suitable quasi-experimental research design to evaluate the longitudinal effect of an intervention.[165, 459] The ITS design has been widely used in health policy evaluation and evaluation of other interventions. To apply this research design there has to be a clearly defined point in time when an intervention came into effect.[166]

In interrupted time series analysis a time series is divided into two or more segments by the intervention, and the outcome variable of interest is measured before and after the intervention reliably and on repeated occasions.[164] ITS analysis can be used to adjust for several threats to internal validity when compared with other quasi-experimental study designs.[165] For example, secular trends (e.g. an upward or a downward trend in the outcome measure) prior to the introduction of the intervention can be taken into account. However, the validity of results generated from interrupted time series analysis depends on a few assumptions. The first

assumption is exchangeability, in which it is assumed that the characteristics of individuals are similar in the study groups measured prior to the intervention and after the intervention.[459] The other assumption is that the secular trend in the outcome measure will remain unchanged in the absence of an intervention,[459] so any change identified in ITS analysis can be attributed to the intervention. However, it can be difficult to disentangle the effect of an intervention when multiple interventions occur concurrently.

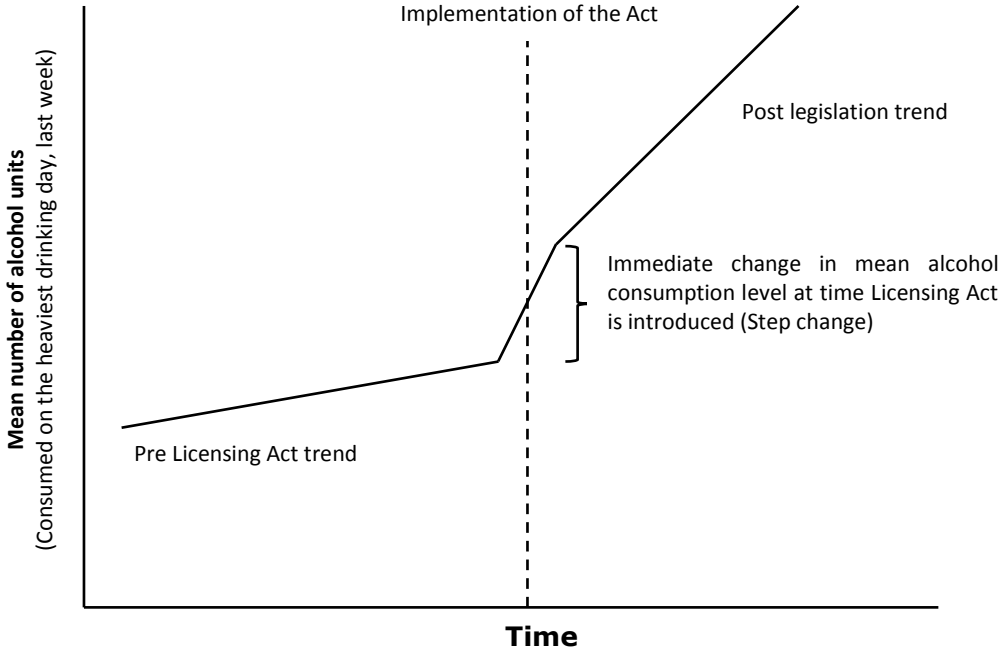
Interrupted time series analysis has two main approaches; the first is based on regression analysis (Segmented Regression), whereas the second is based on a class of mathematical models called Autoregressive Integrated Moving Averages (ARIMA) models.[460, 461] ARIMA models have the ability to model complex autocorrelation, seasonal effects and can be used to model non-linear trends in health policy evaluation and this has been discussed in detail elsewhere.[462, 463] However, there are several difficulties and limitations in using ARIMA models for health policy evaluation.[464] When compared with linear regression methods, ARIMA is a different way of modelling the time series data as it attempts to model the data-generation process which gave rise to the time series.[460] Conversely, regression analysis involves fitting a pre specified model, and it has the ability to identify any immediate changes in the level of the outcome measure, or changes in the trend even for relatively shorter time series.[116] Therefore, segmented regression results can be used to identify not only the magnitude of an effect due to an intervention but also the timing of any changes in the outcome measure since the intervention. ARIMA models also require a large number of data points when compared with regression analysis. Hence, out of these two methods, segmented regression analysis was selected for alcohol control policy evaluation studies presented in this thesis. The strengths and limitations of segmented regression analysis are discussed in detail below.

5.2.5 Segmented Regression analysis

Segmented regression is a powerful method for estimating the magnitude of the effect of an intervention. Segmented regression analysis can identify whether an intervention had an immediate or delayed impact on the outcome measure.[116] When there are enough data to monitor long term trends, segmented regression can identify whether the effect of the intervention on outcome measure was a transient or long-term effect.[116] This analysis requires data to be measured at regular points in time, and there should be a minimum of three data points before and after the intervention.[166] However, when monthly or quarterly data are available to identify seasonal variations, it is recommended to have at least 12 data points before and after an intervention to allow identification of any seasonal variations.[166]

Two parameters are defined in a segmented regression model: the trend and the level of the outcome measure. The trend is the slope of each segment, in other words, the rate of change in the outcome measure. The level is the change in y-intercept when the intervention occurs, as shown in Figure 5-4. This is also called a step change in the segmented regression. An immediate effect of the intervention can be identified from a step change in the level of the outcome measure, whereas a change in the trend between segments represents a gradual change in the outcome measure. The following figure shows an illustration of this model considering a hypothetical scenario for the effect of the Licensing Act 2003 on adult alcohol consumption.

Figure 5-4: Illustration of the segmented regression model



5.2.5.1 Statistical modelling

Visual inspection of the pre-intervention and post-intervention pattern of an outcome measure is the first step when analysing time series data. Even though it is possible to detect more obvious changes in the outcome measure at this step, it is difficult to determine the exact magnitude of any change and to identify whether the change in the outcome measure is due to chance alone. Through visual inspection it is also difficult to identify whether there were other factors contributing towards the identified change in the outcome measure such as correlation between successive observations, which will be discussed in detail in the next section. Therefore, segmented regression analysis is used to answer these questions by fitting a least squares regression line to pre and post intervention segments while assuming a linear relationship between time and outcome measure. For example, the linear segmented regression model given below can be used

to analyse the impact of the Licensing Act 2003 on adult alcohol consumption on the heaviest drinking day.

$$Y_t = \beta_0 + \beta_1 * \text{time}_t + \beta_2 * \text{Licensing Act}_t + \beta_3 * \text{time after Licensing Act}_t + e_t$$

Where;

Y_t = Mean number of alcohol units per drinker in month t

β_0 = Baseline level of the mean number of alcohol units on the heaviest drinking day

β_1 = Trend of alcohol consumption prior to the Act

β_2 = Change in the level of alcohol consumption immediately after the Licensing Act

β_3 = Change in the trend of alcohol consumption after the Act

e_t = Random variability not explained by the model

time_t = Time in months

Licensing Act_t = An indicator for time t showing whether it is before (Act=0) or after (Act=1) the Licensing Act 2003

time after Licensing Act_t = A continuous variable counting the number of months after the Licensing Act 2003 at time t

In relation to the above model, ($\beta_1 + \beta_3$) provides the post intervention slope, since β_3 represents the absolute change in the trend of the outcome measure after comparing it with the baseline trend, which is β_1. An example of the layout of a dataset, which can be used for the data analysis of this segmented regression model is given in Appendix 8.7.

After modelling the variables, as shown above, the most parsimonious segmented regression model can be obtained by a backward elimination process.[116, 459] As the initial step, all variables related to the

level and trend changes are included in the model and then non-significant terms are removed during the backward elimination process. However, the most parsimonious model which includes all statistically significant predictors may not always correctly estimate the effect of an intervention. This can happen due to the correlation of adjacent data points and seasonal effects within time series data.

5.2.5.2 Autocorrelation and seasonal effects

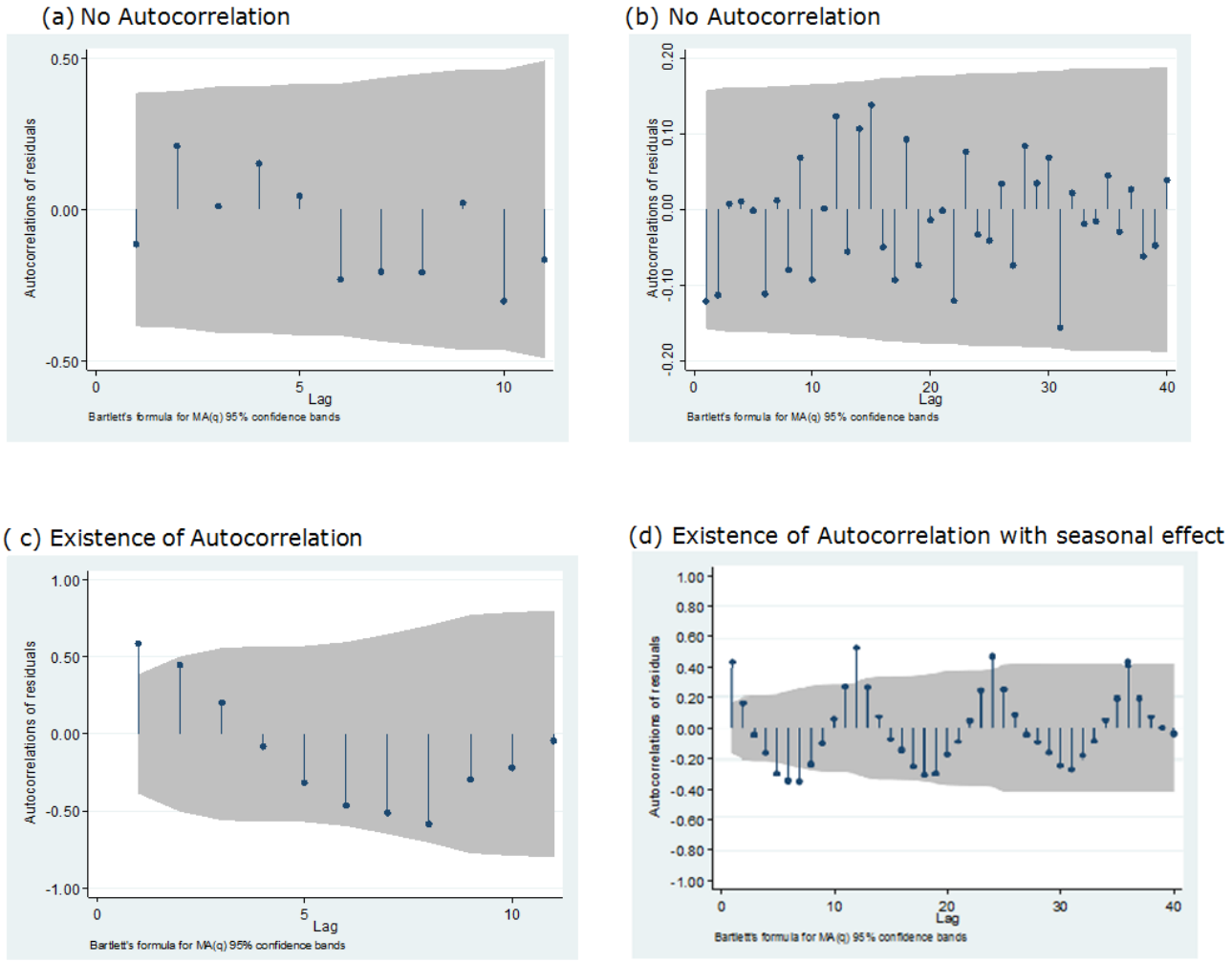
The special feature of time series data is the dependencies that typically exist between successive observations; in other words, the outcome variable is interrelated with itself over successive time intervals. This is known as serial correlation or autocorrelation. Average correlation between adjacent data points (with one lag) is called first-order autocorrelation and average correlation between data points with two lags is called second-order autocorrelation and so forth. Autocorrelation can range from -1 indicating a perfect negative correlation to +1 indicating a perfect positive correlation between data points. Negative and positive autocorrelation can be distinguished by observing the direction of an outcome measures' deviation from one-time point to the next.[465] If the autocorrelation is negative then the adjacent outcome values are likely to be dissimilar. In other words, it will be a sequence of high, low, and high outcome measures obtained over time rather than having similar outcome measures. When positive autocorrelation exists in the dataset, successive observations will be similar to each other. For example, a high outcome value will be followed by another high outcome value. Negative autocorrelation can underestimate standard errors whereas positive autocorrelation can overestimate the standard errors.[465] Therefore, this can lead to type one error, which means rejecting

a true null hypothesis, or type two error, which means accepting a false null hypothesis.

Autocorrelation across a time series can be presented graphically using an autocorrelation function (ACF). An ACF plots the residuals from the segmented regression analysis, which is the difference between observed values of the time series and the values predicted by the model. Randomly scattered residuals show that there is no autocorrelation as shown in Figure 5-5 (a) and (b). The shaded area of ACF functions represents the 95% confidence intervals for autocorrelation between data points at each lag.[461] The points outside this shaded area in the ACF function represent significant autocorrelation in the dataset which is greater than would be expected due to chance alone. For example, Figure 5-5 (c) shows significant autocorrelation at lags 1 and 2, whereas the Figure 5-5 (d) shows significant autocorrelation at lags 1, 12 and 24 months suggesting the presence of seasonality.

Autocorrelation and seasonality in time series data violate one of the linear regression assumptions, which is the independence between data points. Furthermore, when autocorrelation or seasonality is present in a data set it is difficult to attribute any observed change in the pattern of the data to an intervention as it could also be due the normal behaviour of the time series. Therefore, in segmented regression analysis correcting for autocorrelation is important to identify the effect of an intervention.

Figure 5-5: Example of autocorrelation functions with and without autocorrelation



5.2.5.3 Correcting for Autocorrelation and Seasonal Effect

Autocorrelation at lag one can be corrected using a modified form of segmented regression, which is the Prais-Winsten regression. However, Prais-Winsten regression is not able to model autocorrelation at lags higher than one, or seasonal autocorrelation patterns. To model higher order autocorrelation, non-linear seasonal effects, and non-linear changes in the outcome measure ARIMA models or more advanced regression models such as Generalised Additive models (GAMs) and Generalised Additive Mixed models (GAMM) can be used.[466] These models use smooth functions to incorporate any autocorrelation and seasonality present in the dataset.[466]

5.2.5.4 Strengths and Limitations of Segmented Regression

Segmented regression analysis has the potential to control for existing secular trends prior to the introduction of an intervention. It allows researchers to identify whether there were any immediate or delayed impacts on the outcome measures due to an intervention, which is important when evaluating the effect of an intervention. When there are enough data with an adequate sample size to allow stratified analyses, segmented regression can be used to evaluate effects of the intervention on different subgroups such as male, female, and different age groups. The graphical representation of results is another advantage of segmented regression analysis as it can be used to visually inspect any changes in the outcome measure during pre-intervention and post-intervention periods.

However, similar to other policy evaluation methods, segmented regression cannot disentangle the effect of a specific policy or an intervention when several policies or interventions occur concurrently. Furthermore, segmented regression analysis cannot be used to draw inferences about

individual-level outcomes and to control for individual-level characteristics when population level data were used for the analysis. Linear segmented regression discussed here involves fitting linear regression models; therefore this method can only be used when the trends prior to the intervention and after the intervention are linear. However, non-linear seasonal effects, and non-linear changes in the outcome measure can be modelled using more advanced regression analysis which include Generalised Additive models (GAMs) and Generalised Additive Mixed models (GAMM).[466]

5.2.6 Data analysis in the current study

Quarterly HSE data on heaviest drinking day alcohol consumption were used in this study, due to their ability to identify any seasonal variations and any effects from other concurrently occurring interventions on adults' alcohol consumption. As mentioned in detail in Chapter 2, HSE randomly allocate its Primary Sampling Units to the 12 months so that each quarter provides a nationally representative sample.

Descriptive data analysis included identifying the proportion of abstainers for each year using abstinence data and identifying changes in the mean number of alcohol units consumed by adults and adult drinkers over time. As discussed in the section 5.2.5, segmented regression analysis provides a suitable method for assessing changes in adults' alcohol consumption levels in England since the implementation of the Licensing Act 2003. Therefore, during the next phase of the data analysis segmented regression analysis was used to identify how alcohol consumption on the heaviest drinking day may have changed since the implementation of the Act.

Segmented regression models were built to identify changes in the total unit (all alcoholic beverages together) consumption on the heaviest drinking day among all adults and adults who consumed alcohol in the week prior to the interview. Further analysis on the heaviest drinking day consumption was carried out by stratifying the data, according to gender, age and socio-economic status and beverage type. Beverage specific analysis were not further divided into subgroups due to limited sample size of quarterly data. Segmented regression models for total consumption and beverage specific consumption were generated using revised unit assumptions (Primary analysis) and previous unit assumptions (Sensitivity analysis) to identify if there were any notable effects on the outcome measure due to changes in alcohol unit assumptions.

The Likelihood ratio test was used to build the final parsimonious segmented regression model. Out of the variables included in the model (trend of alcohol consumption prior to act, change in the level of alcohol consumption immediately after the Act, and change in the trend of alcohol consumption after Act), the variables that were not significant at the 5% significance level were dropped from the model. Each segmented regression model was checked to see whether there was any autocorrelation or seasonal variations. An example of the data layout used during the segmented regression analysis is given in Appendix 8.7 and Stata 13 was used for all analyses.

5.3 Results

5.3.1 Descriptive analysis

Between 2001 and 2013 there was a gradual increase, from 33% to 41%, in the number of people who did not drink in the week prior to the interview, as shown in Figure 5-6. Missing data or in other words the proportion of people who did not answer or mentioned "don't know" in relation to their alcohol consumption status on the heaviest drinking day was less than 1% in each year.

Figure 5-6: Percentage of abstainers on the heaviest drinking day of the last week for each year from 2001-2013

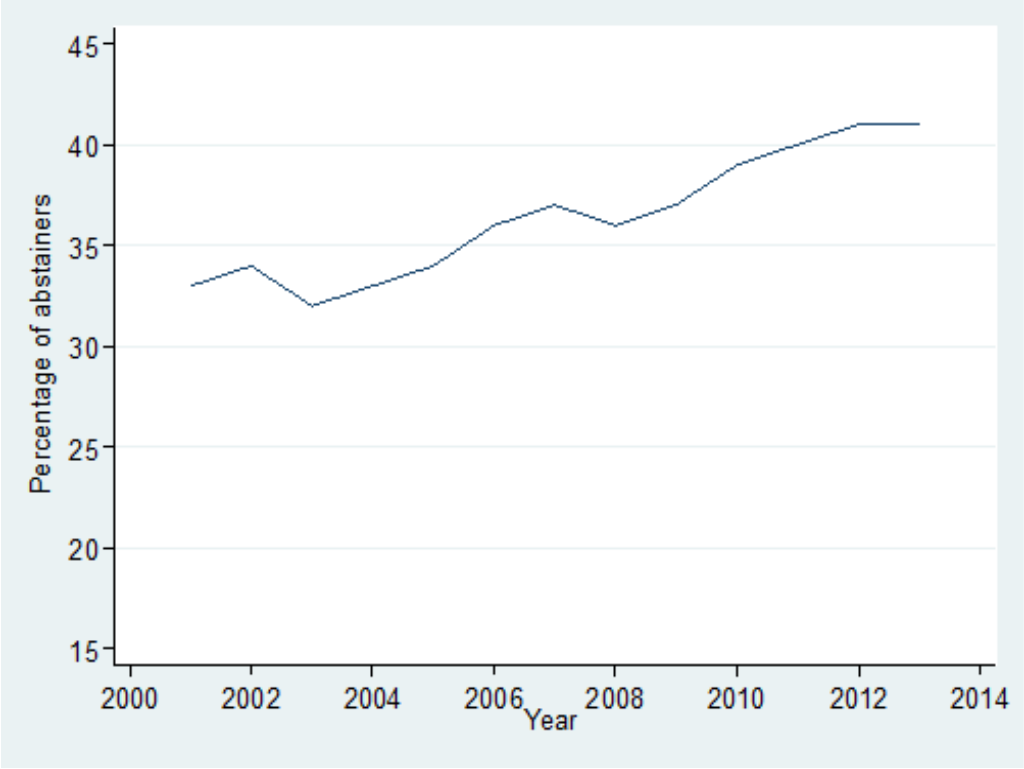
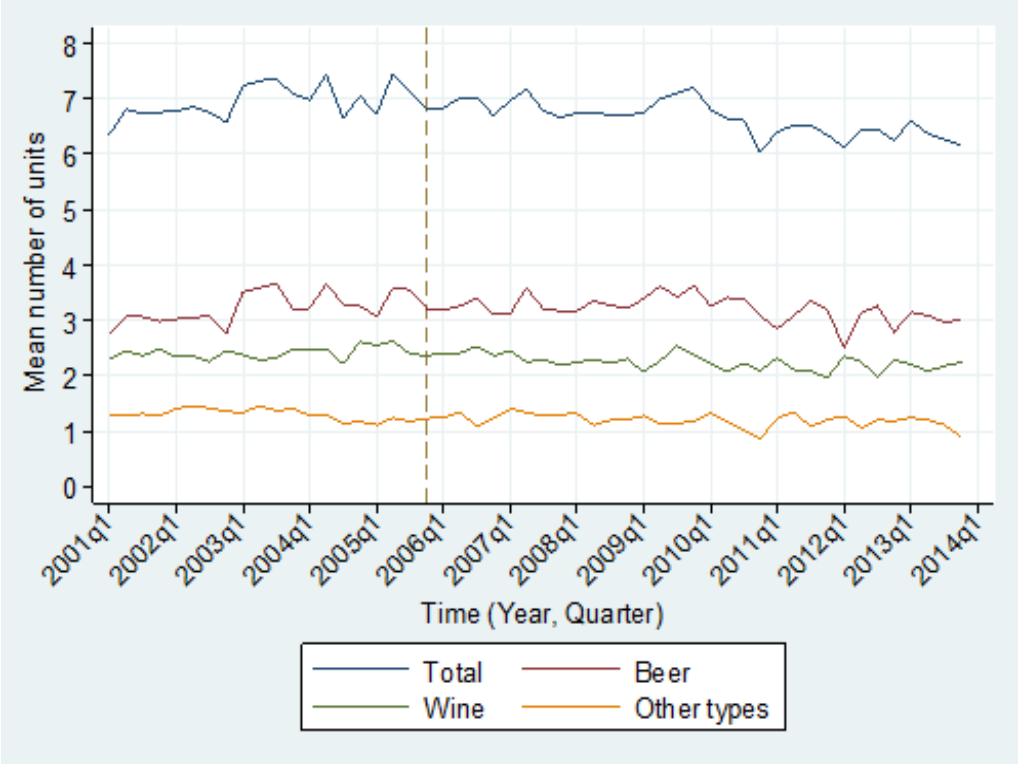


Figure 5-7 used the revised unit assumption (primary analysis) to show the changes over time in the mean number of alcohol units consumed on the heaviest drinking day by adult drinkers for each month. The total units represent the total number of beer units, wine units and any other alcohol

units consumed by any drinker on the heaviest drinking day of the week prior to the interview. The total alcohol units consumed on the heaviest drinking day decreased slightly between 2001 and 2013 but remained above 6 units of alcohol until 2010. Beverage specific alcohol consumption levels show that beer consumption made the largest contribution towards the total units of alcohol consumed on the heaviest drinking day, around 3 units of alcohol. Wine consumption had the second highest contribution towards the total units consumed on the heaviest drinking day whereas spirits, sherry and alcopops showed lower levels of consumption.

Figure 5-7: Alcohol consumption on the heaviest drinking day among adults who drank alcohol in the last week



Note: Other types include spirits, sherry and alcopops

5.3.2 Segmented Regression analysis

All of the parsimonious, segmented regression models showed that there were no seasonal effects or remaining autocorrelation (Appendix 8.8 provides autocorrelation functions of segmented regression models presented in the results section below). Therefore, there was no need to carry out further analysis to adjust for autocorrelation or seasonal effects using Prais-Winsten regression, GAM or GAMM models.

5.3.3 Total alcohol consumption on the heaviest drinking day

5.3.3.1 Among all adults and adults who drank alcohol last week

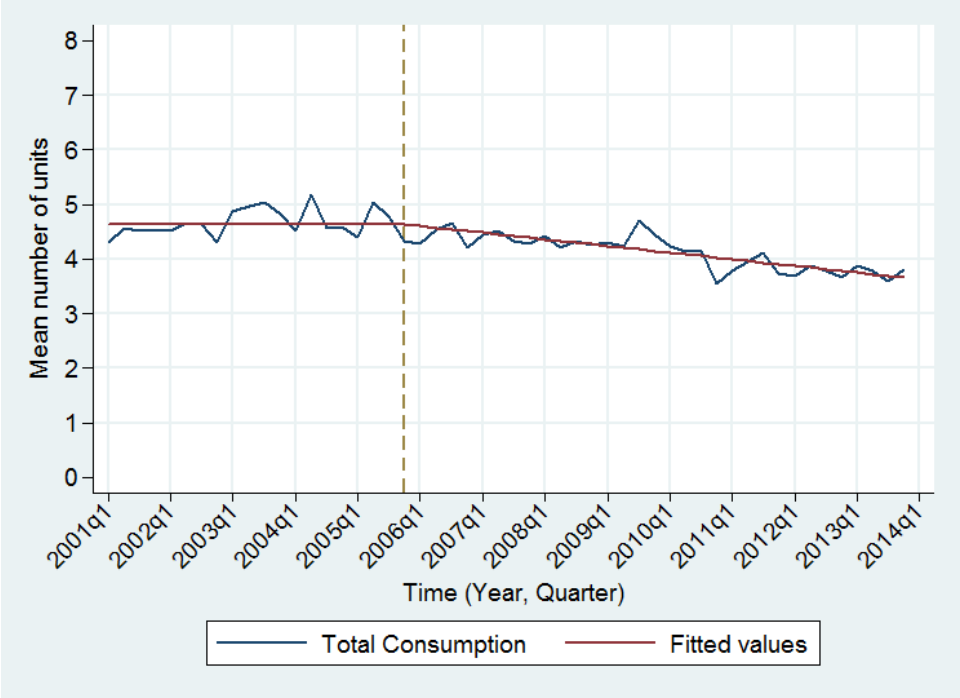
Figure 5-8 shows how the total alcohol consumption (all alcoholic beverages together) on the heaviest drinking day of the last week changed over time among all adults and adults who drank alcohol in the last week. The primary analysis based on the revised unit assumptions showed that adults' heaviest drinking day consumption remained constant at around 4.6 units prior to the Act as shown in Figure 5-8 (a). After the introduction of the Act, there was no immediate change in consumption, but there was a statistically significant downward trend in heaviest drinking day consumption, and it decreased by 0.03 units of alcohol per quarter (95% CI -0.036 to -0.024, $p<0.001$) as given in Table 5-4. As shown in Figure 5-8 consumption among drinkers in 2001 was 6.7 units, and this increased by 0.018 units per quarter prior to the introduction of the Act (95% CI 0.004 to 0.032, $p=0.012$). After the introduction of the Act, there was no immediate change but there was a significant downward trend in the heaviest drinking day alcohol consumption level among adults who drank alcohol in the last week as given in Table 5-4.

According to the sensitivity analysis based on previous unit assumptions, adults' heaviest drinking day consumption prior to the Act remained constant at around 3.6 units. After the Act, it decreased by 0.023 units of alcohol per quarter (95% CI -0.028 to -0.018, $p<0.001$) as shown in Figure 5-8 (c). Among adults who drank alcohol in the last week, heaviest drinking day consumption was increasing by 0.014 units per quarter (95% CI 0.002 to 0.026, $p=0.024$), starting from 5.3 units in 2001. After the Act, there was no immediate change but there was a statistically significant downward trend as shown in Figure 5-8 (d).

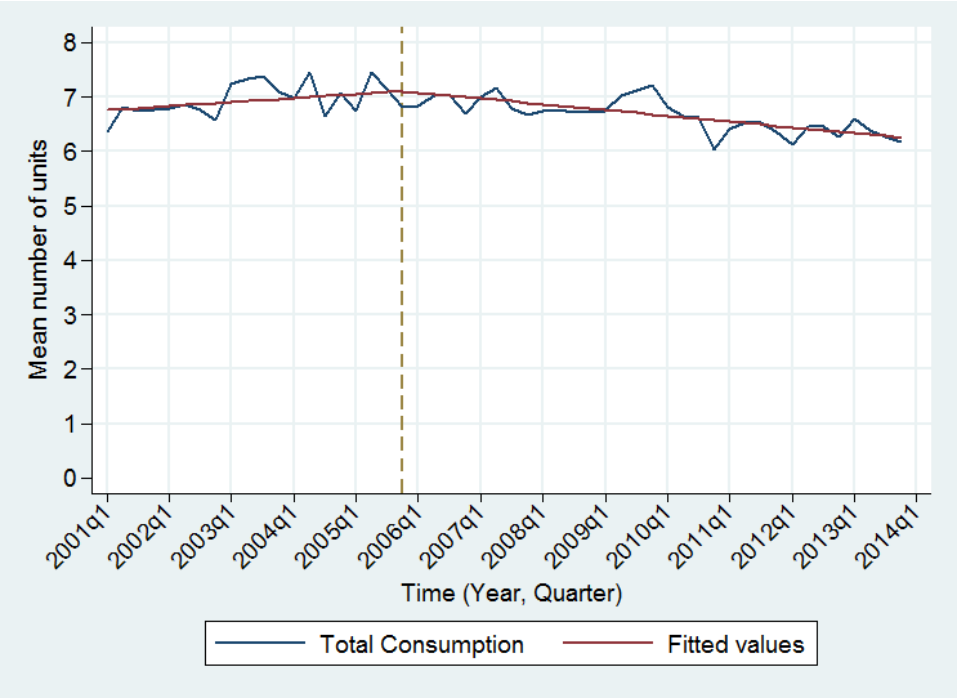
Figure 5-8: **Total alcohol consumption** (all alcoholic beverages together) on the heaviest drinking day of the last week, before and after the implementation of Licensing Act 2003

Primary Analysis (Revised unit assumptions)

(a) Among all adults



(b) Among adult drinkers

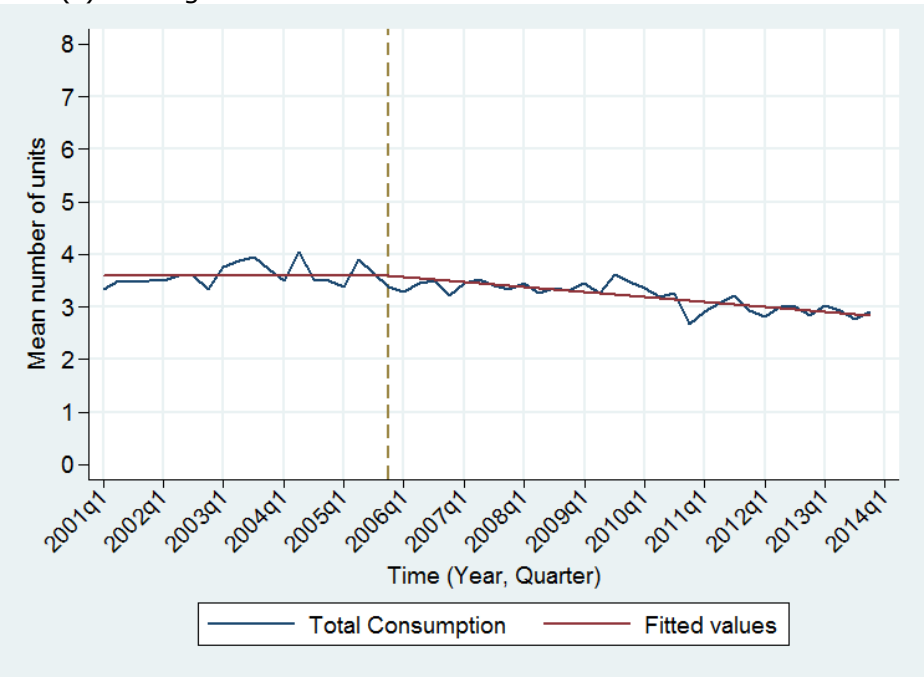


Note: Dashed line shows the Licensing Act implementation

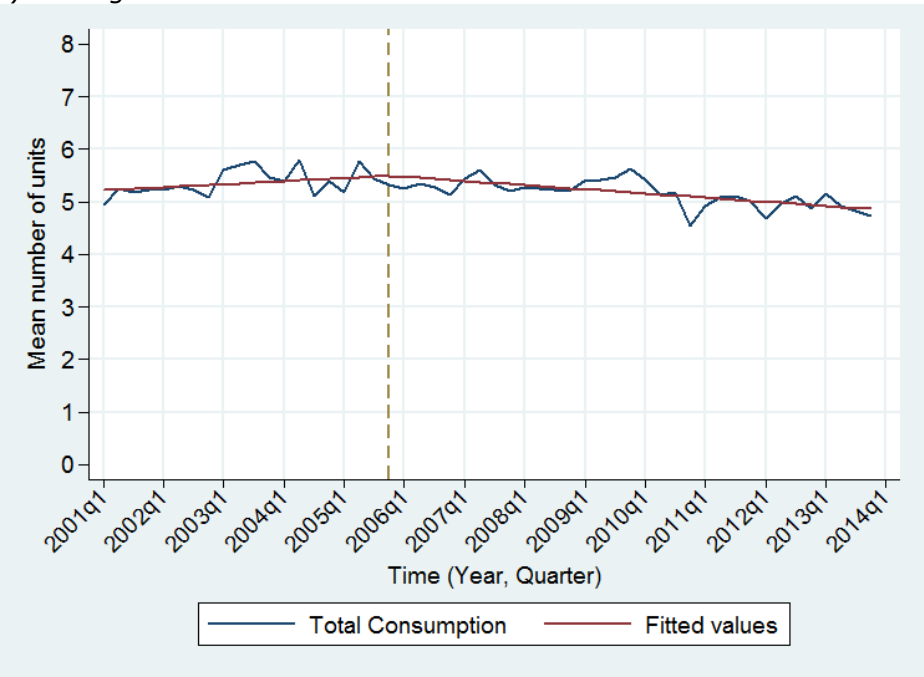
Figure 5-8 Continued: **Total alcohol consumption** (all alcoholic beverages together) on the heaviest drinking day of the last week, before and after the implementation of Licensing Act 2003

Sensitivity Analysis (Previous unit assumptions)

(c) Among all adults



(d) Among adult drinkers



Note: Dashed line shows the Licensing Act implementation

Table 5-4: Results of segmented regression analysis of the change in alcohol consumption (heaviest drinking day) among all adults and among drinkers before and after the implementation of Licensing Act 2003

Unit Assumption	Model for Total alcohol consumption	β_{1}- Baseline trend	95% CI	p-value	β_{2}- Step level change	95% CI	p-value	β_{3}- Change in trend	95% CI	p-value
Primary Analysis	(a) Among all adults	-	-	-	-	-	-	-0.030	-0.036 to - 0.024	<0.001
	(b) Among adult drinkers	0.018	0.004 to 0.032	0.012	-	-	-	-0.045	-0.064 to -0.025	<0.001
Sensitivity Analysis	(c) Among all adults	-	-	-	-	-	-	-0.023	-0.028 to - 0.018	<0.001
	(d) Among adult drinkers	0.014	0.002 to 0.026	0.024	-	-	-	-0.034	-0.051 to -0.016	<0.001

Note: only parameters significant in the parsimonious model included

β_{1}-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Licensing Act

β_{2}-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after implementation of the Act

β_{3}-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.3.3.2 Among male and female drinkers

Figure 5-9 shows the changes in total alcohol consumption (all beverages together) on the heaviest drinking day of the last week, among male and female drinkers. Prior to the Act, the heaviest drinking day consumption among male drinkers remained constant at around 8.3 units according to the revised unit assumptions (Figure 5-9 (a)). After the implementation of the Act, there was no step change in consumption among male drinkers, but there was a statistically significant downward trend. As shown in Table 5-5, heaviest drinking day consumption decreased by 0.027 units of alcohol per quarter (95% CI -0.035 to -0.018, $p<0.001$) according to the primary analysis. However, female drinkers' alcohol consumption on the heaviest drinking day remained constant at 5.5 units prior to the Act as shown in Figure 5-9 (b). There was no step change in heaviest drinking day consumption among female drinkers, but it decreased by 0.018 units of alcohol per quarter (95% CI -0.023 to -0.013, $p<0.001$) after the implementation of the Act (Table 5-5).

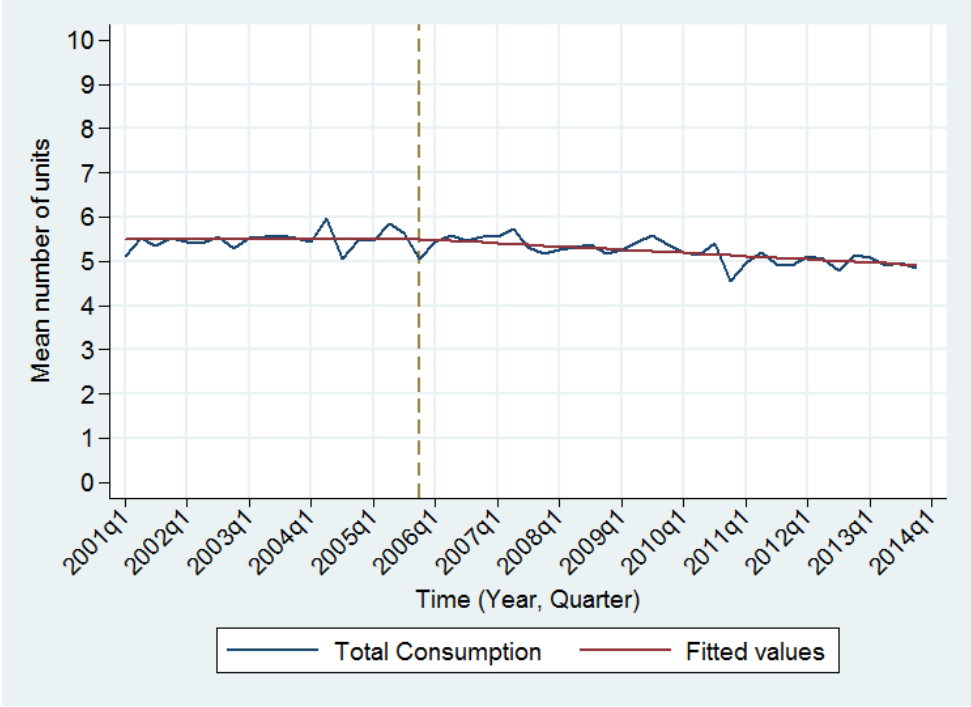
The sensitivity analysis showed that the heaviest drinking day consumption among male drinkers remained constant at around 6.9 units prior to the Act as shown in Figure 5-9 (c). After the implementation of the Act, there was no step change in consumption, but there was a statistically significant downward trend. As shown in Table 5-5, heaviest drinking day consumption decreased by 0.023 units of alcohol per quarter (95% CI -0.031 to -0.015, $p<0.001$). Among females, heaviest drinking consumption remained constant at around 3.7 units as shown in Figure 5-9 (d). There was no step change, but there was a statistically significant downward trend after the Act and it decreased by 0.011 units of alcohol per quarter (95% CI -0.015 to -0.007, $p<0.001$).

Figure 5-9: **Total alcohol consumption** (all alcoholic beverages together) on the heaviest drinking day of the last week among men and women drinkers, before and after the implementation of Licensing Act 2003

Primary Analysis (Revised unit assumptions)

(a) Among Male

(b) Among Female

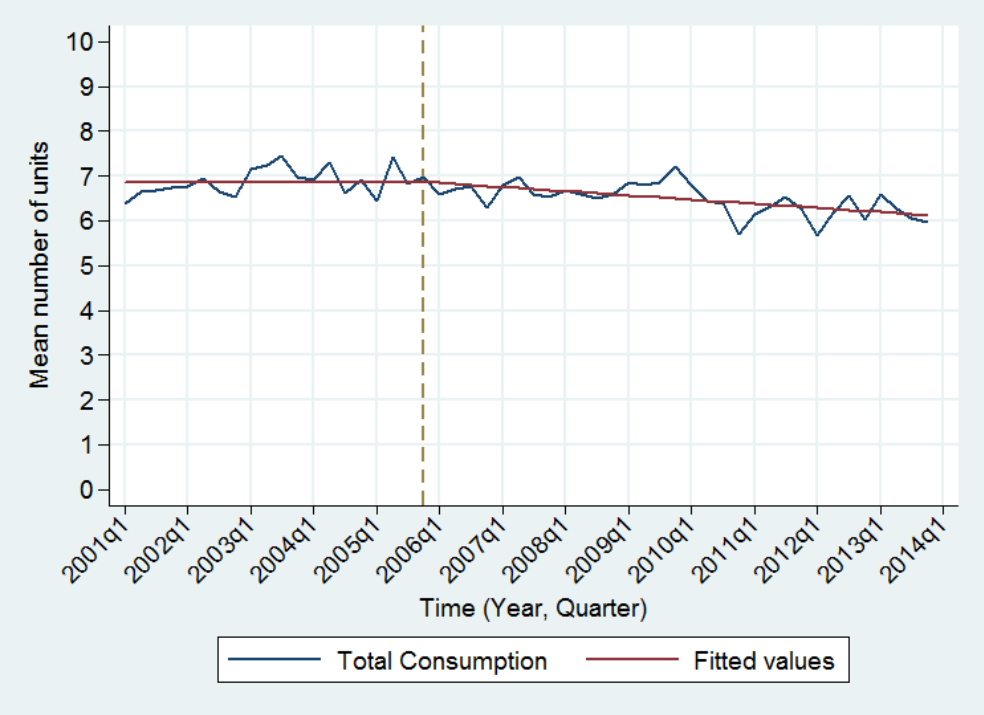


Note: Dashed line shows the Licensing Act implementation

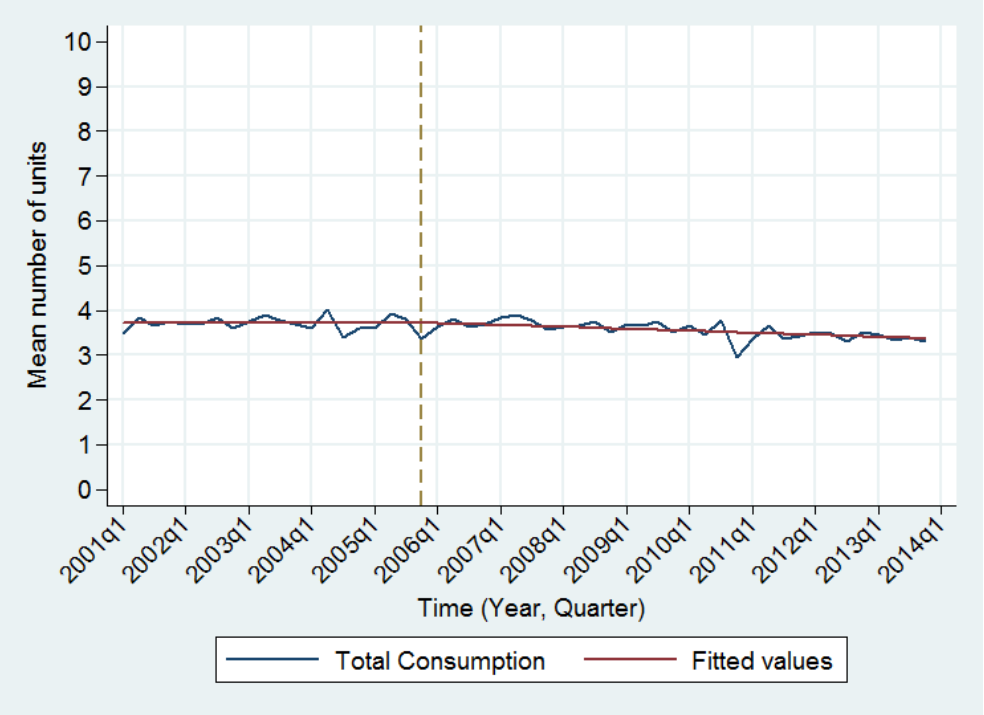
Figure 5-9 Continued: **Total alcohol consumption** (all alcoholic beverages together) on the heaviest drinking day of the last week among men and women drinkers, before and after the implementation of Licensing Act 2003

Sensitivity Analysis (Previous unit assumptions)

(c) Among male



(d) Among female



Note: Dashed line shows the Licensing Act implementation

Table 5-5: Results of segmented regression analysis of the change in alcohol consumption (heaviest drinking day) among all adults and among drinkers before and after the implementation of Licensing Act 2003

Unit Assumption	Model for Total alcohol consumption	β_1- Baseline trend	95% CI	p-value	β_2- Step level change	95% CI	p-value	β_3- Change in trend	95% CI	p-value
Primary Analysis	(a) Among male drinkers	-	-	-	-	-	-	-0.027	-0.035 to -0.018	<0.001
	(b) Among female drinkers	-	-	-	-	-	-	-0.018	-0.023 to -0.013	<0.001
Sensitivity Analysis	(c) Among male drinkers	-	-	-	-	-	-	-0.023	-0.031 to -0.015	<0.001
	(d) Among female drinkers	-	-	-	-	-	-	-0.011	-0.015 to -0.007	<0.001

Note: only parameters significant in the parsimonious model included

β_1-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Licensing Act

β_2-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after implementation of the Act

β_3-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.3.3.3 Among different age groups

Figure 5-10 shows the changes in total alcohol consumption (all beverages together) on the heaviest drinking day of the last week according to the age group. Prior to the Act, the heaviest drinking day consumption among aged 16-24 remained constant at around 10.7 units and 9 units according to the revised and previous unit assumptions respectively (Figure 5-10 (a) and Figure 5-10 (e)). Though there was no step change in consumption after the Act, drinkers in this age group showed the highest downward trend when compared with other age groups. This was 0.051 units per quarter (95% CI -0.072 to -0.030, $p<0.001$) and 0.046 units per quarter (95% CI 0.066 to 0.026, $p<0.001$) according to the revised and previous unit assumptions respectively.

Similarly, among aged 25-44 there was no trend in heaviest drinking day consumption prior to the Act and it was constant at around 8 units and 6.2 units according to revised and previous unit assumptions. After the Act there was no change in consumption among drinkers in this age group. However, there was a significant downward trend in consumption and this was 0.03 units per quarter (95% CI -0.038 to -0.020, $p<0.001$) and 0.018 units per quarter (95% CI -0.026 to -0.010, $p<0.001$).

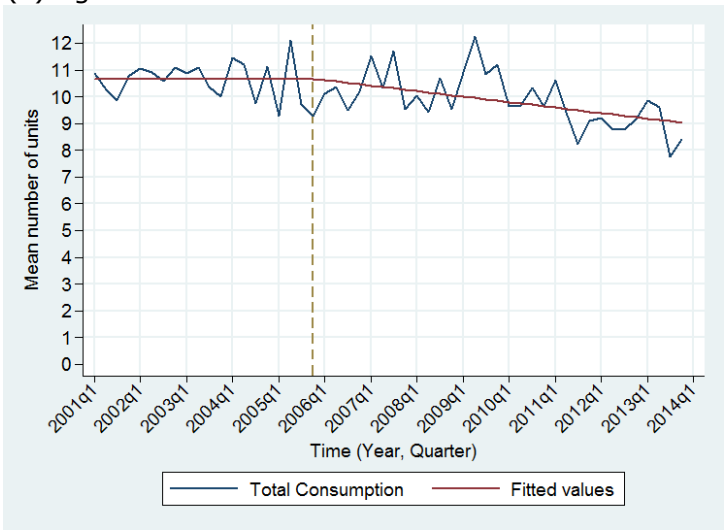
Drinkers in the age group of 45-64 didn't show any change in consumption prior to the Act or after the according to both revised and previous unit assumptions. Heaviest drinking day consumptions among drinkers in this age group was constant at around 6 units and 4.5 units according to revised and previous unit assumptions.

Drinkers in the oldest age group showed a slightly increasing trend of heaviest drinking day consumption prior to the act according to the revised unit assumptions and it was 0.006 units per quarter (95% CI 0.001 to 0.11, $p<0.001$). There was no change in heaviest drinking day consumption among drinkers in this age group after the Act according to both revised and previous unit assumptions (Table 5-6).

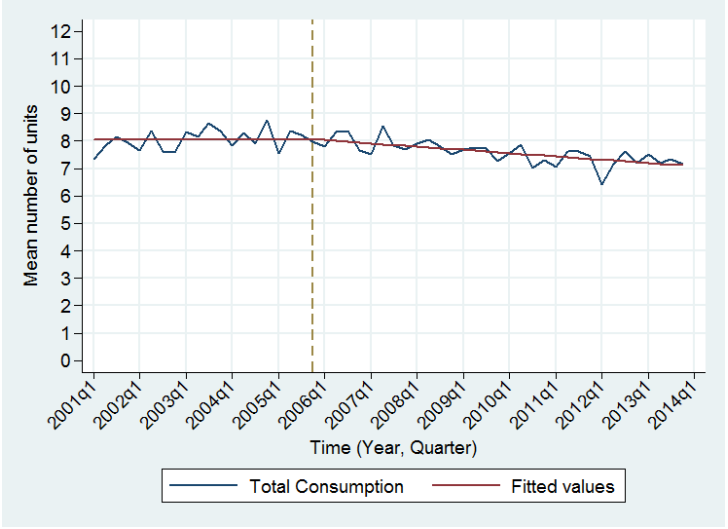
Figure 5-10: **Total alcohol consumption** (all alcoholic beverages togther) on the heaviest drinking day according to different age groups, before and after the Licensing Act 2003

Primary Analysis (Revised unit assumptions)

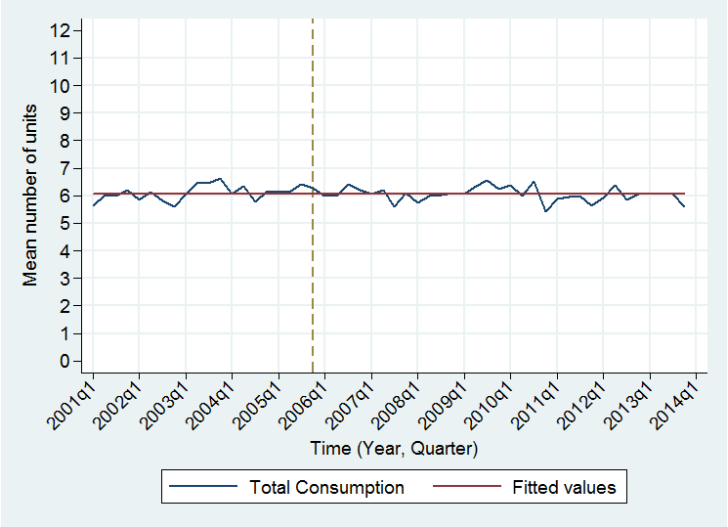
(a) Aged 16- 24



(b) Aged 25-44



(c) Aged 45-64



(d) Aged 65+

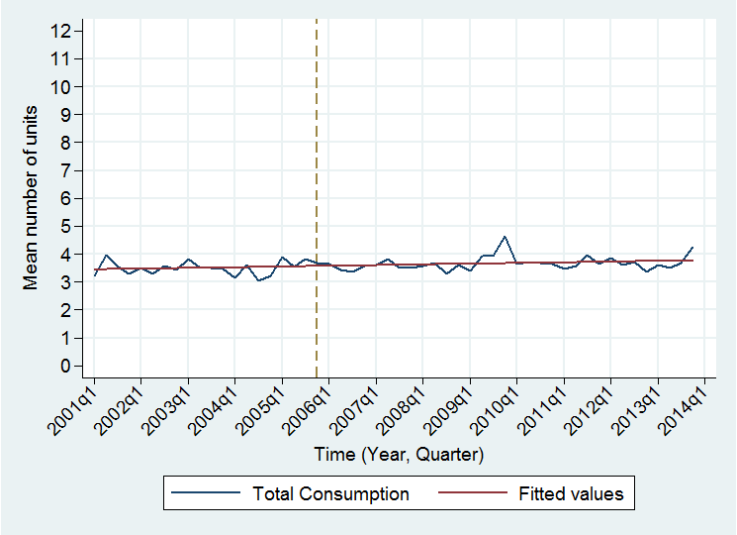
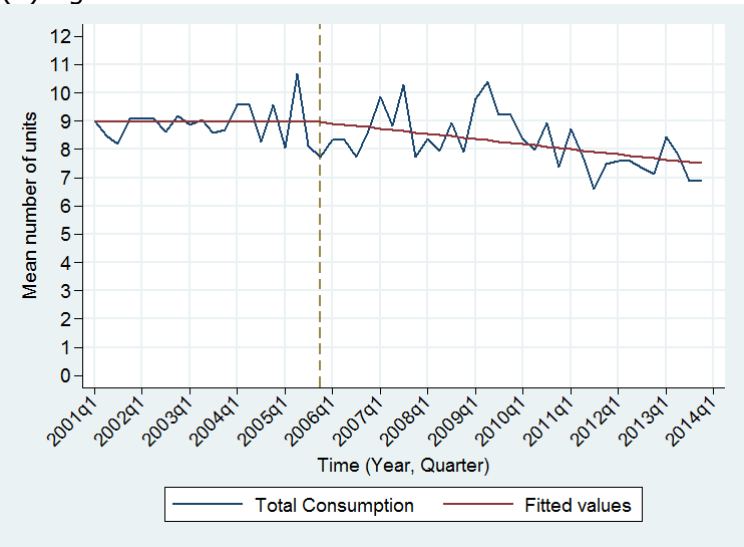


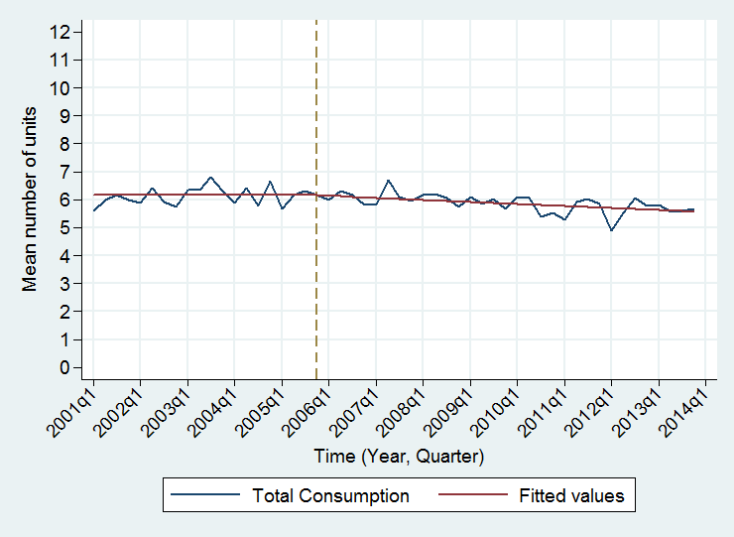
Figure 5-10 Continued : **Total alcohol consumption** (all alcoholic beverages togther) on the heaviest drinking day according to different age groups, before and after the Licensing Act 2003

Sensitivity Analysis (Previous unit assumptions)

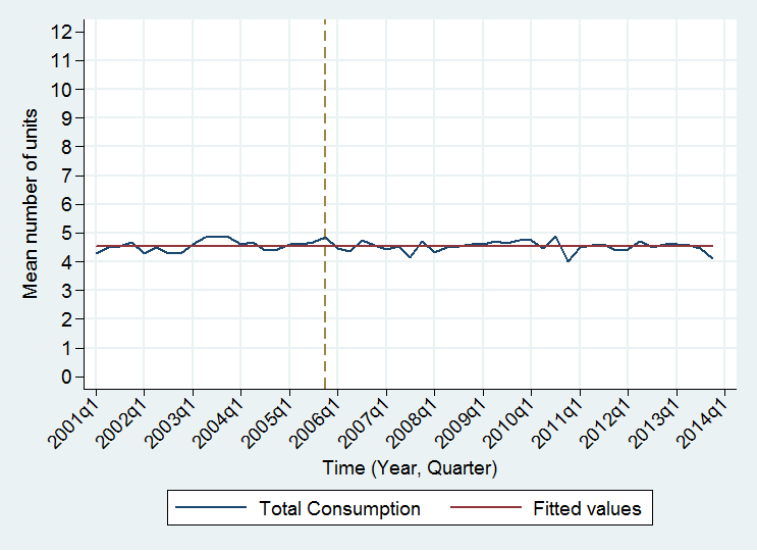
(e) Aged 16- 24



(f) Aged 25-44



(g) Aged 45-64



(h) Aged 65+

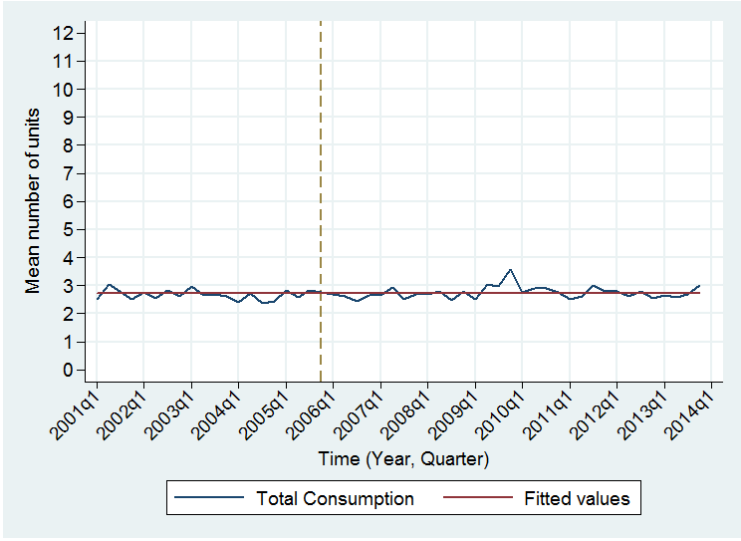


Table 5-6: Change in alcohol consumption (heaviest drinking day) according to different age groups, before and after the implementation of Licensing Act 2003

Unit Assumption	Model for Total alcohol consumption	β_1- Baseline trend	95% CI	p-value	β_2- Step level change	95% CI	p-value	β_3- Change in trend	95% CI	p-value
Primary Analysis	(a) Age 16-24	-	-	-	-	-	-	-0.051	-0.072 to -0.030	<0.001
	(b) Age 25-44	-	-	-	-	-	-	-0.030	-0.038 to -0.020	<0.001
	(a) Age 45-64	-	-	-	-	-	-	-	-	-
	(b) Age 65+	0.006	0.001 to 0.11	0.010	-	-	-	-	-	-
Sensitivity Analysis	(e) Age 16-24	-	-	-	-	-	-	-0.046	-0.066 to -0.026	<0.001
	(f) Age 25-44	-	-	-	-	-	-	-0.018	-0.026 to -0.010	<0.001
	(g) Age 45-64	-	-	-	-	-	-	-	-	-
	(h) Age 65+	-	-	-	-	-	-	-	-	-

Note: only parameters significant in the parsimonious model included
β_1-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Licensing Act
β_2-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after implementation of the Act
β_3-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.3.3.4 Among groups with different socio economic status

Prior to the Act, heaviest drinking day total alcohol consumption among managerial and professional drinkers remained constant at around 6.91 units and 5 units according to revised and previous unit assumptions (Figure 5-11 (a) and (d). After the Act, there was no step change but there was a slight downward trend in the heaviest drinking day consumption among managerial and professional drinkers (Table 5-7). It was 0.035 units per quarter (95% CI -0.043 to -0.027, $p<0.001$) and 0.022 units per quarter (95% CI -0.029 to -0.016, $p<0.001$).

Heaviest drinking day consumption among drinkers in intermediate occupations was stable at around 6.6 units and 5 units per quarter prior to the Act according to revised and previous unit assumptions respectively. After the Act there was no step change but there was a slightly decreasing trend in consumption among drinkers in intermediate occupations as shown in Figure 5-11 (b) and (f) according to both unit assumptions.

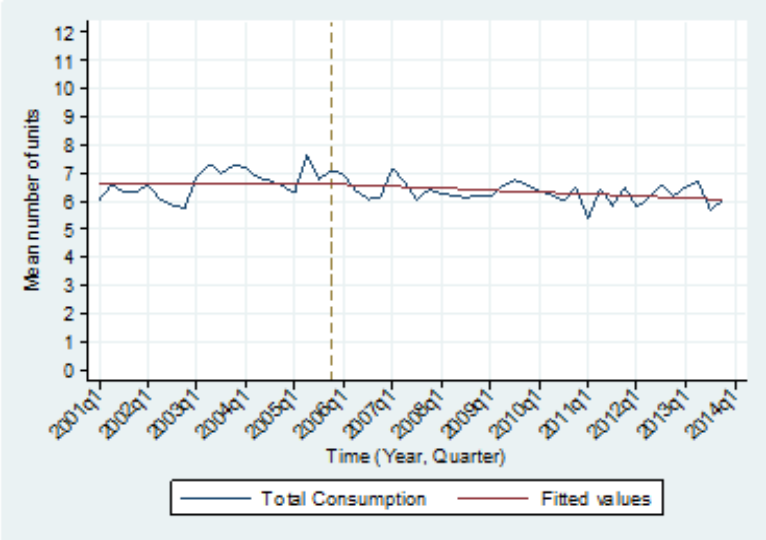
Heaviest drinking day consumption among routine, manual and other drinkers including unemployed was increasing prior to the Act and this was 0.037 units per quarter (95% CI 0.014 to 0.060, $p=0.002$) and 0.032 units per quarter (95% CI 0.011 to 0.054, $p=0.004$) according to revised and previous unit assumptions. After the Act, there was no step change but there was a decreasing trend in heaviest drinking day consumption among drinkers in routine and manual occupations as shown in Figure 5-11 (c) and (f).

Figure 5-11: **Total alcohol consumption** (all alcoholic beverages togther) on the heaviest drinking day according to different socio-econonmic groups, before and after the Licensing Act 2003

Primary Analysis (Revised unit assumptions)

(a) Managerial and professional occupations

(b) Intermediate occupations



(c) Routine, manual, other occupations and unemployed

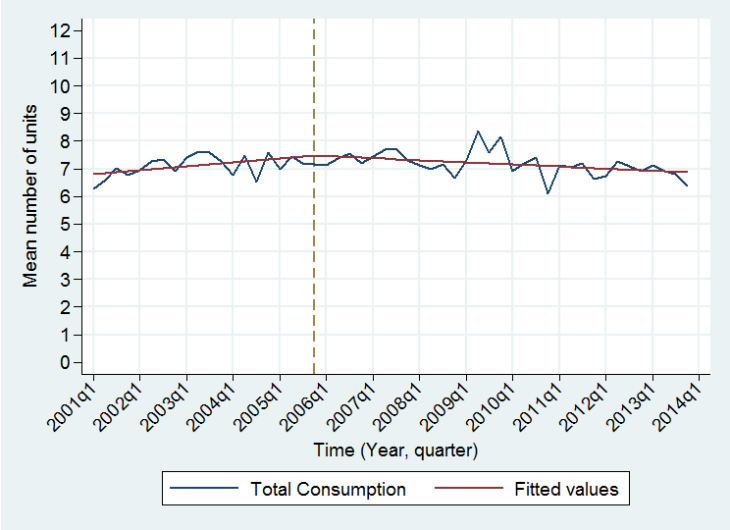
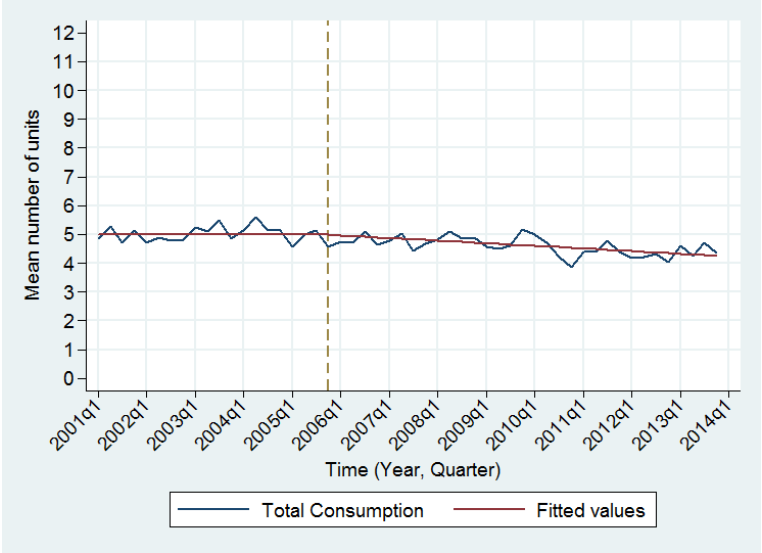


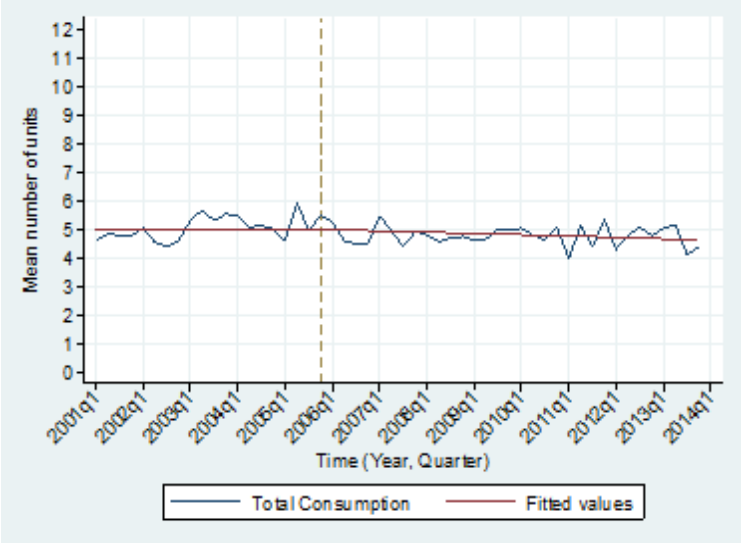
Figure 5-11: **Total alcohol consumption** (all alcoholic beverages togther) on the heaviest drinking day according to different socio-econonmic groups, before and after the Licensing Act 2003

Sensitivity Analysis (Previous unit assumptions)

(d) Managerial and Professional occupations



(e) Intermediate occupations



(f) Routine, manual, other occupations and unemployed

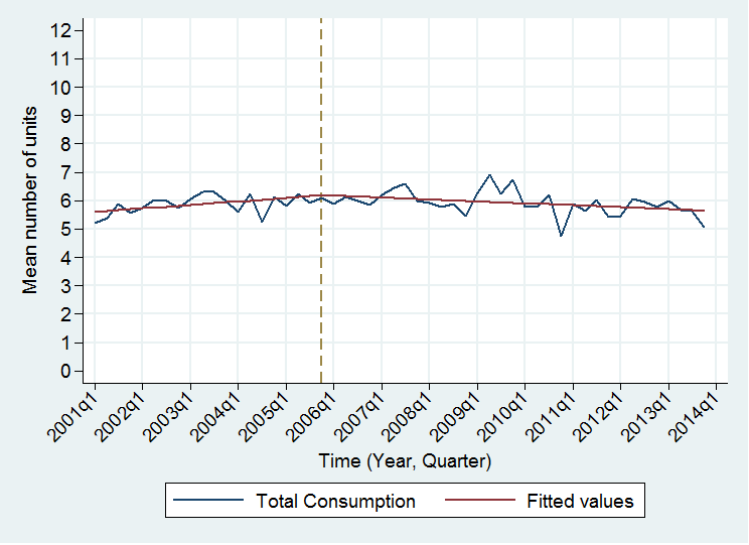


Table 5-7: Change in alcohol consumption (heaviest drinking day) according to different age groups, before and after the implementation of Licensing Act 2003

Unit Assumption	Model for Total alcohol consumption	β_1- Baseline trend	95% CI	p-value	β_2- Step level change	95% CI	p-value	β_3- Change in trend	95% CI	p-value
Primary Analysis	(a) Managerial and professional	-	-	-	-	-	-	-0.035	-0.043 to 00.027	<0.001
	(b) Intermediate	-	-	-	-	-	-	-0.017	-0.028 to -0.006	0.003
	(a) Routine manual and other	0.037	0.014 to 0.060	0.002	-	-	-	-0.056	-0.088 to -0.024	0.001
Sensitivity Analysis	(e) Managerial and professional	-	-	-	-	-	-	-0.022	-0.029 to -0.016	<0.001
	(f) Intermediate	-	-	-	-	-	-	-0.010	-0.020 to -0.001	0.030
	(g) Routine and manual	0.032	0.011 to 0.054	0.004	-	-	-	-0.048	-0.078 to -0.018	0.002

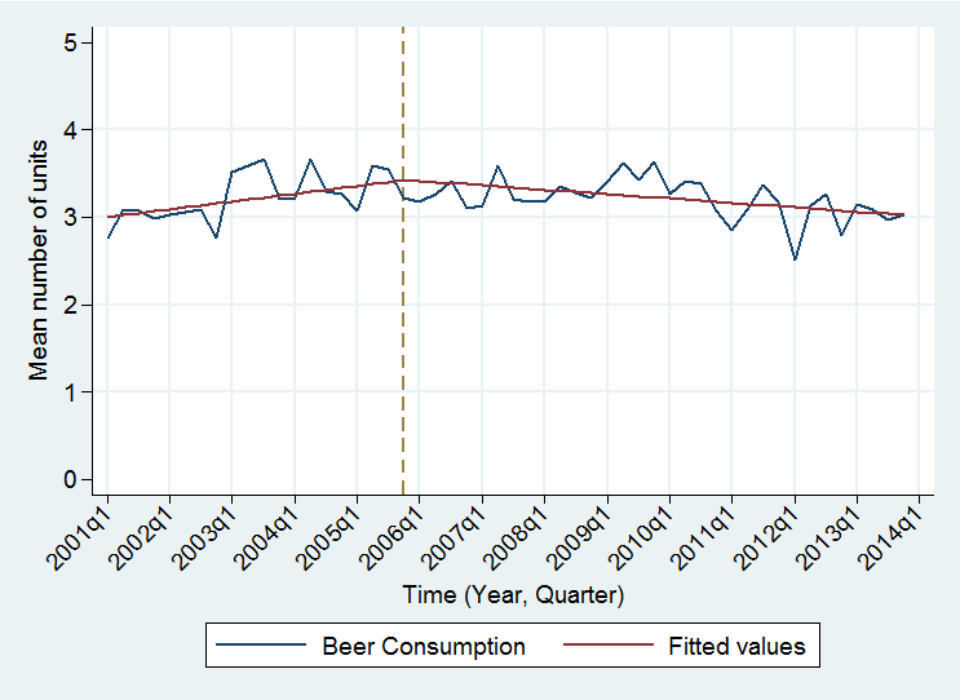
Note: only parameters significant in the parsimonious model included
β_1-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Licensing Act
β_2-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after implementation of the Act
β_3-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.3.4 Beer consumption on the heaviest drinking day among adults who drank alcohol in the last week

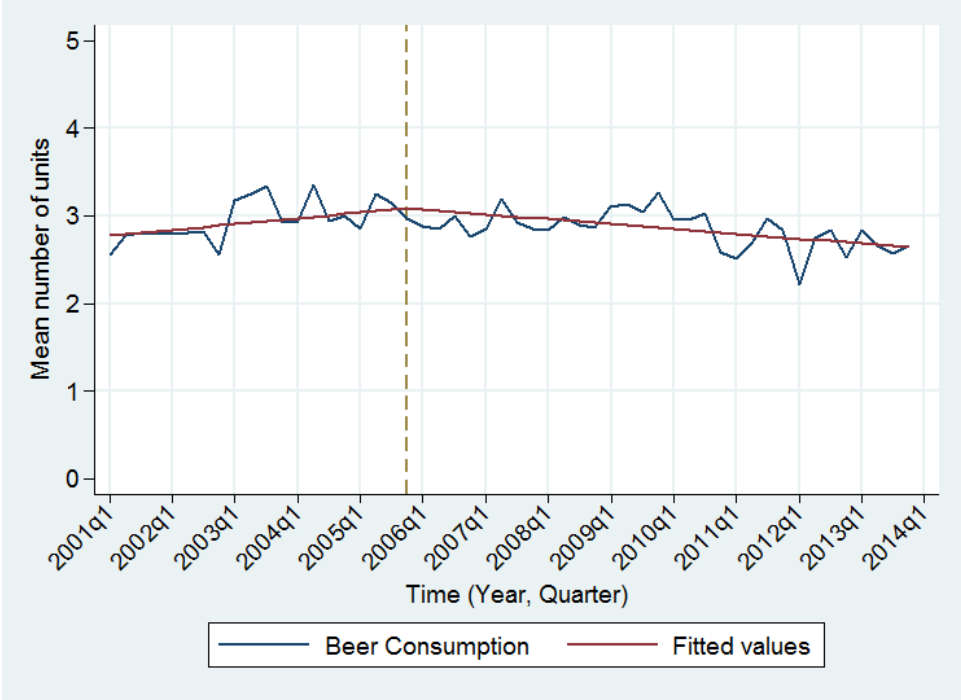
As shown in Figure 5-12, prior to the implementation of the Licensing Act beer consumption on the heaviest drinking day among adult drinkers increased over time according to both primary and sensitivity analysis. According to the primary analysis, heaviest drinking day beer consumption increased among drinkers by 0.022 units per quarter (95% CI 0.009 to 0.035, $p<0.001$) starting from around 3.0 units in January 2001. Similarly, according to sensitivity analysis heaviest drinking day beer consumption increased by 0.017 units per quarter among drinkers (95% CI 0.005 to 0.028, $p<0.006$), starting from around 2.8 units in January 2001. After the Act, there was no immediate change in the heaviest drinking day beer consumption among drinkers according to both unit assumptions, but there was a significant downward trend as shown in Figure 5-12 and Table 5-8.

Figure 5-12: **Beer consumption** on the heaviest drinking day among adults who drank alcohol last week, before and after the Licensing Act 2003

(a) Primary Analysis (Revised unit assumptions)



(b) Sensitivity Analysis (Previous unit assumptions)



Note: Dashed line shows the Licensing Act implementation

Table 5-8: Results of segmented regression analysis of the change in beer consumption in the heaviest drinking day last week before and after the implementation of Licensing Act 2003

Model for **Beer Consumption**	β_{1}- Baseline trend	95% CI	p-value	β_{2}- Step level change	95% CI	p-value	β_{3}- Change in trend	95% CI	p-value
Primary Analysis	0.022	0.009 to 0.035	0.001	-	-	-	-0.035	-0.053 to -0.016	<0.001
Sensitivity Analysis	0.017	0.005 to 0.028	0.006	-	-	-	-0.030	-0.047 to -0.014	<0.001

Note: only parameters significant in the parsimonious model included

β_{1}-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Act

β_{2}-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after the Act

β_{3}-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.3.5 Wine consumption on the heaviest drinking day among adults who drank alcohol last week

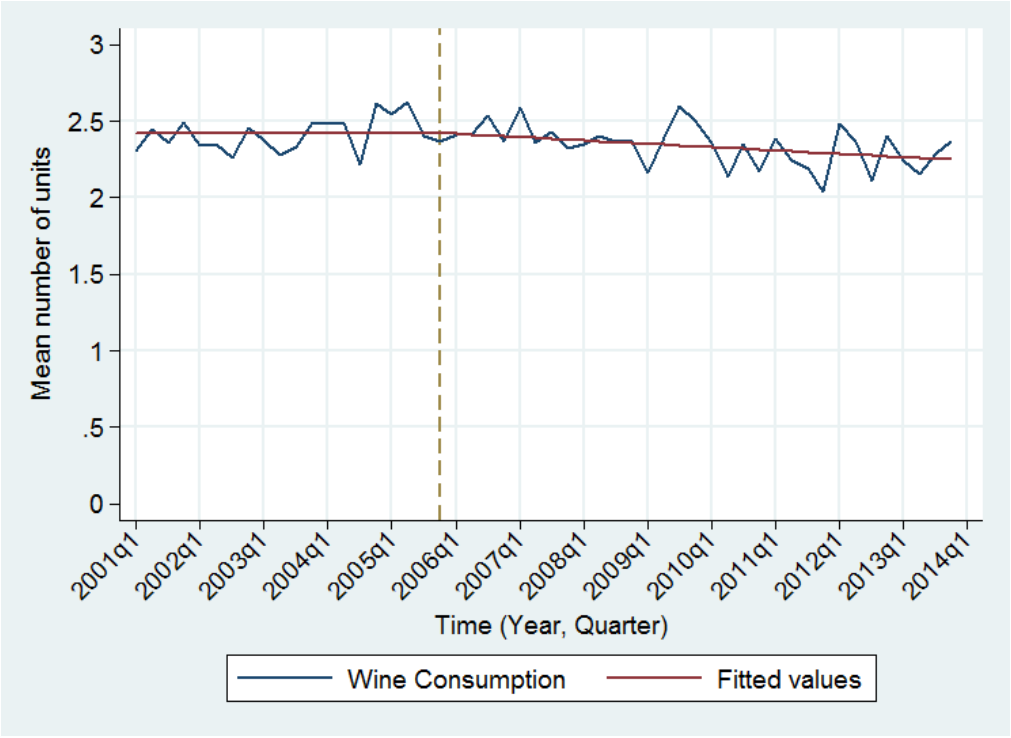
This section used the two models discussed in section 5.2.3.3 to evaluate changes in wine consumption before and after the implementation of the Licensing Act while taking into account of any changes due to wine glass size change over time.

Model (a) assumed an average glass of wine (170ml) contained two units of alcohol. Model (b) assumed a 170ml glass contained two units of alcohol from 2001 to 2006, and took the glass size changes into account from 2007 onwards. The only factor which differentiates Model (a) and Model (b) is the changes in glass sizes introduced in the HSE from 2007 onwards. Therefore, any differences that exist between these two models from 2007 onwards are due to revised wine glass sizes.

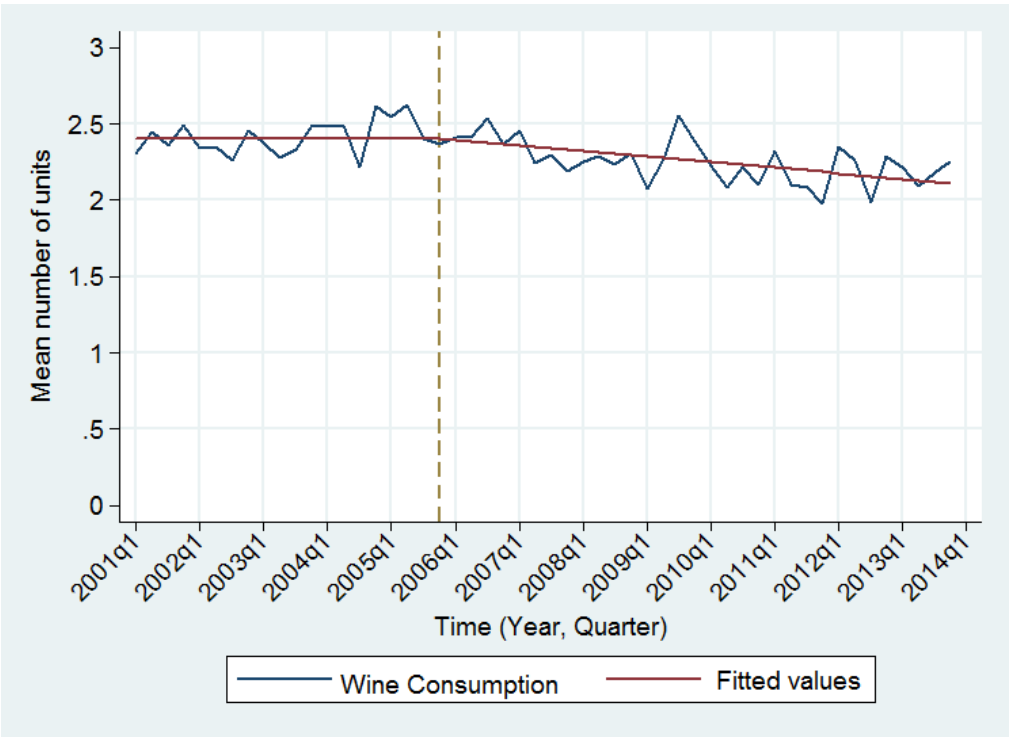
As shown in Figure 5-13 and Table 5-9, prior to the implementation of the Act, wine consumption on the heaviest drinking day remained constant at around 2.4 units in both models. After the Act, there was no step change in wine consumption among drinkers, but there was a statistically significant downward trend in both models. As shown in Figure 5-13, heaviest drinking day wine consumption decreased by 0.005 units of alcohol per quarter (95% CI -0.008 to -0.002, p=0.005) according to the Model (a)). However, Model (b), which used the glass size changes from 2007 onwards showed that heaviest drinking day consumption decreased by 0.009 units of alcohol per month (95% CI -0.012 to -0.016, p<0.001).

Figure 5-13: **Wine consumption** on the heaviest drinking among adults who drank alcohol last week, before and after the implementation of Licensing Act 2003

(a) **Primary Analysis** - Using revised unit assumptions which assumed an average glass of wine (170ml) contained two units of alcohol (Revised unit assumptions)



(b) **Sensitivity Analysis**- Using revised unit assumptions which assumed 170ml glass contained two units of alcohol from 2001 to 2006, and glass size options (125, 175, 250ml) introduced from 2007 onwards (Previous unit assumptions)



Note: Dashed line shows the Licensing Act implementation

Table 5-9: Results of segmented regression analysis of the change in **wine consumption** in the heaviest drinking day last week before and after the implementation of Licensing Act 2003

Model	β_1- Baseline trend	95% CI	p-value	β_2- Step level change	95% CI	p-value	β_3- Change in trend	95% CI	p-value
Model (a)	-	-	-	-	-	-	-0.005	-0.008 to -0.002	0.005
Model (b)	-	-	-	-	-	-	-0.009	-0.012 to -0.006	<0.001

Note: only parameters significant in the parsimonious model included

β_1-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Act

β_2-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after the Act

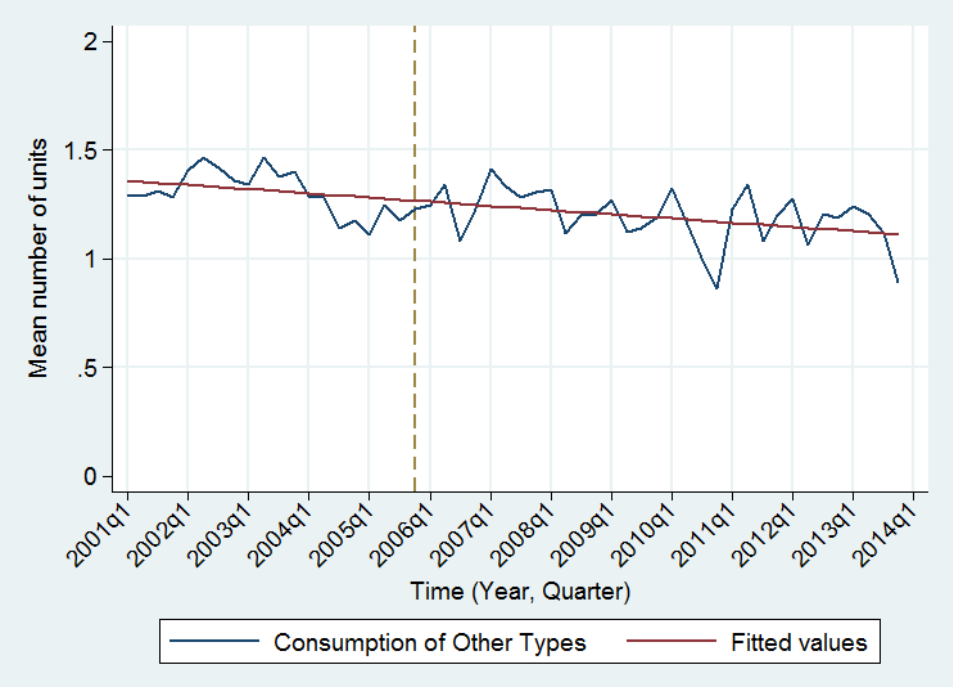
β_3-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.3.6 Other alcoholic drinks consumption on the heaviest drinking day among adults who drank alcohol last week

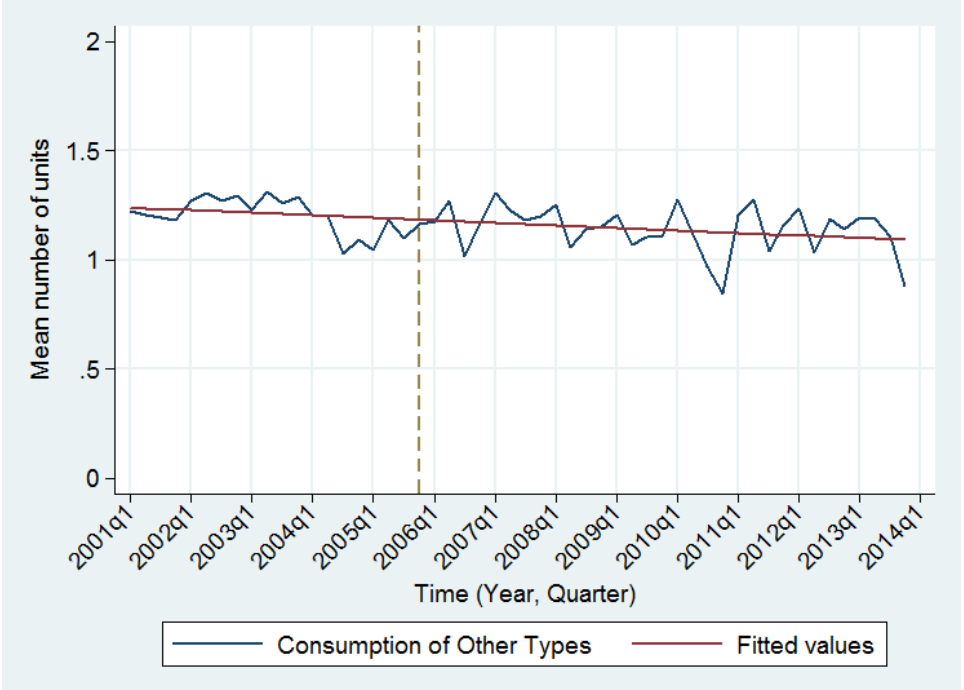
Before and after the implementation of the Licensing Act, the consumption of other alcoholic drinks (total consumption of spirits, sherry and alcopops) decreased over time, according to primary and sensitivity analysis, as shown in Figure 5-14. According to primary analysis, consumption of other alcoholic drinks on the heaviest drinking day in the last week was decreasing by 0.005 units per quarter (95% CI -0.007 to -0.003, $p<0.001$) starting from around 1.37 units in January 2001 (Table 5-10). According to the sensitivity analysis, consumption of other alcoholic drinks on the heaviest drinking day in the last week was decreasing by 0.003 units per quarter (95% CI -0.005 to -0.001, $p=0.002$), starting from around 1.24 units in January 2001.

Figure 5-14: **Other alcoholic types consumption** on the heaviest drinking day among adults who drank alcohol on the last week, before and after the implementation of Licensing Act 2003

(a) Primary analysis (Revised unit assumptions)



(b) Sensitivity analysis (Previous unit assumptions)



Note: Other alcoholic drinks include the consumption of spirits, sherry, and alcopops
Dashed line shows the Licensing Act implementation

Table 5-10: Results of segmented regression analysis of the change in alcohol consumption in the heaviest drinking day last week before and after the implementation of Licensing Act 2003

Other Alcohol Type consumption	β_1- Baseline trend	95% CI	p-value	β_2- Step level change	95% CI	p-value	β_3- Change in trend	95% CI	p-value
Primary Analysis	-0.005	-0.007 to -0.003	<0.001	-	-	-	-	-	-
Sensitivity Analysis	-0.003	-0.005 to -0.001	0.002	-	-	-	-	-	-

Note: only parameters significant in the parsimonious model included

β_1-Quarterly change in the mean number of alcohol units consumed on the heaviest drinking day before implementation of the Act

β_2-Step change in the mean number of alcohol units consumed on the heaviest drinking day immediately after implementation of the Act

β_3-Absolute change (quarterly) in the trend of mean number of alcohol units consumed on the heaviest drinking day after the Act, compared with the baseline trend

5.4 Discussion

To my knowledge, this is the first study using a nationally representative sample to rigorously analyse changes in the volume of adult alcohol consumption since the implementation of the Licensing Act 2003. The work presented in this chapter has shown that there was a gradual decline in heaviest drinking day alcohol consumption following the implementation of the Act. Prior to the implementation of the Act, total alcohol units (all alcoholic beverages together) consumed on the heaviest drinking day among adult male and female drinkers remained constant at around 8.3 units and 5.5 units respectively according to the revised unit assumptions. Following the implementation of the Act, there was a gradual decline in the heaviest drinking day alcohol consumption and it was consistent across all types of beverages consumed on the heaviest drinking day which included beer, wine and other types of drinks such as spirits, sherry, and alcopops. Aged 16-24 showed the greatest downward trend in consumption since the end of the Act compared with other age groups and it was 0.05 units per quarter. These findings suggest that there was no abrupt change in consumption, but there was a small, gradual and long-term downward trend in adult alcohol consumption over recent years since the Act was implemented.

5.4.1 Strengths and limitations

5.4.1.1 Strengths

Unlike many previous studies that have used before and after evaluation to evaluate the effect of the Licensing Act on alcohol consequences and consumption, the current study used an interrupted time series study design, which is considered to be one of the strongest quasi-experimental study designs.[116, 459, 467] Therefore, the current study is less

likely to be affected by several threats to internal validity that are common in other quasi-experimental study designs.[165] For example, the segmented regression analysis used in the current study controlled for any underlying trends in the outcomes over time. Unlike previous studies using annual alcohol consumption data to evaluate the effect of the Licensing Act,[223, 254] the current study used quarterly survey data for four years prior to the act and eight years after the Act, therefore it is more sensitive to any impact of the Act on adult alcohol consumption. In addition, this study used a nationally representative dataset and therefore the results are largely generalizable to the UK population.

5.4.1.2 Limitations

Limitations attempted to address in the data analysis

This study's results are based on a natural experimental study design thus limits the ability to establish causation between the Act and alcohol consumption. One of the major limitations of this study is in relation to the change in the survey instrument use to measure alcohol consumption over time, which occurred due to changes in alcohol unit assumptions and wine glass sizes. Any changes in the instrument used to measure the outcome over time can affect the internal validity of a study.[165] However, the current study addressed this limitation by using sensitivity analysis to explore various models generated according to previous and revised unit assumptions while taking into account the effect of glass size changes over time. Changes in alcohol unit assumptions were addressed by generating data that were comparable over time according to both previous and revised unit assumptions. Despite the change in alcohol unit assumptions, all models based on previous and revised unit assumptions showed similar trends,

confirming that the decline in adult alcohol consumption identified was not just a result of changes to unit assumptions over time.

In relation to the wine glass size change, it was not possible to generate data according to the revised glass sizes for the whole time period considered in this study, since glass size (125ml, 175ml, 250ml) questions were not asked in HSE prior to 2007. This study used three models to explore changes in wine unit assumptions and glass size changes. The comparison between these models showed that despite the change in wine unit assumptions there was a gradual decline in heaviest drinking day wine consumption. However, the model with specific wine glass sizes showed a steeper downward trend for wine consumption when compared with the model which used an unspecified glass of wine and assumed an average glass size for all drinkers. In 2007, the Office for National Statistics found that young people and people who were in professional and managerial occupations were more likely to drink from large glasses whereas older people were less likely to use large glasses.[253] Therefore, the introduction of different wine glass sizes may have been more sensitive to changes in alcohol consumption among different groups of people. The rise in teetotalism among younger adults (aged 16 to 44) in recent years who were more likely to drink from large glasses may have contributed towards the steeper decline in wine consumption identified in the model with different glass sizes compared to the model without wine glass size options.

Other limitations in the current study

This study could not identify whether there had been any changes to the adult alcohol consumption since the Licensing Act in terms of their location of drinking (on-trade/off-trade), drinking times and durations of drinking due to unavailability of data on these variables from HSE. Another

limitation of the data used in this study is in relation to the self-defined drink sizes. When calculating alcohol unit measures, alcohol surveys in England rely on the volume of alcohol consumption reported by their respondents. However, these self-defined drink sizes are known to underestimate the actual amount of alcohol consumed and this underestimation may have increased over time due to increasing trend of home-drinking.[468] A review of 18 studies examining participants' knowledge and understanding of standard drinks such as units and pints, and their ability to pour a standard drink, showed that there is a greater tendency to underestimate the actual alcohol content in a self-defined drink.[380] Moreover, the proportion of the population covered in the data analysis likely to have varied over time due to increasing abstinence rates. This declining proportion of drinkers may affect population subgroups differently and therefore it can have an impact on the overall representativeness of the survey population.

Furthermore, this study used quarterly data in the data analysis rather than annual data as quarterly data can be used to identify any seasonal variations and any short-term changes in consumption. However, this has limited the capability of exploring changes in alcohol consumption in different population subgroups. The important research questions this study could not answer due to use quarterly data with limited sample size include how beverage specific consumption varied according to gender, age and socio-economic status, and how drinkers with different drinking levels (moderate, harmful, hazardous) may have changed their consumption since the Act. Ideally, examining the alcohol consumption changes in at least 32 subgroups formed by categorising drinkers according to their gender (men and women), age (16-24, 25-44, 45-64, 65+), socio-economic status (professional and managerial, intermediate occupations, routine and manual, and unemployed) could have provided a comprehensive picture of

the Act's effect on different population subgroups. For example, it could have allowed comparison of consumption among groups such as men (aged 25-44) in intermediate occupations with women (aged 25-44) in intermediate occupations. However, such detailed analysis was not possible in the current study due to the use of quarterly HSE data with limited sample size.

5.4.1.3 How to address these limitations in a future study?

Most of the limitations of this study can be addressed by using an appropriate dataset which provide data for a sufficiently large nationally representative sample at quarterly or monthly intervals and collects detailed information on alcohol consumption among individuals such as the volume of consumption, frequency of consumption, place of drinking (on/off trade), drinking times and durations. From the review of alcohol consumption data sources carried out in Chapter 2 of this thesis, the most suitable data source which fulfils most of these requirements would be the Kantar Worldpanel Alcovision survey. This survey collects detailed alcohol consumption measures quarterly from a nationally representative sample of around 30000 individuals. Therefore, it would allow the identification of changes in alcohol consumption in different population subgroups by dividing them into at least 32 subgroups as mentioned above. Moreover, it would allow identifying changes in alcohol consumption among these subgroups since the Act not only in terms of the total consumption but also in terms of beverage specific consumption. The use of such data set will also enable identifying changes in consumption among drinkers according to their level of drinking (moderate, hazardous and harmful) and according to the location of drinking (on/off trade).

5.4.2 Explanation of insignificant autocorrelation/seasonal effect

One of the main reasons for this study to use quarterly HSE data was to explore any seasonal variation in the heaviest drinking day alcohol consumption. However, the data analysis showed that there was no significant autocorrelation/seasonal variation within the dataset, which was an unexpected finding. This is most likely to due to the outcome measure used in this study which is heaviest drinking day consumption. The heaviest drinking day consumption refers to extreme levels of drinking at least within that week and therefore these extremes are more likely to be consistent over time, rather than an average alcohol consumption measure over a period such as last week or last month which is likely to have greater variability.

The usual expectation is that there would be a seasonal effect on heaviest drinking day consumption among drinkers, particularly during Christmas and New Year period. However, recent research has revealed a much broader picture in relation to heavy drinking or atypical drinking in England which is more likely to be a spread throughout the whole year. [469-471] The heavy drinking occurs in England occur due to many reasons and these include holidays (e.g. Christmas, New Year, Easter, Summer, and bank holiday weekends), celebrations (e.g. birthdays, weddings, engagements, Halloween, Guy Fawkes night, St Patrick's Day, sporting events on TV or live, and festivals such as rock or pop concerts), and commiserations (e.g. bereavement, funeral, unemployment or other change in work patterns).[469-471] Hence the heavy drinking occasions in England are likely to be spread across the whole year. Moreover, the current study generated mean consumption measures by aggregating heaviest drinking day consumption measures across each quarter. This may have led to a more evenly spread heaviest drinking day consumption across the four quarters and hence this

study found no seasonality in the heaviest drinking day consumption measures.

5.4.3 Alternative explanations on the declining trend of alcohol consumption

Even though the findings of the current study are similar to previous studies showing a decline in adults' alcohol consumption after the implementation of the Act,[223, 254] the identified decline in alcohol consumption may not be directly attributable to the extended opening hours granted by the Licensing Act 2003. There was no step change or considerably large downward trend in the heaviest drinking day consumption soon after implementation of the Licensing Act. Therefore, the decline identified in this study may have been affected by other factors such as the age, period and cohort effect, and concurrently occurring interventions such as other policies or interventions brought in at the same time as the implementation of the 2003 Licensing Act. These potential confounders are discussed below.

5.4.3.1 Birth cohort effects

Age, period and cohort (APC) studies aim to separate the population trends into three types of demographic trends. These are the trends across the life-course (age effects), trends across the whole population over time (period effects) and trends across successive generations (cohort effects).[472] Most of the APC studies conducted in different settings have shown similar findings in relation to the age effect on alcohol consumption which peaks during the early adulthood and then declines with age.[472-475]

However, the period and cohort effect on alcohol consumption has been found to vary according to the setting.[472-476]

Kemm J descriptively analysed the alcohol consumption among several birth cohorts (1978-1998) in Great Britain and found that both men and women are likely to be non or very light drinkers as they grow older.[473] However, it showed an increasing trend of heavy drinking in more recent birth cohorts.[473] Building on this study's findings, Meng et al conducted an APC analysis on alcohol consumption among birth cohorts of 1984-2009 in Great Britain and found a complex picture of the components contributing to recent trends in alcohol consumption.[472] This study found a significant cohort effect on alcohol consumption in Great Britain since 1985. According to this study, recent birth cohorts born after 1984 have shown a rapidly increasing abstinence rates and decreasing mean weekly consumption levels.[472] The mean weekly consumption levels have dropped notably among men from around 22 units per week in 1980-1984 birth cohort up to 15 units per week in the 1990-1994 birth cohort. Among women the 1985-1989 birth cohort showed a peak mean consumption of around 14 units per week, however, this has started to decrease afterwards and it was around 12 units per week in the most recent 1990-1994 cohort.[472]

These findings explain the current study findings particularly in relation to alcohol consumption among aged 16-24. The current study hypothesised that there would be a gradual increase in alcohol consumption among 16-24 since the Licensing Act 2003; however, it found the highest declining trend in consumption (0.05 units per quarter) among aged 16-24 compared to all other subgroups included in the study. According to the recent APC study findings mentioned above, the declining trend of heaviest drinking day consumption particularly among aged 16-24 is less likely to be due to Licensing Act but more likely to be due to the cohort effect of the

cohorts born after 1985. Moreover, this cohort effect is likely to have influenced the declining trend in consumption since the Act observed in other subgroups in this study including men, women and all drinkers as they included participants from the cohorts born since 1985.

5.4.3.2 More powers to the police and other authorities

Even though the current study focused on the extended opening hours granted by the Licensing Act, the Act was implemented with some other interventions as described in Chapter 1, section 1.8. Providing new powers to the police and other responsible authorities to take action against problematic alcohol selling points and increase penalties for selling alcohol to people who are already drunk is one of the key actions included in the Act.[477] A nationwide survey of 225 local authority chairs of licensing committees in England showed that the effect of the Licensing Act was neutral towards alcohol-related consequences such as public noise levels, violence, underage drinking, crime and drink-drive incidents.[251] However, it showed an increased level of police involvement after the Act and emphasised the fundamental role played by police in reducing alcohol misuse.[251] Therefore, these other activities such as providing more powers to the police, which were implemented as part of the Licensing Act, may have contributed towards the decline in adults' alcohol consumption. In addition to all the activities related to the Licensing Act, there were several other distinct events occurring concurrently as discussed below and they may have also contributed towards this small gradual decline in adults' alcohol consumption in England.

5.4.3.3 Alcohol awareness campaigns and other interventions

From the turn of the millennium, growing concerns related to alcohol consequences, and political involvement in tackling alcohol misuse lead to increased public awareness about alcohol-related problems in England and Wales. In 2000, the Home Office published a White Paper emphasising the importance of changing the alcohol-related regulatory framework,[478] and in 2003 the Cabinet Office Strategy Unit published an estimate of public expenditure due to alcohol misuse, which was around £20 billion per year.[479] Against this background, the Licensing Act came into effect in 2005, when other interventions were also taking place. For example, in 2004 the Portman Group, which is a group of leading alcohol producers in the UK, established the Drinkaware website aiming to provide advice on responsible drinking.[480] Since then this website has been widely promoted by the alcohol drinks industry, with Drinkaware logos starting to appear on beer advertisements.[480] In October 2006, almost a year after the implementation of the Act, the Government launched the Know Your Limits campaign, a £4 million high-profile mass media campaign which aimed to reduce binge drinking among 18 to 24 year olds.[481] This campaign achieved a very high level of awareness among the target age group, through advertisements showing the consequences of binge drinking that were broadcast in cinemas, television, radio and as online advertisements.[482] A stakeholder update of Know Your Limits campaign emphasised that 82% of the target age group (18-24 years old) felt that this campaign made them rethink about the excess drinking of alcohol, and the campaign was continued in 2007/08 with more focus on students and employers.[483] From 2009 onwards the Government's Know Your Limits campaign focused on one week to encourage adults to rethink their alcohol consumption and it was named as Alcohol Awareness week.[484] From then on, Alcohol Awareness week has

been continued annually by Alcohol Concern, a charity working in England and Wales,[485] and over time several other campaigns joined the battle of reducing alcohol misuse in the UK. In 2011, the Department of Health introduced the Public Health Responsibility Deal which aimed at fostering a culture of responsible drinking with the help of the alcohol industry.[219] This included pledges to improve consumer choice by introducing lower alcohol products and labelling of bottles with clear unit content.[219] Furthermore, in 2012, the government launched the nationwide Change4Life alcohol campaign which ran for 6 weeks highlighting the importance of sticking to sensible drinking limits and the risks of excessive drinking.[206] It used TV advertisements and online tools such as an online alcohol unit calculator to increase awareness. Mass media campaigns have been effective in different settings in reducing alcohol consumption and related harm.[21] Therefore, the mass media campaigns and other population-level interventions carried out in England from 2004 onwards may have also contributed towards the small but gradual decline in adults' alcohol consumption.

5.4.3.4 Characteristics of drinking occasions

A recent study has demonstrated a much broader picture of alcohol consumption in Great Britain by categorising the drinking occasions into eight categories. This study used a nationally representative sample of 60,215 drinkers (aged 18+) and assessed their drinking occasions during 2009-2011. The total number of drinking occasions included in the study were 187 878 and 67% of them were off-trade, 22.1% of them were on-trade and the remaining (10.9%) occasions were in both on and off-trade.

The eight drinking occasion categories identified by this study included one drinking occasions that is likely to occur in both on and off trade premises (mixed location heavy drinking); two drinking occasions that are

likely to occur in on-trade (going out with friends, going out for a meal); and five drinking occasions that are likely to occur in off -trade (get-together at someone's house, heavy drinking at home with a partner, drinking at home alone, light drinking at home with family, and light drinking at home with a partner).[197]

According to this study, the vast majority of mixed location and on-trade drinking occasions normally started in afternoons or early evenings and lasted only around 1-3 hours. Going out with friends was the only occasion which had a very low probability to start drinking sessions after 10 pm.[197] Similarly most of the off-trade drinking sessions also started in early evenings and usually lasted less than three hours. Therefore, any extra opening times (from 11 pm onward) used by the licensed premises since the Licensing Act may not have been useful to many drinkers in England.

5.4.3.5 Increasing trend of home drinking and self-defined glass sizes

People are more likely to pour alcohol for themselves and others when drinking from home rather than from on-trade premises. Therefore, the underestimation due to self-defined drink sizes[380] is more likely to arise from off-trade alcohol consumption. Scientific literature from the UK shows that there has been a long term trend towards consuming more alcohol at home rather than at on-trade premises.[468] From 2001 to 2011, UK adult per capita alcohol consumption in on-trade premises has declined from 5 litres to 3.3 litres.[486] Conversely, during the same period of time in the UK, adult per capita off-trade consumption has increased from 5.8 litres to 6.7 litres.[486] By 2011 the alcohol consumption in off-trade alcohol twice the level of alcohol consumed on-trade. This increment in off-trade consumption may have resulted in a higher degree of survey underestimation over time.

Furthermore, people are more likely to underestimate their alcohol consumption when they pour alcohol into larger vessels than into small ones.[380] Therefore, the increasing use of larger wine glass sizes over time in England may have increased the survey underestimation of alcohol consumption in both on and off-trade.

5.5 Conclusions

There has been a gradual decline in the heaviest drinking day alcohol consumption since the implementation of the Licensing Act 2003. However, it is difficult to attribute this decline directly to the Licensing Act. The gradual decline in adult alcohol consumption in England is unlikely to be due to the extended opening hours but it could have occurred due to increased policy powers since the Act, birth cohort effects, the characteristics of drinking occasions, mass media campaigns, and increased survey underestimation due increasing off-trade consumption and self-defined drink sizes.

6 APPLYING THE LESSONS LEARNED FROM THE UK CONTEXT TO THE SRI LANKAN CONTEXT

6.1 Introduction

Previous chapters of this thesis discussed the benefits of evaluating alcohol control policies/contextual factors affecting alcohol consumption particularly in the UK and Sri Lanka (Chapter 1), reviewed existing data sources on alcohol consumption in the UK (Chapter 2), then identified and assessed the potentially suitable data sources for alcohol control policy evaluation in the UK (Chapter 3 and Chapter 4), and finally used one of the data sources to evaluate the effect of the Licensing Act 2003 in England (Chapter 5). Moreover, Section 1.5 and Section 5.2 provided details of study designs that are suitable for evaluating the effect of alcohol control policies/contextual factors affecting alcohol consumption in different settings.

This chapter aims to apply the lessons learned from the above-mentioned sections in this thesis to the Sri Lankan context by identifying data sources which are potentially suitable for alcohol control policy/contextual factor evaluation in Sri Lanka and by evaluating the effect of the end of the conflict in 2009 on adult alcohol consumption. Chapter 1 (section 1.3), discussed that the factors influencing alcohol consumption during post-conflict periods can vary between displaced/directly affected populations and non-displaced/indirectly affected populations. As discussed in section 1.10, the conflict in Sri Lanka mainly took place in seven provinces, therefore, when evaluating the effect of the end of conflict on alcohol consumption among Sri Lankans it is important to conduct the evaluation separately for the areas that were directly affected and indirectly affected by the conflict. That allows disentangling the factors influencing alcohol

consumption during post-conflict period separately for areas that were directly and indirectly affected by the end of the conflict.

Hence, the following section of this chapter aims to review and identify potentially suitable data sources for alcohol control policy and contextual factor evaluation in general, with particular consideration of their suitability for evaluating the effect of end of conflict on adult alcohol consumption in Sri Lanka separately for the areas that were directly and indirectly affected by the conflict.

In addition, it considers whether those data sources can be used to investigate the effect of the end of conflict on different population subgroups and geographical areas.

6.2 Existing data sources on alcohol consumption in Sri Lanka

When compared with the UK, Sri Lanka has a limited number of data sources on alcohol consumption. The primary care system in Sri Lanka is different from the UK and patients are not registered with a particular GP. Therefore, Sri Lankans can randomly visit any GP practice, and there are no records maintained on patient consultations. Hence, primary care in Sri Lanka does not have routinely collected alcohol consumption data like in the UK. Moreover, there are no market research data available on alcohol consumption in Sri Lanka.

In 2008 and in 2012, the Sri Lankan government collected alcohol consumption data for a nationally representative sample as part of the National Non-Communicable Disease Risk Factor Survey.[264, 487] This survey used a modified version of alcohol consumption questions suggested by the WHO STEPS manual which is particularly designed for chronic disease risk factors surveillance.[488] According to the STEPS manual, this survey

generated only a few measures on alcohol consumption and these include prevalence of alcohol consumption, quantity and frequency of average consumption (all types of beverages together) and last seven day consumption. As per the lessons learned from Chapter 4, this survey does not use include one of the key alcohol consumption measures recommend by the international guidelines (the volume and frequency of heavy episodic drinking) and does not use the recommend survey questions (Beverage Specific Quantity Frequency) for measuring average consumption.

Moreover, this survey has not been continued since 2012. Hence it cannot be used in the formal time series analysis to evaluate the effect of the end of the conflict on adult alcohol consumption in Sri Lanka. Therefore, currently there are only a few data sources that provide alcohol consumption data over time with at least on an annual frequency, as discussed in the section below.

6.2.1 Alcohol consumption data sources in Sri Lanka

6.2.1.1 Alcohol sales data

Summary

Alcohol sales data in Sri Lanka can be obtained from the Department of Excise. These data have been collected by the Department of Excise since its inception in 1974.[259] All on-trade and off-trade premises selling alcohol in Sri Lanka are required to provide a monthly report based on their alcohol sales to the relevant Excise Department area office, of which there are 62 around the whole island. Every area office subsequently provides their reports to the relevant district office, of which there are 23 in Sri Lanka. Finally, the district offices forward their annual reports to the Excise

Department Head Office, which then keeps the record of the district level beverage specific annual alcohol sales data for the whole country.[301] These data have historically been kept as a log book (paper records) at the Department of Excise Head Office and they are not available in the form of electronic records or PDFs. However, these paper records are available to photocopy on request from the Department of Excise Head Office.

Strengths

Excise Department alcohol consumption data have been collected for around four decades and therefore these data could potentially be used to monitor trends in alcohol consumption and for alcohol control policy evaluation purposes. The Excise Department provides alcohol sales data at the district level as well as by the beverage type of alcohol. Therefore, these data can be used to monitor beverage specific consumption as well as regional level alcohol consumption in Sri Lanka. In terms of recorded alcohol consumption, these data provide a nationally-representative dataset as the Department of Excise collects alcohol sales data from every on-trade and off-trade alcohol outlets across the whole island.

Limitations

These population-level alcohol sales data cannot be used to identify the characteristics of people who drink, their average volume of consumption and patterns of drinking such as heavy episodic drinking. Even though the area offices of the Department of Excise collect monthly alcohol sales data, the Head Office maintains a database of annual alcohol sales data. Therefore, there are currently no national level monthly or quarterly alcohol sales data available for research purposes.

Alcohol sales data from the Department of Excise do not include unrecorded or illicit alcohol consumption measures. In Sri Lanka illicit alcohol contributes to a significant amount of alcohol consumption,[141, 259, 489] therefore, Department of Excise alcohol sales data does not provide a complete picture of the total alcohol consumption in the country.

Moreover, the Department of Excise alcohol sales data for the seven districts that were directly affected by the conflict (Jaffna, Mannar, Vavuniya, Mullaitivu, Kilinochchi, Batticaloa, and Trincomalee) are incomplete and inconsistent over time. For example, there were no data for any type of alcohol sold in Killinochchi district in 2001 and in 2002. There were no data for any type of alcohol sold in Mullathiv District for the period from 2003-2009. In addition, some numbers reported for these districts are unrealistically low during the conflict period. It is difficult to expect the same level of coverage of alcohol sales data collection in these districts over time as the government officials may not have had the same level of access during and after the end of conflict into these districts. Due to these reasons, it would be inappropriate to use alcohol sales data from the Department of Excise to evaluate the changes in alcohol consumption in the areas that were directly affected by the conflict.

However, consistent alcohol sales data for the 18 districts that were not directly affected by the conflict are available from the Department of Excise. These areas were consistently under government control, therefore one can expect the same level of alcohol sales data collection over time from government officials in these areas. Hence, it would be appropriate to use these data to evaluate the effect of the end of conflict on adult alcohol consumption among populations living in the 18 districts that were not directly affected by the conflict.

6.2.1.2 Trend Survey on Alcohol

Summary

The "Trend Survey on Alcohol" is a repeated cross sectional face-to-face survey and it is the only survey which currently monitors individual level alcohol consumption over time Sri Lanka.[490] This survey is conducted by the Alcohol and Drug Information centre (ADIC), a non-governmental organization and it has been carried out by ADIC since 1998.[490] This survey is conducted only among adult (aged≥15) men and collects data on alcohol drinking status, frequency of alcohol consumption, reasons for alcohol use, type of alcohol used, monthly expenditure on alcohol and information on attempts to quit alcohol use.

The ADIC survey was initially conducted in three out of the 25 districts in Sri Lanka and over time the number of districts covered by this survey has increased. For this survey around 250 participants are selected from each district. However, this survey uses non-random, accidental sampling method in selecting its sample which results in several limitations as discussed in the survey limitations section below.

Strengths

The ADIC survey is the only longitudinal survey on alcohol consumption in Sri Lanka. It is a biannual survey; therefore, the data collected by this survey are more sensitive for alcohol consumption behaviour changes among adults than an annual survey. Moreover, it collects detailed information on individual level alcohol consumption in different districts in Sri Lanka.

Limitations

ADIC survey is unlikely to provide nationally or regionally representative alcohol consumption related estimates due to its non-random, accidental sampling method. For example, in 2012 ADIC survey was conducted in 11 out of the 25 districts and its sample had a higher proportion of younger men and lower proportion of older men when compared with the statistics from Department of Census and Population Sri Lanka. This can be seen from Table 6-1 which compares ADIC survey sample with Department of Census and Statistics data according to the age groups used by ADIC survey (15-24, 25-39, and ≥40). There are no survey weights used in ADIC survey and this discrepancy between ADIC survey sample and Department of Census and Statistics exits not only in 2012 survey but also in other ADIC surveys from 1998-2014.

Table 6-1: Percentage of adult men in Sri Lanka (Department of Census and Statisics) and percentage of men included in ADIC survey sample according to different age groups in 2012

Age group	Total Population		Colombo		Anuradhapura	
	ADIC Survey Total sample	Department of Census and Statistics	ADIC Survey Sample	Department of Census and Statistics	ADIC Survey Sample	Department of Census and Statistics
15-24	40.1%	21.5%	40.5%	21.2%	37.3%	21.6%
25-39	36.6%	30.6%	35.7%	31.2%	37.3%	33.5%
≥40	23.3%	47.9%	23.8%	47.6%	25.4%	44.9%
Total (aged ≥15)	100%	100%	100%	100%	100%	100%

The ADIC survey alcohol consumption estimates vary substantially and unrealistically from one year to the other year. For example, the proportion of drinkers in Anuradhapura district varied from 60.1% in 2006 to 32.7% in 2007. For Colombo district, the proportion of drinkers estimated

in 2006 was 56.6% and in 2007 this was 32.7%. These variations are likely to be due to non-random accidental sampling method used in the survey.

Furthermore, the number of districts included in the ADIC survey has varied over time. In 1998 and in 1999, this survey was conducted only in three out of the 25 districts in Sri Lanka; Anuradhapura, Colombo, and Galle. In 2000 and in 2001, it was conducted only in one district; Anuradhapura and Colombo respectively. This survey was not conducted in any of the districts that were directly affected by the conflict until 2011. Hence, ADIC survey cannot be used to obtain any data on the period prior to end of conflict for the populations directly affected by the conflict.

From 2006 to 2014, ADIC continuously conducted this survey in 6 districts that were not directly affected by the conflict. However, as mentioned above this survey has major limitations in relation to its sampling method. Its data are based on a much younger sample population and its alcohol consumption estimates such as the prevalence of drinking vary substantially from one year to the other. Therefore, that would be inappropriate use any of the ADIC survey data for alcohol control policy/ contextual factor evaluation which require reliable estimates based on a nationally or regionally representative sample over time.

6.2.2 Summary

This review of alcohol consumption data sources in Sri Lanka shows that the only data source that can be used for alcohol control policy or contextual factor evaluation in Sri Lanka is the Department of Excise alcohol sales data.

However, the alcohol sales data available from Department of Excise are inconsistent and incomplete for the districts that were directly affected by the conflict. Therefore, this data source can only be used to evaluate the

effect of the end of war in the 18 districts that were not directly exposed to the conflict. Moreover, these data do not include unrecorded/illicit alcohol sales in Sri Lanka, known to contribute a significant amount of total alcohol consumed in some areas. Therefore, these data cannot be used to evaluate changes in total alcohol consumption in the 18 districts; however, they can be used to evaluate the changes in recorded alcohol consumption, as the Department of Excise collects alcohol sales data from every on and off trade alcohol outlets in Sri Lanka.

Therefore, the next phase of this chapter will use the Department of Excise alcohol sales data to evaluate the effect of the end of the war on recorded alcohol consumption in the 18 districts that were not directly affected by the conflict.

6.3 Effect of the end of conflict on recorded adult alcohol consumption in Sri Lanka

As discussed in Chapter 1 (section 1.10), alcohol consumption among Sri Lankans appears to have been increasing in recent years; however the effect of the end of armed conflict on alcohol consumption in Sri Lanka has not yet been formally quantified and evaluated. Therefore, this section of the thesis aimed to evaluate the effect of the end of armed conflict in 2009 on recorded alcohol consumption among adults in the 18 districts that were not directly exposed to this conflict using interrupted time series analysis, which is considered to be the strongest quasi-experimental approach.[116]

In addition to evaluating effect of the end of conflict on adult alcohol consumption in the total population living in 18 districts, the following section aimed to further investigate the provincial level temporal changes in alcohol consumption before and after the end of conflict. In Section 1.10, it was hypothesised that end of the conflict likely to have had a higher influence on alcohol consumption in Western and Central province due to the higher income and urbanization level in the Western province and the higher proportion of Tamils in Central province, who are more likely to be current and hazardous drinkers. The initial part of this study on alcohol consumption in the total population living in 18 districts has been published in Alcohol and Alcoholism and a copy of this paper is given in Appendix 8.4.[491]

6.3.1 Methods

6.3.1.1 Alcohol sales and mid-year population data

District level beverage specific alcohol sales data were collected from the Department of Excise for the period from 1998 to 2013. These data were consistently available from the Department of Excise for the 18 districts that were not directly exposed to the armed conflict. The beverage specific data (in million litres for ten types of beverages) were converted into litres of pure alcohol according to their alcohol by volume percentage (ABV): arrack (35%); beer (7%); toddy (7%); wine (12%); whisky (40%); brandy (38%); gin (38%); rum (37%); liquors and bitters (37%); and vodka (40%). The ABV for each drink type was determined according to the percentages used by recent national surveys,[263, 266] and information given by key officials of the Department of Excise. In Sri Lanka around 75% of beer is sold as strong beer with around 8-8.8% ABV. However, beer sales data are not provided separately for different strength of beer hence a weighted average of 7% was used for beer ABV.

Mid-year population statistics for the total population (age≥15) living in the 18 districts that were consistently under government control were available from the Department of Census and Statistics for the whole study period 1998-2013. However, mid-year population statistics for specific regions of the country (provinces) were only available from 2001 onwards. Therefore, regional level data analysis was restricted to the period from 2001-2013.

Furthermore, the provincial level data analysis was focused on the two most popular drinks in Sri Lanka; beer and arrack. This is due to the lack of legibility of district level alcohol sales data in the photocopied datasheets obtained from the Department of Excise. In relation to beer and arrack sales in the 18 districts considered in this study, I re-contacted the

relevant officials and clarified any figures that were not legible in the photocopied datasheets for the period from 2001-2013 but it was not possible to do this for all other eight types of drinks due to time and resource constraints. Hence the provincial level data analysis was limited to arrack and beer.

6.3.1.2 Data analysis

Recorded total per capita alcohol consumption was generated for the total population living in the 18 districts and was used as the main outcome measure. These per capita consumption measures were generated by dividing annual sales in litres of pure alcohol by mid-year population estimates (age≥15) for the period from 1998-2013. In addition, beverage specific per capita consumption for the total population living in 18 districts were generated for beer, arrack and 'other beverages'. The 'other beverages' category included the total consumption of all other types of drinks: wine, whisky, brandy, gin, rum, liquors and bitters, vodka and toddy. Regional level arrack and beer per capita alcohol consumption measures were generated using provincial level alcohol sales and mid-year population (age≥15) estimates for the period from 2001-2013.

As discussed in Chapter 5 (Section 5-2) segmented regression analysis is a powerful method for evaluating the effect of an intervention, even with a relatively short time series, and it can be used to identify whether the intervention had an immediate or delayed impact on average level and trend in alcohol consumption. Therefore, segmented regression analysis was used to quantify the effect of the end of the war on adult per capita alcohol consumption in Sri Lanka.

The Likelihood ratio test was used to build the final segmented regression model. The most parsimonious model was identified by backward elimination dropping any parameters that were not significant at the 5% significance level.[116] The autocorrelation function (ACF) of each parsimonious model was inspected to see whether there was any remaining autocorrelation between the model residuals at successive time points. Residuals greater than the 95% confidence intervals of an ACF represent significant autocorrelation in the dataset greater than would be expected due to chance alone.[461] However, there was no residual autocorrelation in any of the parsimonious segmented regression models and hence there was no need to adjust the models further for autocorrelation. All analyses were conducted using STATA 13.[492]

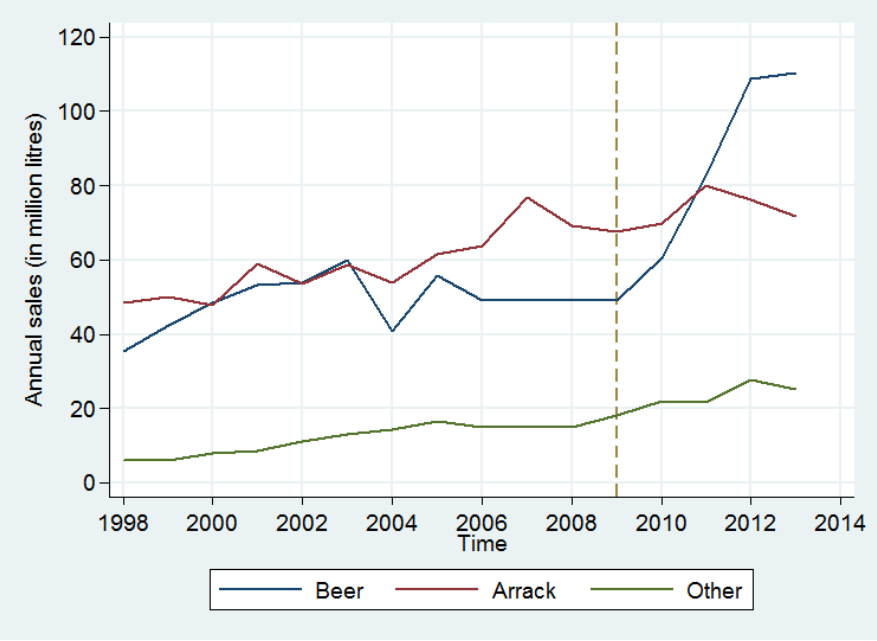
6.3.2 Results

6.3.2.1 Data analysis based on the total population living in areas that were not directly affected by conflict

Descriptive Analysis

As shown in Figure 6-1 below, arrack and beer showed the highest alcohol sales in Sri Lanka when compared with the total sales of all other alcoholic drinks. From 1998 to 2009 beer sales increased from 35.3 million litres to 49.1 million litres, which is an increment of 39% over 12 years. However, after 2009 beer sales increased dramatically from 49.1 million litres to 110.21 million litres in 2013, an increment of 125% within four years. Arrack sales have been gradually increasing since 1998 starting from 48.5 million litres to 71.8 million litres in 2013 showing an increment of 48% over a 16-year period of time. Similarly, the total sales of all other types of drinks (wine, whisky, brandy, gin, rum, vodka, liquors and bitters and toddy) showed a gradual increase over time.

Figure 6-1: Main types of alcohol sales before and after the end of war



Note: Dashed line represents the end of war in 2009

During the study period, the majority of alcohol (in litres of pure alcohol) was sold as arrack, but it accounted for a decreasing proportion of alcohol sales over time. In 2009 arrack sales accounted for 80% of total sales in pure litres of alcohol, decreasing to 64% in 2013. Beer was the second most popular drink, and during the study period, the beer sales as a proportion of total alcohol sales increased from 15% in 2009 to 25% in 2013. Other alcoholic drinks, including toddy, wine, whisky, brandy, gin, rum, vodka, liquors and bitters made up around 5% of total alcohol sales in 2009, increased up to 11% by 2013.

As shown in Figure 6-2, total per capita alcohol consumption during the conflict period increased from 1.59 litres of pure alcohol in 1998 to 2.07 litres in 2009. After 2009, per capita consumption increased up to 2.56 litres of pure alcohol in 2013. Per capita arrack consumption showed a gradual increase from 1.27 litres of pure alcohol in 1998 to 1.59 litres in 2009 and 1.64 litres in 2013. Per capita beer consumption increased markedly over the study period, increasing from 0.23 litres of pure alcohol in 1998 to 0.28 in 2009 and 0.63 litres in 2013. The increase in beer consumption during the post-conflict period alone was 125%. Per capita consumption of other alcoholic drinks showed a gradually increasing trend over time, and it increased from 0.09 litres of pure alcohol in 1998 to 0.18 in 2009 and 0.28 litres in 2013.

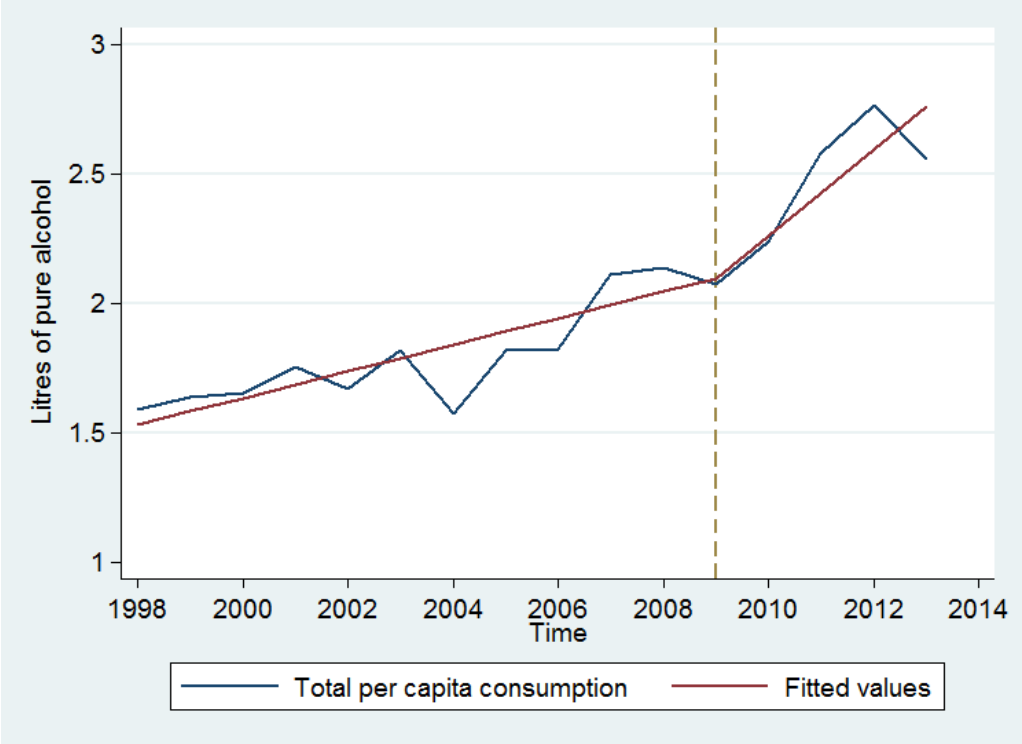
Figure 6-2: Total and beverage specific per capita consumption over time (1998-2013)

Note: Dashed line represents the end of war in 2009

Segmented Regression Analysis

As shown in Figure 6-3 and Table 6-2, prior to the end of the armed conflict in 2009, adult per capita alcohol consumption was increasing by 0.051 litres of pure alcohol per year (95% CI 0.029-0.074, $p<0.001$). After 2009, there was no immediate step change in the mean level of adult per capita consumption. However, there was a significant change in the trend of per capita consumption; after the conflict, it increased by 0.166 litres of pure alcohol per year (95% CI 0.095-0.236, $p<0.001$), almost a three-fold increment in the increase per year compared to the trend prior to the end of the conflict.

Figure 6-3: Adult per capita total alcohol consumption before and after the end of armed conflict in 2009



Note: Dashed line represents the end of armed conflict in 2009

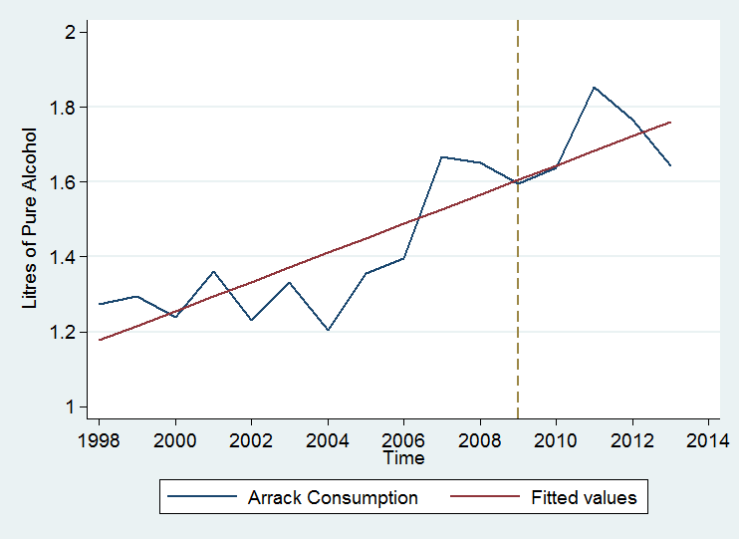
As shown in Figure 6-4(a) and Table 6-2, prior to the end of the conflict in 2009, per capita arrack consumption increased by 0.039 litres of pure alcohol per year (95% CI 0.026-0.051, p<0.001). After 2009, there was no immediate step-level change in arrack consumption, nor a significant change in the trend.

Conversely, prior to the end of the armed conflict, per capita beer consumption was constant at around 0.29 litres of alcohol per year as shown in Figure 6-4(b). After 2009, there was no step-level change in beer consumption but there was a significant change in the trend, such that after the conflict consumption increased by 0.096 litres of pure alcohol per year (95% CI 0.080-0.111, p<0.001).

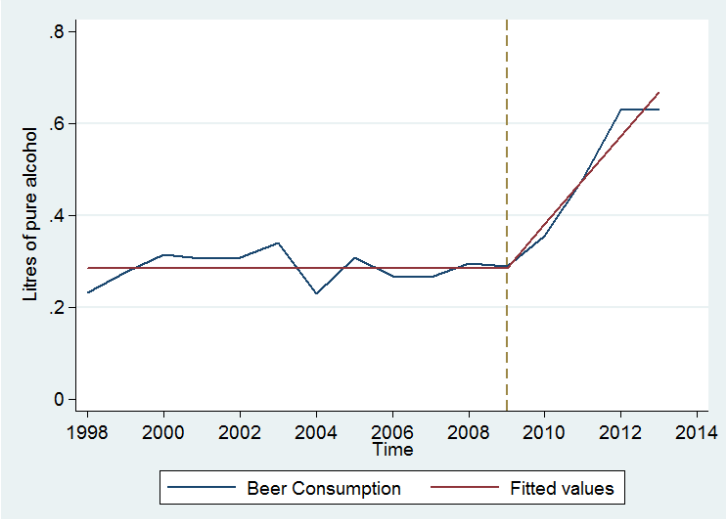
As shown in Figure 6-4(c), per capita consumption of all other drinks increased by 0.012 litres of pure alcohol per year (95% CI 0.007- 0.016, $p<0.001$) prior to the end of the conflict, and by 0.032 litres of pure alcohol per year (95% CI 0.017- 0.046, $p<0.001$) after the end of the conflict. There was no immediate step level increase in other drinks consumption after 2009.

Figure 6-4: Beverage specific adult per capita consumption before and after the end of armed conflict in 2009

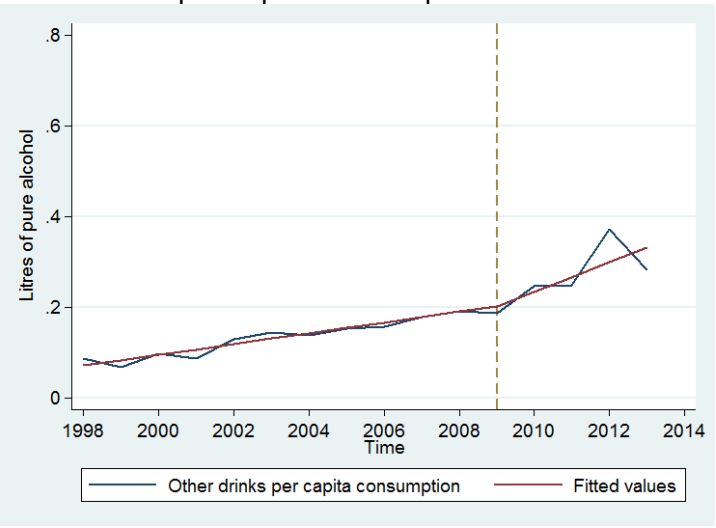
(a) Arrack(a form of spirits) per capita consumption



(b) Beer per capita consumption



(c) Other drinks per capita consumption



Note: Dashed line represents the end of armed conflict in 2009
Graphs have different y-axis scales

Table 6-2: Segmented regression analysis results for per capita consumption

Model	β_{1-} Annual trend prior to 2009	95% CI	p-value	β_{2-} Step level change	95% CI	p-value	β_{3} - Change in trend in 2009	95% CI	p-value	β_{4-} Annual trend after 2009	95% CI	p-value
Total Per Capita Consumption	0.051	0.029-0.074	<0.001	-	-	-	0.114	0.030-0.199	0.012	0.166	0.095-0.236	<0.001
Arrack Consumption	0.039	0.026-0.051	<0.001	-	-	-	-	-	-	-	-	-
Beer Consumption	-	-	-	-	-	-	0.096	0.080-0.111	<0.001	0.096	0.080-0.111	<0.001
Other Drinks Consumption	0.012	0.007-0.016	<0.001	-	-	-	0.020	0.003-0.038	0.026	0.032	0.017-0.046	<0.001

Note: only parameters significant in the parsimonious model included

β_{1-} Annual trend in the total per capita alcohol consumption prior to the end of armed conflict in 2009

β_{2-} Step change in the total per capita consumption immediately after the end of armed conflict in 2009

β_{3-} Absolute change in trend in the per capita consumption after the end of armed conflict in 2009, compared with the baseline trend

β_{4-} Annual trend the total per capita consumption (β_{1+} β_{3}) of alcohol after the end of armed conflict in 2009

6.3.2.2 Provincial level data analysis

Arrack consumption

As shown in Figure 6-5, when compared with other provinces the Central province had the highest per capita arrack consumption throughout the whole study period and it was constant at around 2.29 (95% CI 2.15-2.44, p<0.001) pure alcohol per year. Per capita arrack consumption in Western and North Western provinces also remained constant before and after the end of conflict and in Western province it was constant at around and 1.76 (95% CI 1.63-1.89, p<0.001) litres of pure alcohol whereas in North Western province it was constant at around 1.10 (95% CI 0.847-1.357, p<0.001) litres of pure alcohol.

As shown in Table 6-3, prior to the end of the conflict in 2009, in Southern province per capita arrack consumption increased by 0.074 (95% CI 0.044-0.104, p<0.001) litres of pure alcohol per year. During the same period in North Central province, per capita arrack consumption increased by 0.086 (95% CI 0.052-0.120, p<0.001) litres of pure alcohol per year. In Uva and Sabaragamuwa provinces this was 0.052 (95% CI 0.034-0.69, p<0.001) and 0.052 (95% CI 0.027-0.078, p=0.001) litres of pure alcohol per year. However, after 2009, there was no immediate step-level change in any of these provinces, nor a significant change in the trend of arrack consumption.

As a result of this increasing trend, adult per capita arrack consumption in Southern, North Central, Uva and Sabaragamuwa provinces increased from 1.15, 0.78, 0.66, 1.07 litres of pure alcohol in 1998 to 1.8, 1.55, 1.23, 1.44 litres of pure alcohol by 2013 respectively.

Figure 6-5: Adult per capita arrack consumption in seven provinces

Note: Dashed line represents the end of armed conflict in 2009

Table 6-3: Segmented regression analysis results for arrack per capita consumption in seven provinces

Model	β_{1}- Annual trend prior to 2009	95% CI	p-value	β_{2}- Step level change	95% CI	p-value	β_{3} - Change in trend in 2009	95% CI	p-value	β_{4}- Annual trend after 2009	95% CI	p-value
Western	-	-	-	-	-	-	-	-	-	-	-	-
Central	-	-	-	-	-	-	-	-	-	-	-	-
Southern	0.074	0.044-0.104	<0.001	-	-	-	-	-	-	-	-	-
North Western	-	-	-	-	-	-	-	-	-	-	-	-
North Central	0.086	0.052-0.120	<0.001	-	-	-	-	-	-	-	-	-
Uva	0.052	0.034-0.69	<0.001	-	-	-	-	-	-	-	-	-
Sabaragamuwa	0.052	0.027-0.078	0.001	-	-	-	-	-	-	-	-	-

Note: only parameters significant in the parsimonious model included

β_{1}- Annual trend in the total per capita alcohol consumption prior to the end of armed conflict in 2009

β_{2}- Step change in the total per capita consumption immediately after the end of armed conflict in 2009

β_{3}- Absolute change in trend in the per capita consumption after the end of armed conflict in 2009, compared with the baseline trend

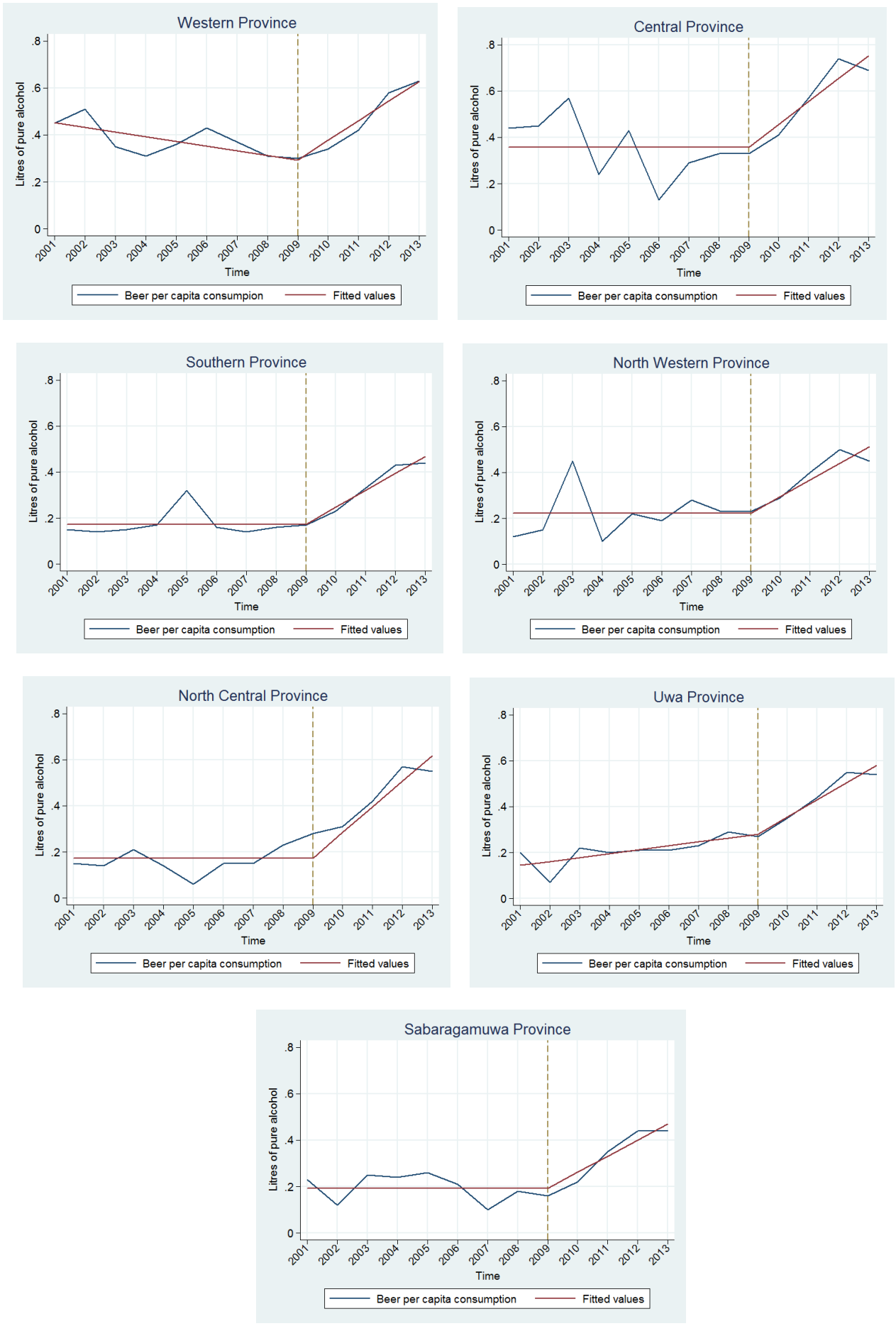
β_{4}- Annual trend the total per capita consumption (β_{1}+ β_{3}) of alcohol after the end of armed conflict in 2009

Beer consumption

As shown in Figure 6-6, per capita beer consumption in Western province decreased from 0.45 litres of pure alcohol in 1998 to 0.30 litres of pure alcohol in 2009. This declining trend prior to the end of war in 2009 was 0.02 (95% CI -0.034 to -0.005, p=0.11) litres of pure alcohol per year. In contrast, per capita beer consumption in Uva province increased from 0.20 litres of pure alcohol in 1998 to 0.27 litres of pure alcohol in 2009. This increasing trend of per capita beer consumption in Uva province prior to the end of conflict was 0.017 (95% CI 0.006-0.028, p=0.008) litres of pure alcohol per year. In Central, Southern, North Western, North Central, and Sabaragamuwa provinces per capita beer consumption prior to the end of conflict remained constant at around 0.356, 0.173, 0.022, 0.173, 0.193 litres of pure alcohol respectively.

After the end of the conflict in 2009, there was no step change in per capita beer consumption but there was a significant change in the trend of per capita beer consumption in all seven provinces. As shown in Table 6-4, the increasing trend of per capita beer consumption after the end of conflict was highest in the North Central province, increasing by 0.111 litres of pure alcohol per year (95% CI 0.082-0.140, p <0.001). Central province had the second highest increasing trend of per capita beer consumption after the end of the conflict at 0.099 litres of pure alcohol per year (95% CI 0.044-0.153, p=0.002). The third highest trend in per capita beer consumption was in Western province with an increasing trend of 0.084 litres of pure alcohol per year (95% CI 0.053-0.115, p<0.001), whereas the Sabaragamuwa province had the lowest trend in per capita beer consumption increase at 0.069 litres of pure alcohol per year (95% CI 0.044-0.093, p<0.001).

Figure 6-6: Adult per capita **beer** consumption in seven provinces



Note: Dashed line represents the end of armed conflict in 2009

Table 6-4: Segmented regression analysis results for **beer** per capita consumption in seven provinces

Model	β_{1}- Annual trend prior to 2009	95% CI	p-value	β_{2}- Step level change	95% CI	p-value	β_{3} - Change in trend in 2009	95% CI	p-value	β_{4}- Annual trend after 2009	95% CI	p-value
Western	-0.020	-0.034 to -0.005	0.011	-	-	-	0.103	0.063-0.144	< 0.001	0.084	0.053-0.115	<0.001
Central	-	-	-	-	-	-	0.099	0.044-0.153	0.002	0.099	0.044-0.153	0.002
Southern	-	-	-	-	-	-	0.074	0.050-0.096	< 0.001	0.074	0.050-0.096	<0.001
North Western	-	-	-	-	-	-	0.072	0.029-0.116	0.004	0.072	0.029-0.116	0.004
North Central	-	-	-	-	-	-	0.111	0.082-0.140	< 0.001	0.111	0.082-0.140	<0.001
Uva	0.017	0.006-0.028	0.008	-	-	-	0.057	0.025-0.090	0.003	0.074	0.049-0.099	<0.001
Sabaragamuwa	-	-	-	-	-	-	0.069	0.044-0.093	< 0.001	0.069	0.044-0.093	<0.001

Note: only parameters significant in the parsimonious model included

β_{1}- Annual trend in the total per capita alcohol consumption prior to the end of armed conflict in 2009

β_{2}- Step change in the total per capita consumption immediately after the end of armed conflict in 2009

β_{3}- Absolute change in trend in the per capita consumption after the end of armed conflict in 2009, compared with the baseline trend

β_{4}- Annual trend the total per capita consumption (β_{1}+ β_{3}) of alcohol after the end of armed conflict in 2009

6.3.3 Discussion

Recorded alcohol consumption among Sri Lankans living in areas that were not directly affected by the armed conflict increased markedly after the end of the conflict in 2009, with a dramatic acceleration in the trend of adult per capita consumption. Whilst the consumption of arrack continued to increase as steadily as it had before the conflict, per capita beer consumption increased dramatically following the end of the armed conflict with the highest per capita consumption growth rate among all types of beverages.

The effect of the end of conflict on provincial level adult per capita arrack and beer consumption was consistent with the above-mentioned trends. There was no change in the trend of per capita arrack consumption in any province but there was a rapidly increasing trend in per capita beer consumption in all provinces. North Central, Central and Western provinces had the highest, second highest and third highest trend in per capita beer consumption.

6.3.3.1 Explanations on the findings based on the total population in 18 districts

Economic Development

Economic development is known to be a key factor associated with increased alcohol consumption, particularly in low and middle-income countries.[150, 493] In line with the economic development observed in other post-conflict settings,[145] Sri Lanka's economy picked up soon after the cessation of the armed conflict and achieved middle-income country status in January 2010.[494] In 2011 Sri Lanka had the highest Human Development Index rank in South Asia.[494] The tourism industry, one of the country's main

income sources, started to flourish at the end of the armed conflict. Despite a long-term history of tourism, between 1999 and 2009 international tourist arrivals grew only by 4% due to the uncertain security situation, while the global tourism growth rate was 45%.[495] However, by 2013, Sri Lanka was number one in the list of best countries to travel to according to the Lonely Planet tourist guide website.[496] Tourist arrivals increased from 0.4 million in 2009 to 1.2 million by 2013.[497] At 337 billion rupees (70% increase compared to 2009), tourism's direct contribution to the Sri Lankan economy in 2013 was significant.[498]; nevertheless, as discussed below, alcohol consumption by tourists has not been sufficient to alter the trend in alcohol consumption in the country. Per capita, Gross National Income (GNI) among Sri Lankans increased from $820 per year in 1998 to $2020 in 2009 which is an increment of $100 per year.[303] Since 2009 per capita GNI has increased by $368 per year up to $3490 in 2013.[303]

There is an inverted U-shape relationship between beer consumption and income. The rapid increase in beer consumption demonstrated in Sri Lanka is in line with the other low and middle income countries that have seen significant economic growth such as Russia, China and India.[499] Furthermore, increased globalisation has resulted in a convergence pattern of alcohol consumption in countries around the world and traditionally beer drinking countries experience a decline in consumption whereas traditionally spirit and wine drinking countries experience an increase in beer consumption. The rapid increase in beer but not spirit consumption in Sri Lanka is also in line with this international trend.[499] Sri Lanka has experienced this increase in alcohol consumption despite continuous increases in alcohol prices over time,[500] which is likely to be due to incomes rising faster than prices, making alcohol more affordable.[303, 501]

Tourism

In addition to the contribution from the economic development, tourists' arrival may have also contributed to the increased consumption of beer and other drinks in Sri Lanka as tourists are more likely to consume these rather than arrack. However, the influence of consumption by tourists on the trend in annual per capita consumption measures is likely to be minimal as tourists represent a relatively small proportion each year when compared with the total population of Sri Lanka. For example, assuming that all tourists who visited Sri Lanka were adults and stayed for the whole year of 2013 (which had the highest number of tourist arrivals since the end of conflict), the total per capita consumption with and without tourists in 2013 was 2.34 and 2.56 litres of pure alcohol respectively. However, the actual impact of tourists consumption is likely to be much smaller than this as it is unlikely that all tourists are adults and their stay tends to be relatively short.[497] In 2013, almost 80% of tourists stayed in Sri Lanka only up to a fortnight.[497]

Alcohol industry penetration

In addition to economic development, alcohol industry penetration and increased availability of alcohol during post-conflict periods have shown strong links with increased alcohol consumption in different settings.[111, 113] Similarly, Sri Lanka has also become a hot spot for alcohol industry activity since 2009. Arrack and beer are largely produced by two companies. The Distilleries Company of Sri Lanka (DCSL) is the leading arrack producer with more than 75% of market share, whereas the Lion Brewery (Ceylon) PLC, partially owned by the Carlsberg Group, is the market leader of the beer industry with around 80% market share.[502] Both companies have seen market expansion since the end of the armed conflict. DCSL's net profit

increased from 2682 million Sri Lankan Rupees in 2009 to 6873 million Rupees by 2013, an increment of 156%.[503] Lion Brewery's rapid market expansion increased its net profit from 88 million Sri Lankan Rupees in 2009, to 1046 million Rupees by 2013, almost a 12-fold increment within 4 years.[504]

The Lion Brewery used several strategies to achieve this high level of profit within a short period of time, whilst keeping beer prices attractive to both local and foreign consumers. In 2010, the Lion Brewery increased its brewing plant's capacity by 30% and in 2011 introduced a new beer brand called Corona.[504] At the same time, Lion Brewery identified the growing market for beer in Sri Lanka through its market research and comparisons with other Asian countries such as India, Thailand and Vietnam, and commissioned a new brewhouse in 2012.[504] This new brewhouse was equipped with the modern facilities required to modernise and expand production to meet the increasing demand from Sri Lankans who were more likely to socialise, stay out and search for sources of enjoyment after the end of the armed conflict.[504] During the same year, Lion Brewery was appointed as the sole importer and distributor of Diageo, the world largest premium alcohol beverage business selling all types of alcohol including spirits, beer, wine, whisky, vodka, rum and gin.[504] All these measures taken by the beer industry in Sri Lanka likely to have increased the availability of alcohol during the post-conflict period and influenced the dramatic increase in beer consumption as well as the slight increase in consumption of other drinks.

Weak low enforcement and lack of alcohol control policies

In this context, weak law enforcement and lack of alcohol control strategies may be other reasons for this rapid increase in consumption during the post-armed conflict period in Sri Lanka.[259, 288] Even though the Sri Lankan government in power from November 2005 to January 2015 developed an alcohol control strategy and a new alcohol control act, they continued to provide licences for new liquor sales outlets and registered more alcohol producers.[259, 505] Conversely, intensive raids on illicit alcohol brewers carried out by the Excise Department and Police Department in 2010 may have forced people to consume legally-produced alcohol products which would have made a positive contribution towards the increment of recorded alcohol sales.[505]

6.3.3.2 Explanations for the provincial level findings

After the end of conflict, there was no significant change in the trend of arrack per capita consumption in any of the provinces. However, in relation to the level of arrack consumption, Central province showed the highest per capita arrack consumption when compared with the other provinces throughout the whole study period. This is likely to be due to the ethnic composition of Central province which has the highest Tamil population (23.8%) when compared with other six provinces indirectly affected by the conflict; Western (6.8%), Southern (1.8%), North Western (3%), North Central (1%), Uva (14%), and Sabaragamuwa (9.2%).[306] Tamils have been found to have relatively higher current and heavy drinking rates when compared with Sinhalese who represent the majority in all seven districts.[255, 265, 266]

Per capita beer consumption showed a rapidly increasing trend after the end of conflict in all seven provinces and this trend was highest in the North Central province, not in the Western province as hypothesized initially. Of the provinces considered in this study, North Central province is the geographically closest province to the areas that were directly affected by the conflict. Even though the conflict between the Sri Lankan military forces and LTTE mainly took place in the Northern and Eastern provinces, the North Central province, which neighbours the Northern and Eastern provinces, was affected by this conflict from time to time. For example, in 2006 LTTE used a bus bomb and killed around 68 civilians and injured over 70 civilians in Kebithigollewa, a town situated in North Central province.[506] Therefore, the end of conflict in 2009 may have had a greater impact on the day to day lives of population living in this province when compared to other provinces. Even though the mean monthly household income increase in this province from 2009 to 2012 was only Rs.1397,[305, 307] its unemployment rate reduced from 4.7 in 2009 to 2.5 in 2011, the highest unemployment rate reduction during that time period in the seven provinces considered in this study.[507] North Central province is predominantly an agricultural farming area and this reduced unemployment is likely to be due to increased agricultural activity although it generates relatively low income.[507]

Moreover, the direct involvement of Lion Brewery in helping the farmers in this this province is likely to have had an impact on peoples' perceptions about the alcohol industry. During the post conflict period, Lion brewery worked with 3581 farmers in this province and helped them in many ways, such as introducing modern farming technologies and methods to reduce cost while increasing their income.[508] According to Lion Brewery this was their most far reaching community service scheme within the country.[508] The reduction in unemployment and alcohol industry's

involvement in this province is likely to have led to its increasing trend of beer consumption during the post conflict period.

Further variation in beer consumption within other provinces included in this study can mainly be explained by considering their ethnic composition, proportion of urban and rural areas and mean household income level presented in Section 1.10.2. However, it was not possible to consider these factors in the data analysis as they have been collected infrequently over time.

In addition to these factors, the tourism industry is likely to have contributed towards increased income and urbanization, particularly in Western, Central, North Central, and Southern provinces, as they have the key tourist attractions.[497] However, tourism is unlikely to have a direct effect on alcohol consumption in any of these areas. For example, in 2013 the number of nights spent at the key tourist attractions in the Western province (the most visited province by tourists) was 2,637,262 which is equivalent to 7225 foreigners spending a whole year in Western province.[497] Assuming that all foreigners were adults and consumed beer, the per capita beer consumption in Western province with and without foreigners in 2013 was 0.6303 and 0.6294 litres of pure alcohol respectively.

6.3.3.3 Strengths and limitations

Strengths

To the best of my knowledge this study is the first study to formally assess and quantify the effect of the end of conflict on adult alcohol consumption in Sri Lanka. It has evaluated not only the effect of the end of the conflict on alcohol consumption among the total population living in the areas that were indirectly affected by the conflict but also provincial level

changes in consumption. The findings from this study add to the limited evidence base on alcohol consumption in post-conflict countries, identifying an increasing trend in alcohol consumption since the end of the war among Sri Lankans who were not displaced or directly exposed to war.

Limitations

This study's results are based on ecological data analysis thus limits the ability to establish causation between the conflict exposure and alcohol consumption. Moreover, there were only four data points to identify the per capita consumption trend after the end of armed conflict. Even though this satisfies the minimum number of data points required to carry out segmented regression analysis,[116] it was not possible to identify whether the effects of alcohol consumption identified in this study were sustained after the conflict.

Furthermore, this study did not include data from the seven districts that were directly exposed to the conflict as there were no complete and consistent alcohol sales and mid-year population data available from the government departments for these seven districts for the whole study period. However, since the end of armed conflict, a notable increase in alcohol consumption and alcohol consequences has been reported in these areas.[142, 295] This could be due to trauma exposure,[295] mental health problems,[295, 299] poverty and unemployment,[299, 507] removal of restrictions on selling alcohol in the armed conflict affected areas,[505] and alcohol industry penetration in these areas.[504]

The alcohol sales data used in this study provided a representative dataset on recorded alcohol consumption among the 18 districts as they included alcohol sales figures from every on-trade and off-trade alcohol outlets. The recorded alcohol consumption measures of this study are therefore, largely generalizable to the areas that were not directly affected by the war in Sri Lanka. This study focused only on recorded per capita consumption due to unavailability of annual unrecorded alcohol consumption estimates from the Department of Excise or from any other data sources. However, it is known that illicit alcohol contributes to a significant amount of total alcohol consumed in Sri Lanka.[141, 259, 317, 489] The WHO estimate of unrecorded alcohol consumption in Sri Lanka for the period from 2008-2010 was 1.5 litres of pure alcohol, which is around 40% of the total consumption for that period.[1] Depending on the area of Sri Lanka this percentage may be as high as 60%,[141, 261, 262] and the trend in unrecorded alcohol consumption is increasing.[317] Therefore, it is important to monitor not only the recorded but also unrecorded consumption using methods such as annual alcohol surveys, which would enable research into total alcohol consumption among Sri Lankans.

6.3.4 Conclusion

Rapid socio-economic development, reduction in unemployment, alcohol industry penetration, weak law enforcement and lack of alcohol control strategies during the post-conflict period may have driven the rapid increase in alcohol consumption among Sri Lankans. Enforcement of existing policies and formulation of new alcohol control strategies in Sri Lanka are vital. Future research should focus on identifying the individual-level characteristics of drinkers, the average volume of total consumption

(recorded and unrecorded), patterns of drinking such as binge drinking and alcohol use disorders among drinkers in the areas that were directly exposed and not exposed to the armed conflict. Such information will facilitate the successful delivery of alcohol harm reduction strategies through the identification of groups of people who are more likely to misuse alcohol and be at higher risk of experiencing alcohol-related harm.

Moreover, this study provides crucial evidence on the risk of alcohol-related harm in post-conflict regions, informs the global alcohol control community including researchers, policymakers, and advocates about this important public health problem. In due course, this evidence can be used to guide and support countries around the world with on-going conflicts enabling the rapid implementation of alcohol control strategies during post-conflict periods. This will reduce the risk of additional public health burden in post-conflict settings.

7 SUMMARY, CONCLUSIONS AND FUTURE DIRECTIONS FOR RESEARCH

Countries around the world have different alcohol consumption levels, consequences and alcohol control policies. While the UK is experiencing a downward trend in alcohol consumption, Sri Lanka is seeing an increasing trend in alcohol consumption. However, both countries experience a significant public health burden due to alcohol misuse. Therefore, it is important to evaluate existing alcohol control policies or contextual factors affecting alcohol consumption in these settings and to identify existing data sources that can be used for alcohol control policy evaluation.

This thesis aimed to investigate the suitability of existing data sources in the UK and in Sri Lanka for evaluating the impact of alcohol control policies or contextual factors affecting alcohol consumption, validate potentially suitable measures and use validated measures to evaluate the impact of a recent alcohol control policy/contextual factor. This concluding chapter summarises the key findings from the research in this thesis, provides a comparison between the UK and Sri Lanka status in terms of existing data sources and alcohol control policies, and discusses implications of findings and avenues for future research on alcohol control policy evaluation in the UK and in Sri Lanka.

7.1 Existing data sources in the UK and in Sri Lanka

7.1.1 Existing data sources in the UK

The UK has an abundant amount of data sources on alcohol consumption and Chapter 2 provided a comprehensive summary of these data sources (survey data, primary care data, market research data) while focusing on survey data that are particularly suitable for evaluating the Licensing Act 2003. However, this chapter showed that only a limited number of data sources could be used for alcohol control policy evaluation in general and for the Licensing Act 2003 evaluation specifically.

Further evaluation of primary care data in Chapter 3 showed that the recording of alcohol consumption in primary care remains low, particularly when recent recording within a given year is considered. Moreover, alcohol consumption recording in primary care is higher among at-risk groups such as women in childbearing age and older people who are likely to have an illness linked to alcohol. Therefore, this chapter showed that primary care data cannot be reliably used for evaluating the effect of the Licensing Act 2003 on adult alcohol consumption.

Chapter 4 assessed the quality of alcohol survey data while comparing them with the existing international guidelines for measuring alcohol consumption and identified the Health Survey for England's heaviest drinking day alcohol consumption measure as the most suitable measure for evaluating the effect of the Licensing Act 2003. This measure was consistent over time and it was available on a quarterly basis for a nationally representative sample.

7.1.2 Existing data sources in Sri Lanka

When compared with the UK, Sri Lanka has a very limited number of sources of alcohol consumption data and currently none of the individual level alcohol consumption data sources in Sri Lanka are suitable for alcohol control policies/contextual factor evaluation purposes. However, in terms of population level alcohol consumption, the Department of Excise alcohol sales data were identified as an appropriate data source for monitoring alcohol consumption in Sri Lanka. Therefore, this data source was used in evaluating the effect of the end of conflict on adult alcohol consumption.

The lessons learned by reviewing and assessing existing data sources in the UK in this thesis will be beneficial in implementing the necessary improvements to existing data sources or in generating a new tool for measuring alcohol consumption such as an annual national alcohol survey in Sri Lanka. The suggestions for these improvements will be discussed in detail in Section 7.3 below.

7.2 How to improve UK data sources?

None of the data sources presented in Chapter 2 are without limitations. However, when compared with primary care alcohol consumption data, alcohol survey data have the ability to provide much more detail on alcohol consumption among individuals. Moreover, surveys can be designed to obtain data on a nationally representative sample in pre-defined time intervals (quarterly or monthly). Therefore, further improvements of alcohol survey data in the UK will be particularly beneficial for alcohol control policy evaluation purposes which require detailed and timely information on alcohol consumption.

7.2.1 Alcohol survey data

The comparison of international guidelines for monitoring alcohol consumption with alcohol surveys in England in Chapter 4 showed that alcohol surveys in England could be further improved by having the recommended questions on all the key indicators of alcohol consumption (alcohol consumption status, average consumption, frequency and volume of binge drinking) consistently over time. In addition to this key set of questions, it is recommended to also ask about drinking locations (on/off trade) and drinking times and drinking with meals or not.

On the basis of my findings on Chapter 4, I responded to a recent Health Survey for England consultation (Appendix 8.5) and described which measures should be included and the importance of consistency over time in the data collected. This is likely to have contributed towards retaining the heaviest drinking day alcohol consumption measures in annual data collection, and adding the average weekly alcohol consumption measure to the core set of questions annually for the period from 2016-2020 (Appendix 8.6).

However, the international guidelines considered in Chapter 4 do not necessarily include all that is needed for successful evaluation of alcohol control policy. Evaluating the effect of alcohol control policies or contextual factors on alcohol consumption would benefit from more detailed information with which to investigate whether and how the policy/contextual factors caused a change in alcohol behaviour.

As discussed in the previous sections of this thesis, alcohol consumption among individuals is a complex behaviour and numerous studies have shown that the Theory of Planned Behaviour (TPB) can be used to predict alcohol consumption among individuals.[238, 239] Therefore, including questions related to drinkers' attitudes, subjective norms and

perceived behaviour control in UK surveys would be beneficial for evaluating the effect of alcohol control policies and identifying their causal pathways towards changing drinking behaviour among individuals. Moreover, collecting data on topics such as social supply of alcohol (someone else buying alcohol for the drinker), preloading (drinking alcohol before going out to places such as bars and nightclubs), traveling times to buy alcohol, exposure to alcohol advertising, and alcohol purchasing information would be important for evaluating different alcohol policy options such as pricing policies, policies aimed at reducing alcohol availability, and policies on alcohol marketing.

Of the above-mentioned policy options, minimum unit pricing policy has been recommended as key to reducing consumption and the health harms of alcohol in the UK.[55, 59] However, evaluation of pricing policies in the UK has been limited due to lack of a longitudinal survey obtaining data on both price and alcohol consumption. Therefore, the recent modelling studies of alcohol pricing policies have used repeated cross sectional survey data, particularly the GHS alcohol consumption data and Expenditure and Food Survey (now called as the Living Costs and Food Survey) data on volumes of alcohol purchased and prices paid by individuals,[195, 509] and have matched GHS and EFS data at subgroup level. However, this approach of combining alcohol consumption and purchase data from two different surveys on two different populations is not ideal as there can be differences in purchasing preferences and consumption preferences. Therefore, a single longitudinal data source providing information on both alcohol consumption and alcohol purchase would be valuable for UK alcohol pricing policy evaluation purposes.

7.2.2 Primary care data

In addition to the above-mentioned suggestions for improving alcohol survey data in the UK, any further improvements in primary care data would also be beneficial in identifying and supporting problem drinkers, monitoring trends in consumption and evaluating the effectiveness of alcohol harm reduction strategies.

GPs are reported as having difficulties in selecting the appropriate Read code due to availability of numerous alcohol consumption related Read codes, some of these Read codes are outdated or do not provide specific information on the volume of alcohol consumption.[329] For example, currently used Read code lists include a group of codes which refer to the type of alcohol consumed such as 'Spirit drinker' and 'Beer drinker' but those codes do not allow the clinician to capture the volume of alcohol consumed. Therefore, creating a more GP friendly Read code list with the prioritization of more relevant Read codes would improve the quality of alcohol consumption data recorded in primary care.

Providing financial incentives and managerial support for practitioners in terms of training opportunities and extra time required for identification and recoding of alcohol consumption is another way of improving the quality of data from primary care.[329, 433, 437] Appropriate training on conducting standardized alcohol screening tests such as AUDIT or AUDIT-C and on the use of relevant Read codes would be beneficial in terms of fostering a more standardized approach to alcohol consumption recording in primary care rather than the currently used highly personalized approach of data entry and use of free text.[329] Further training on initiating alcohol consumption related discussions with patients and conducting screening tests in the primary care environment may help to reduce general practitioners' ambivalence about their role in alcohol consumption screening and providing

brief intervention.[433, 436] In addition, alcohol consumption recording in primary care can be improved by universal screening of patients rather than using the current approach of targeted screening of patients who are at risk of alcohol-related health problems.[442] This targeted approach can miss a large proportion of patients who might consume harmful quantities of alcohol.[437, 440, 441]

These steps should increase the proportion of patients having alcohol consumption records in primary care and improve the comparability of alcohol consumption data across different practices in the UK as well as over time. This would increase the identification of harmful drinkers as well as the delivery of an appropriate level of care such as brief intervention or extended brief intervention.[510, 511] Provision of brief intervention in primary care has proven to be effective in triggering behavioural changes towards a reduction in alcohol consumption especially among heavy drinkers.[512, 513] Therefore, improvements in screening and recording of alcohol consumption in primary care can ultimately facilitate a reduction in alcohol misuse in the UK.

7.3 How to improve Sri Lanka data sources using lessons learned from the UK context?

The currently available individual level alcohol consumption data sources in Sri Lanka are not suitable for alcohol control policy or contextual factor evaluation purposes. Therefore, improving existing alcohol surveys or generating a new survey will be important for evaluating the new National Policy on Alcohol Control in Sri Lanka.[183, 514]

7.3.1 Improvements in survey data

As mentioned in Section 6.2, the recent national surveys on alcohol consumption conducted by the government have several limitations particularly in relation to the questions used. Moreover, the bi-annual alcohol survey conducted by ADIC does not include any questions on the volume of alcohol consumption. The lessons learned by reviewing international guidelines and assessing alcohol consumption data sources in the UK context could be used to inform the improvement of these data or to generate a new data sources. If there were no funding constraints, a new survey on alcohol consumption in Sri Lanka could include all recommended alcohol consumption questions by the international guidelines; Beverage Specific Quantity Frequency (BSQF) questions or within location BSQF questions for measuring average volume of alcohol consumption, Graduated Quantity Frequency (GQF) questions for measuring the volume and frequency of heavy episodic drinking, questions on drinking context (where, with whom, with meal/without meal). In addition, all other questions recommended for the UK surveys in the section above (Section 7.2.1) such as drinkers' attitudes, subjective norms and perceived behaviour control and information on social supply of alcohol can be added to a new survey. However, these questions will need to be adapted to the Sri Lankan context as discussed below.

Types of beverages and illicit consumption:

The beverage preference in the UK and Sri Lanka are different and the questions would need to be adapted to reflect that. For example, alcohol survey questions in Sri Lanka will need to include arrack and toddy as beverage options.

Moreover, in the UK less than 10% of alcohol is unrecorded whereas in Sri Lanka illicit alcohol can contribute up to 60% of alcohol consumption in some areas. Therefore, alcohol survey questions in Sri Lanka will need to include "Kassippu" (the name used for illicit alcohol in Sri Lanka) as another beverage category, which means that confirming the confidentiality of survey respondents will be particularly important in Sri Lanka as survey respondents are reluctant to report their "Kassippu" consumption.[264]

Regional variations

When compared with the UK, Sri Lanka has substantial variations across geographical regions in terms of the populations' ethnicity, religion and the language. For example, in the Eastern and Northern provinces the vast majority of the population speak Tamil, whereas in other areas of the country people speak in Sinhalese. Hence, it would be important to conduct the survey in Sinhalese and Tamil language in relevant areas. There can be considerable differences in drinking locations, drinking preferences, attitudes, subjective norms and perceived behaviour control among the major ethnic groups in Sri Lanka. Therefore, it would be important to capture this by having a broad range of response options or by using open ended questions. Moreover, alcohol control policy evaluations in Sri Lanka will benefit from having a question on the level of trauma exposure, particularly in the areas that were directly affected by the conflict.

Glass sizes and unit assumptions

The glass sizes or beverage containers in Sri Lanka are likely to be different from what is used in the UK. For example, villages in Sri Lanka use coconut shells as a container to drink toddy. Therefore, it would be important to consider these variations when adapting the survey instruments

recommended by international guidelines or used in the UK to the Sri Lankan context.

When compared with the drinkers in the UK, drinkers in Sri Lanka are less likely to be aware of alcohol unit measures. Therefore, it would be important to use show cards with pictures of commonly used containers.

Survey sample

Due to considerable variations in drinking behaviour among Sri Lankans, not only in terms of socio-demographic factors but also in terms of geographical location, Sri Lanka will require a large nationally representative survey which will enable evaluation of policy measures at relevant population subgroup levels. The key subgroups to consider in Sri Lankan context will include gender (men and women), age (16-24, 25-44, 45-64, 65+), socio-economic status (professional and managerial, intermediate occupations, routine and manual, and unemployed), ethnicity (Sinhalese, Tamil, Muslim, Other) and the level of drinking (moderate, heavy, hazardous).

7.3.2 Improvements in routinely collected alcohol consumption data

The lessons learned by evaluating the primary care data in the UK are unlikely to be directly transferable to Sri Lankan context as the primary care system in Sri Lanka is different from the system in the UK. However, Sri Lanka is currently undergoing a transition period in relation to healthcare data management and moves from paper-based healthcare records at hospitals to an electronic database called as electronic Indoor Morbidity and Mortality Record (eIMMR).[180, 181]

Therefore, the lessons learned by assessing routinely collected primary care data sources in the UK may be valuable in development of alcohol consumption recording in eIMMR. The use of appropriate alcohol screening tools such as AUDIT and AUDIT-C are likely to be minimal in Sri Lanka due to lack of awareness about these tools among Sri Lankan GP practitioners. According to a study conducted in 2003, only 25.7% of GPs in two urban districts (Colombo and Gampaha) of Sri Lanka had heard of different types of alcohol screening tests (CAGE and MAST). Similar to the UK context, providing appropriate training on alcohol consumption screening is likely to improve the alcohol consumption recording in eIMMR. However, providing financial incentives, which has been shown to increase the rates of healthcare data recording in the UK may be less appropriate in Sri Lanka due to the limited resources available for such purposes. Future research should assess the current and future role of GPs in Sri Lanka in in recording alcohol consumption in their patients and in identifying those at risk of harm from alcohol misuse.

7.3.3 Department of Excise Alcohol Sales data

In Sri Lanka, the Department of Excise monitors alcohol sales data. However, alcohol sales data from the Department of Excise is only available on an annual basis. It will be more useful if the data were available more frequently such as on a monthly basis for the whole country. This could be achieved with relatively little effort as the regional level alcohol sales data are already being collected on a monthly basis in Sri Lanka.

7.4 Alcohol control policies in the UK

The UK has experience of implementing several alcohol control policies as mentioned in Section 1.7.3. This thesis focussed on evaluating the Licensing Act 2003 which allowed flexible opening hours for licensed premises in the UK. Despite the widespread concerns relating to the extended opening hours and fears of an increase in binge drinking, there has been a downward trend in heaviest drinking day alcohol consumption since the Act. However, the gradual decline in adult alcohol consumption in England is unlikely to be due to the extended opening hours but more likely to be due to increased policy powers since the Act, birth cohort effects, the characteristics of drinking occasions, mass media campaigns, and increased survey underestimation due increasing off-trade consumption and self-defined drink sizes.

Even though the declining trend in heaviest drinking day consumption in England is relatively small, it is likely to have had an impact on the overall risk of mortality among individuals. According to recently published literature a reduction in the mean weekly alcohol consumption by one unit of alcohol among men and women aged 18-24 who drink once a week can reduce their relative risk of death from an alcohol related condition by about 0.045 and 0.0225 respectively.[515] Chapter 5 showed that the greatest decline in the heaviest drinking day consumption since the Act among adults aged 16-24 which was 0.051 units per quarter. This is equivalent to a reduction of the heaviest drinking day consumption by 1.428 units over a seven-year period which is likely to have led to a small but notable reduction in the relative risk of death from an alcohol related condition among individuals in this group.

In addition to the Licensing Act 2003, PHRD is the other key strategy launched by the government in 2011 which has been found to be ineffective as the alcohol industry has failed to meet PHRD targets such as removing

one billion units of alcohol sold annually from the market.[222, 516] Therefore, formulation and implementation of new alcohol control policies or improving the existing policies will be vital in order to reduce the current alcohol related burden in England as well as in the UK.

Among the potential policy options, minimum unit pricing policy represents a key policy that can be implemented to reduce alcohol misuse in the UK.[56] Current evidence has addressed the government's concerns about the effect of a minimum unit pricing policy on responsible drinkers. The Sheffield Alcohol Policy Model has shown that a minimum unit pricing policy would have a greater impact on harmful drinkers but little impact on moderate drinkers irrespective of their income levels.[56] Therefore, minimum unit pricing policy has the potential to reduce the existing alcohol related health, social as well as economic burden in the UK.

According to the recently updated low-risk drinking guidelines, men and women are not supposed to drink more than 14 units per week.[187] This has made a marked change to previous low-risk drinking guidelines for men which recommended having no more than 21 units per week (3-4 units per day). However, it has been identified that there is a lack of public awareness about the low-risk drinking guidelines.[517-519] In 2009, only 44% and 52% of respondents (age≥16) of a national survey correctly identified the low-risk drinking limits for men and women respectively.[520] Another survey conducted recently has shown that older adults' (age≥50) lack of awareness of drinking guidelines is even higher, as only 26% participants could correctly identify the recommended drink limits.[521]

Adhering to the low-risk drinking guidelines requires not only the knowledge of drinking guidelines but also knowledge of alcohol content in different drinks and serving sizes. Current evidence shows that people often underestimate the actual alcohol content in a self-defined drink and have a

lack of ability to pour standard drinks.[380] Similarly, there is a lack of awareness of alcohol-related consequences and it has been reported that people are more concerned about alcohol related short-term health consequences rather than long-term consequences.[519] Therefore, it is important to take necessary actions to increase the awareness among the public about the low-risk drinking guidelines, alcohol content in different types of drinks and alcohol-related consequences. This can be done by implementing population-level interventions such as mass media campaigns and making further improvements in existing individual-level interventions such as the "Making every contact count" strategy and brief intervention in primary care.[431, 432, 512, 519]

Even though there is a downward trend in alcohol consumption in the UK, alcohol consumption among people aged 45 and over has remained almost constant for a long period of time.[522] Despite this level of alcohol consumption, alcohol-related consequences such as hospital admissions and deaths due to alcohol misuse have been increasing steadily among people in this age group.[523] Moreover, the UK population is ageing and currently, around one-third of the population is aged 50 and over.[524] Hence, future research can focus on alcohol consumption in different age groups especially among older adults (age≥50) who are more likely to be affected by harmful alcohol consumption.[521]

7.5 Applicability of policy options and lessons learned from the UK context to Sri Lankan context

7.5.1 Policy options

When compared with the UK, Sri Lanka has much less experience in implementing different policy options to tackle alcohol misuse. However, the policy options used in the UK are unlikely to be directly transferable to Sri Lanka due to differences in the socio-economic and cultural context between the two countries. For example, the Licensing Act 2003 provided flexible opening hours to the licensed premises with the aim of introducing a more liberalized approach called café culture. However, such approach is unlikely to be suitable for Sri Lanka, where cultural norms discourage drinking, drinking is predominantly a habit among men, and very heavy drinking is more common than in the UK. During 2008-2010, alcohol consumption among drinkers in Sri Lanka was 39 units per week compared to 26 units per week in the UK.[188, 317] The key differences between the UK and Sri Lanka that need to be considered when transferring policy options from the UK context to Sri Lankan context are discussed below.

Areas directly and indirectly affected by conflict

Unlike the UK, Sri Lanka has been affected by a long-term conflict. Therefore, when implementing alcohol control policies in Sri Lanka it is important to consider their impact separately for the areas that were directly and indirectly affected by the conflict. For example, an increase in alcohol outlet density is likely to have a greater impact on alcohol consumption in the areas directly affected by the conflict than in the areas that were indirectly affected by the conflict.

Cultural norms, ethnicity and religion

Unlike the UK, Sri Lanka has substantial geographical variations in terms of ethnicity, language, and culture. Therefore, it is important to consider these variations when implementing alcohol control policies in Sri Lanka. For example, providing broad access to information on alcohol related harm and conducting public awareness programmes have been recommend by the WHO as an important policy option.[12] In line with this recommendation UK has conducted numerous national level awareness campaigns such as the Change 4 life campaign. However, similar alcohol awareness campaigns in Sri Lanka will need to be adapted according to regional variation particularly in terms of the language.

Legal and Illegal alcohol

When compared with the UK, a considerable amount of alcohol in Sri Lanka is consumed as illicit alcohol. Therefore, alcohol control policy options in Sri Lanka will need to take this into account. For example, continuous increment in taxes for legal alcohol could lead to an increase in illicit alcohol consumption in Sri Lanka. Hence, prior to implementing such policies in Sri Lanka it will be important to assess their likely impact on illicit alcohol consumption among different population subgroups. Moreover, increasing the raids on illicit alcohol brewers and providing further resources and powers to the police to deal with illicit alcohol industry likely to be potential polity options for controlling illicit alcohol industry in Sri Lanka.

Increasing trend of beer consumption

In the UK, beer consumption is decreasing whereas in Sri Lanka beer consumption is rapidly increasing. As discussed in Chapter 6, rapid socio-economic development and alcohol industry penetration is likely to have increased the affordability and availability of beer in Sri Lanka. On the other hand, the direct involvement of the beer industry in helping people in the rural areas of Sri Lanka is likely to have had a greater impact on their perceptions about the alcohol industry. Therefore, alcohol control policies in Sri Lanka will need to consider these issues in tackling the rapidly increasing trend in beer consumption. For example, forcing greater openness about the involvement of the alcohol industry in society and limiting such involvement could be potential policy options.

The studies conducted up to now on alcohol consumption in Sri Lanka haven't explored the individual level alcohol consumption in detail using a nationally representative sample in Sri Lanka. Therefore, currently Sri Lanka does not have reliable information and evidence on beverage specific consumption, pattern of drinking and trend in alcohol consumption on a nationally representative sample by population subgroups. Having such detailed information on alcohol consumption will be vital in formulating evidence based policy measures for a country like Sri Lanka that has unique issues such as conflict exposure and substantial variation in alcohol consumption by ethnicity. Hence, consistent monitoring of alcohol consumption on a nationally representative sample and enabling research into alcohol consumption habits among Sri Lanka likely to be important policy options in tackling this increasing trend of beer consumption in Sri Lanka.

7.5.2 Research methods on policy evaluation

The previous sections of this thesis discussed the study designs that are particularly suitable for evaluating population level interventions. The lessons learned by using these study designs and data analysis techniques will be beneficial for evaluating future population level alcohol control policies in Sri Lanka. Natural experiments and time series methods will particularly be beneficial for evaluating the future public health policy options in Sri Lanka, and they allow researchers to look at the effect of introducing a new policy at a particular point in time whilst controlling for temporal trends. Therefore, training epidemiologists, public health specialists and researchers in these techniques would provide them with the skills to evaluate a range of policies in Sri Lanka. Moreover, the work involved in this thesis has highlighted the importance of outcome as well as process evaluation of policies implemented at population level and how mixed methods can help in providing a fuller picture of the effectiveness of policy options.

7.5.3 Avenues for future research

The government of Sri Lanka has recently published a new national policy document on alcohol control, which aims to achieve best practice in alcohol control by formulating and implementing new legislations while enforcing the existing alcohol control policies in the country.[183] This includes ten target areas for policy improvements including changes in policies related to alcohol marketing, pricing, availability, accessibility of alcohol products from any source and drink-driving.

The new national policy on alcohol control aims to eliminate all direct and indirect forms of alcohol advertising, promotion and marketing. According to this policy document legislations are planned to be developed in relation to eliminating point of sale advertising, internet promotions, promotions through corporate social responsibility (CSR) projects, and any form of promotion through locally and internationally produced publications and entertainment programmes such as television dramas and cinemas. Furthermore, it mentions that new laws and regulations will be developed to ensure labelling and packaging of alcohol products to make sure that they do not contain any misleading terms or images which imply the product is harmless or confers health benefits. Minimising alcohol consumption among individuals through pricing is another policy area considered under the new national policy. The government aims to change the existing tax system in Sri Lanka and introduce a new tax system where alcohol products will be taxed according to the pure alcohol content within them. According to this new national policy document alcohol availability and accessibility to those below the age of 21 will be restricted in a sustained and coordinated manner. This is planned to be achieved through enforcement of NATA Act and implementation of further legislative measures. The current drink-drive Blood Alcohol Concentration (BAC) limit for drivers in Sri Lanka is 0.08g per 100ml of blood, which is the same as in the England according to the drink-drive law.[525] The new national policy in Sri Lanka aims to reduce this limit to 0.01g per 100ml of blood. Moreover, the penalties for drink-driving and the capacity of the police to detect people driving while impaired due to alcohol are planned to be improved. The national policy for alcohol control in Sri Lanka further aims to improve the policy measures for several other areas of concern. These include elimination of illicit alcohol production and sale through sustained, vigorous law enforcement and community interventions.

Protecting third parties from the negative consequences of alcohol is another area of policy focus as it can help to reduce the risk of domestic violence, child abuse and suicide in Sri Lanka.

Consistent monitoring and evaluation will be required to confirm and encourage the actual implementation and enforcement of all these strategies mentioned in the Sri Lankan national alcohol control policy document, which is ambitious in its aims to achieve best practice in alcohol control.

However, Sri Lanka will require a sufficiently large nationally representative dataset on alcohol consumption among individuals for monitoring the effectiveness of policy options suggested by the new National policy document as mentioned in Section 7.3 above. Thereafter, other data sources such as the Department of Excise alcohol sales data, police data on drink-drive accidents and hospital data can be combined to generate better understanding of policy options implemented in Sri Lanka.

To address the gap in monitoring and evaluation of alcohol control policies in Sri Lanka I took the initial steps towards a collaborative project with the guidance from my supervisors in 2015. The proposed project aimed to implement the Sri Lankan arm of International Alcohol Control Policy Evaluation (IAC) study, which not only generates high-quality individual level alcohol consumption measures using longitudinal cohort surveys but also uses those data to evaluate key national policies.

Successful implementation of the above-mentioned project or other similar projects aiming to generate high quality alcohol consumption data for alcohol control policy evaluation in Sri Lanka will not only enable future research projects identifying individual level characteristics of drinkers but also support successful formulation, implementation and delivery of alcohol harm reduction strategies in Sri Lanka. In addition, it will contribute to the international evidence base for public health action by providing comparative

data on Sri Lanka's alcohol policy status and the effect of the policy as implemented. Therefore, the other countries with similar socio-economic background such as South Asian countries will particularly benefit from this study as they will be able to use the learnings from this study to tackle alcohol related burden.

7.6 Overall Conclusions

This thesis identified the existing data sources that can be used for alcohol control policy evaluation purposes in two settings; UK and Sri Lanka. It has highlighted the further improvements required in existing alcohol consumption related data sources in both countries and discussed the potential of applying lessons learned from the UK context to Sri Lankan context. Despite the current trend in alcohol consumption, both countries experience a significant public health burden due to alcohol misuse. Therefore, both countries will require formulation and implementation of new policy measures. However, Sri Lanka does not have high-quality individual level alcohol consumption data to support the monitoring and evaluation of alcohol control policies. Therefore, this thesis has emphasised the need to generate high-quality alcohol consumption data in Sri Lanka and carry out monitoring and evaluation of alcohol control policies to tackle the alcohol-related burden.

7.7 Role of the candidate

The initial idea for this PhD was from my supervisors; Dr Tessa Langley, Dr Lisa Szatkowski and Professor Sarah Lewis. The candidate continued to develop the project and each specific research question, with the guidance from supervisors. Alcohol sales data for Sri Lanka study was

obtained as photocopied datasheets from the original log book maintained at the Department of Excise. THIN dataset was initially extracted by Dr Yue Huang based on the read code list provided by the candidate. The candidate conducted the literature review, identified/extracted Read codes for alcohol consumption, carried out all the data management tasks and all statistical analyses. The candidate generated all tables, figures and wrote the thesis. Thesis draft was read and approved by the supervisors.

8 APPENDICES

8.1 Alcohol consumption related read codes used in Primary Care

medcode	Medcode Description
ZV4KC00	[V] Alcohol use
1361.00	Teetotaller
1361.11	Non drinker alcohol
1361.12	Non-drinker alcohol
1362.00	Trivial drinker - <1u/day
1362.11	Drinks rarely
1362.12	Drinks occasionally
1363.00	Light drinker - 1-2u/day
1364.00	Moderate drinker - 3-6u/day
1365.00	Heavy drinker - 7-9u/day
1366.00	Very heavy drinker - >9u/day
1367.00	Stopped drinking alcohol
1368.00	Alcohol consumption unknown
1369.00	Suspect alcohol abuse - denied
136..00	Alcohol consumption
136A.00	Ex-trivial drinker (<1u/day)
136a.00	Increasing risk drinking
136B.00	Ex-light drinker - (1-2u/day)
136b.00	Feels should cut down drinking
136C.00	Ex-moderate drinker - (3-6u/d)
136c.00	Higher risk drinking
136D.00	Ex-heavy drinker - (7-9u/day)
136d.00	Lower risk drinking
136E.00	Ex-very heavy drinker-(>9u/d)
136J.00	Social drinker
136K.00	Alcohol intake above recommended sensible limits
136L.00	Alcohol intake within recommended sensible limits
136M.00	Current non drinker
136N.00	Light drinker
136O.00	Moderate drinker
136P.00	Heavy drinker

136Q.00	Very heavy drinker
136R.00	Binge drinker
136S.00	Hazardous alcohol use
136T.00	Harmful alcohol use
136V.00	Alcohol units per week
136W.00	Alcohol misuse
136X.00	Alcohol units consumed on heaviest drinking day
136Y.00	Drinks in morning to get rid of hangover
136Z.00	Alcohol consumption NOS
136F.00	Spirit drinker
136G.00	Beer drinker
136H.00	Drinks beer and spirits
136I.00	Drinks wine
4I91.00	Breath ethanol level
4I91.11	Breath alcohol level
ZV70411	[V]Medicolegal blood alcohol test
ZV70L00	[V]Blood-alcohol and blood-drug test
6892.00	Alcohol consumption screen
388u.00	Fast alcohol screening test
38D3.00	Alcohol use disorders identification test
66e..00	Alcohol disorder monitoring
66e0.00	Alcohol abuse monitoring
68S..00	Alcohol consumption screen
9k15.00	Alcohol screen - AUDIT completed
9k16.00	Alcohol screen - fast alcohol screening test completed
9k17.00	Alcohol screen - AUDIT C completed
9k18.00	Alcohol screen - AUDIT PC completed
ZR1E.00	Alcohol dependence scale
ZR1E.11	ADS - Alcohol dependence scale
ZR1F.00	Alcohol use disorders identification test
ZR1F.11	AUDIT - Alcohol use disorders identification test
ZR1G.00	Alcohol use inventory
ZRa1.00	Michigan alcoholism screening test
ZRa1.11	MAST - Michigan alcoholism screening test
ZRa1100	Brief Michigan alcoholism screening test
ZRa1111	BMAST - Brief Michigan alcoholism screening test
ZRa1200	Short Michigan alcoholism screening test

ZRa1211	SMAST - Short Michigan alcoholism screening test
ZRaU.00	Munich alcoholism test
ZRaU.11	MALT - Munich alcoholism test
ZV79100	[V]Screening for alcoholism
38D2.00	Single alcohol screening questionnaire
38D4.00	Alcohol use disorder identificatn test consumptn questionnre
38D5.00	Alcoh use disor id test Piccinelli consumption questionnaire
38Df.00	Five-shot questionnaire on heavy drinking
38Dz.00	Severity of alcohol dependence questionnaire
38Dz.11	SADQ - Severity of alcohol dependence questionnaire
9k13.00	Alcohol questionnaire completed
ZRk6.00	Severity of alcohol dependence questionnaire
ZRk6.11	SADQ - Severity of alcohol dependence questionnaire

8.2 Availability of alcohol consumption data for patients registered in primary care – eLetter

British Journal of General Practice
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RESEARCH

Alcohol consumption screening of newly-registered patients in primary care: a cross-sectional analysis

Zarnie Khadjesari, Louise Marston, Irene Petersen, Irwin Nazareth, Kate Walters
DOI: 10.3399/bjgp13X673720 Published 1 October 2013

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1 August 2014

Availability of alcohol consumption data for patients registered in primary care

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Further to the recently published research paper on alcohol consumption screening of newly registered patients in primary care in the UK,[1] we investigated the recording of alcohol consumption among all patients registered and active in The Health Improvement Network (THIN). THIN is a dataset of electronic primary care records from over 500 UK general practices, which provides a representative sample of the UK population.[2,3] This study started in early 2013, before the recent publication by Khadjesari et al.[1]

For each year from 2003 to 2012, all patients aged >=16 years who were registered with a THIN practice for the whole of the year were identified. We used Read codes[4] for levels of drinking and the results of alcohol consumption screening tests to identify the proportion of patients with an alcohol consumption status recording in each year as well as ever since they registered with their practice (code lists available on request from the authors). We further analysed the alcohol consumption records documented in 2012 in terms of their completeness and meaningfulness. This was done by identifying incomplete records, which indicated patients as having a record of alcohol consumption but did not provide any further information on level of drinking or unit measures of alcohol consumption.

Approximately 3 million patients aged >=16 years were alive and registered with a THIN practice during each year (Table 1). In 2003 only 29% of patients had a record of alcohol consumption since they registered with their practice, and only 4% of patients had their consumption recorded during that year. However, the completeness of recording has improved over time. In 2011 the proportion of patients having an alcohol consumption recording ever since registration with their practice rose above 50% and this increased to approximately 65% in 2012. Just 12.5% of patients registered in THIN in 2012 had their consumption recorded during that year. However, not all of these records were meaningful due to their incompleteness. For example, there were Read codes were documented indicating 'alcohol consumption' or classifying the patient as a 'drinker' but the classifying information attached to these Read codes did not have any unit measures or information on the level of alcohol consumption. Some other records were also identified as non-meaningful since they suggested an implausibly high level of consumption or were a record of a screening test but with invalid, or missing test results. Therefore, only 11.7% of patients had a complete and meaningful alcohol consumption recording in their records in 2012.

Table 1: Alcohol consumption recording in primary care from 2003 to 2012

Year	Number of patients active in each year	Number of patients having a record since registration	Number of patients having a record in this year	Percentage of patients having a record since registration	Percentage of patients having a record in this year
2003	3,016,220	875,846	120,839	29.04	4.01
2004	3,051,224	984,251	151,513	32.26	4.97
2005	3,104,865	1,075,307	129,801	34.63	4.18
2006	3,123,560	1,154,826	138,119	36.97	4.42
2007	3,143,188	1,238,856	144,601	39.41	4.60
2008	3,159,658	1,330,802	151,702	42.12	4.80
2009	3,099,390	1,401,125	171,661	45.21	5.54
2010	3,034,089	1,484,432	188,627	48.93	6.22
2011	2,987,201	1,622,675	234,633	54.32	7.85
2012	2,918,231	1,888,454	365,632	64.71	12.53

The recent study by Khadjesari et al reported that a total of 292,376 (76%) of 382,609 newly registered patients in 2007-2009 had entries for alcohol consumption.[1] However, newly registered patients represent only about 15% of the patients registered within a practice and they are relatively younger than total practice populations. Therefore the results reported may not be broadly generalizable to the UK population and do not fully capture the magnitude of the change in recording over time.[1]

Our study has found that alcohol consumption recording among all patients registered and active in THIN remains low, particularly when recent recording within a given year is considered. In conclusion, our study further emphasises the importance of making efforts to improve alcohol consumption recording in primary care, which at an individual level will be beneficial in identifying and supporting problem drinkers, and at a population level may provide useful data to monitor trends in consumption and evaluate the effectiveness of alcohol harm reduction strategies.

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Conflict of Interest:

None declared

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Conflict of Interest:
None declared.

8.3 Measuring Alcohol Consumption in Population Surveys

Alcohol and Alcoholism Advance Access published June 25, 2015

Alcohol and Alcoholism, 2015, 1–9
doi: 10.1093/alcalc/agv073
Article

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Measuring Alcohol Consumption in Population Surveys: A Review of International Guidelines and Comparison with Surveys in England

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Received 26 January 2015; Revised 7 May 2015; Accepted 31 May 2015

Abstract

Aims: To review the international guidelines and recommendations on survey instruments for measurement of alcohol consumption in population surveys and to examine how national surveys in England meet the core recommendations.

Methods: A systematic search for international guidelines for measuring alcohol consumption in population surveys was undertaken. The common core recommendations for alcohol consumption measures and survey instruments were identified. Alcohol consumption questions in national surveys in England were compared with these recommendations for specific years and over time since 2000.

Results: Four sets of international guidelines and three core alcohol consumption measures (alcohol consumption status, average volume of consumption, frequency and volume of heavy episodic drinking) with another optional measure (drinking context) were identified. English national surveys have been inconsistent over time in including questions that provide information on average volume of consumption but have not included questions on another essential alcohol consumption measure, frequency of heavy episodic drinking. Instead, they have used questions that focus only on maximum volume of alcohol consumed on any day in the previous week.

Conclusions: International guidelines provide consistent recommendations for measuring alcohol consumption in population surveys. These recommendations have not been consistently applied in English national surveys, and this has contributed to the inadequacy of survey measurements for monitoring vital aspects of alcohol consumption in England over recent years.

INTRODUCTION

Monitoring alcohol consumption across a population is crucial to evaluating whether national policies and approaches are being effective in reducing alcohol-related harm (World Health Organization Regional Office for Europe, 2012; World Health Organization, 2010). Individual-level alcohol consumption data obtained using general population surveys have advantages over other measures of alcohol use such as sales data. They measure not only the volume but also patterns of individual alcohol consumption (World Health Organization, 2000) and allow researchers to link alcohol drinking with related consequences as well as to adjust for individual-level characteristics (Dawson, 2003). Furthermore, individual-level data enable comparison of drinking patterns between population subgroups (World Health Organization, 2000). However, self-reported alcohol consumption typically only accounts for 40–60% of total alcohol sales (Midanik, 1982; Bellis *et al.*, 2009; Boniface and Shelton, 2013). This underestimation of self-reported alcohol consumption is

likely to occur mainly due to sampling-frame issues (Shield and Rehm, 2012; Meier *et al.*, 2013), non-response bias (Zhao *et al.*, 2009; Maclennana *et al.*, 2012; Meiklejohn *et al.*, 2012; Gorman *et al.*, 2014) and under-reporting bias (Boniface *et al.*, 2014; Stockwell *et al.*, 2014; Livingston and Callinan, 2015). For example, general population surveys normally include people living in private households; hence, they do not take into account the alcohol consumption among homeless people, military personnel, people in care homes, university students living in halls of residence and prisoners, some of which groups are more likely to be involved in heavy drinking (Meier *et al.*, 2013).

In addition to the above limitations, the survey instruments themselves and the framing of the questions are likely to influence the adequacy of survey measures of alcohol consumption (Feunekes *et al.*, 1999; Rehm *et al.*, 1999; Dawson, 2003; Heeb and Gmel, 2005; Greenfield and Kerr, 2008). Multiple guidelines for how drinking should be measured in surveys have been proposed, but whether they are consistent in their recommendations has not been considered to date.

In the UK, alcohol survey data substantially underestimate alcohol consumption extrapolated from sales data, and this underestimation has increased over time (Catto, 2008). According to the General Lifestyle Survey (GLF) in 2008, the survey underestimation of alcohol consumption was around 40% when compared with the sales data (Boniface and Shelton, 2013), and the difference between GLF measure and alcohol sales was equivalent to 430 million units a week (Bellis *et al.*, 2009). In other words, a bottle of wine per adult (16 years and over) per week is unaccounted for due to survey underestimation (Bellis *et al.*, 2009). Adjusting GLF survey data to account for several potential biases from the methodology of the surveys, such as undersampling of dependent drinkers, increased the GLF's annual per capita alcohol consumption estimate, but it still remained 22% lower than the estimate obtained from equivalent alcohol sales data (Meier *et al.*, 2013). The issues with alcohol survey instruments in English surveys may have contributed towards this residual underestimation. It is important, therefore, to identify whether alcohol consumption measures from English surveys are based on the best available survey instruments. This study aims to identify and compare the recommendations on alcohol survey instruments from international guidelines and to establish whether national surveys in England are adequately measuring the key aspects of alcohol consumption.

METHODS

A literature search for international guidelines for measuring alcohol consumption in general population surveys was carried out. It was conducted within the websites of the World Health Organization (WHO), National Institutes of Health (NIH), Centres for Disease Control and Prevention (CDC), European Commission, UK Department of Health (DH) and the UK Office for National Statistics, as well as the PubMed database, by using the following search strategy: (recommendations OR standards OR guidelines OR agreement) AND (measuring OR monitoring OR reporting OR questions) AND (alcohol consumption OR ethanol consumption OR drinking alcohol OR drinking pattern). From the results of these searches, we identified those publications that provide international guidelines for measuring alcohol consumption among adults (age ≥16) in general population surveys. The references cited by identified guidelines were also scrutinized in order to identify any other existing international guidelines.

We extracted data on alcohol consumption measures and recommended survey instrument or questions from each guideline and the process used to establish them. When guidelines had both a minimum set of questions and a recommended set of questions for alcohol research, the recommended set of questions was extracted. The analysis was limited to the recommendations on alcohol survey instruments that measure levels and patterns of alcohol consumption. Therefore, the recommendations for measuring alcohol consequences or minimizing other limitations of national surveys, such as sampling-frame issues, under-reporting and non-response bias, were not included in the analysis.

We then looked for commonality between the guidelines in terms of recommended measures and survey instruments and described these common core recommendations. For example, all four guidelines recommend measuring frequency and volume of heavy episodic drinking (binge drinking) and using Graduated Quantity Frequency (GQF) questions as the survey instrument.

Finally, we identified the three major general population surveys that have been collecting alcohol consumption data using detailed questions on average volume of consumption and heavy episodic drinking among adults (age ≥16) in England (Goddard, 2007) and have been used to provide national-level estimates on adults alcohol consumption (Robinson and Harris, 2009; Office for National Statistics, 2013b; Lifestyles Statistics-Health & Social Care Information Centre, 2014). These are the Health Survey for England (HSE), GLF (previously called the General Household Survey, GHS) which ceased in 2012, and the Opinions and Lifestyle Survey (previously called the Omnibus Survey). All three surveys provide national data for England; GLF and Opinions and Lifestyle survey additionally provide data for other countries of the Great Britain. Alcohol consumption questions in these surveys were compared with the common core recommended alcohol consumption measures and survey instruments identified from the international guidelines. For each survey, the most recently available version of the questionnaire with alcohol consumption-related questions was used for initial comparison; for the HSE, this was 2013; for the GLF, 2011; and for the Opinions and Lifestyle Survey, this was 2008/2009 (Office for National Statistics, 2009; Office for National Statistics, 2011b; NatCen Social Research and University College London, 2013). After 2009, the Opinions and Lifestyle Survey did not include alcohol consumption questions; but in 2012, some of the GLF's alcohol consumption questions were transferred into it (Office for National Statistics, 2011a). We then assessed the consistency of the alcohol-related questions in each survey over time, from the year 2000 onwards until its most recent survey.

RESULTS

Guidelines for measuring alcohol consumption

Four sets of international guidelines that provide recommendations for measuring alcohol consumption in general population surveys were identified; the International Guide for Monitoring Alcohol Consumption and Related Harm by the WHO; Agreement on ways to measure alcohol consumption by the Kettil Bruun Society (KBS), an international organization of scientists engaged in research on alcohol use and alcohol problems; Recommended Alcohol Questions by the National Institute on Alcohol Abuse and Alcoholism (NIAAA); and Standardized Measurement of Alcohol-Related Troubles (SMART) Project Guidelines by the European Commission (Dawson and Room, 2000; World Health Organization, 2000; National Institute on Alcohol Abuse and Alcoholism, 2003; Moskalewicz and Sieroslawski, 2010).

In 2000, the WHO published the International Guide for Monitoring Alcohol Consumption and Related Harm aiming to provide

guidance on epidemiological monitoring of alcohol consumption and to improve the global and regional comparability of alcohol-related data (World Health Organization, 2000). It was drafted by a large number of leading experts in alcohol research with reference to the relevant evidence at that time. An agreement on ways to measure and report drinking patterns and alcohol-related problems in adult general population surveys was developed at the thematic conference of KBS held on April 2000, with participation of over 40 researchers from 12 countries (Dawson and Room, 2000). This thematic conference used 26 research papers plus the WHO guidance document mentioned above to draw their conclusions.

In 2003, a task force of the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2003) developed four recommended sets of alcohol questions for surveys that can include only a limited number of alcohol questions. They developed these using the recent epidemiological studies at that time and the WHO guide.

The European Commission's SMART project published its guidance and recommended alcohol questions for European countries in 2010. This project developed standardized comparative survey methodologies on heavy drinking, binge drinking, context of drinking, alcohol dependence and alcohol-related problems as well as public support for alcohol policy measures for use in the European Union (EU) (Moskalewicz and Sieroslawski, 2010). The methodology, developed on the basis of a review of European survey experiences from over 20 countries as well as a literature review, was tested in 10 countries with different sociocultural background and patterns of alcohol consumption.

All four guidelines emphasize that the surveys measuring alcohol consumption need to contain items on alcohol drinking status, average volume of alcohol consumption, and frequency and volume of heavy episodic drinking, where the volume of alcohol is calculated by multiplying the quantity and frequency of relevant drinking occasions over the past year. A minimum set of three questions (that can be used to obtain all above-mentioned alcohol consumption measures) have also been provided by the guidelines as shown in Table 1. In addition to this minimum set, all four guidelines give their recommended items for surveys that are able to include a larger number of questions. These include more detailed questions on volume of average alcohol consumption, frequency and volume of binge drinking and an optional section on drinking context (Table 1). For measuring average volume of alcohol consumption, Beverage Specific Quantity Frequency (BSQF) questions were identified as the most appropriate survey instrument, whereas Quantity Frequency (QF) questions were identified as adequate when surveys have limited resources and space for alcohol questions. QF questions measure how often alcohol was consumed and how much on each occasion, whereas BSQF questions do the equivalent for different types of alcohol beverage separately. All guidelines recommend GQF questions to assess heavy episodic drinking. GQF questions start by asking for the highest level of consumption on any occasion during the past year and then, based on the answer, ask a series of follow-up questions on frequency of consuming lesser quantities (e.g. frequency of consuming more than 144, 96, 60, 36 or 24 g of pure alcohol) (Dawson and Room, 2000; World Health Organization, 2000; Moskalewicz and Sieroslawski, 2010).

In addition to the above questions on essential alcohol consumption measures, questions on drinking context were also recommended by all four guidelines. Commonly recommended drinking context questions ask whether participants drank with or without meal, alone or with others and the place of drinking.

Some other additional alcohol consumption measures were also recommended by individual guidelines. For example, the WHO and SMART guidelines recommended including questions on unrecorded consumption (home brewed or purchased abroad) and duration of heavy drinking occasions. However, these additional questions were recommended for surveys that can include a large number of questions and they were not commonly recommended by all four guidelines.

Comparison of English survey questions with guidelines

Comparison of the most recently available questionnaire with guidelines

For all three surveys, the most recently available questionnaire with alcohol consumption-related questions covered only two essential alcohol consumption measures out of the three essential measures recommended by the international guidelines (Table 2). They are alcohol drinking status and average volume of alcohol consumption. English surveys addressed these two essential alcohol consumption measures precisely according to the international guidelines by using questions on abstention and BSQF questions with the past year as the reference period.

English surveys did not include questions on the frequency of heavy episodic drinking, the other essential measure recommended by the international guidelines. They have used an alternative set of questions on binge drinking that focusses only on the volume of alcohol consumed on the heaviest drinking day of the last week. The guidelines, on the contrary, recommend using GQF questions that measure not only the volume of binge drinking but also the frequency of binge drinking with the past year as the reference period.

In addition to the above questions on essential alcohol consumption measures, questions on drinking context were not addressed at all by either HSE or GLF. However, the Opinions and Lifestyle Survey included some of the recommended items on drinking context such as questions on place of drinking.

Comparison of survey questions overtime from the year 2000 onwards

The next phase of the analysis, which is the assessment of the consistency of alcohol-related questions in each survey over time from the year 2000 onwards, showed that HSE and GLF surveys have broadly maintained their structure over time. However, there has been some inconsistency in the inclusion of BSQF questions that provide data on the average volume of alcohol consumption, a core measure. The BSQF question category has been excluded for 8 years in HSE, from 2003 to 2010. The GLF has also been inconsistent in including BSQF and overall frequency of drinking questions; BSQF questions were not included in the GLF in 2003/2004, 2004/2005 and in 2007 questionnaires. There have also been some changes in the total number of questions asked, the order of questions and the wording of questions. The Opinions and Lifestyle Survey was not included in this phase of the analysis as it did not include alcohol consumption questions annually.

DISCUSSION

Alcohol consumption data from national surveys are essential for epidemiological and public health research purposes, and existing international guidelines are broadly consistent in their recommendations for how alcohol consumption should be measured in these surveys. Alcohol consumption status, average volume alcohol consumption, and frequency and volume of binge drinking are the essential alcohol consumption measures recommended by all four guidelines with another recommended item on drinking context for surveys that can include a large number of questions. English national surveys have collected data only on two core items, as they did not include questions on the frequency of binge drinking. The alternative method they have

Table 1. Common core categories of alcohol consumption measures and the associated questions recommended by international guidelines (**M**: minimum set of questions for surveys with limited resources)

Required measures (reference period)	Recommended survey instrument	WHO Guidelines in 2000	KBS Conference Guidelines in 2000	NIAAA Guidelines in 2003	EU Commission (SMART) Guidelines in 2010
(1) Alcohol drinking status (past year and lifetime)—CORE ITEM	Questions on abstention	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime
(2) Volume of alcohol consumption (past year)—CORE ITEM	Quantity frequency questions—QF (past year)	(1) In the past year, how often did you drink any alcoholic beverage? (M) (2) How many drinks did you usually have on days you drank in the past year? (M)	(1) Overall frequency of drinking considering all types of alcoholic beverages (M) (2) Usual quantity of drinking, all alcoholic beverages together (M)	(1) During the last 12 months, how often did you usually have any kind of alcoholic drink? (M) (2) During the last 12 months, how many alcoholic drinks did you have on a typical day you drank alcohol? (M)	(1) How often did you drink beer, wine, spirits or any other alcoholic drink in past 12 months? (Recommendations for usual quantity—not included)
	Beverage-specific quantity and frequency—BSQF (past year)	(3) After a filter question that determines whether or not specific type of beverage was consumed, ask for the largest as well as usual beverage specific quantity and frequency	(3) Beverage-specific frequencies of drinking, usual quantities of drinking, size of usual drink, maximum quantity and frequency	(3) Beverage-specific consumption	(2) How often did you drink beer in the past year? (3) How much did you drink on average on a day when you drank beer over the past 12 months? Repeat Q2, 3 for wine, sprits and for another type
(3) Frequency and volume of heavy episodic drinking (past year)—CORE ITEM	GQF questions starting with the largest number of drinks (past year)	(4) Counting all types of beverages combined, what was the largest number of drinks that you drank in a single day in the past year?	(4) The largest amount drunk in last 12 months, all beverages together? (5) How often above amount was consumed?	(4) The largest number of drinks containing alcohol you drank within 24 h during the past year? (5) How often above amount was consumed? Repeat Q5 for lifetime	Recommendations not included
		(5) In the past year, how often did you drink five or more drinks of any alcoholic beverage or combination of beverages in a single day? (M) (Preferably should obtain from questions with cut-off values of 12+, 8–11, 5–7, 3–4 and 1–2 drinks, a drink is equivalent to 12 g of pure alcohol)	(6) Frequency of consuming >60 g ethanol or if above, frequency of consuming>96 g ethanol in a single day? (M) (Preferably should obtain from questions with cut-offs: 24, 36, 60, 96, 144 and 240 g of pure alcohol)	(6) During the last 12 months, how often did you have five or more (males) or four or more (females) drinks containing any kind of alcohol in within a two hour period? (M) (A drink is equivalent to 12 g of pure alcohol)	(4) How often in the past 12 months, have you had six drinks or more on one occasion? (Which is equivalent to 60 g of pure alcohol) (5) Repeat Q4 for 12 drinks

Continued

Table 1. Continued

Required measures (reference period)	Recommended survey instrument	WHO Guidelines in 2000	KBS Conference Guidelines in 2000	NIAAA Guidelines in 2003	EU Commission (SMART) Guidelines in 2010
(4) Drinking context OPTIONAL ITEM	Questions on drinking context	(6) During the past year, where did you usually drink?	(7) Questions on whether the participant *Had drinks with meals or not	(7) Questions on drinking contexts	(6) When you drink alcohol do you usually drink *With a meal or at some other time?
		(7) What proportion of time you spent in different locations	*Had drinks on a weekday/weekend	(Specific questions not included)	*Where?
			*Had drinks alone or with others		*With whom?
		(8) How often did you drink in above-mentioned locations?	*Had drinks in public (bar/restaurants) or not in public		

used, which focusses on volume of alcohol drunk in the heaviest drinking day of the last week, is likely to underestimate the scale of heavy drinking in England. The inclusion of beverage-specific questions, the only source of information in English surveys for measuring volume of average alcohol consumption, has been inconsistent over time.

It is perhaps not surprising that some of the guidelines are consistent, as they have been constructed by some of the same leading experts in the field and based on their understanding of the available evidence. The recommendations from the SMART project stand alone in resulting from a full systematic review of the evidence, and with testing of these recommended questions across multiple European countries, including the UK. It is reassuring that the recommendations of the SMART project on essential alcohol consumption measures are similar to those of the other guidelines. We have compared the guidelines with national survey data for England. Welsh and Scottish Health Surveys containing similar, but not identical, alcohol questions to those in the HSE also exist, and the GLF and Opinions and Lifestyle Survey provide data for other UK countries as well; however, in the interests of clarity, we have focussed on surveys used in England.

We have used the guidelines as a means of assessing the quality of alcohol consumption data for in England but it should be recognized that consistency with the guidelines may still not constitute successful alcohol consumption measurement. Even surveys that have the 'best-case' measures according to the guidelines are likely to produce estimates that are lower than sales. This will be partly due to biases in who is surveyed in the national surveys, resulting from the sampling frame and non-response, but problems with the survey instruments remain. For example, BSQF is the recommended survey instrument to measure volume of alcohol consumption according to all four international guidelines, but BSQF is less reliable for measuring irregular drinking patterns since it is based on average measures and it does not capture the volume of alcohol taken as a combination of various types of drinks (Moskalewicz and Sieroslawski, 2010). There have been attempts to improve the recording of self-reported alcohol consumption by using more detailed drinking location-specific questions (Casswell *et al.*, 2002; Casswell *et al.*, 2012), and by using the 'yesterday' method, which includes questions about the amount of alcohol consumed on the day before the interview (Stockwell *et al.*, 2008). The 'yesterday' method has proved to be effective in minimizing under-reporting of overall alcohol consumption, but it appears to be best used to augment other methods capable of describing longer-term alcohol drinking patterns such as the GQF (Stockwell *et al.*, 2008). The location-specific alcohol consumption questions have been used by the International Alcohol Control Study (IAC). For Australia and New Zealand, this method has generated alcohol consumption estimates that were equal to 86 and 94% of alcohol sales, respectively (Casswell *et al.*, 2002; Livingston and Callinan, 2015). However, this highly detailed method is time consuming and may not be suitable for multi-purpose surveys of the type discussed in this paper (Casswell *et al.*, 2012).

Heavy episodic drinking, extreme drinking or binge drinking refers to a drinking pattern of consuming an intensive volume of alcohol over a short period of time that is likely to lead to intoxication and acute consequences (World Health Organization, 2014; World Health Organization, http://www.who.int/substance_abuse/terminology/who_lexicon/en/). According to the WHO, heavy episodic drinking is defined as 'drinking at least 60 g (7.5 units) or more of pure alcohol on at least one occasion in the past 30 days' (World Health Organization, 2014), where 60 g is an approximate cut-off value for high-risk drinking, though the cut-offs used for high-risk drinking varies slightly between countries (World Health Organization, 2000). For example, in the UK, binge drinking is defined as drinking twice or more than the sensible drinking limits of 3–4 units per day for men and 2–3 units per day for women, where a unit represents about 8 g ethanol (Parliamentary Office of Science and Technology, 2005; HM Government, 2007). The English surveys may use questions on the maximum amount of alcohol drunk on the heaviest drinking day of the previous week, rather than the GQF questions on frequency of heavy drinking incidences over the last year, because they are aiming to identify those drinking above the sensible drinking limits and binge drinking limits as defined by the DH who use daily benchmarks (Goddard, 2007; Office for National Statistics, 2013a). However, the shorter reference period of last week is likely to greatly underestimate the proportion of heavy drinkers and miss infrequent drinkers (World Health Organization, 2000; National Institute on Alcohol Abuse and Alcoholism, 2003; Moskalewicz and Sieroslawski, 2010). Even though it is difficult to estimate exactly by how much binge drinking is being underestimated in English surveys as a result of the current survey approach, a study from Canada that compared the GQF measure on last year alcohol consumption with a weekly drinking measure on previous week consumption found that the former gave five times higher prevalence estimate of binge drinking (Rehm *et al.*, 1999). Therefore, the English survey binge drinking measure based on just one

Table 2. Comparison of English survey questions with the common core categories of alcohol consumption measures recommended by international guidelines

Required measures (reference period)	Recommended survey instrument	HSE (2013)	GLF (2011)	ONS Opinions Survey (2008/2009)
(1) Alcohol drinking status (past year and lifetime)—CORE ITEM	Questions on abstention	(1) Do you ever drink alcohol nowadays, including drinks you brew or make at home?	(1) Do you ever drink alcohol nowadays, including drinks you brew or make at home?	(1) Do you ever drink alcohol nowadays, including drinks you brew or make at home?
		(2) If Q1 = No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?	(2) If Q1 = No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?	(2) If Q1 = No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally?
		(3) If Q2 = Never, have you always been a non-drinker or did you stop drinking for some reason?	(3) If Q2 = Never, have you always been a non-drinker or did you stop drinking for some reason?	Questions not included
(2) Volume of alcohol consumption (past year)—CORE ITEM	Quantity frequency questions—QF (past year)	(4) If Q1 = Yes OR Q2 = Very occasionally, thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months?	(4) If Q1 = Yes OR Q2 = Very occasionally, Would you say: hardly drink at all, drink a little, drink a moderate amount, drink quite a lot, drink heavily	(3) Thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months?
			(5) Thinking now about all kinds of drinks, how often have you had an alcoholic drink of any kind during the last 12 months?	
		Questions on usual quantity—not included	Questions on usual quantity—not included	Questions on usual quantity—not included
	Beverage-specific quantity and frequency—BSQF (past year)	IF Q1 = Yes or Q2 = Very occasionally	IF Q1 = Yes or Q2 = Very occasionally	IF Q1 = Yes or Q2 = Very occasionally
		Type 1: Normal strength beer, lager, stout, cider, shandy	Type 1 :Normal strength beer, lager, stout, cider or shandy	Type 1: Strong beer, lager, stout, cider
		(5) How often have you had type 1 drink during the last 12 months?	(6) How often have you had a drink of type 1 during the last 12 months?	(4) How often have you had a type 1 during the last 12 months?
		(6) How much type 1 drink have you usually drunk on any one day during the last 12 months? (Half pint, small cans, large cans, bottles)	(7) How much type 1 drinks have you usually drunk on one day during the last 12 months? (Half pints, small cans, large cans, bottles)	(5) How much type 1 drinks have you usually drunk on any one day during the last 12 months? (Half pints, cans, bottles)
		(7) How many (Q6 size) type 1 drink have you usually drunk on any one day during the last 12 months?	(8) How many (size Q7) of type 1 drinks have you usually drunk on any one day during last 12 months?	(6) How many (Q5 size) type 1 drink have you usually drunk on any day during the last 12 months?
		Repeat above questions for other drink types	Repeat above questions for other drink types	Repeat above questions for other drink types
		Repeat Q5–Q7 for strong beer, lager, stout or cider	Repeat Q6–Q8 for strong beer, lager, stout or cider	Repeat Q4–Q6 for normal strength beer, lager, stout, cider
		Repeat Q5 and Q6 for spirits and sherry	Repeat Q6 and Q7 for spirits and sherry	Repeat Q4 and Q5 for spirits and sherry
		Repeat Q5 and Q6 for wine with extra question on glass size	Repeat Q6 and Q7 for wine with extra question on glass size	Repeat Q4–Q6 for wine with extra questions on wine glass size
		Repeat Q5–Q7 for alcopops	Repeat Q6–Q8 for alcopops	Repeat Q4–Q6 for alcopops and other drinks

Continued

Table 2. Continued

Required measures (reference period)	Recommended survey instrument	HSE (2013)	GLF (2011)	ONS Opinions Survey (2008/2009)
(3) Frequency and volume of heavy episodic drinking (past year)—CORE ITEM	GQF questions starting with the largest number of drinks (past year)	GQF questions not included Alternative method used: This only produces the volume of consumption in the heaviest drinking day last week (8) Did you have an alcoholic drink in the 7 days ending yesterday? (9) On how many days out of the last week did you have an alcoholic drink? (10) If (Q9 > 1) Did you drink more on some days than others, or did you drink about the same on each of those days? (11) Which day last week did you (have an alcoholic drink/have the most to drink)? (12) What types of drinks did you have that day (Q11 day)? (Type 1: Normal strength beer/lager/cider/shandy) (13) If (Q12 = Type (1) How much of type 1 drinks did you drink that day (Q11 day)? (Half pints, small cans, large cans, bottles) (14) How many (Q13 size) of type 1 drinks did you have that day? If (Q12 = Other drink types mentioned below) Repeat Q13 and Q14 for strong beer, lager, stout or cider Repeat Q13 for spirits and Sherry Repeat Q13 and Q14 for alcopops and for wine with glass size Repeat Q13 for three other types of drinks	GQF questions not included Alternative method used: This only produces the volume of consumption in the heaviest drinking day last week (9) Did you have an alcoholic drink in the 7 days ending yesterday? (10) On how many days out of the last week did you have an alcoholic drink? (11) If (Q10 > 1) Did you drink more on some days than others, or did you drink about the same on each of those days? (12) Which day (last week) did you last have the most to drink? (13) What types of drink did you have that day (Q12 day)? (Type 1: Normal strength beer/lager/cider/shandy) (14) If (Q13 = Type (1) How much of type 1 drinks did you drink that day (Q12 day)? (Half pints, small cans, large cans, bottles) (15) How many (Q14 size) of type 1 drinks did you have that day? If (Q13 = Other drink types mentioned below) Repeat Q14 and Q15 for strong beer, lager, stout or cider Repeat Q14 for spirits and sherry Repeat Q14 and Q15 for alcopops and for wine with glass size	GQF questions not included Alternative method used: This only produces the volume of consumption in the heaviest drinking day last week (7) Did you have an alcoholic drink in the 7 days ending yesterday? (8) On how many days out of the last 7 did you have a drink? (9) If (Q8 > 1) Did you drink more on some days than others, or did you drink about the same on each of those days? (10) If (Q8 = 1|Q9 = varied) On which day did you have (a drink/most to drink)? (11) If (Q9 = varied| same) Thinking about (most to drink day/most recent drinking day) what types of drink did you have? (Type 1: Strong beer, larger, stout and cider) (12) If (Q11 = Type (1) How many half pints of strong beer, lager, stout and cider did you drink that day? (13) Specify amount of type 1 you drunk that day If (Q11 = Other drink types mentioned below) Repeat Q12 and Q13 for normal strength beer, lager, stout, cider, shandy Repeat Q12 and Q13 for wine with extra questions on glass size Repeat Q12 and Q13 for alcopops, sprit and sherry
(4) Drinking context OPTIONAL ITEM	Questions on drinking context	Questions not included	Questions not included	Questions on alcohol drinking places and companion

day of the previous week might be expected to miss even more binge drinkers because of the shorter time frame. It may also be affected by seasonality due to its shorter reference period and may fail to represent respondents' overall pattern of binge drinking. Therefore, the English surveys' heaviest drinking day measure on its own cannot be used for most epidemiological research purposes. A review of data from Scotland's routine national surveys has also reported similar findings on binge drinking measures based on the shorter reference period of last week (Catto, 2008).

An individual's average volume of alcohol consumption is the other most important indicator used in alcohol epidemiology as it has a causal impact on chronic diseases such as cancers, diabetes mellitus, depressive disorder and liver cirrhosis (Rehm *et al.*, 2003, 2010). Despite its importance, the BSQF questions that provide the information on average volume of consumption in English surveys have been inconsistently included over time so that this core measure is also unavailable for some years. This has resulted in gaps in time series data on average volume of consumption and limits the potential of these data for formal time series analysis to identify trends in consumption and evaluate policy interventions.

According to the international guidelines, total alcohol consumption from surveys should be calculated by aggregating the average

volume of consumption and consumption due to binge drinking occasions (World Health Organization, 2000; Moskalewicz and Sieroslawski, 2010). This adjustment has also proved to improve prevalence estimates for heavy drinking, since respondents do not normally include heavy drinking occasions in estimates of their average consumption (Mandy Stahre *et al.*, 2006). Therefore, using the average volume of alcohol consumption generated by BSQF questions on its own can contribute towards the survey underestimation of alcohol consumption in England when comparing with sales data.

In January 2012, the GLF was ceased (Office for National Statistics, 2011b), and this has ended a unique and powerful time series of alcohol consumption data in its 35th year (Goddard, 2007). Even though alcohol consumption questions asked in the GLF have been transferred to the Opinions and Lifestyle Survey (Office for National Statistics, 2012b), they do not include the detailed beverage-specific questions asked in the GLF (Office for National Statistics, 2011a), and the Opinions and Lifestyle Survey has a relatively small sample size due to its format of monthly surveys (Office for National Statistics, 2012c). Out of the three major surveys that used to provide national estimates on alcohol consumption in England, HSE is currently the only survey that continues to measure alcohol consumption annually. However, HSE is also limited by inconsistent inclusion of questions on essential alcohol consumption measures and its small sample size when compared with GLF. Some of the limitations of England's major national surveys in measuring alcohol consumption may be addressed by more recent additions to the spectrum of surveys in this country. The Alcohol Toolkit Study (ATS) includes all essential alcohol consumption indicators including the frequency of binge drinking in a large nationally representative sample of adults in England (Beard *et al.*, 2015). This study uses the Alcohol Use Disorders Identification Test (AUDIT) to measure alcohol consumption, which includes the minimum recommended number of alcohol questions but not the detailed survey instruments shown in Table 1. Alcohol Policy Interventions in Scotland and England (APISE), which is the other recent study, represents England and Scotland's arm of the IAC (Casswell *et al.*, 2012); it covers all essential alcohol consumption measures but uses a small sample size of 3725 adults split evenly between England and Scotland (Sheffield Alcohol Research Group, 2015). Both these studies are bounded by limited funding available only for a few years (Beard *et al.*, 2015; Gateway to Research-Research Councils UK, 2015).

Therefore, future surveys should aim to use methodologies that reduce their inherent biases, but should also strive to retain consistency of core indicators of alcohol epidemiology that are essential for monitoring public health and evaluating alcohol control policies and other interventions. It is important that this includes a measure of the frequency of binge drinking. Ideally, the recommended survey instruments on all core alcohol consumption indicators should be included in the newer Integrated Household Survey, which is carried out quarterly and has a much larger sample size than HSE (Office for National Statistics, 2012a). Including more detailed alcohol questions on drinking context would be helpful in identifying the associations between drinking and its consequences (World Health Organization, 2000; Moskalewicz and Sieroslawski, 2010). For example, drinking without meals (Trevisan *et al.*, 2001), in public drinking places (Rossow, 1996), with many others (Wells and Graham, 2003) has been associated with higher rates of alcohol consequences. Ensuring that measurement of alcohol consumption in all countries adheres to the guidelines would not only provide more reliable estimates for each country to evaluate its own level of public health risk and effectiveness of national policy, but it also improve the global and regional comparability of data on alcohol use and health consequences in order to improve monitoring and to facilitate research, risk assessment and advocacy.

FUNDING

This work was supported by the UK Centre for Tobacco and Alcohol Studies (UKCTAS), a UKCRC Public Health Research: Centre of Excellence. M.D.N. is funded by the UK Centre for Tobacco and Alcohol Studies (UKCTAS). T. L., L.S. and S.L. are members of the UK Centre for Tobacco and Alcohol Studies, a UKCRC Public Health Research: Centre of Excellence. Funding to the UKCTAS from the British Heart Foundation, Cancer Research UK, the Economic and Social Research Council, the Medical Research Council and the National Institute of Health Research, under the auspices of the UK Clinical Research Collaboration is gratefully acknowledged.

CONFLICTS OF INTEREST STATEMENT

None Declared.

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8.4 Rapidly Increasing Trend of Recorded Alcohol Consumption Since the End of the Armed Conflict in Sri Lanka

Alcohol and Alcoholism, 2017, 1–7
doi: 10.1093/alcalc/agx044
Article

Article

Rapidly Increasing Trend of Recorded Alcohol Consumption Since the End of the Armed Conflict in Sri Lanka

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Received 25 November 2016; Revised 4 May 2017; Editorial Decision 26 June 2017; Accepted 28 June 2017

Abstract

Aim: To evaluate temporal changes in recorded alcohol consumption in Sri Lanka during and after the armed conflict 1998–2013.

Methods: District level alcohol sales, and mid-year population data for the whole study period (1998–2013) were consistently available from the Department of Excise and the Department of Census and Statistics for 18 of 25 districts. These data were used to estimate the recorded per capita consumption for the areas that were not directly exposed to the armed conflict. An interrupted time series design was employed to estimate the impact of the end of the armed conflict on recorded adult per capita alcohol consumption of population lived in the 18 districts.

Results: Adult per capita recorded alcohol consumption among Sri Lankans living in the 18 districts was 1.59 l of pure alcohol in 1998. This increased up to 2.07 l in 2009 and 2.55 l in 2013. Prior to the end of the conflict in 2009 adult per capita recorded consumption increased by 0.051 l of pure alcohol per year (95% CI: 0.029–0.074, $P < 0.001$); after 2009 this was 0.166 l per year (95% CI: 0.095–0.236, $P < 0.001$). Beer consumption showed the highest per capita growth compared with other beverages.

Conclusions: Adult per capita recorded alcohol consumption among Sri Lankans living in areas that were not directly exposed to the conflict increased markedly after the end of the conflict. Rapid socio-economic development, alcohol industry penetration and lack of alcohol control strategies during the post-conflict period may have driven this increase.

Short summary: Adult per capita recorded alcohol consumption among Sri Lankans living in 18 districts that were not directly exposed to the armed conflict increased markedly after the end of the conflict in 2009, with a dramatic acceleration in the trend of per capita beer consumption.

INTRODUCTION

Harmful alcohol consumption causes many preventable health and social issues and around 3.3 million deaths per year globally (Rehm *et al.*, 2009a,b; World Health Organization, 2014a). Sri Lanka, a South Asian lower middle-income country with a population of more than 20 million people (The World Bank), has a significant

public health burden due to alcohol misuse. Around 75% of all deaths in Sri Lanka are due to non-communicable diseases such as cardiovascular disease and cancers (World Health Organization, 2014b), and alcohol misuse has been identified as one of the top five factors contributing to this disease burden (Ministry of Health, 2012; World Health Organization, 2014b). Harmful use of alcohol in Sri Lanka has also been identified as a major risk factor contributing directly and indirectly to drink-drive accidents (World Health Organization, 2014a), domestic violence (Samarasinghe, 2006), worsening poverty (Baklien and Samarasinghe, 2004; Samarasinghe, 2006), mental illness, self-harm and suicides (Jayasinghe and Foster, 2011; World Health Organization, 2014d). These alcohol-related health and social issues, as well as alcohol consumption among Sri Lankans, have been increasingly reported since 2009 (Ministry of Health, 2012), when the 26-year armed conflict between Sri Lankan military forces and Liberation Tigers of Tamil Eelam (LTTE), who fought for a separate mono-ethnic Tamil state in Northern and Eastern Provinces of Sri Lanka, ended (Richards, 2014). However, the conflict mainly took place in 7 of the country's 25 districts; the majority of Sri Lankans (87%) (Department of Census and Statistics, 2012) living in the rest of the country were not displaced or directly exposed to this conflict (Internal Displacement Monitoring Centre (IDMC) and Norwegian Refugee Council (NRC), 2010; Richards, 2014).

Despite evidence of excessive alcohol consumption among military personnel (Jones and Fear, 2011), evidence of increased alcohol consumption among civilians during post-conflict periods is extremely limited due to the small number of studies, particularly in low and middle-income countries where the vast majority of ongoing and previous conflicts have taken place (Weaver and Roberts, 2010; Ezard, 2012). Moreover, existing studies have mainly focused on populations directly exposed to conflicts, such as refugees or displaced persons and alcohol consumption among these populations can be increased due to individual-level factors such as gender, trauma exposure, mental illnesses and unemployment (Weaver and Roberts, 2010; Henkel, 2011; Ezard, 2012; Roberts *et al.*, 2014), and population level factors as mentioned below. The findings of these studies have been limited due to a lack of comparison populations and failure to use standardized and validated alcohol consumption measurement methods (Weaver and Roberts, 2010; Ezard, 2012; Roberts *et al.*, 2014).

Alcohol consumption among non-displaced or indirectly affected populations in post-conflict settings may also increase due to population-level factors such as rapid socio-economic development (UNDP, 2008), urbanization (Roberts *et al.*, 2012), lack of alcohol control strategies (Wallace and Roberts, 2013) and alcohol manufacturers and distributors taking advantage of weakened trading systems (Wallace and Roberts, 2013; Roberts *et al.*, 2014). A few studies have identified increased alcohol consumption among non-displaced populations (DiMaggio *et al.*, 2009), but these were based on high-income countries and their results have also been limited due to methodological issues. For example, a study conducted after the terrorist attack on September 11th, 2001 in the United States, identified an increase in alcohol consumption among residents living in Manhattan (Vlahov *et al.*, 2002). However, its response rate was only around 64% and it used the most basic quasi-experimental study design comparing a single measure before and after the attack (Vlahov *et al.*, 2002). Therefore, its results may have been affected by secular trends or sudden fluctuations in the outcome measure (Wagner *et al.*, 2002). The importance of conducting adequate research on alcohol consumption and related disorders among conflict-affected populations particularly in low and middle-income countries was emphasized by Roberts and Ezard (2015).

Alcohol consumption among Sri Lankans has been increasing in recent years and the effect of the end of armed conflict on alcohol consumption in Sri Lanka has not yet been formally quantified and evaluated. This study aimed to evaluate the effect of the end of armed conflict in 2009 on recorded alcohol consumption among adults in the 18 districts that were not directly exposed to this conflict using interrupted time series analysis, which is considered to be the strongest quasi-experimental approach (Wagner *et al.*, 2002).

METHODS

Alcohol sales and mid-year population data

In Sri Lanka, the Department of Excise collects beverage-specific alcohol sales data from every on-trade and off-trade premise within the island. These data do not include information on unrecorded alcohol such as illicit alcohol sales or home brewed alcohol (Department of Excise-Sri Lanka). District level alcohol sales data and mid-year population data (age ≥ 15) for the whole study period (1998–2013) were consistently available from the Department of Excise and the Department of Census and Statistics respectively for the 18 districts that were not directly exposed to the armed conflict. These beverage-specific data (in million litres for 10 types of beverages) were converted into litres of pure alcohol according to their alcohol by volume (ABV) percentage. The ABV for each drink type was determined according to the percentages used by recent national surveys (Ministry of Healthcare and Nutrition, 2008; Katulanda *et al.*, 2014), and information given by key officials of the Department of Excise.

Recorded total per capita alcohol consumption was used as the main outcome measure and per capita consumption measures were generated by dividing annual sales in litres of pure alcohol by mid-year population estimates (age ≥ 15). In addition, beverage specific per capita consumption was analysed for beer (7% ABV), arrack (a form of spirits with around 35% ABV) and 'other beverages'. The 'other beverages' category included the total consumption of all other types of drinks: wine (12% ABV), whisky (40% ABV), brandy (38% ABV), gin (38% ABV), rum (37% ABV), liquors and bitters (37% ABV), vodka (40% ABV) and toddy (7% ABV).

Statistical analysis

Segmented regression, a form of interrupted time series analysis, was used to evaluate the effect of the end of the armed conflict on consumption. This method is able to estimate the magnitude of the effect of an intervention whilst controlling for existing secular trends prior to the introduction of an intervention (Wagner *et al.*, 2002). It can identify whether an intervention had an immediate or delayed impact on an outcome measure and whether it was a transient or longer-term effect (Wagner *et al.*, 2002). Segmented regression was used to estimate the magnitude and timing of any change in total adult per capita alcohol consumption, and beverage specific consumption of arrack, beer and other drinks since the end of the armed conflict.

The model includes parameters representing the trend (rate of change) in per capita consumption prior to the end of armed conflict (β_1), step change in the mean level of per capita consumption immediately after the end of armed conflict (β_2), and change in the trend

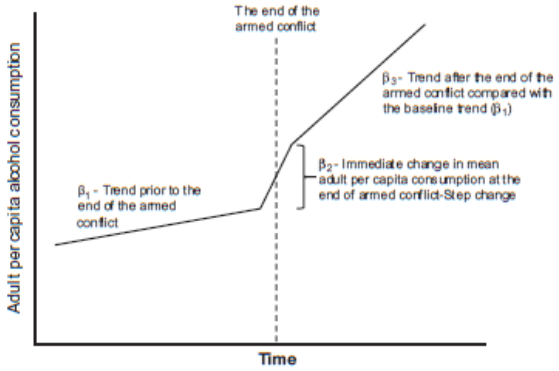

Fig. 1. Illustration of the segmented regression model.

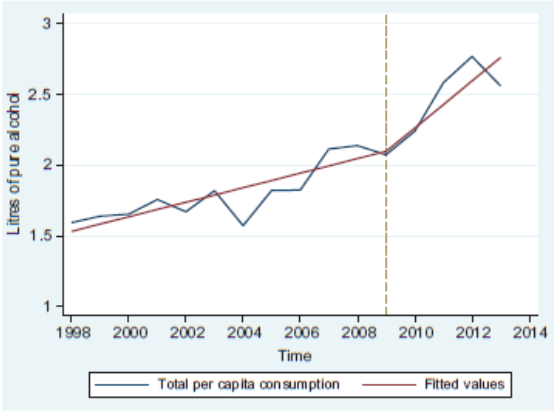

Fig. 2. Adult per capita total alcohol consumption before and after the end of armed conflict in 2009.
Note: Dashed line represents the end of armed conflict in 2009.

in per capita consumption after the end of armed conflict (β_3) (Fig. 1). The sum of β_1 and β_3 provides the post-intervention slope ($\beta_4 = \beta_1 + \beta_3$). By using this model an immediate effect of the armed conflict can be identified by an immediate step change in the mean level of consumption, whereas a gradual change in consumption over time can be identified by a change in trend.

The Likelihood ratio test was used to build the final segmented regression model. The most parsimonious model was identified by backward elimination dropping any parameters that were not significant at the 5% significance level (Wagner *et al.*, 2002). The autocorrelation function (ACF) of each parsimonious model was inspected to see whether there was any remaining autocorrelation between the model residuals at successive time points. Residuals greater than the 95% confidence intervals of an ACF represent significant autocorrelation in the dataset greater than would be expected due to chance alone (Yaffee and McGee, 2000). However, there was no residual autocorrelation in any of the parsimonious segmented regression models and hence there was no need to adjust the models further for autocorrelation. All analyses were conducted using STATA 13 (StataCorp, 2013).

RESULTS

Descriptive analysis

During the study period, the majority of alcohol (in litres of pure alcohol) was sold as arrack, but it accounted for a decreasing proportion of alcohol sales over time. In 2009 arrack sales accounted for 80% of total sales in pure litres of alcohol, decreasing to 64% in 2013. Beer was the second most popular drink, and during the study period, the beer sales as a proportion of total alcohol sales increased from 15% in 2009 to 25% in 2013. Other alcoholic drinks, including toddy, wine, whisky, brandy, gin, rum, vodka, liquors and bitters made up around 5% of total alcohol sales in 2009, increased up to 11% by 2013.

As shown in Fig. 2, total per capita alcohol consumption during the conflict period increased from 1.59 l of pure alcohol in 1998 to 2.07 l in 2009. After 2009, per capita consumption increased up to 2.56 l of pure alcohol in 2013. As shown in Fig. 3a, per capita arrack consumption showed a gradual increase from 1.27 l of pure alcohol in 1998 to 1.59 l in 2009 and 1.64 l in 2013. Per capita beer consumption increased markedly over the study period, increasing from 0.23 l of pure alcohol in 1998 to 0.28 in 2009 and 0.63 l in 2013 (Fig. 3b). The increase in beer consumption during the post-conflict period alone was 125%. Per capita consumption of other alcoholic drinks showed a gradually increasing trend over time, and it increased from 0.09 l of pure alcohol in 1998 to 0.18 in 2009 and 0.28 l in 2013 (Fig. 3c).

Segmented regression analysis

As shown in Fig. 2 and Table 1, prior to the end of the armed conflict in 2009, adult per capita alcohol consumption was increasing by 0.051 l of pure alcohol per year (95% CI: 0.029–0.074, $P < 0.001$). After 2009, there was no immediate step change in the mean level of adult per capita consumption. However, there was a significant change in the trend of per capita consumption; after the conflict, it increased by 0.166 l of pure alcohol per year (95% CI: 0.095–0.236, $P < 0.001$), almost a 3-fold increment in the increase per year compared to the trend prior to the end of the conflict.

As shown in Fig. 3a and Table 1, prior to the end of the conflict in 2009, per capita arrack consumption increased by 0.039 l of pure alcohol per year (95% CI: 0.026–0.051, $P < 0.001$). After 2009, there was no immediate step-level change in arrack consumption, nor a significant change in the trend.

Conversely, prior to the end of the armed conflict, per capita beer consumption was constant at around 0.29 l of alcohol per year as shown in Fig. 3(b). After 2009, there was no step-level change in beer consumption but there was a significant change in the trend, such that after the conflict consumption increased by 0.096 l of pure alcohol per year (95% CI: 0.080–0.111, $P < 0.001$).

As shown in Fig. 3c, per capita consumption of all other drinks increased by 0.012 l of pure alcohol per year (95% CI: 0.007–0.016, $P < 0.001$) prior to the end of the conflict, and by 0.032 l of pure alcohol per year (95% CI: 0.017–0.046, $P < 0.001$) after the end of the conflict. There was no immediate step level increase in other drinks consumption after 2009.

DISCUSSION

Recorded alcohol consumption among Sri Lankans living in areas that were not directly affected by the armed conflict increased markedly after the end of the conflict in 2009, with a dramatic acceleration

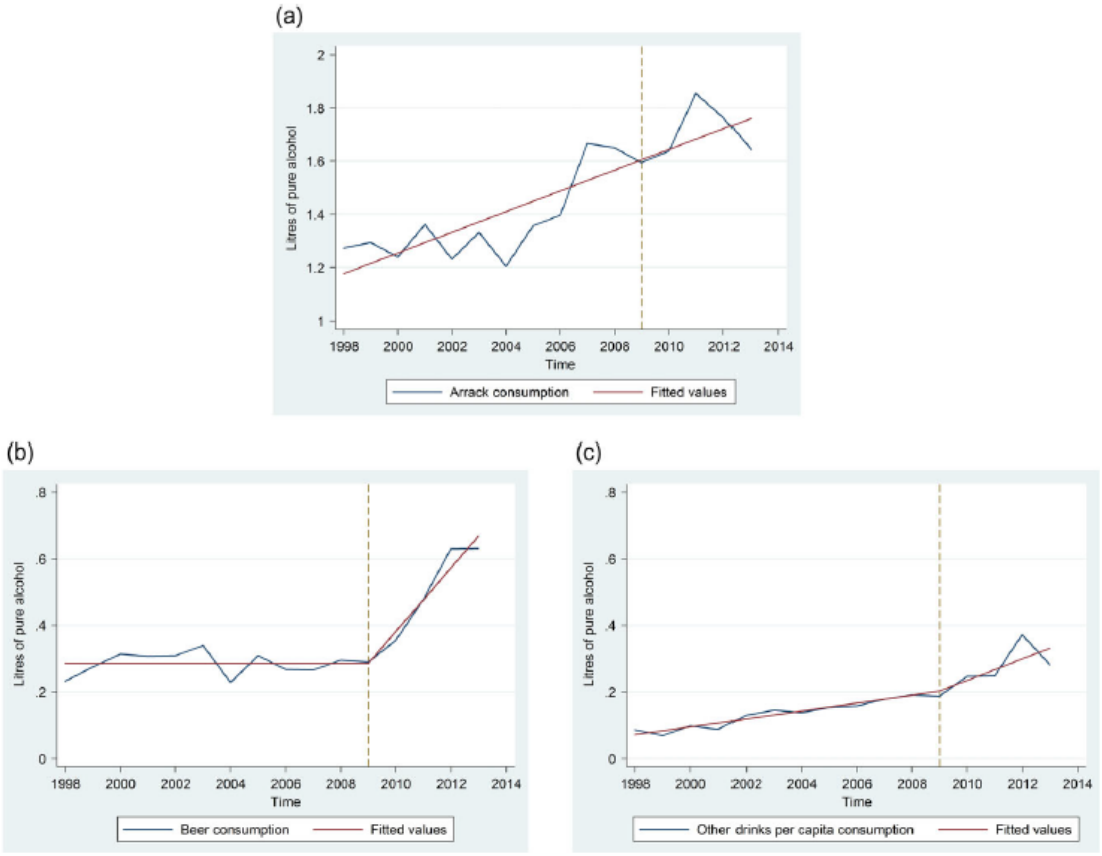

Fig. 3. Beverage specific adult per capita consumption before and after the end of armed conflict in 2009. (a) Arrack (a form of spirits) per capita consumption. (b) Beer per capita consumption. (c) Other drinks per capita consumption.
Note: Dashed line represents the end of armed conflict in 2009 and Graphs have different y-axis scales.

in the trend of adult per capita consumption. Whilst the consumption of arrack continued to increase as steadily as it had before the conflict, per capita beer consumption increased dramatically following the end of the armed conflict with the highest per capita consumption growth rate among all types of beverages.

Economic development is known to be a key factor associated with increased alcohol consumption, particularly in low and middle-income countries (Schmidt and Room, 2012; FORUT, 2014). In line with the economic development observed in other post-conflict settings (UNDP, 2008), Sri Lanka's economy picked up soon after the cessation of the armed conflict and achieved middle-income country status in January 2010 (UNDP, 2012). In 2011 Sri Lanka had the highest Human Development Index rank in South Asia (UNDP, 2012). The tourism industry, one of the country's main income sources, started to flourish at the end of the armed conflict. Despite a long history of tourism, between 1999 and 2009 international tourist arrivals grew only by 4% due to the uncertain security situation, while the global tourism growth rate was 45% (Godahewa, 2011). However, by 2013, Sri Lanka was number one in the list of best countries to travel to according to the Lonely Planet tourist guide website (Atkinson *et al.*, 2012). Tourist arrivals increased from 0.4 million in 2009 to 1.2 million by 2013 (Sri Lanka Tourism Development Authority, 2013). At 337 billion rupees (70% increase compared to 2009), tourism's direct contribution to the Sri Lankan economy in 2013 was significant (World Travel & Tourism Council, 2014); nevertheless, as discussed below, alcohol consumption by tourists has not been sufficient to alter the trend in alcohol consumption in the country. Per capita, Gross National Income (GNI) among Sri Lankans increased from $820 per year in 1998 to $2020 in 2009 which is an increment of $100 per year (The World Bank). Since 2009 per capita GNI has increased by $368 per year up to $3490 in 2013 (The World Bank).

There is an inverted U-shape relationship between beer consumption and income. The rapid increase in beer consumption demonstrated in Sri Lanka is in line with the other low and middle-income countries that have seen significant economic growth such as Russia, China and India (Colen and Swinnen, 2016). Furthermore, increased globalization has resulted in a convergence of alcohol consumption in countries around the world—traditionally beer drinking countries experience a decline in consumption whereas traditionally spirit and wine drinking countries experience an increase in beer consumption. The rapid increase in beer but not spirit consumption in Sri Lanka is also in line with this international trend (Colen and Swinnen, 2016). Sri Lanka has experienced this increase in alcohol consumption despite continuous increases in alcohol prices over time (Ministry of

Table 1. Segmented regression analysis results for per capita consumption

Model	β_1—Annual trend prior to 2009	95% CI	*P*-value	β_2—Step level change	95% CI	*P*-value	β_3—Change in trend in 2009	95% CI	*P*-value	β_4—Annual trend after 2009	95% CI	*P*-value
Total per capita consumption	0.051	0.029–0.074	<0.001	–	–	–	0.114	0.030–0.199	0.012	0.166	0.095–0.236	<0.001
Arrack consumption	0.039	0.026–0.051	<0.001	–	–	–	–	–	–	–	–	–
Beer consumption	–	–	–	–	–	–	0.096	0.080–0.111	<0.001	0.096	0.080–0.111	<0.001
Other drinks consumption	0.012	0.007–0.016	<0.001	–	–	–	0.020	0.003–0.038	0.026	0.032	0.017–0.046	<0.001

Note: only parameters significant in the parsimonious model included.
β_1—Annual trend in the per capita alcohol consumption prior to the end of armed conflict in 2009.
β_2—Step change in the per capita consumption immediately after the end of armed conflict in 2009.
β_3—Absolute change in trend in the per capita consumption after the end of armed conflict in 2009, compared with the baseline trend.
β_4—Annual trend in the per capita consumption ($\beta_1 + \beta_3$) of alcohol after the end of armed conflict in 2009.

Finance and Planning, Sri Lanka, 2013), which is likely to be due to incomes rising faster than prices, making alcohol more affordable (Nelson, 2013; The World Bank).

In addition to the contribution from the economic development, tourists' arrival may have also contributed to the increased consumption of beer and other drinks in Sri Lanka as tourists are more likely to consume these rather than arrack. However, the influence of consumption by tourists on the trend in annual per capita consumption measures is likely to be minimal as tourists represent a relatively small proportion each year when compared with the total population of Sri Lanka. For example, assuming that all tourists who visited Sri Lanka were adults and stayed for the whole year of 2013 (which had the highest number of tourist arrivals since the end of conflict), the total per capita consumption with and without tourists in 2013 was 2.34 and 2.561 of pure alcohol, respectively. However, the actual impact of tourists' consumption is likely to be much smaller than this as it is unlikely that all tourists are adults and their stay tends to be relatively short (Sri Lanka Tourism Development Authority, 2013). In 2013, almost 80% of tourists stayed in Sri Lanka only up to a fortnight (Sri Lanka Tourism Development Authority, 2013).

In addition to economic development, alcohol industry penetration and increased availability of alcohol during post-conflict periods have shown strong links with increased alcohol consumption in different settings (Wallace and Roberts, 2013; Roberts *et al.*, 2014). Similarly, Sri Lanka has also become a hot spot for alcohol industry activity since 2009. Arrack and beer are largely produced by two companies. The Distilleries Company of Sri Lanka (DCSL) is the leading arrack producer with more than 75% of market share, whereas the Lion Brewery (Ceylon) PLC, partially owned by the Carlsberg Group, is the market leader of the beer industry with around 80% market share (Carlsberg Group, 2013). Both companies have seen market expansion since the end of the armed conflict. DCSL's net profit increased from 2682 million Sri Lankan Rupees in 2009 to 6873 million Rupees by 2013, an increment of 156% (Distilleries Company of Sri Lanka PLC, 2014). Lion Brewery's rapid market expansion increased its net profit from 88 million Sri Lankan Rupees in 2009, to 1046 million Rupees by 2013, almost a 12-fold increment within 4 years (Lion Brewery (Ceylon) PLC).

The Lion Brewery used several strategies to achieve this high level of profit within a short period of time, whilst keeping beer prices attractive to both local and foreign consumers. In 2010, the Lion Brewery increased its brewing plant's capacity by 30% and in 2011 introduced a new beer brand called Corona (Lion Brewery (Ceylon) PLC). At the same time, Lion Brewery identified the growing market for beer in Sri Lanka through its market research and comparisons with other Asian countries such as India, Thailand and Vietnam, and commissioned a new brewhouse in 2012 (Lion Brewery (Ceylon) PLC). This new brewhouse was equipped with the modern facilities required to modernize and expand production to meet the increasing demand from Sri Lankans who were more likely to socialize, stay out and search for sources of enjoyment after the end of the armed conflict (Lion Brewery (Ceylon) PLC). During the same year, Lion Brewery was appointed as the sole importer and distributor of Diageo, the world largest premium alcohol beverage business selling all types of alcohol including spirits, beer, wine, whisky, vodka, rum and gin (Lion Brewery (Ceylon) PLC). All these measures taken by the beer industry in Sri Lanka likely to have increased the availability of alcohol during the post-conflict period and influenced the dramatic increase in beer consumption as well as the slight increase in consumption of other drinks.

In this context, weak law enforcement and lack of alcohol control strategies may be other reasons for this rapid increase in consumption during the post-armed conflict period in Sri Lanka (Dayaratne, 2013; Nanayakkara *et al.*, 2013). Even though the Sri Lankan government in power from November 2005 to January 2015 developed an alcohol control strategy and a new alcohol control act, they continued to provide licences for new liquor sales outlets and registered more alcohol producers (Dayaratne, 2013; Department of Excise-Sri Lanka). Conversely, intensive raids on illicit alcohol brewers carried out by the Excise Department and Police Department in 2010 may have forced people to consume legally produced alcohol products which would have made a positive contribution towards the increment of recorded alcohol sales (Department of Excise-Sri Lanka).

Our results are based on ecological data that limits establishing causation between the conflict exposure and alcohol consumption. Moreover, there were only four data points to identify the per capita consumption trend after the end of armed conflict, although this satisfies the minimum number of data points required to carry out segmented regression analysis (Wagner *et al.*, 2002).

Furthermore, this study did not include data from the seven districts that were directly exposed to the conflict as there were no complete and consistent alcohol sales and mid-year population data available from the government departments for these seven districts for the whole study period. However, since the end of armed conflict, a notable increase in alcohol consumption and alcohol consequences has been reported in these areas (Somasundaram and Sivayokan, 2013; Inter Press Service—News Agency, 2014). This could be due to trauma exposure (Somasundaram and Sivayokan, 2013), mental health problems (Somasundaram and Sivayokan, 2013; Siriwardhana and Wickramage, 2014), poverty and unemployment (Department of Census and Statistics, 2013; Siriwardhana and Wickramage, 2014), removal of restrictions on selling alcohol in the armed conflict affected areas (Department of Excise-Sri Lanka), and/or alcohol industry penetration in these areas (Lion Brewery (Ceylon) PLC).

The alcohol sales data used in this study provided a representative dataset on recorded alcohol consumption among the 18 districts as they included figures from every on-trade and off-trade alcohol outlets. The recorded alcohol consumption measures of this study are therefore largely generalizable to the areas that were not directly affected by the war in Sri Lanka. This study focused only on recorded per capita consumption due to unavailability of annual unrecorded alcohol consumption estimates from the Department of Excise or from any other data sources. However, it is known that illicit alcohol contributes to a significant amount of total alcohol consumed in Sri Lanka (Gamburd, 2008; Liyanage *et al.*, 2012; Dayaratne, 2013; World Health Organization, 2014c). The WHO estimate of unrecorded alcohol consumption in Sri Lanka for the period from 2008 to 2010 was 1.5 l of pure alcohol, which is around 40% of the total consumption for that period (World Health Organization, 2014a). Depending on the area of Sri Lanka this percentage may be as high as 60% (Abeysinghe, 2002; Baklien and Samarasinghe, 2004; Gamburd, 2008), and the trend in unrecorded alcohol consumption is increasing (World Health Organization, 2014c).

Rapid socio-economic development, alcohol industry penetration, weak law enforcement and lack of alcohol control strategies during the post-conflict period may have driven the rapid increase in alcohol consumption among Sri Lankans. Enforcement of existing policies and formulation of new alcohol control strategies in Sri Lanka are vital. Future research should focus on identifying the individual-level characteristics of drinkers, the average volume of total consumption (recorded and unrecorded), patterns of drinking such as binge drinking and alcohol use disorders among drinkers in the areas that were directly and indirectly exposed to the armed conflict. Such information will facilitate the successful delivery of alcohol harm reduction strategies through the identification of groups of people who are more likely to misuse alcohol and be at higher risk of experiencing alcohol-related harm.

ACKNOWLEDGEMENTS

We thank Mr Kala Rasika Wijesinghe, Officer in Charge of Legal and Statistics Branch of the Department of Excise, Sri Lanka, and Mrs I.R. Bandara, Director, Population Census and Demography, Department of Census and Statistics, Sri Lanka for their support in providing relevant data for this study.

FUNDING

M.D.N. was funded by the UK Centre for Tobacco and Alcohol Studies and a scholarship (the Vice Chancellor's Scholarship for Research Excellence (International)) from The University of Nottingham. T.L., L.S. and S.L. are members of the UK Centre for Tobacco and Alcohol Studies, a UK Clinical Research Collaboration Public Health Research: Centre of Excellence. Funding to the UK Centre for Tobacco and Alcohol Studies from the British Heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council, and the Department of Health, under the auspices of the UK Clinical Research Collaboration is gratefully acknowledged (Grant no. MR/K023195/1).

AUTHORS' CONTRIBUTIONS

All authors contributed to the design of this research study. M.D.N. conducted the analysis and produced the first draft of the article, and all authors contributed to subsequent revisions and preparation of the final report. All authors read and approved the final article.

CONFLICT OF INTEREST STATEMENT

None declared.

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8.5 Responses to the – Health Survey for England User Consultation 2013

Health Survey for England – health, social care and lifestyles

User Consultation Questionnaire

Through this consultation we aim to find out how different people and organisations use information from the survey and how important it is to them and their work. We also need to know what information they would like over the next 5-7 years. This will help us justify the need for the survey and its associated public expenditure. Your answers will help us decide if we should change the way the survey is done or change the information it collects. We want to ensure that the survey continues to be relevant to the people who use it and that we are meeting their information needs in the best and most cost-effective way, within the two constraints of a survey that is not too long for respondents and the available funding.

We will publish our findings from this consultation in 2014.

The consultation document describes the current survey design and gives more details about the information the survey has collected. Please read it before answering these questions.

Personal Details

Knowing who has responded to the consultation helps us to analyse the results and to respond to any specific points where necessary. In this section you are asked to provide information about yourself and your organisation (if applicable). We ask for your email address and telephone number in case we need to contact you to discuss your information requirements. We will not share or publish these without your permission.

Please complete the following details:

1. Name: Manjula Nugawela

I am a PhD student studying at the Division of Epidemiology and Public Health of the University of Nottingham (UK Centre for Tobacco and Alcohol Studies). As a partial fulfilment of my PhD I recently completed a study on "Quality of Alcohol Consumption Measures from General Population Surveys in England" with the guidance and supervision from Dr. Tessa Langley, Dr. Lisa Szatkowski, and Professor Sarah Lewis. This study aimed to compare the measurement of alcohol consumption related behaviour from national surveys in England with international guidelines and recommendations. A manuscript is currently being prepared for submission to a peer-reviewed journal.

The Health Survey for England was one of the surveys we included in our analysis. During the analysis of this study adult alcohol consumption questions from the Health Survey for England were compared with the international guidelines for measuring alcohol consumption in general population surveys, provided by the World Health Organization, European Commission, National Institute of Alcohol Abuse and Alcoholism and the KBS Society which is an international organization of scientists involved in alcohol research.[7, 385, 386, 450]

This study showed that further improvements are essential in alcohol consumption questions in national surveys including the Health Survey for England. The suggestions provided below are based on the findings of our study and they mainly focus on improvements that are essential in adult alcohol consumption related questions.

2. Type of respondent or organisation: *please click the appropriate box*

Academic	☒
Charity or voluntary organisation	☐
Media	☐
Member of the public	☐
Private sector	☐
Public sector - Department of Health	☐
Public sector - Public Health England	☐

Public sector - NHS England ☐

Public sector - Other NHS organisation ☐

Public sector - Local Authority ☐

Public sector - other ☐

Other ☐

If other please specify below:

3. Organisation name: Division of Epidemiology and Public Health of the University of Nottingham (UK Centre for Tobacco and Alcohol Studies- UKCTAS)
4. Email address: mcxmdnug@nottingham.ac.uk
5. Telephone number:
6. May we contact you please to discuss your responses if we would like clarification or to answer any questions you may have asked?

Yes ☒ (please check you have entered your email address or phone number)

No ☐

Your use of the surveys

7. Please use the grid below to answer the following questions about survey publications:

Health Survey for England publications	Were you aware of the following?		Have you used the following for your work or studies?		Please rate how useful you find this
	Yes	**No**	**Yes**	**No**	
Annual Summary of key findings	☒	☐	☒	☐	2 - poor
Annual reports on survey findings (volume 1)	☒	☐	☒	☐	2 - poor
Annual Survey Methods reports (volume 2) includes questionnaires	☒	☐	☒	☐	5 - very good
Trend tables for adults on HSCIC website	☒	☐	☐	☒	Choose an item.
Trend tables for children on HSCIC website	☒	☐	☐	☒	Choose an item.

Please add comments to help us understand your ratings e.g. what made them useful or not useful and how easy it was to find the information you wanted to read

Annual Summary of key findings and Annual reports on survey findings

In relation to the alcohol consumption measures the methods used to obtain the findings presented in the above reports have to be improved as they do not adequately align with the key indicators of alcohol consumption measures. For example, international guidelines recommend producing an annual alcohol consumption measure adjusted for heavy drinking occasions.[7, 386] The measures of average weekly alcohol consumption used in these reports do not adjust for heavy episodic drinking and may therefore underestimate the actual consumption.[378, 458] Hence we suggest that these reports need to provide findings on the key indicators of alcohol consumption measures mentioned below (Question 8).

Trend tables

Even though we haven't used the trend tables in our current research project, these tables will be useful for future studies that aim to evaluate the effects of alcohol control policies and other interventions.

8. What additional topics or analyses, if any, would you like to see in the report or trend tables?

- Annual alcohol consumption adjusted for heavy episodic drinking occasions
- Prevalence of heavy episodic drinkers
- Prevalence of heavy episodic drinkers among drinkers

  Where heavy episodic drinking is defined as "drinking at least 60g (7.5 units) or more of pure alcohol on at least one occasion weekly".[526, 527]

9. Would you like to be able to access interactive tools to get visual displays of the key survey data over the internet?

Yes ☒ No ☐

Please add any comments or suggestions about what you would like to see here.

10. Were you aware that not everything collected by the survey is reported in the main reports but is all made available in the UK Data Service catalogue at http://ukdataservice.ac.uk/ before reading this consultation?

Yes ☒ No ☐

11. Please use the grid below to answer the following questions about the survey resources in the UK Data Service catalogue http://discover.ukdataservice.ac.uk/series/?sn=2000021

Health Survey for England resources in the UK Data Service catalogue	**Were you aware of this?**		**Have you used this?**		**Please rate how useful you find this**
	Yes	**No**	**Yes**	**No**	
That each survey dataset is available in the UK Data Service catalogue and can be downloaded for analysis?	☒	☐	☐	☒	Choose an item.
The UK Data Service offers a NESSTAR tabulation service that you can use to select survey variables and generate customised tables?	☒	☐	☐	☒	Choose an item.
The dataset documentation includes Questionnaires, Showcards, Coding Frames and Consent Booklets and Interviewer, Nurse, Coding and Editing Instructions	☒	☐	☒	☐	5 - very good
The dataset documentation includes a user guide and lists of variables	☒	☐	☒	☐	5 - very good

If you wish to add any comments please do so here:

12. Since 2011 survey respondents were asked if they consent to their survey data being linked to the NHS Central Register (cancer and mortality data) and to the Hospital Episodes Statistics data. A linked dataset is being developed. How useful would these be to you?

Very useful ☒

Useful ☐

Not Useful ☐

Don't know ☐

What analyses, if any, would you want from the linked dataset?

13. For what purpose(s) do you currently use the Health Survey for England information?

Please tick all that apply:

Writing media articles	☐
Monitoring the prevalence of health or illness	☐
Monitoring changes in health and/or lifestyles	☒
Informing policy making	☐
Policy monitoring and evaluation	☒
Comparing local indicators with national figures	☐
Planning services	☐
For my personal interest	☐
For my studies or student projects	☐
Research and analysis- academic	☒
Research and analysis – other	☐
Other, please explain below.	☐

14. If the Health Survey for England was stopped what impact would not having the survey data have on your work?

If the Health Survey for England was stopped then there will not be a high quality national data source that can provide reliable estimates on individual level alcohol consumption measures from 2012 onwards. National survey data on volume of alcohol consumption, pattern of drinking and characteristics of drinkers are vital in formulating, evaluating and improving alcohol control

policies to reduce alcohol misuse.[7] UK government has taken several actions to reduce harmful alcohol consumption by implementing Licensing Acts, industry partnerships and mass media campaigns. All of these strategies will be more effective if their implementation and impacts are monitored and evaluated.[5]

In our study of national surveys providing data on alcohol consumption outlined above, the General Lifestyle Survey was identified as the survey which most closely matched the international guidelines on survey questions to measure alcohol consumption. However, the General Lifestyle Survey ceased in January 2012 and, in addition alcohol consumption questions are not consistently included in the Opinions & Lifestyle Survey over time.[410] The Health Survey for England therefore plays a vital role in collecting data on alcohol consumption over time, as it will enable studies which evaluate alcohol control policies and other interventions aiming to reduce alcohol consumption.

Survey Content

Your answers about what aspects of health and social care you want to know about, how frequently you want updated information, and how important it is to you, will help us decide what the survey will cover in future and how long it will be.

Current Core Questions

The survey has a group of core questions asked by the interviewer or the nurse. This includes standard socio-demographic questions, (such as age, sex, ethnicity, employment status, income), which are essential to enable us to see if health varies across different groups within the population and to monitor equality. Most core questions are asked each year but some are asked only in alternate years. Measurements such as height, weight, and waist size and saliva, blood and urine samples are collected. Further details about the core content are in the consultation document.

This section asks in detail about how useful these core items are to you now and if you will require these data in future. Some aspects of health change more slowly over time than others, and some users may require data less frequently than others. So it may not be necessary to collect data on these questions every year in future.

15. The survey collects detailed information about people's current general health and recent sickness and records prescribed medicines taken and long standing illnesses in detail. For survey users' convenience, variables where these illnesses and medicines have been grouped into condition/disease types are available in the survey dataset. Please use the grid below to tell us about your use and need for the core health and social care questions in the survey:

Topics (collected annually except where specified as 2 yearly)	**Were you aware this was collected and available?**		**Have you used this?**		**Please rate the importance of these data to you**	**How frequently, if at all, would you require these data in future?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
	Yes	**No**	**Yes**	**No**			
C1: General health Including recent sickness and self-assessed general health.	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C2: Long standing illness(s) and their type(s) and if limiting.	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C3: Prescribed medicines Number, drug code and type, Reasons for taking medication asked to allow coding to types in the British National Formulary	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C4: Folic Acid	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.
C5: EQ5D health outcomes/ quality of life questionnaire (2 yearly)	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C6: General Health Questionnaire (GHQ12) psychological well-being (2 yearly)	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.

Topics (collected annually except where specified as 2 yearly)	**Were you aware this was collected and available?**		**Have you used this?**		**Please rate the importance of these data to you**	**How frequently, if at all, would you require these data in future?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
	Yes	**No**	**Yes**	**No**			
C7: Social Care need Questions for people aged 65 and over questions about their need for care, receipt of care and payment for care, and personal care plans Asks about bladder and bowel problems	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.
C8: Informal social care provision Questions to all adults about their provision of informal care to others.	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.

16. The core survey also collects detailed information about smoking, drinking alcohol, fruit and vegetable consumption, height and weight (see survey publications for further information). Please use the grid below to tell us about your use and need for these questions:

Topics (collected annually unless specified differently)	**Are you aware this was collected and available?**		**Have you used this?**		**Please rate the importance of these data**	**How frequently, if at all, would you require these data in future?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
	Yes	**No**	**Yes**	**No**			
C9: Adult smoking questions and details of nicotine products and replacements used	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C10: Child self-completion smoking module	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.

Topics (collected annually unless specified differently)	**Are you aware this was collected and available?**		**Have you used this?**		**Please rate the importance of these data**	**How frequently, if at all, would you require these data in future?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
	Yes	**No**	**Yes**	**No**			
C11: Adult drinking alcohol questions (Drinking in last 7 days, heaviest drinking day)	☒	☐	☒	☐	5 - very important	Annually	No
C12: Child self-completion alcohol questions	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C13: Fruit and vegetable consumption module (2 yearly) (allows calculation of portions per day and whether meet 5-a-day target)	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
C14: Height and weight measurements (adults and children)	☒	☐	☒	☐	4 - important	Annually	No
C15: Self-reported height and weight, perception of weight and if trying to lose weight.	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.

17. Please tell us how you use the core topics and add any comments about why they are important to you in the space below.

We analysed the alcohol consumption questions in Health Survey for England (for specific years and over time since 2000) for our study on "Quality of Alcohol Consumption Measures from General Population Surveys in England".

The questions we used to compare with the international guidelines are as below;

1) Drinking in last 7 days, Heaviest drinking day questions (From 2000-2011)
2) Beverage Specific Quantity Frequency Questions (From 2000-2002 questionnaires and in 2011 questionnaire)
3) Any other alcohol consumption related questions

- Questions on overall frequency of drinking (From 2000-2011)
- Drinking in pregnancy in 2002
- Attitude of drinking in 2007
- Drink diary in 2011

Importance

Alcohol Consumption Data

In the UK alcohol consumption is the third biggest lifestyle risk factor for disease and death, after smoking and obesity.[9] Monitoring alcohol consumption over time will be vital in order to formulate, evaluate and improve alcohol control policies to reduce harmful alcohol consumption and alcohol related consequences.[7]

Whilst alcohol consumption can also be measured using population level sales data, individual level alcohol consumption data obtained using general population surveys have unique advantages over sales data as mentioned below;

- They measure not only the volume but also patterns of individual alcohol consumption.[7]
- Individual level data also enable the identification of characteristics of people who drink and comparison of drinking patterns within population subgroups. [7]

High quality alcohol consumption data over time from general population surveys are therefore essential for us as researchers who conduct studies on evaluating alcohol control policies and other interventions to reduce alcohol misuse.

Height & Weight

- Height and weight measures are important in alcohol studies as they are vital in obtaining more precise estimates of blood alcohol concentration levels.[385, 386]

18. Would you like to see any other topics added to the core content? If yes, please describe them below and say why they are important, and how often you need them.

We would like to see the two topics mentioned below added to the core content since they represent the key indicators of alcohol epidemiology and UK surveys currently do not use the best available methodologies to measure them.

1) **Heavy Episodic Drinking (Binge Drinking) Frequency over the past 12 months**

Suggested Frequency: Annually

Importance: Heavy episodic drinking frequency identifies the proportion of the population who are at a higher risk of having alcohol related consequences.[7] According to the World Health Organization, heavy episodic drinking is "drinking at least 60g (7.5 units) or more of pure alcohol on at least one occasion weekly".[526, 527] International guidelines recommend using the "frequency of heavy episodic drinking over the past 12 months" obtained from the Graduated Quantity Frequency (GQF) questions in identifying this drinking pattern.[7, 385, 386, 450]

The Health Survey for England does not ask GQF questions, instead it use the "quantity of alcohol drunk on the heaviest drinking day in the last week" in identifying the heavy episodic drinking pattern.[378, 415, 458] This method uses a shorter reference period than the recommendation, which is likely to greatly underestimate the proportion of heavy episodic drinkers and miss infrequent drinkers.[7, 386, 450] Furthermore, currently used questions on heaviest drinking day of the last week may underestimate the actual consumption by omitting any other heavy drinking occasions in the last week as it focuses only on the heaviest drinking day.

Therefore we recommend adding 'Graduated Quantity Frequency' (GFQ), questions which measure how often large quantities of alcohol are consumed on one occasion, with at least two quantity thresholds for 60g (7.5 units) and 120 g (15 units).

2) Beverage Specific Quantity Frequency questions with the reference period of past 12 months

Suggested Frequency: Annually

Importance: Annual alcohol consumption is the other most important indicator of alcohol drinking among adults.[386] It is also considered to be a good predictor of alcohol related problems at individual level.[386] According to the international guidelines, annual alcohol consumption should be measured by aggregating consumption due to usual drinking occasions obtained from Beverage

Specific Quantity Frequency (BSQF) questions and consumption due to heavy drinking occasions obtained from heavy episodic drinking frequency questions.[7, 386]

The average weekly alcohol consumption measure produced from UK surveys has been derived from an annual alcohol consumption measure calculated using the BSQF questions preferred by the guidelines, but it has not adjusted for heavy drinking occasions.[378, 458] Hence the currently used average weekly alcohol consumption measure in the UK is very likely to underestimate actual consumption. Moreover, BSQF questions have not been asked in the Health Survey for England in all years of the survey, hence a measure of annual alcohol consumption cannot be derived at all for some years.

Therefore we recommend adding BSQF questions to the core content annually, and adjusting the annual alcohol consumption measure obtained from BSQF questions for the consumption due to heavy drinking occasions.

19. What would you drop from the current core to fit in the new topics you want?

We would drop the "Drinking in last 7 days, heaviest drinking day" questions since the currently used binge drinking estimates derived from these questions have several limitations and do not align with the international recommendations as discussed above. Then this space can be utilised by the above suggested topics which are recommended by the international guidelines as the best available methods for measuring the annual alcohol consumption and the prevalence and volume of high risk consumption.
However, a limitation of removing "Drinking in last 7 days, heaviest drinking day" questions would be that there will be no comparable binge drinking measure to monitor trends over recent years.

Survey Content – Biological measures, saliva, blood and urine samples. During the nurse visit some measurements and samples are taken.

20. Please tell us if you were aware that these measurements were available from the survey and if you have used them in the past.
Most of these are part of the current core content of the survey and are collected each year or every two years.
Also, for only those measurements that you do want in future, please tell us the minimum frequency you require; what the impact of not having the data would be on your work; and to what extent you can get the data you need from other sources.

Measurements	Were you aware this was collected or available?		Have you used this?		Do you require these data in future? What is the minimum frequency you need?	*Answer these only if you do need the data in future*	
	Yes	**No**	**Yes**	**No**		**If these data were not collected in future what would be the impact on your work?** (none, low, medium or severe)	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
Blood pressure measurements (including equipment) e.g. to permit assessment of hypertension	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
Waist and hip circumference – age 11+	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
Saliva sample collection and measurement of cotinine for children (relevant to smoking)	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
Saliva sample collection and measurement of cotinine for adults	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
Urine sample age 16+ - potassium, sodium, creatinine	☒	☐	☐	☒	Choose an item.	Choose an item.	Choose an item.
Urine sample age 16+ - albumin (kidney disease see 2009 and 2010 survey)	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.
Urine sample age 16+ - melatonin (2010 survey)	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.
Blood - glycated haemoglobin (to assess control in diabetes)	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.
Blood - cholesterol (total and HDL relevant to coronary heart disease)	☐	☒	☐	☒	Choose an item.	Choose an item.	Choose an item.

Please describe how you have used, or would use these data in future.

21. In some years, other measurements or tests of physical function have been taken. Would you be interested in using any of these in future?

Lung function for age 7+
Step test for age 16- 74
Grip strength for age 65+ (2005 survey)
Physical function for age 65+: balance and walking speed (2005 survey)
Infant length (last collected in 2007)

Yes ☐ *If **yes**, please go to question 22*
No ☐ *If **no**, please go to question 23*
Don't know ☒ *If d**on't know**, please go to question 23*

22. Please use the grid below to tell us about your requirements for the particular measurements in this list that you do want in future.

		Answer these only if you do need the data in future		
Measure	**Please tick if you have used this before**	**If you do require these data in future please tell us the minimum frequency you need?**	**If this was not collected in future what would be the impact on your work?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
Lung function – age 7+	☐	Choose an item.	Choose an item.	Choose an item.
Step test – age 16- 74	☐	Choose an item.	Choose an item.	Choose an item.
Grip strength for age 65+ (2005 survey)	☐	Choose an item.	Choose an item.	Choose an item.
Physical function for age 65+: balance and walking speed (2005 survey)	☐	Choose an item.	Choose an item.	Choose an item.
Infant length (last collected in 2007)	☐	Choose an item.	Choose an item.	Choose an item.

Please describe how you have, or would, use these measures.
Click here to enter text.

Blood Samples from respondents aged 16+

Some standard blood tests have been done on the non-fasting blood samples from respondents over the years. These tests can be used for a range of purposes as indicators of health or certain conditions.

23. Were you aware that non-fasting blood samples from people aged 16+ are taken each year and that data derived from these is available before reading this consultation?

Yes ☐ No ☒

24. Were you aware that blood samples are kept frozen and are available for further analysis through the Health Survey for England Bloodbank service before reading this consultation?

Yes ☐ No ☒

25. Have you ever used other data derived from the blood samples, i.e. other information besides glycated haemoglobin or cholesterol? Would you need any information derived from blood samples in future for your work?

Yes, I have used or will need in future ☐ *If **yes** please go to question 26*

No ☒

Don't Know ☐ *If **no** or **don't know** please go to question 27*

Other blood analytes

26. Please tell us if you have used any other blood measures in the past and if you require these data in future and how frequently. For only those measurements that you do require in future, please indicate the impact on your work of not having the data and if other sources do provide you with sufficient data.

		Answer these only if you do need the data in future		
Blood sample (non-fasting) measures or analytes (age 16+)	**Please tick if you have used this before**	**If you do require these data in future please tell us the minimum frequency you need?**	**If this was not collected in future what would be the impact on your work?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
Blood - C reactive protein	☐	Choose an item.	Choose an item.	Choose an item.
Blood – creatinine	☐	Choose an item.	Choose an item.	Choose an item.
Blood – fibrinogen	☐	Choose an item.	Choose an item.	Choose an item.
Blood – flu antibodies	☐	Choose an item.	Choose an item.	Choose an item.
Blood - Hb + ferritin	☐	Choose an item.	Choose an item.	Choose an item.

Blood – MCV	☐	Choose an item.	Choose an item.	Choose an item.
Blood – serum albumin	☐	Choose an item.	Choose an item.	Choose an item.
Blood – serum transferrin	☐	Choose an item.	Choose an item.	Choose an item.
Blood – serum vitamin B12	☐	Choose an item.	Choose an item.	Choose an item.
Blood – serum vitamin D	☐	Choose an item.	Choose an item.	Choose an item.
Use of the frozen blood samples for my own research	☐	Choose an item.	Choose an item.	Choose an item.

Please describe how you have used the blood data and how you would use it in future.

Survey Content: topics outside the core

The current survey design allows for around 10 minutes of interview administered question topics in addition to the core questions. For some topics, respondents are given self-completion questionnaires booklets to fill in. Many topics have been covered by the survey in past years and some were repeated to enable measurement of change.

27. These topics have been in the survey in recent years. Please tell us if you have used any of these in the past by ticking their boxes

Topic		Have used	Topic		Have used
A1	Hypertension (blood pressure, doctor diagnosed, treatment etc.)	☐	A13	Hay fever	☐
A2	Cardiovascular disease (including doctor diagnosed coronary heart disease, ischaemic heart disease, heart attack, angina, stroke, heart murmur)	☐	A14	Eczema	☐
A3	Undiagnosed probable angina or myocardial infarction	☐	A15	Oral and dental health	☐
A4	Use of health services for cardiovascular disease	☐	A16	Falls and fractures	☐
A5	Diabetes	☐	A17	Drinking alcohol diary	☒

Topic	Have used	Topic	Have used
A6 Respiratory health (including asthma, COPD	☐	A18 Physical activity and exercise	☐
A7 Kidney disease	☐	A19 Well-being (Warwick_Edinburgh Mental Well-being scale)	☐
A8 Chronic Pain	☐	A20 Strengths and difficulties (SDQ) (age 4-15) relevant to child mental health	☐
A9 Sexual health	☐	A21 Attitudes and knowledge about health	☐
A10 Contraception	☐	A22 Use of cycle helmets by children	☐
A11 End of life care	☐	A23 Social capital and social exclusion	☐
A12 Ear and hearing problems	☐	A24 Healthy foundations segmentation (social marketing) (only in 2010 survey)	☐

28. Do you require any of these data topics in future?.

Yes ☒ *If **yes**, please go to question 29*

No ☐ *If **no**, please skip to question 30*

Don't know ☐ *If **don't know**, please skip to question 30*

29. For only the topics that you do require in future, please tell us the minimum frequency that meets your needs and also indicate the impact on your work of not having the data and if other sources do provide you with sufficient data. (*There is no need to select options for topics you do not want in future.)*

Topic	**What is the minimum frequency you need in future?** (annually, every 2, 3,4 or 5 years, less often)	**If this was not collected in future what would be the impact on your work?**	**Can you get the data you need on this topic from other sources?** (Yes, no, partially)
A1 Hypertension (blood pressure, doctor diagnosed, treatment etc.)	Choose an item.	Choose an item.	Choose an item.
A2 Cardiovascular disease (including doctor diagnosed coronary heart disease, ischaemic heart disease, heart attack, angina, stroke, heart murmur)	Choose an item.	Choose an item.	Choose an item.
A3 Undiagnosed probable angina or myocardial infarction	Choose an item.	Choose an item.	Choose an item.
A4 Use of health services for cardiovascular disease	Choose an item.	Choose an item.	Choose an item.
A5 Diabetes	Choose an item.	Choose an item.	Choose an item.
A6 Respiratory health (including asthma, COPD	Choose an item.	Choose an item.	Choose an item.
A7 Kidney disease	Choose an item.	Choose an item.	Choose an item.
A8 Chronic Pain	Choose an item.	Choose an item.	Choose an item.
A9 Sexual health	Choose an item.	Choose an item.	Choose an item.
A10 Contraception	Choose an item.	Choose an item.	Choose an item.
A11 End of life care	Choose an item.	Choose an item.	Choose an item.
A12 Ear and hearing problems	Choose an item.	Choose an item.	Choose an item.
A13 Hay fever	Choose an item.	Choose an item.	Choose an item.
A14 Eczema	Choose an item.	Choose an item.	Choose an item.
A15 Oral and dental health	Choose an item.	Choose an item.	Choose an item.
A16 Falls and fractures	Choose an item.	Choose an item.	Choose an item.

Topic	What is the minimum frequency you need in future? (annually, every 2, 3,4 or 5 years, less often)	If this was not collected in future what would be the impact on your work?	Can you get the data you need on this topic from other sources? (Yes, no, partially)
A17 Drinking alcohol diary	Less Often	2 - low impact	Partially
A18 Physical activity and exercise	Choose an item.	Choose an item.	Choose an item.
A19 Well-being (Warwick_Edinburgh Mental Well-being scale)	Choose an item.	Choose an item.	Choose an item.
A20 Strengths and difficulties (SDQ) (age 4-15) relevant to child mental health	Choose an item.	Choose an item.	Choose an item.
A21 Attitudes and knowledge about health	Choose an item.	Choose an item.	Choose an item.
A22 Use of cycle helmets by children	Choose an item.	Choose an item.	Choose an item.
A23 Social capital and social exclusion	Choose an item.	Choose an item.	Choose an item.
A24 Healthy foundations segmentation (social marketing) (only in 2010 survey)	Choose an item.	Choose an item.	Choose an item.

Drinking alcohol diary

Even though this method has the advantage of having more reliable reporting of alcohol consumption over the last 7 days, it has some serious limitations due to the shorter reference period.[7] A shorter reference period like last 7 days may fail to represent respondents overall drinking volume or pattern of consumption and is likely to miss infrequent drinkers.[7]

Moreover the international guidelines recommend using the last 12 months as the reference period in measuring most of the alcohol consumption measures as it provides a more comprehensive picture of alcohol consumption.[386] It also provides the opportunity to study the relationship between alcohol consumption and related consequences which are not likely to occur due to a consumption level over a short period like last 7 days.[386] Therefore we consider the estimates provided from this method are not to be of great potential value.

Other topics you want in future

1. Would you like to see any other topics relating to **adults** covered in one or more years of the Health Survey for England in future? Please describe what you would like included below, how frequently and why it is important to your work.

   Questions on Drinking Context and duration of drinking

   Suggested Frequency: Annually

   Importance: These questions can be used to improve the precision of alcohol consumption estimates.[386] For example drinking context is an important factor in explaining the volume of alcohol consumed and it enables identification of the associations between drinking and its consequences.[7] It has been identified that heavy drinking of alcohol without meals, without company, or outdoor can be more risky than drinking the same amount alcohol with meals and with company.[386] Duration of drinking is important in calculating more precise estimates of blood alcohol concentration levels.[385, 386]

2. Would you like to see any other topics relating to **children** covered in one or more years of the Health Survey for England in future? Please describe what you would like included below, how frequently and why it is important to your work.

3. Are there any topics which are connected for your purposes and so would be better analysed together and asked in the same survey year? If so, please tell us in the space below.

   Unrecorded Alcohol Supply

   Suggested Frequency: Every 2-3 years

   Importance: Unrecorded alcohol consumption refers to alcohol which is not taxed and is outside the usual system or regular market of government control.[526] For example homemade or illegally produced alcohol, purchased directly from farmers or other producers. The questions on unrecorded alcohol supply are important to assess the proportion of overall sales that was covered by the survey data.[386]

4. If you want to tell us anything else about specific topics or why they are useful to you, please write in the space below.

Having compared the recommendations from four different international guidelines for measuring alcohol consumption in general population surveys, we would like to give a summary of essential items to be included in the core set of questions and other highly desirable items related to alcohol consumption that are also in need of continuous monitoring over time.

The Essential Set of Alcohol Consumption Measures- Annually

1) Abstention (Life time, Past 12 months)
2) Overall frequency of drinking (Past 12 months)
3) Beverage Specific Quantity Frequency Questions (Past 12 months)
4) Heavy Episodic Drinking Frequency Questions (Past 12 months)
    - Preferably starting with a question on the largest amount drunk in the last 12 months and how often this amount was consumed
    - Followed by 'Graduated Quantity Frequency' (GFQ), questions with at least two quantity thresholds for 60g (7.5 units) and 120g (15 units)

Other Highly Desirable Items-Annually

5) Drinking Context and duration of heavy drinking occasions

    Recommended drinking context questions;
    - With meal or without meal
    - Where (home, restaurant, pub, outside, other)
    - With whom

Optional – Every 2-3 years

6) Unrecorded Alcohol Supply

Survey Design and Methodology

We have the opportunity to change the survey in the future, if that would be appropriate.
The way the survey is carried out currently and the number of people surveyed, (i.e. the sample size), reflects how we could best meet survey users' need for information with the budget available. However, the level of detail wanted in future, and the areas or groups of people within the population for whom data are required, may have changed. Please answer the following questions to help us understand your preferences.

5. What do you consider to be the most important aspects of the Health Survey for England?
Please rank your choices below (1 being the highest and 5 being the lowest) and select only one ranking for each option.

	1st	2nd	3rd	4th	5th
a. Biological measurements	☐	☐	☐	☒	☐
b. Consistency of questions over time	☐	☐	☒	☐	☐
c. Potential to innovate by introducing new or extra questions	☐	☐	☐	☐	☒
d. Quality and precision of the data produced	☒	☐	☐	☐	☐
e. Maintaining the annual frequency of the surveys	☐	☒	☐	☐	☐

<u>Sample size requirements</u>

Please answer the following questions to help us understand what size sample will meet your needs.

6. Which of the following levels or breakdowns of data do you, or would you, use?
For alcohol studies among adults, data on below mentioned breakdowns will be most important.

England	☒
Regional (9 or 10 regions)	☒
Adults	☒
Children	☐
Age groups by sex	☒

Ethnicity	☒
Degree of urbanisation/rurality	☐
Area deprivation quintile	☒
Household income quintile	☒
Educational attainment	☒
Socio-economic group or employment status or NS-SEC	☒

7. For what other breakdowns or levels of aggregation would you find survey estimates useful?

8. Have you ever combined survey data from more than one year together for your analyses? E.g. data for years 2008-2010?

Yes	☒
No	☐

If yes, please list the topics you have done this for

We analysed the survey questionnaires for years of 2000-2011

9. The current core sample size is around 8000 adults and 2000 children a year with a minimum of 700 per region. Further information about the sample and the precision of estimates from the survey is in the consultation document in the section 'Survey design and sample size' and in Appendix 3. Does this core sample size meet your needs?

Yes	☐
Not sure	☒
No	☐

If not, please tell us why not

The analysis of our study was limited to the recommendations on estimating levels and patterns of alcohol consumption and it mainly focused on recommendations to minimise methodological issues. Therefore the recommendations for measuring alcohol consequences and minimising general issues (sampling bias, reporting bias, etc) related to national surveys were not included in our analysis.

Data about ethnic minorities

In 2004 there was an increase (or boost) to the numbers of people from ethnic minority groups within the survey sample to enable analysis of data for the groups separately. The current sample size is not large enough to permit much analysis by ethnic minority groups but it might be possible to obtain funding to do another boosted sample. This would be expensive and the cost is affected by the amount and detail of the survey data collected.

10. How interested are you in having a survey focussed on ethnic minorities to enable comparisons across groups?

Yes, very interested	☐	}
Yes, of some interest	☒	} *if **yes**, please go to question 40*
No, not interested	☐	*If **no** please go to question 44*
Don't know	☐	*If **don't know** please go to question 44*

11. Would you like survey results data for all ethnic groups or for only some groups?

All groups	☒	*If all please skip to question 42*
Only some groups	☐	*If some please go to question 41*

12. Please indicate which ethnic groups you would like results for?

White - English/Welsh/Scottish/Northern Irish/British	☐
White – Irish	☐
White - Gypsy or Irish Traveller	☐
Any other white background	☐
White and Black Caribbean	☐
White and Black African	☐
White and Asian	☐
Any other mixed/multiple ethnic background	☐
Indian	☐
Pakistani	☐

Bangladeshi	☐
Chinese	☐
Any other Asian background	☐
African	☐
Caribbean	☐
Any other Black/African/Caribbean background	☐
Arab	☐
Any other ethnic group (please describe)	

13. Please tell us which data for ethnic minority groups would be most important to you? Please describe the topics and any biological or physical measurements.

Alcohol consumption data for ethnic minority groups would be important for us as there is evidence that consumption levels, patterns and types of beverages consumed can vary according to the ethnicity.[7] Apart from the alcohol consumption measures, height and weight measures will be important in calculating more precise estimates of blood alcohol concentration levels.[385, 386]

14. What would you use survey information about ethnic minorities for and how important is it to your work? Is there anything important that you are not able to do now without these data?

We could use the survey information on alcohol consumption among ethnic minorities to compare their consumption levels and to identify whether there are any groups with higher risk of alcohol misuse and related harm compared to others. Furthermore these data can also be used to assess the effectiveness of alcohol control policies among ethnic minorities. For example we could compare the consumption levels among ethnic minorities before and after the Licensing Act 2003.

Sample boosts

15. Are there any other groups of people for whom an increase to the sample size would be important to you? It will not be possible for the HSCIC to fund this every year but might be possible in some years or if the sample size increase was funded by the user(s) organisation(s).

Please tick all that apply:

a. Children (age 0-15) ☐
b. Older people (age 65+) ☐
c. Other groups or geographical areas *(please describe below)* ☐
Click here to enter text.

16. For each group for which you would like a larger sample, please explain what data you would like collected and how you would use this information. How important to your work is it and is there anything important that you are not able to do without these data?

Priorities for the future survey design if the funding changes

Telling us about your preferences and priorities by answering the following questions will help us design a survey which best meets users' needs if the amount of funding available for the survey changes in future.

17. If <u>more</u> money becomes available to fund the survey this could be spent in different ways. Please indicate your preferences below:

	1st	**2nd**	**3rd**	**4th**	**No opinion**
More analysis of the data	☐	☐	☐	☒	☐
A larger sample	☒	☐	☐	☐	☐
Additional questions	☐	☒	☐	☐	☐
Additional/more frequent biological measures	☐	☐	☒	☐	☐

If you have comments, please add them here:
Click here to enter text.

18. If less money becomes available in future to fund the survey then some cuts would need to be made. We would not advise reducing the sample size because that would severely restrict the analysis of different groups within the population, even at the England level. Please indicate your preferences in this situation below:

	1st	**2nd**	**3rd**	**4th**	**No opinion**
Stop collecting some biological measures	☐	☐	☒	☐	☐
Stop collecting some question data	☐	☒	☐	☒	☐
Reduce the frequency of collecting some data or biological measures (this could affect core and additional topics)	☐	☒	☐	☐	☐
Reduce the amount and depth of analysis published (users would need to do more analysis themselves)	☒	☐	☐	☐	☐

If you have comments or questions, please add them here:

We would recommend using the essential set of questions suggested above (Question 33) annually and removing or reducing the number of questions asked on the other sections "highly desirable" and "optional".

However if this is not enough, then the international guidelines give an alternative for Beverage Specific Quantity Frequency Questions (BSQF) that are used to calculate the annual alcohol consumption. The alternative is the Quantity Frequency method, a shorter approach and involves asking only two questions, one on usual quantity and the other one on overall frequency.[7, 386] The Health Survey

for England already includes the overall frequency questions, therefore the question on "usual quantity you drank over the past 12 months" should be included in the survey when BSQF questions cannot be included. This will make sure that the survey can still provide an estimate for the annual alcohol consumption every year.

However the Quantity Frequency method has some serious limitations as mentioned below:

1) It does not capture the variation in different alcoholic beverages[386]
2) It forces respondents to recalculate their varying drinking practices into one common quantity measure [386]

19. Please read the 'Future design of the survey section (paragraph 30 onwards) of the consultation document. It describes three options for the design of the survey within the current budget and summarises what would be gained and lost by changing. Please indicate your preferences between the options below.

	Ranking			
	1	**2**	**3**	**No opinion**
Option 1: the current design	☐	☒	☐	☐
Option 2: less frequent biological measurements and nurse visit data and slightly bigger main sample	☒	☐	☐	☐
Option 3: main sample is 1.5 times bigger but few measurements and no blood, urine or saliva data from samples	☐	☐	☒	☐

Please add any comments or questions you have here.

20. What other changes, if any, would you like to see to the design of the survey?

21. Would you or your organisation be interested in funding, or part funding, questions, measurements or sample boosts in future surveys?

Yes ☐ No ☒ Maybe ☐

If you have any questions or additional comments please write them in the space below.

Thank you very much indeed for answering this questionnaire and telling us about how you use the survey data and what you would like from the survey in future.

We will report the findings from this consultation on the HSCIC website in 2014.

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8.6 Response from HSCIC for User Consultation Respondents

HEALTH SURVEY FOR ENGLAND

CORE SURVEY CONTENT BY YEAR: 2016-2019

Year	Comments
2016	
2017	The year that includes the urine sample
2018	The year that covers the self-reported height and weight and the perception of weight
2019	

Household interview

	2016	2017	2018	2019
CAPI				
Household composition	•	•	•	•
Household relationships	•	•	•	•
Tenure + no. of bedrooms	•	•	•	•
Smoking in household	•	•	•	•
Car ownership	•	•	•	•
Household income	•	•	•	•
Disability benefits	•	•	•	•
Identify Household Reference Person (HRP)	•	•	•	•
Economic status/occupation of HRP	•	•	•	•

Individual interview

	2016	2017	2018	2019
CAPI				
General health (all ages)	•	•	•	•
Self-reported height and weight (16+)			•	
Longstanding illness and acute sickness (all ages)	•	•	•	•
Personal Care Plans (16+)	•		•	
Hypertension (doctor-diagnosed) (16+)	•	•	•	•
Diabetes (doctor-diagnosed) (16+)	•	•	•	•
Social care receipt - full module (65+)	•		•	
Social care receipt - short module (65+)		•		•
Social care provision (16+)		•		•
Fruit & vegetables (5+)	•	•	•	•
Smoking (18+)	•	•	•	•
Drinking – heaviest drinking day (18+)	•	•	•	•
Drinking – average weekly consumption (18+)	•	•	•	•
Economic status/occupation (16+)	•	•	•	•
Education attainment (16+)	•	•	•	•
National identity (16+)	•	•	•	•
Ethnic group (16+)	•	•	•	•

	2016	2017	2018	2019
Self -completion				
Smoking [1]	•	•	•	•
Drinking – heaviest drinking day[1]	•	•	•	•
EQ-5D, including VAS (16+)		•		•
GHQ12 (13+)	•		•	
Well-being (WEWMBS) (16+)	•		•	
ONS life satisfaction question (16+)	•	•	•	•
Physical activity (IPAQ) (16+)	•	•	•	•
Sexual orientation (16+)	•	•	•	•
Religion (8+)	•	•	•	•
Perception of own weight (8+)			•	
Parent perception of child's weight (16+)			•	
Measurements				
Height (2+)	•	•	•	•
Weight (all)	•	•	•	•
Consents				
Data linkage (16+)	•	•	•	•
Re-contact (16+)	•	•	•	•

Nurse visits

	2016	2017	2018	2019
Questions				
Folic acid	•	•	•	•
Nicotine replacements	•		•	
Prescribed medicines	•	•	•	•
Measurements				
Blood pressure 5+	•	•	•	•
Waist/hip circumference 11+	•	•	•	•
Biological samples				
Cholesterol (total and HDL)	•	•	•	•
Glycated haemoglobin	•	•	•	•
Kidney function[2]		•		
Salt intake[3]		•		
Cotinine (4-15)	•	•	•	•
Cotinine (16+)	•		•	

[1] Children and young people aged 8-17 and up to age 24, at interviewer discretion

[2] Analytes used are Cystatin C, creatinine and albumin. These are taken from the blood and urine samples

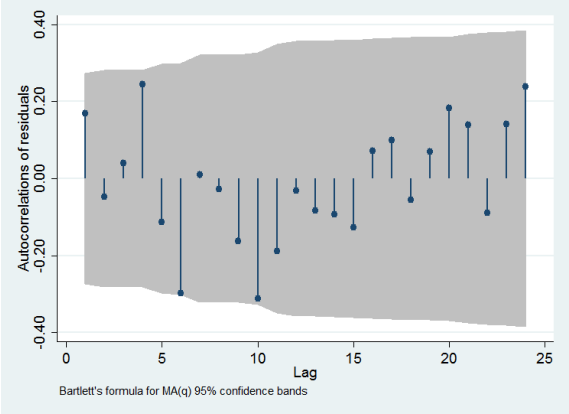
[3] Analytes used are potassium, sodium and creatinine. These are taken from the urine sample

8.7 Structure of data for the segmented regression analysis of Licensing Act 2003

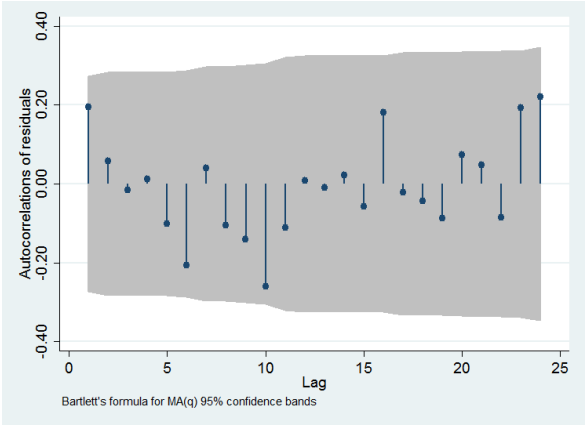
Observation	Mean number of alcohol units	Time	Licensing Act 2003	Time After Licensing Act
1	6.89	1	0	0
2	6.15	2	0	0
3	5.96	3	0	0
4	6.76	4	0	0
5	6.91	5	0	0
6	6.78	6	0	0
7	6.81	7	0	0
8	6.58	8	0	0
9	6.86	9	0	0
10	6.52	10	0	0
11	6.39	11	0	0
12	7.81	12	0	0
13	6.85	13	0	0
14	6.37	14	0	0
15	7.09	15	0	0
55	6.71	55	0	0
56	7.52	56	0	0
57	7.25	57	0	0
58	6.55	58	0	0
59	6.56	59	0	0
60	7.74	60	1	1
61	6.91	61	1	2
62	6.98	62	1	3
63	6.58	63	1	4
64	6.81	64	1	5
65	7.44	65	1	6
66	6.79	66	1	7
67	7.00	67	1	8
68	7.31	68	1	9
69	6.79	69	1	10
70	6.40	70	1	11
71	6.57	71	1	12
72	7.50	72	1	13
73	6.77	73	1	14
74	6.80	74	1	15
75	7.34	75	1	16

8.8 Autocorrlation fuctions(ACF) for timeseries figures presented in Chapter 5

ACF of Figure 5-8_A



ACF of Figure 5-8_B



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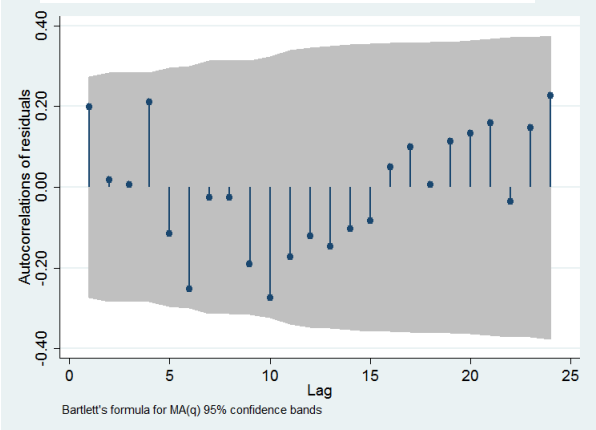

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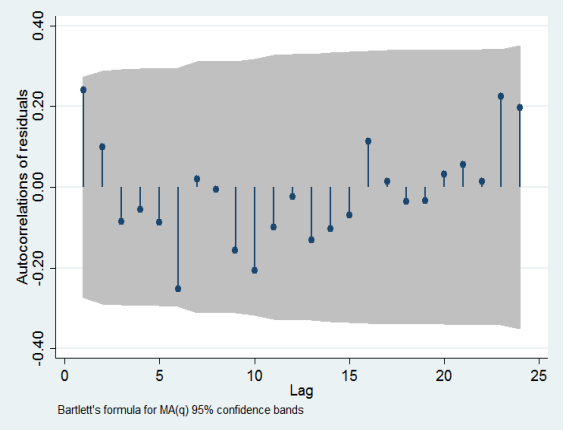

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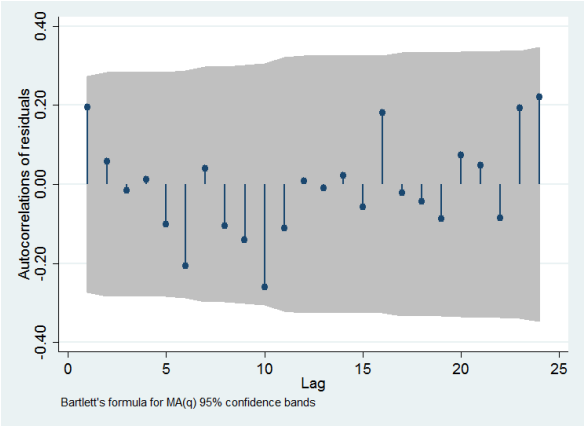

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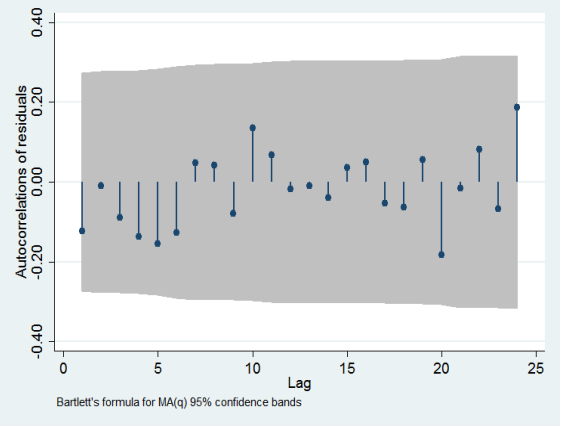

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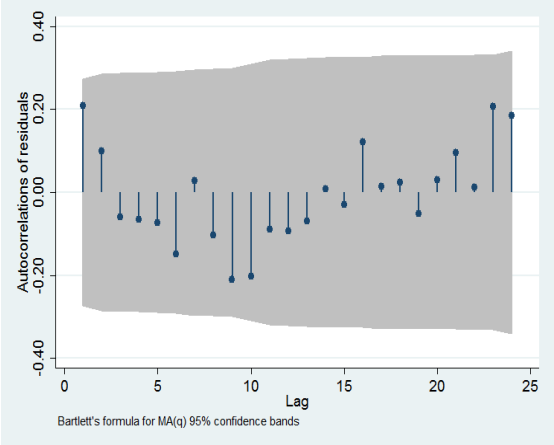

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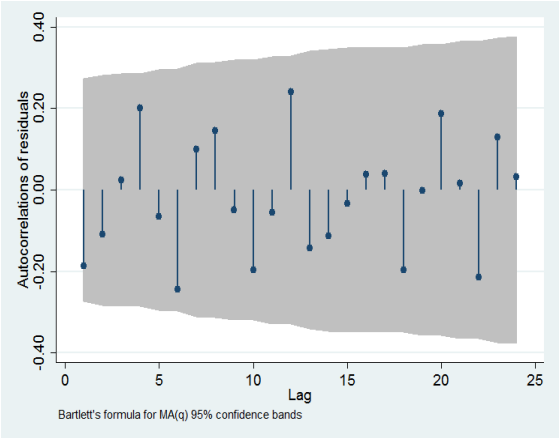

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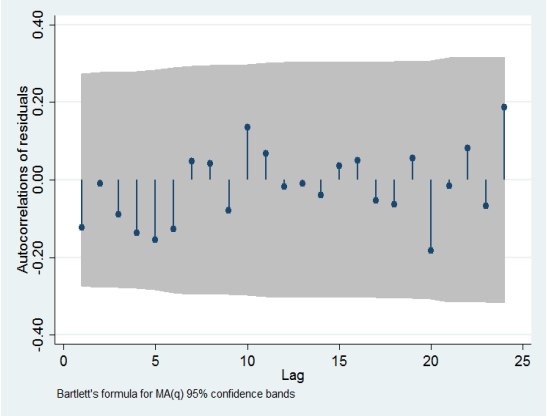

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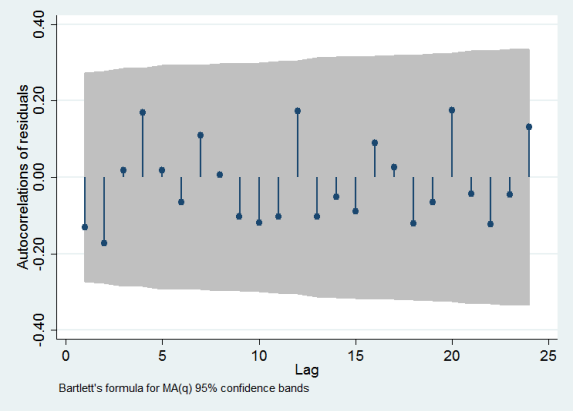

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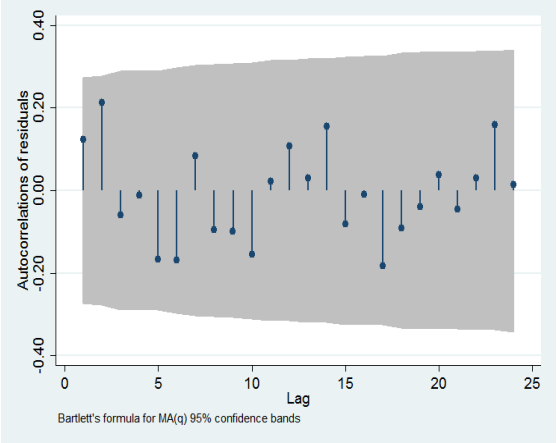

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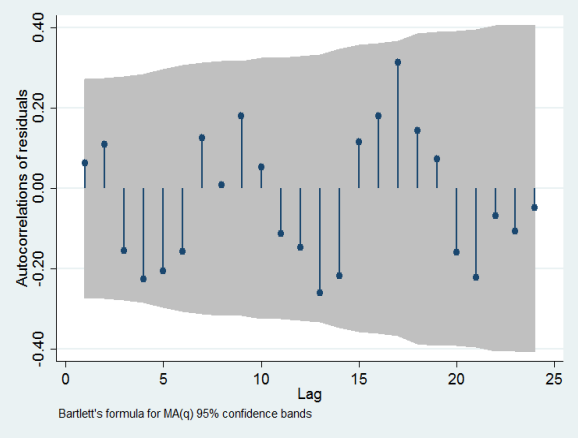

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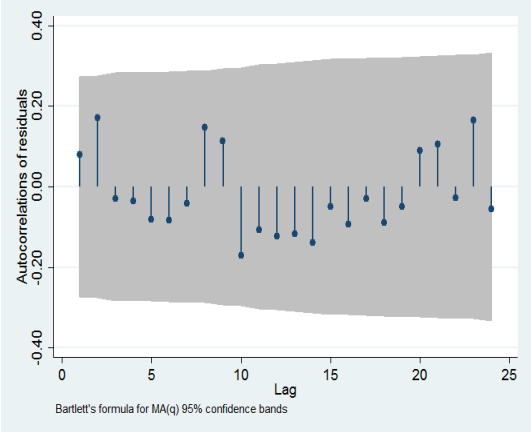

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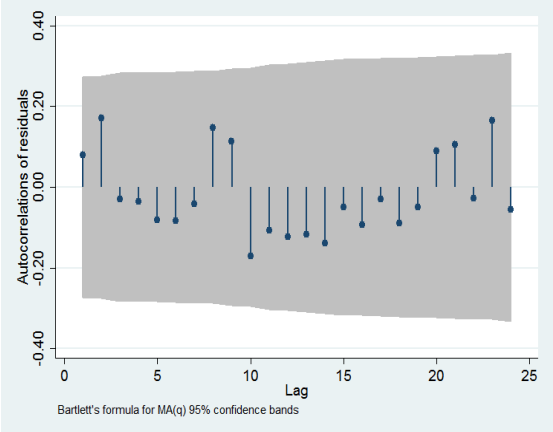

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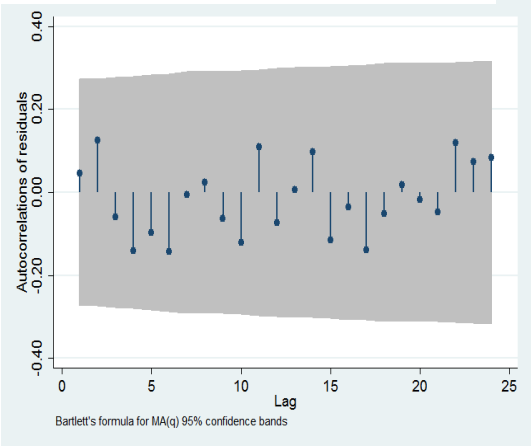

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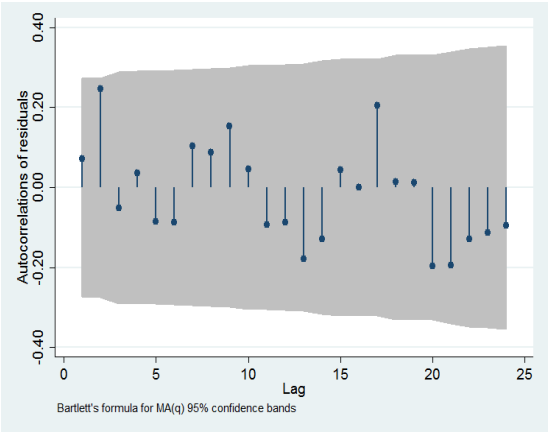

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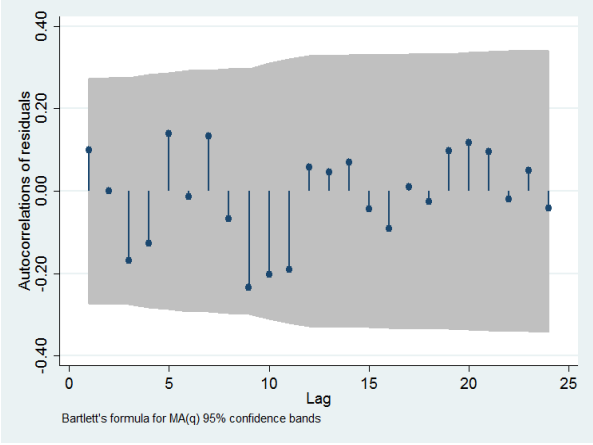

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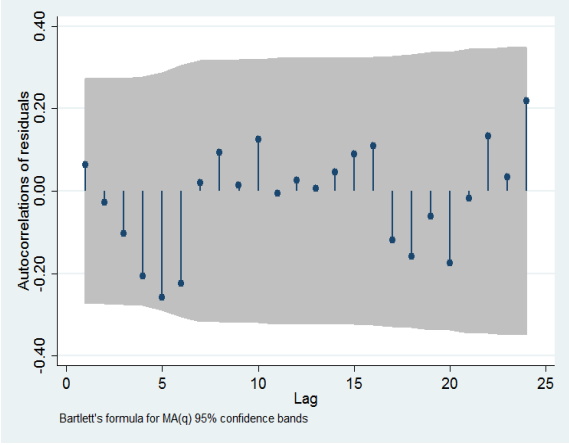

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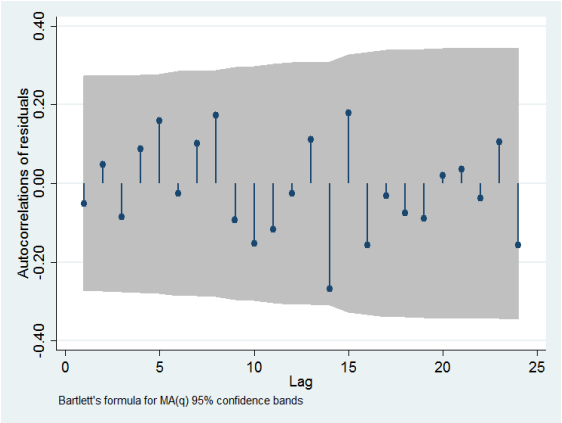

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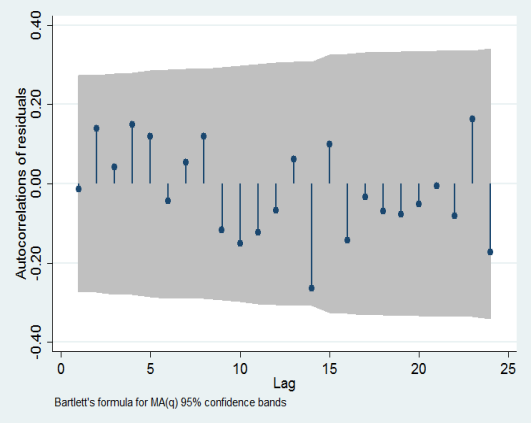

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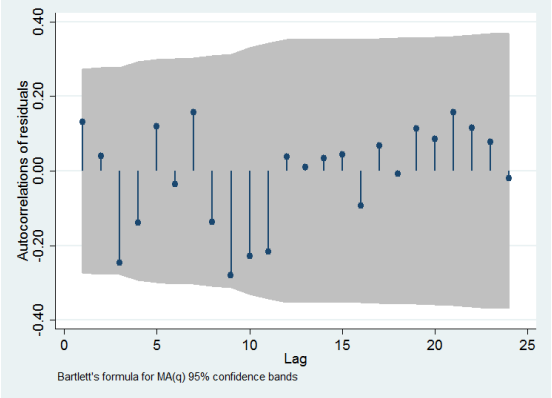

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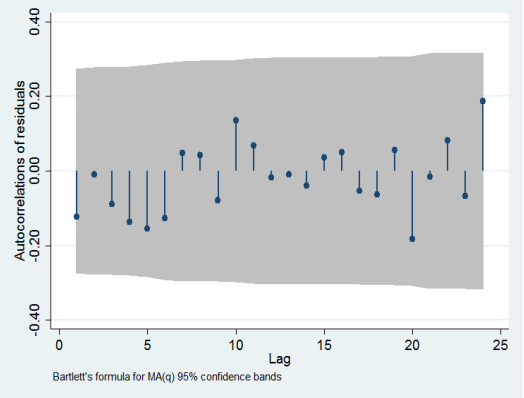

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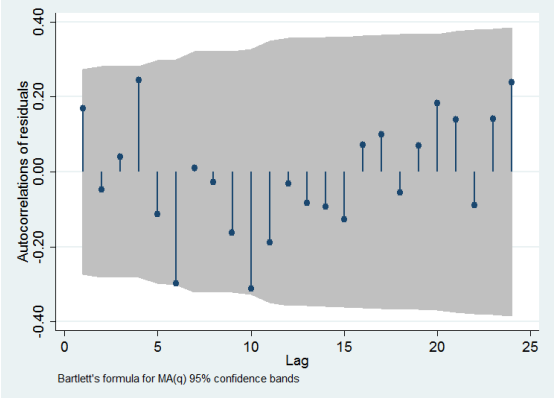

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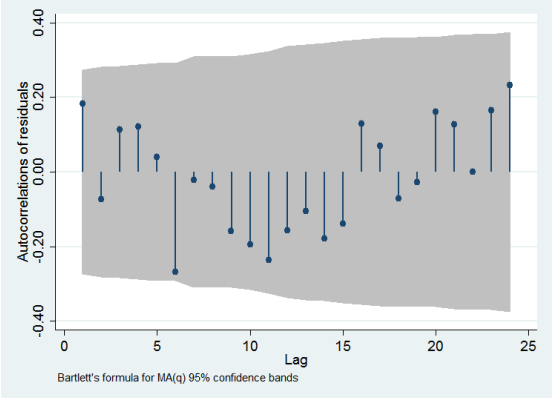

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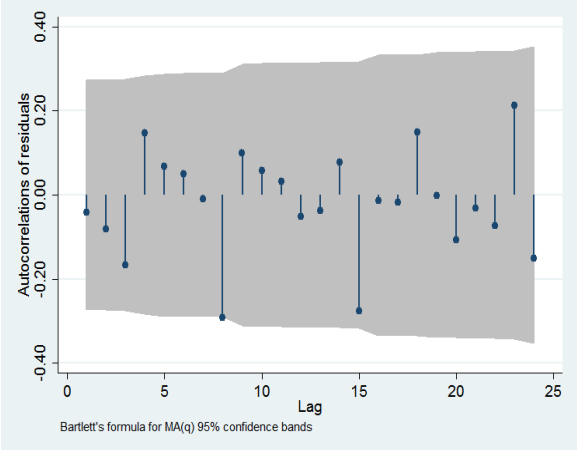

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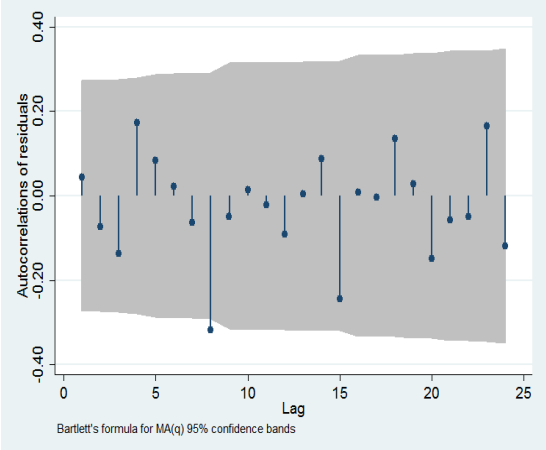

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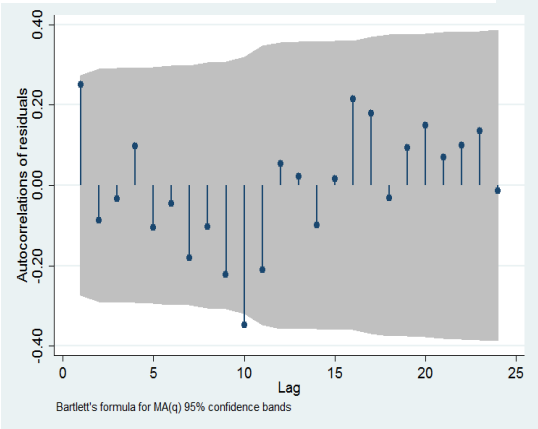

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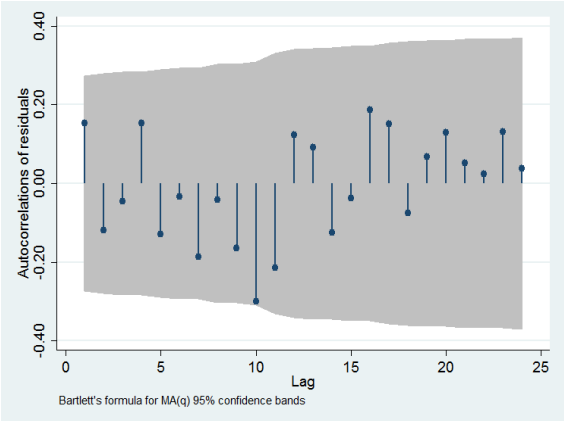

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