

Exploring alcohol experiences amongst young people

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Abstract

Whilst national guidelines have recommended abstinence before 18 years of age, in the North West of England, the use of alcohol is common practice by 15 years. The related harms amongst young people (such as violence, regretted sex, hospital admission) place significant burdens on public and individual health. Public health data are vital in order to monitor levels of harm and evaluate prevention strategies. This PhD submission presents a series of peer-reviewed journal articles (and other supporting publications) which evidence how I have used original research to further understand alcohol misuse and its impacts on at-risk groups such as underage drinkers, heavy episodic drinkers and those who may have been drinking alcohol during pregnancy.

I have used a number of novel methodologies to explore alcohol consumption and further understand the need for early intervention. Firstly, we used simultaneous surveys of parents and children to understand both the child's consumption and their parents' understanding of their child's consumption. Secondly, we used English hospital admission data to explore for the first time the prevalence of Foetal Alcohol Syndrome and related disorders. Thirdly, we initiated a feasibility study to understand the potential reach of a community-based alcohol brief intervention and liver blood test. Finally, we used a combination of breathalyser readings and nightlife surveys to increase the accuracy of surveys of nightlife users.

The articles presented in this PhD provide a significant contribution to public health knowledge on the epidemiology of alcohol consumption and related harm, as well as discussing the evidence base for effective prevention strategies. This submission considers the methodologies, findings and impacts of my research. The work for all publications was undertaken during my employment at Liverpool John Moores University.

Peer-reviewed journal articles submitted for PhD

Lead authored articles

1. **Morleo, M.**, Jones, L., Bellis, M.A. (2014). Alcohol age of initiation and long-term impact: a cross sectional survey of adults in England. *Journal of Substance Use*. 1-7.
Impact factor: 0.81
2. **Morleo, M.**, Cook, P.A, Elliott, G and Phillips-Howard P.A. (2013). Parental knowledge of alcohol consumption: a cross-sectional survey of 11-17 year old schoolchildren and their parents. *BMC Public Health*, 13:412.
Impact factor: 2.32
3. **Morleo, M.**, Woolfall, K., Dedman, D., Mukherjee, R., Bellis M.A., Cook, P.A. (2011). Under-reporting of foetal alcohol spectrum disorders: an analysis of hospital episode statistics. *BMC Pediatrics* 11:14.
Impact factor: 1.93
4. **Morleo, M.**, Cook, P.A, Bellis M.A., Smallthwaite L (2010). Use of fake identification to purchase alcohol amongst 15-16 year olds: a cross-sectional survey examining alcohol access, consumption and harm. *Substance Abuse Treatment, Prevention and Policy* 5:12.
Impact factor: 1.23

Joint lead authored article

5. Cook, P.A., **Morleo, M.**, Billington, D., Sanderson-Shortt, K., Jones, C., Gabbay, M., Sheron, N., Bellis, M.A., Phillips-Howard, P., Gilmore, I. (2015). Evaluation of work-based screening for early signs of alcohol-related liver disease in hazardous and harmful drinkers. *BMC Public Health*. 15:532.
Impact factor: 2.32

Co-authored article

6. Bellis, M.A., Hughes, K., Jones, L., **Morleo, M.**, Nicholls, J., McCoy, E., Webster, J, Sumnall, H (2015). Holidays, celebrations, and commiserations: measuring drinking during feasting and fasting to improve national and individual estimates of alcohol consumption. *BMC Public Health*. 13:113.
Impact factor: 2.32

7. Calafat, A., Bellis, M.A., Fernandez del Rio, E., Juan, M., Hughes, K., **Morleo, M.**, Becona, E., Duch, M., Stamos, A., Mendes, F. (2013). Nightlife verbal and physical violence among young Europeans holidaying: what are the triggers to violence? *Public Health*. 127:908-915.

Impact factor: 1.43

8. Cook, P.A., Phillips-Howards, P.A., **Morleo, M.**, Harkins, C., Briant, L., and Bellis, M.A. (2011). The Big Drink Debate: perceptions of the impact of price on alcohol consumption from a large scale cross-sectional convenience survey in north west England. *BMC Public Health*. 11:664.

Impact factor: 2.32

Table 1: Contribution to submitted work

Article number	Author status*	Summary of contribution
1	Lead	<p><i>Contribution to the article: 80%; study: 40%.</i></p> <p>I had overall responsibility for the manuscript: designing their content; co-conceptualising the research design (including study design, research framework and data analyses); conducting data analyses; and drafting and editing the manuscripts. The research program was co-designed with Mark Bellis and Lisa Jones; the administration of the research programme was co-managed with Lisa Jones.</p>
2	Lead	<p><i>Contribution to the article: 75%; study: 40%.</i></p> <p>As per article 1, I had overall responsibility for the manuscript, which included content design, co-conceptualising the research design; data analysis; and drafting and editing the manuscripts. I managed the delivery of the research programme for the study; it was co-designed with Penny Cook and Penny-Phillips-Howard.</p>
3	Lead	<p><i>Contribution to the article: 75%; study: 10%.</i></p> <p>As per articles 1-2, I had overall responsibility for the manuscript, which included content design, co-conceptualising the research design; data analysis (here conducted with Dan Dedman); and drafting and editing the manuscripts. The article was based on secondary data.</p>
4	Lead	<p><i>Contribution to the article: 75%; study: 10%.</i></p> <p>As per articles 1-3, I had overall responsibility for the manuscript, which included content design, co-conceptualising the research design; data analysis (here conducted with Dan Dedman); and drafting and editing the manuscripts. The study was co-designed with Mark Bellis and Karen Hughes, and</p>

		managed by Trading Standards North West.
5	Joint lead author	<p><i>Contribution to the article: 40%; study: 25%.</i></p> <p>I co-conceptualised the research design for this project with Penny Cook, David Billington and Penny Phillips-Howard, co-managed the delivery of the project with Penny Cook and Kevin Sanderson-Shortt, co-analysed the data and contributed to the writing of the manuscript</p>
6	Co-author	<p><i>Contribution to the article: 10%; study: 10%.</i></p> <p>Articles 1 and 6 are derived from the same research program. As with for Article 1, I co-designed the research programme with Mark Bellis and Lisa Jones; and co-managed the administration of the research with Lisa Jones until I left the Centre in 2014. I contributed to the editing of the manuscript</p>
7	Co-author	<p><i>Contribution to the article: 15%; study: 0%.</i></p> <p>I co-analysed the data and contributed to the writing of the manuscript</p>
8	Co-author	<p><i>Contribution to the article: 10%; study: 5%.</i></p> <p>I contributed to the writing of the manuscript and the coordination of the study. I also developed the coding for data cleaning and analysis.</p>

Table 2: Details of the peer review process undertaken

Journal name	Article number(s)	Details of peer review process
Journal of Substance Use	1	Articles are peer reviewed according to the journal's guidelines. No specific details are provided on the website but the peer review conducted was blind.
BMC Public Health	2, 5, 6, 8	Articles are assessed by the editors and/or peer reviewers. An open peer review system is used. Reviewers assess the articles based on originality, validity and significance.
BMC Pediatrics	3	Articles are assessed by the editors and/or peer reviewers. An open peer review system is used. Reviewers assess the articles based on originality, validity and significance.
Substance Abuse Treatment, Prevention and Policy	4	Articles are assessed via a single-blind peer review system. Manuscripts are sent to at least two experts and potentially a statistical reviewer to assess for originality, merit and significance to the field. The editor then decides whether to accept the article.
Public Health	7	Papers are reviewed by the editor initially before being reviewed by at least two external reviewers. Reviewers assess whether relevance, presence of new findings/information, technical validity and presentation.

Supporting evidence - additional articles and reports

1. Cook, P.A., **Morleo, M.**, Sanderson-Shortt, K., Billington, D., Gabbay, M., Sheron, N., Perkins, C., Bellis, M.A. (2014). Population screening for early signs of alcohol-related liver disease in hazardous and harmful drinkers in Liverpool and Knowsley. Liverpool: Centre for Public Health, Liverpool John Moores University.
2. **Morleo, M.**, Cook, P.A., Bellis, M.A. (2011). Improving accuracy in recording alcohol consumption: a survey in Greater Manchester. Liverpool: Centre for Public Health, Liverpool John Moores University.
3. **Morleo, M.**, Hennessey, M., Smallthwaite, L. Perkins, C., Bellis, M.A., (2011). Changes in young people's alcohol consumption and related violence, sex and memory loss: 2009-2011. North West of England. Liverpool: North West Public Health Observatory, Centre for Public Health, Liverpool John Moores University.
4. Bellis, M.A., **Morleo, M.**, Hughes, K., Downing, J., Wood, S., Smallthwaite, L., Cook, P.A. (2010). A cross-sectional survey of compliance with national guidance for alcohol consumption by children: measuring risk factors, protective factors and social norms for excessive and unsupervised drinking. *BMC Public Health*. 10:547.
5. Bellis, M.A., Hughes, K., Quigg, Z., **Morleo, M.**, Jarman, I. and Lisboa, P. (2010). Cross-sectional measures and modelled estimates of blood alcohol levels in UK nightlife and their relationships with drinking behaviours and observed signs of inebriation. *Substance Abuse Treatment, Prevention and Policy* [online], 5, 5. Available at: <http://www.substanceabusepolicy.com/content/5/1/5>.
6. Bellis, M.A., Hughes, K., Cook, P.A., **Morleo, M.** (2009). Off measure: how we underestimate the amount we drink. Liverpool: Centre for Public Health, Liverpool John Moores University.
7. Bellis, M.A., **Morleo, M.**, Tocque, K., Dedman, D., Phillips-Howard, P. Perkins, C., Jones, L. (2009). Contributions of alcohol use to teenage pregnancy: an initial examination of geographical and evidence based associations. Liverpool: North West Public Health Observatory, Centre for Public Health, Liverpool John Moores University.
8. Bellis, M.A., Phillips-Howard, P.A., Hughes, K., Hughes, S., Cook, P.A., **Morleo, M.**, Hannon, K., Smallthwaite, L., Jones, L. (2009). Teenage drinking, alcohol availability and pricing: a cross sectional study of risk and protective factors for alcohol-related harms in school children. *BMC Public Health*. 9:380.
9. **Morleo, M.**, Lightowlers, C., Anderson, Z., Cook, P.A., Harkins, C. and Bellis, M.A. (2009). A review of the impact of the Licensing Act on levels of violence in England

and Wales: a public health perspective. *Crime Prevention and Community Safety*. 11, 204-218.

10. Hughes, K., Anderson, Z., **Morleo, M.**, Bellis, M.A. (2008). Alcohol, nightlife and violence: the relative contributions of drinking before and during nights out to negative health and criminal justice outcomes. *Addiction*, 103(1), 60-65.
11. Bellis, M.A., Hughes, K., **Morleo, M.**, Tocque, K., Hughes, S., Allen, T., Harrison, D., Fe-Rodriguez, E. (2007). Predictors of risky alcohol consumption in schoolchildren and their implications for preventing alcohol-related harm. *Substance Abuse Treatment, Prevention and Policy* 2:15.

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The work presented in this thesis has been produced in collaboration with a wide range of partners and organisations, all of who I am thankful to for their support and guidance. First and foremost, I would like to thank Zara Quigg, Mark Bennett, and Anna Carline for their endless patience and support, and without whom this PhD would never be complete. In addition, I would also like to thank Professors Penny Cook, Harry Sumnall, Karen Hughes and Mark A Bellis for their continued guidance as well as former colleagues Caryl Beynon, Suzy Hargreaves, Ayesha Hurst, Jim McVeigh, Penny Phillips-Howard, Kerry Woolfall and Clare Perkins. Special thanks to my family and friends for their invaluable assistance both in this PhD and beyond.

Finally, I would like to dedicate this PhD to my late father Gaetano Morleo for all of the love, laughter and strength he brought to our lives.

1. Introduction

Worldwide, alcohol consumption was associated with 3.3 million deaths in 2012 (WHO, 2014). Alcohol-related liver disease disproportionately affects the working age population, and affected individuals are now younger on average than before: the modal age category for hospital admission for alcoholic liver disease dropped from 55-64 years to 45-54 years (from 1989/90 to 2002/03) (Thomson et al., 2008). Annually, 320,000 of the known alcohol-related deaths worldwide are amongst young people (15-29y), for whom the acute adverse consequences of alcohol misuse (such as alcohol-related road traffic accidents) are most common (Jernigan, 2001, Jones and Bellis, 2014). Whilst alcohol consumption amongst young people in England could be declining, consumption remains high amongst a minority (Atkinson et al., 2012, Fuller, 2015, Measham, 2008, Morleo et al., 2011c). This minority are particularly at risk of harms including violence and regretted/unprotected sex (Bellis et al., 2010b, Hibell et al., 2012, Kiene et al., 2009, Phillips-Howard et al., 2010), hospital admission (Jones and Bellis, 2014, van Hoof et al., 2010) and neurological damage (Crews et al., 2007). Therefore, the possibility that alcohol initiation could be occurring at an earlier age (Degenhardt et al., 2000, Jernigan, 2001), is a particular cause for concern. Those whose alcohol careers begin whilst they are underage may be at a heightened risk of long term harm including academic problems, risky sexual behaviour, and criminal behaviour (Ellickson et al., 2003, Stueve and O' Donnell, 2005). More recently, a systematic review has concluded that higher alcohol consumption in late adolescence (15-19y) is linked to higher consumption into adulthood (McCambridge et al., 2011).

With high levels of youth alcohol misuse and associated harms in the UK (Hibell et al., 2012), young people were identified as a priority group for national Government in tackling alcohol misuse and related harm (Department of Health et al., 2007, HM Government, 2012). The Chief Medical Officer (CMO) for England developed national guidelines on alcohol consumption by young people <18y, the age of legal purchase (Donaldson, 2009). Newer guidelines have since been released but they relate to adult drinkers (Lea, 2016). The guidance for young people was developed following a systematic literature review on alcohol consumption and related harms, expert opinion, and public consultation (Donaldson, 2009). The final guidelines recommended an alcohol free childhood as the best option and that onset of drinking should be delayed as long as possible, at least until 15y. If 15-17y olds do drink,

they should do so only under the supervision or guidance of a parent/carer, should not drink more than once a week, and should never exceed the adult recommended maximum daily units (females: 2-3 units; males: 3-4 units). However, alcohol consumption amongst certain groups of <18y (such as those who drink due to boredom or those with higher levels of expendable income) has continued to be high (Fuller and Hawkins, 2014, Morleo et al., 2011c). Such a discrepancy between established guidelines and young people's realities inevitably calls into question the utility of government guidelines in everyday life particularly for any at-risk groups. In a qualitative study in Scotland of 66 drinkers (19-65y), participants reported viewing the Government daily guidelines (2-3 units for a woman; 3-4 units for a man) as irrelevant and unrealistic (Lovatt et al., 2015). However, such guidelines are an essential tool in forming the basis of lifestyles interventions as they can be used to guide individuals towards healthier consumption. In fact, a range of interventions have been delivered in England including screening and brief advice to try to tackle alcohol misuse and prevent associated harms (Cook et al., 2014, HM Government, 2012, Morleo et al., 2011b, Sanderson-Shortt et al., 2010). Strategies such as higher taxation/minimum pricing have been advocated (Babor et al., 2010), and a systematic review of 72 papers supports their effectiveness in reducing excessive drinking and related harms (Elder et al., 2010). However, evidence of actual long term behaviour change is limited and further work is needed to understand the role of price on underage drinkers (Elder et al., 2010), particularly as they may not be the ones funding the purchase.

This thesis illustrates how I have conducted original research and secondary data analyses to support the need for early years interventions to prevent/reduce alcohol misuse and promote healthy lifestyles. To do this, the thesis is split into two sections. The first examines the need for early intervention by exploring the long term impacts of underage alcohol consumption and then goes on to investigate the difficulties in trying to engage with adults (and in so doing underlines the importance of reaching people both before harms are encountered and whilst individuals are in more universal settings such as schools). For the first time, we have explored English hospital admission data to try to provide an insight into disorders such as Foetal Alcohol Syndrome. The second section explores how surveys have been used to investigate alcohol consumption and harm in young people in different settings such as schools and nightlife settings. A number of novel methodologies are discussed here such as the dyad methodologies employed in schools where children and their parents are surveyed

simultaneously to understand both children's consumption as well as parental knowledge of that consumption. My thesis will inform the development of strategies and interventions aiming to tackle alcohol consumption and related harms amongst young people.

The work summarised in this submission has been supported by local and regional policymakers and practitioners, colleagues from LJMU and the University of Salford. The submission is the applicants' own and original work. The majority of the work was carried out during my employment at the Centre for Public Health (CPH), Liverpool John Moores University (LJMU) and none of the work has been submitted for any other degree award.

2. Understanding the need for early intervention

This chapter describes the importance of early intervention for alcohol use. This is based on three areas of work; the long-term impacts of underage alcohol consumption; interventions for adult drinkers in the community; and an exploration of hospital admissions for Foetal Alcohol Syndrome-related disorders. These last two areas highlight the difficulties in understanding prevalence of harm in adult drinkers and the difficulties in engaging large groups of adults effectively in interventions once they have left full time education. This supports the need for early school-aged intervention before long-term chronic harm appears.

2.1 The long term impacts of underage alcohol consumption

Data from the 2014 English national school survey showed that 8% of 11 year olds had consumed alcohol at least once, increasing to 69% for 15 year olds (Fuller, 2015). In comparison, the 2011 European Survey on Alcohol and Drugs (ESPAD) showed that 90% of 15-16 year olds, a slighter older age group, in the UK had consumed an alcoholic drink at least once; 65% had done so in the last 30 days (Atkinson et al., 2012). Research in the USA has shown that those with alcohol careers beginning at a young age are at heightened risk of long term harm (Ellickson et al., 2003, Stueve and O' Donnell, 2005). This is concerning given the suggestion from one Australian survey that alcohol initiation could be starting at an earlier age (Degenhardt et al., 2000). No such data existed for England at the time of publication so I explored the relationship between underage alcohol consumption and experiences of alcohol-related harm.

Submitted articles:

Bellis, M.A., Hughes, K., Jones, L., **Morleo, M.**, Nicholls, J., McCoy, E. et al. (2015). Holidays, celebrations, and commiserations: measuring drinking during feasting and fasting to improve national and individual estimates of alcohol consumption. *BMC Public Health*. 13:113.

Morleo, M., Jones, L., Bellis, M.A. (2014). Alcohol age of initiation and long-term impact: a cross sectional survey of adults in England. *Journal of Substance Use*. 1-7.

In my article (Morleo et al., 2014), using a data extract from a retrospective cross-sectional survey of English residents (≥ 18 y), which was ongoing at the time of the article's publication (Bellis et al., 2015, Jones et al., 2015), I worked with colleagues to explore underage alcohol initiation and examine its long-term impact. I co-designed the study, co-ordinated the fieldwork and led the analysis. Lifetime alcohol consumption was reported by 93.2% of participants. Of these, 36.1% reported regular consumption when they were <18 y. Those aged 18-30y had a threefold greater odds of reporting alcohol consumption <18 y than 61-75y. Of lifetime drinkers, 34.6% reported that they had consumed enough alcohol to feel drunk at least once <18 y. Those who had regularly consumed alcohol <18 y had a 16-fold higher odds of reporting feeling drunk <18 y than those who had not. Of lifetime drinkers, 5.2% reported at least one serious alcohol-related problem (self-defined); those who had regularly consumed alcohol <18 y had a twofold greater odds of reporting this than those who had not.

This potential for increased risky drinking (intoxication <18 y) and lifetime experience of alcohol-related harm amongst those who had consumed alcohol <18 y raises concern. In England, the modal age for patient admission to hospital for alcoholic liver disease dropped from 55-64y in 1989/90 to 45-54y in 2002/03 (Thomson et al., 2008). The potential for chronic harms to appear earlier in individuals' lives has great significance for the future of public health. However, a systematic review has concluded that whilst higher alcohol consumption in late adolescence (15-19y) is linked to higher consumption into adulthood, evidence in relation to experience of later negative consequences was not of high quality and could not be used to determine whether such a link exists (McCambridge et al., 2011). Therefore, further high quality research is needed to identify whether the relationship (as supported by my study) is valid. Any such research in this area would benefit from separating data from underage and of age drinkers to better examine whether being an underage drinker affects drinking habits.

After establishing the relationship between age of initiation and alcohol-related problems, work discussed in the subsequent chapters of this PhD examines intervention approaches that might be useful in reducing alcohol-related harm. The findings presented in this section underline the importance of delaying alcohol consumption, and support the Chief Medical

Officers' guidance in England and Wales advising that children should not drink regularly <18y (Donaldson, 2009) and international legislation that typically bans the purchase of alcohol by those <18y (ICAP, 2010, WHO, 2014). I presented the pilot findings from this analysis at the Public Health Conference in 2013 (Morleo et al., 2013b), and as the data were an extract from a survey that was ongoing at the time of the article's publication, the findings will contribute to any further analyses conducted.

2.2 Engaging with adults to identify alcohol-related liver disease

The toxic effects of alcohol on the liver account for around half of all alcohol-attributed mortality in England (NWPHO, 2012). Alcohol related liver disease disproportionately affects the working age population (Thomson et al., 2008) and was the primary cause of alcohol-attributable mortality for 35-64 year olds in 2010 (Jones and Bellis, 2014). Although damage to the liver is reversible by lifestyle changes if detected early (Sheron et al., 2012), detection has historically been difficult due to a lack of symptoms in the early stages (Sheron et al., 2010). Newer diagnostic tests make early detection possible, but they are rarely used in the community. The research described in this section aimed to understand whether it was feasible for such diagnostic tests to be used in the community in order to identify harm via the delivery of a brief intervention.

Submitted article:

Cook, P.A., **Morleo, M.**, Billington, D., Sanderson-Shortt, K., Jones, C., Gabbay, M. et al. (2015). Evaluation of work-based screening for early signs of alcohol-related liver disease in hazardous and harmful drinkers. BMC Public Health.

Supporting evidence:

Cook, P.A., **Morleo, M.**, Sanderson-Shortt, K., Billington, D., Gabbay, M., Sheron, N. et al. (2014). Population screening for early signs of alcohol-related liver disease in hazardous and harmful drinkers in Liverpool and Knowsley. Liverpool: Centre for Public Health, Liverpool John Moores University.

The Preventing Alcohol Harm in Liverpool and Knowsley (PrevAIL) project, for which I co-designed and co-managed both the research and service delivery element, was a feasibility

study aiming to evaluate a mechanism for detecting the prevalence of alcohol related liver disease using fibrosis biomarkers (Cook et al., 2014, Cook et al., 2015). We delivered blood tests for liver disease in the community through three settings: general practices (n=4), workplaces (n=13) and community health events (n=6). Delivery through workplaces and community health events were a novel delivery method as these tests had previously only been delivered through general practice and secondary care (Sheron et al., 2010, Sheron et al., 2012). Initial attempts at recruitment through community health events were unsuccessful. Their temporary nature (for example at supermarkets) meant that it was not possible to take blood samples on-site and whilst participants were invited to visit the university to complete their participation, none did so. Workplace recruitment was more successful: of 37 workplaces contacted, 13 took part. Participants meeting the inclusion criteria (36-55 years old, resident or working in Liverpool/Knowsley) and not being treated for liver disease were asked to complete an initial screen to identify those consuming more than the then UK the drinking guidelines in the last week (males drinking >21 units, females drinking >14 units per week; one unit as 8mg of pure alcohol) and those reporting alcohol dependence (past or present). These participants were asked to take part in a screen for liver fibrosis, clinical data were collected (height, weight, waist circumference and blood pressure) and a blood sample taken (for conventional liver function tests and fibrosis markers). Over the same data collection period, higher numbers of GP patients completed the initial screening questionnaire: 539 (8% of 6,439) GP patients contacted by post compared with 363 workplace employees (an estimated 2-6% of employees in those organisations of the correct age), However, workplace recruits were more likely to complete the full screen than GP recruits (91% of those who screened positive for risky drinking compared with 17% in the GP sample; AOR: 72.7; 95% confidence intervals, CI: 28.9-182.8).

Recruitment for the project was a large scale community effort. Multiple agencies were involved (primary care, private sector workers/organisations, leaders of local business forums, as well as leading health experts in hepatology, public health, nursing, biochemistry, and microbiology). Fieldwork was extended from nine to 13 months and geographically to include workplaces from Knowsley as well as Liverpool to boost the numbers involved. Whilst the effort in rolling out the project was significant, 48 new cases of individuals at risk of liver disease were identified. It is certainly important to identify these individuals but earlier intervention on reducing alcohol consumption before chronic harm begins would be

more cost-effective long-term. Nevertheless, employers present a valid recruitment route for delivering public health interventions. Future interventions could bring together multiple health issues in order to optimise the limited workplace contact time available (such as obesity, smoking, and alcohol). More resources should be dedicated to building employee trust within their organisation to boost participation and enable employers to deliver such programmes themselves. Methodologies could also be developed to engage with smaller businesses, for example, through networking events or local chambers of commerce. Whilst the study's overall aim was to identify those at risk of liver disease, it also intended to act as a brief intervention, raising awareness with risky drinkers of alcohol-related harms through screening, verbal advice and a leaflet (Cook et al., 2014, Cook et al., 2015). Ideally these individuals would have been followed up to assess any change in alcohol consumption and liver function. If the study were to be repeated, a cost effective way of doing this could be through a smart phone app (Monk et al., 2014).

2.3 Engaging with adults to identify Foetal Alcohol Syndrome Disorders

Alcohol consumption reduction/cessation amongst pregnant mothers can reduce the risk of Foetal Alcohol Syndrome Disorder (FASD), particularly in the early stages of pregnancy, when risks to the pregnancy and foetus may be higher (Department of Health, 2008). New guidelines released by the CMO suggest that because even moderate levels of alcohol can negatively affect the foetus, the safest option is to avoid alcohol during pregnancy (Lea, 2016). However, parents are less likely to be aware of a pregnancy in the early stages and as alcohol consumption in pregnancy is such a sensitive subject, they might find it difficult to report consumption. Adequate monitoring of both parental consumption and incidence of FASD is vital if effective services are to be developed to reduce alcohol consumption in parents and support affected families. Prevalence estimates of FASD are severely limited. Outdated worldwide estimates suggest that 0.97 per 1,000 live births were affected by FAS (Foetal Alcohol Syndrome) (Abel, 1995). Five UK studies contributed to this estimate; none identified FAS but all were restricted in sample size and geography (Abel, 1995, Barrison et al., 1985, Plant, 1987, Primatesta et al., 1993, Sulaiman et al., 1988, Waterson and Murray-Lyon, 1989, Wright et al., 1983). A later analysis of Hospital Episode Statistics (HES) reported 128 cases in 2002/03 in England (British Medical Association, 2007); no further details were provided. Thus, there was no accurate up-to-date, detailed understanding of the prevalence of FASD for England.

Submitted article:

Morleo, M., Woolfall, K., Dedman, D., Mukherjee, R., Bellis M.A., Cook, P.A. (2011). Under-reporting of foetal alcohol spectrum disorders: an analysis of hospital episode statistics. *BMC Pediatrics* 11:14.

Supporting evidence:

Bellis, M.A., **Morleo, M.,** Tocque, K., Dedman, D., Phillips-Howard, P. Perkins, C. et al. (2009). Contributions of alcohol use to teenage pregnancy: an initial examination of geographical and evidence based associations. Liverpool: North West Public Health Observatory, Centre for Public Health, Liverpool John Moores University.

In an examination of HES data (for which I devised the research plan and co-analysed the data), we compared hospital admissions over time (April 2002-March 2008), between geographical regions and with alcohol-related hospital admissions for adult females in order to further understand FAS-related disorders in England (Morleo et al., 2011d). We identified 899 episodes of FAS-related admissions (FAS, fetuses and newborns affected by maternal alcohol use of alcohol, and/or maternal care for (suspected) damage to foetus from alcohol) as well as 322,161 records of women (15-44y) being admitted due to alcohol-attributable conditions. Whilst the rate of admission for alcohol-attributable conditions in women increased significantly by 41%, significant increases were only seen in FAS cases, not the other diagnoses. It would be expected that the North West and North East, known to have higher levels of alcohol harm (PHE, 2016) would have higher levels of FAS-related conditions. This was not found to be the case. No outpatient episodes of FAS-related conditions were reported between 2003/04 and 2007/08 even though children with FASD-related conditions receive treatment as outpatients (British Medical Association, 2007). Together these findings suggest significant under-reporting of FAS-related conditions.

There are a number of reasons as to why FASD is thought to be so under-reported: stigma surrounding alcohol consumption during pregnancy can prevent accurate recording of consumption (Sampson et al., 1997), the level of specialist training required to make a diagnosis (Chandrasena et al., 2009, Sampson et al., 1997), and the likely presence of other

disorders or disabilities (Chandrasena et al., 2009). Passive surveillance systems are particularly limited because of a reliance on correct diagnosis from numerous medical practitioners (May and Gossage, 2001), differential access, changes in service provision (Bellis et al., 2008), and only being able to include those who have been admitted. If FAS-related disorders are to be effectively prevented and treated, improvements to intelligence systems, practitioner awareness and screening are essential. Intervention and engagement should begin as early as possible in order to target parents trying to conceive, who have conceived already as well as current parents. In this way, we will be able to identify and ensure any children who are at risk have access to the correct diagnosis and intervention pathways.

This was the first in-depth analysis of FAS-related hospital admissions in England. Whilst it was not possible to present a full understanding of the prevalence of FAS-related conditions, the study provided a detailed analysis of the available data despite the stated limitations. The research and its limitations highlight the importance of providing appropriate training to paediatricians with regards to consistent recording, and ensuring relevant individuals are signposted to appropriate outpatient clinics for diagnosis, support and intervention (and that these outpatient appointments are then recorded). I presented the findings at the First European Conference on Foetal Alcohol Spectrum Disorders (Morleo and Woolfall, 2010), and it has gone on to inform other studies seeking to estimate prevalence of FAS/FASD (O'Leary et al., 2013, Westrup, 2013). In response to a demand for further research on FASD internationally, the World Health Organization Research Initiative on Alcohol, Health and Development has developed a research protocol to investigate FASD prevalence (WHO, 2012). It is hoped that this protocol can be used to create an internationally collaborative research opportunity that would lead to a full prevalence survey with a randomised and representative sample in England. This must be the next step if we are to understand the true prevalence of FASD nationally and provide any true mechanisms of prevention or support.

3. Using surveys to investigate alcohol consumption and related harm in young people

3.1 School surveys

National school surveys provide information on levels of alcohol consumption and experiences of alcohol-related harm amongst English/UK secondary school pupils (Atkinson et al., 2012, Fuller and Hawkins, 2014, Hibell et al., 2012). However, little detailed data are available on the regional and local experience of alcohol and related harm. Areas such as Merseyside and the North West suffer higher levels of alcohol-related harm (NWPHO, 2012) so it is particularly important that studies examine underage consumption in these areas. This will then inform the development of effective and targeted strategies that can prevent harm.

Submitted articles:

Morleo, M., Cook, P.A, Bellis M.A., Smallthwaite L (2010). Use of fake identification to purchase alcohol amongst 15-16 year olds: a cross-sectional survey examining alcohol access, consumption and harm. *Substance Abuse Treatment, Prevention and Policy* 5:12.

Morleo, M., Cook, P.A, Elliott, G and Phillips-Howard P.A. (2013). Parental knowledge of alcohol consumption: a cross-sectional survey of 11-17 year old schoolchildren and their parents. *BMC Public Health*, 13:412.

Cook, P.A., Phillips-Howard, P.A., **Morleo, M.**, Harkins, C., Briant, L., Bellis, M.A. (2011). The Big Drink Debate: perceptions of the impact of price on alcohol consumption from a large scale cross-sectional convenience survey in north west England. *BMC Public Health*. 11:664.

Supporting evidence:

Bellis, M.A., Hughes, K., **Morleo, M.**, Tocque, K., Hughes, S., Allen, T. et al. (2007). Predictors of risky alcohol consumption in schoolchildren and their implications for preventing alcohol-related harm. *Substance Abuse Treatment, Prevention and Policy* 2:15.

Bellis, M.A., Phillips-Howard, P.A., Hughes, K., Hughes, S., Cook, P.A., **Morleo, M.** et al. (2009). Teenage drinking, alcohol availability and pricing: a cross sectional study of risk and protective factors for alcohol-related harms in school children. *BMC Public Health*. 9:380.

Bellis, M.A., **Morleo, M.**, Hughes, K., Downing, J., Wood, S., Smallthwaite, L. et al. (2010). A cross-sectional survey of compliance with national guidance for alcohol consumption by children: measuring risk factors, protective factors and social norms for excessive and unsupervised drinking. *BMC Public Health*. 10:547.

Morleo, M., Lightowers, C., Anderson, Z., Cook, P.A., Harkins, C. and Bellis, M.A. (2009). A review of the impact of the Licensing Act on levels of violence in England and Wales: a public health perspective. *Crime Prevention and Community Safety*. 11, 204-218.

Morleo, M., Hennessey, M., Smallthwaite, L. Perkins, C., Bellis, M.A., (2011). Changes in young people's alcohol consumption and related violence, sex and memory loss: 2009-2011. North West of England. Liverpool: North West Public Health Observatory, Centre for Public Health, Liverpool John Moores University.

In 2005, CI Research and Trading Standards conducted the first of four North West biennial surveys amongst those <18y in schools. These surveys were commissioned by Trading Standards and the former Government Office North West in order to aid understanding of alcohol consumption and cigarette smoking amongst secondary school children in the region. Much of our analysis focussed on alcohol, aiming to provide further details on areas including access, levels of consumption and experiences of related harm. The submitted (Morleo et al., 2010) and supporting articles (Bellis et al., 2007, Bellis et al., 2009b, Bellis et al., 2010b) present findings from analyses I conducted (or contributed to) on access to alcohol, levels of alcohol consumption and experiences of alcohol-related harm. Analyses used the following variables: demographics (age, gender, resident postcode applied to deprivation quintile), frequency of alcohol consumption, quantity of alcohol consumed during a typical drinking session, experience of alcohol-related harm (regretted sex after drinking, being in a fight after drinking, whether they tended to forget things after drinking), and whether they drank in public places (such as in streets, parks, or outside shops).

For each of the study years, the analysed sample was approximately 10,000 15-16yr olds from schools in the North West region (Bellis et al., 2007, Bellis et al., 2009b, Bellis et al., 2010b, Morleo et al., 2010, Morleo et al., 2011c). I contributed to the analysis and drafting of the papers (Bellis et al., 2007, Bellis et al., 2009b, Bellis et al., 2010b) and led on the design and production of outputs looking at fake identification (Morleo et al., 2010) and change over

time (Morleo et al., 2011c). Overall, we uncovered the widespread nature of alcohol consumption in participants. Risky drinking behaviours (including binge drinking and frequent drinking) were strongly related to expendable income, individuals buying their own alcohol as well as obtaining it from friends, older siblings and adults outside shops. Prevalence of alcohol-related harm increased with drinking frequency, binge frequency, units consumed per week and ownership of fake identification. Amongst drinkers who bought their own alcohol, ownership of fake identification was more likely to be reported by males and those with a higher personal weekly income. The most common alcohol purchasing method for such children was online. However, being bought alcohol by parents was protective against risky drinking behaviours and alcohol-related harm; membership of youth groups/teams was generally protective against these risky behaviours.

In the third year of the NW Trading Standards school survey data collection (2009), we assessed whether the participants' drinking fell within the CMO guidelines (Donaldson, 2009) before the guidelines were released (Bellis et al., 2010b). Whilst the guidelines recommend abstinence before 18y, particularly before 15y, alcohol consumption was common practice by 15y (81.3% did drink alcohol). In fact, over half (54.7%) routinely consumed more heavily than guidance recommends (drinking ≥ 5 drinks/session ≥ 1 month), and/or typically drank unsupervised at home/friend's home (57.4%). Alcohol-related violence, regretted sex and forgetfulness were experienced by significantly fewer children drinking within the guidelines than outside of it. Using data from 2011 (Morleo et al., 2011c), I assessed whether any change had occurred. After accounting for demographic and other confounding factors, the odds of identifying frequent drinkers (drinking ≥ 1 month), heavy drinkers (drinking ≥ 5 drinks/session) and unsupervised outside drinking decreased from 2009 to 2011. As with 2009, those who drank outside the guidelines continued to be at greater risk (alcohol-related violence, regretted sex after drinking and/or forgetting things after drinking) than those who drank within it. However, from 2009 to 2011, there was a significant decrease in the proportion of drinkers reporting involvement in alcohol-related violence (from 25% to 22%; $P < 0.001$) and/or reporting regretted sex after drinking (from 10.6% to 9.6%; $P < 0.01$).

The surveys' particular strength is the very high sample size achieved across each survey year. However, none of the surveys incorporated random sampling and so the findings are not

generalizable to the general population. In order to aid compliance, the survey had to remain short and so it was not possible to investigate other factors that may have helped us understand the young people's drinking environment, for example, the questionnaires did not collect data on whether the drinking was supervised. This is one of the reasons that I sought to investigate parental knowledge around their child's alcohol consumption in a later study, that is discussed below (Morleo et al., 2013a). Decreases in alcohol consumption and related harm over the last decade have been evidenced in school surveys and alcohol-specific hospital admissions analyses for <18ys (Atkinson et al., 2012, Fuller and Hawkins, 2014, NWPFO, 2012). One data review proposes a number of reasons for this: an increase in abstainers (especially in relation to those from minority ethnic groups); the acceptability of drunkenness could be declining; reduced ability to access alcohol through proof of age schemes such as Challenge 21 and increased penalties for serving staff; voluntary regulation of the drinks industry; and an increased likelihood for underage people to under-report their alcohol consumption (Measham, 2008). Further research is required to identify whether the decreases seen represent an actual downward trend. However, the level of access to alcohol by underage individuals and the risky alcohol-related behaviour by a vulnerable minority remains concerning. The Licensing Act 2003 aimed to protect children from alcohol and provided local authorities with powers to challenge establishments that were undermining this objective (for example, by selling alcohol to minors). In 2007, I led a review of the Licensing Act, which included interviews with local authority employees (Morleo et al., 2007). Here, those working in children's services were concerned that despite holding valuable information on individuals who may present a risk to children, they could not object to a personal licence being granted (which are required in order to hold a licence for a premises selling alcohol). Innovative local licensing teams were sharing the names of the applicants with all authorities involved in licensing, which enabled monitoring to occur.

The findings discussed here from the schools surveys highlight the vulnerability of underage young people, underlining the importance of providing interventions for this group and suggesting routes that could be taken for intervention implementation. Appropriate interventions could include the provision of affordable alternative activities to prevent boredom. Because of the evident opportunities for self-purchase offered by fake identification, any training that is provided for alcohol sellers (including those operating online) needs to include advice on identifying fake identification. Trading Standards should

ensure online sellers are included in any test purchasing operations. Also, a minimum price per unit for alcohol would reduce easy access to the cheapest products and make activities other than getting drunk more desirable. Young people are thought to be particularly sensitive to price (Booth et al., 2008, Meier et al., 2008). Following a large scale North West survey of 22,780 drinkers in 2008, I contributed to the writing up of an analysis examining perceptions of the impact of price on alcohol consumption (Cook et al., 2011). Here, those in the youngest age category (18-24 years) were significantly more likely to agree that high prices would reduce consumption compared with older groups. Further, data modelling suggests that ten years after the implementation of a 50p per unit minimum price on alcohol, there would be 270 fewer incidences of alcoholic disorders amongst 11-24 year olds (Purshouse et al., 2010). However, none of these studies specifically address underage drinkers who could be in a very particular situation. Firstly, they could be more likely to purchase cheaper drinks than the of age population: one study of 7,061 US college students in 1997 found that those aged under 21 years (the legal purchasing age) were more likely to buy cheaper drinks than those aged 21-23 years (Wechsler et al., 2000). Secondly, because it is illegal for them to buy alcohol, it might not be them either making or financing the purchase. Any such work in this area should account for their main route of access to alcohol (including details of who buys the alcohol) and how their purchasing patterns differ from the of age population.

In the UK, the Chief Medical Officers' guidelines advise parents that children aged <18y should not drink, but if they do, to reduce risks by reducing the quantity and frequency of alcohol consumed (Donaldson, 2009). However, research in New York City (USA) suggested that up to a fifth of parents of female sixth graders (11-12y) may be unaware of their child's alcohol consumption (O' Donnell et al., 2008), and so are unlikely to be employing appropriate parenting strategies. With the North West being particularly at risk of alcohol-related harm (PHE, 2016), more information is needed on parenting experiences and strategies being employed, and what measures can be put in place to aide parenting underage young people. The North West surveys funded by Trading Standards and the former Government Office North West help us to understand the involvement of parents in children's drinking (Bellis et al., 2010b, Morleo et al., 2010). My analysis of the 2009 data showed that accessing alcohol through parents was the second most common access method; 49.4% did so (most common being via friends/family aged >18y, 50.3%) (Morleo et al., 2010). Female drinkers were significantly more likely to do so than males. Using the North

West schools' data, we consistently identified that parental provision of alcohol was linked with lower incidence of risky behaviours including binge drinking, frequent drinking, alcohol-related violence and alcohol-related sex (Bellis et al., 2007, Bellis et al., 2009b, Bellis et al., 2010b). I led a funding application and obtained funds from NHS Wirral, Wirral Drug and Alcohol Action Team and the Institute for Health Research, Liverpool John Moores University to explore parental knowledge of alcohol consumption further (Morleo et al., 2013a). I was the principal investigator, and co-ordinated the design of the project, data collection and analysis. We used a novel methodology of capturing parents and their child in the same data collection episode at school events to explore the drinking experiences of young people aged 11-17y (under the typical international legal drinking age (ICAP, 2010)) and parenting methods employed. The cross-sectional survey of parent-child dyads simultaneously questioned 935 young people and their parent(s). Compliance was extremely high (90% of those approached). The simultaneous nature of the survey is particularly important given the hidden nature of the behaviours that we were trying to explore – we did not want the parents and the children talking to each other in between surveys as this would have negatively affected the validity of our results. Overall, 41.1% of children reported drinking alcohol; 79.9% of their parents were correctly aware that their child drank alcohol. After accounting for confounding variables, children aged 11-14y had over a twofold greater odds of consuming alcohol without parental knowledge compared with 15-17y olds. Of parent-child dyads where the child reported consuming alcohol, 92.7% of parents reported that they had spoken to their child about alcohol at least once in the past three months, whereas 57.3% of their children reported that this had occurred. Children who consumed alcohol and whose parents did not know they drank alcohol were less likely to report having a parental discussion about alcohol in the last three months. As with previous research (Bremner et al., 2011, Morleo et al., 2010), parental provision of alcohol was commonplace. In fact, parental provision was the most frequently reported method of obtaining alcohol (48.4% of drinkers). Using multinomial regression with main method of obtaining alcohol as the outcome (and using obtaining alcohol from parents as a reference category), girls (vs boys) and older pupils (15-17y, vs 11-14y) were significantly more likely to obtain alcohol through their friends than their parents. Those who consumed alcohol without parental knowledge of their drinking had over a threefold higher odds of mainly obtaining alcohol through their friends compared with children who consumed alcohol with parental knowledge. However, further information is needed on the nature of the parental provision in order to understand this more fully in terms of whether the parents were knowingly providing

alcohol (or whether it was being stolen), whether parents were supervising the alcohol consumption or just providing the alcohol, and what was the context of the consumption (in the family home, at a family event, outside in parks etc).

The next steps for research in this area would be to repeat the survey on a larger scale, with randomly selected schools so that the findings could be tested and validated. Further research should also be conducted with groups who were missed from the survey, that is those families who did not attend the school events and who might be less engaged with the school generally and further work could be conducted with the very youngest group to more fully understand the situation of young children drinking without parental knowledge. This could explore how much they are drinking and how they are accessing alcohol. Nevertheless, findings from this survey are particularly important given the observed protective effect of parental provision evidenced in our North West analyses (Bellis et al., 2007, Bellis et al., 2009b, Bellis et al., 2010b). These studies show the important role of parents in the alcohol behaviours of their children and support should be provided to parents to ensure that parenting strategies include setting authoritative, clear and understandable rules around alcohol and being a good role model. Such information could be disseminated through schools.

Outputs from the school surveys (Bellis et al., 2007, Bellis et al., 2009b) have informed national strategy and guidance (Department for Children Schools and Families et al., 2008, Donaldson, 2009) including the 2012 UK alcohol strategy (HM Government, 2012), as well as an independent review of the effects of alcohol pricing and promotion (Booth et al., 2008). The 2011 dataset was used to provide local authorities with local data for alcohol-related harm in order to inform policy and interventions development (Deacon et al., 2011). The licensing review findings were published as part of a peer review article examining the overall impact of the Licensing Act on public health and violence (Morleo et al., 2009), and discussed at the international Club Health 2008 conference (Morleo, 2008)

3.2 Nightlife surveys

Young people continue to be at risk of alcohol-related harms after they have reached the legal alcohol purchasing age of 18y (Morleo et al., 2014). This is shown through their engagement

in nightlife venues and holiday destinations, where binge drinking can feature heavily (Hughes et al., 2008b, Parker and Williams, 2003, Tutenges and Hesse, 2008). Just under a fifth of violence occurs in or near pubs or nightclubs (Flatley, 2014) as factors such as densely concentrated alcohol outlets, over-crowding, alcohol promotions and poorly maintained venues facilitate increased alcohol consumption and related harm (Hughes et al., 2011, Livingston, 2008). Alcohol surveys often focus on a typical or last week of consumption and so can miss periods of consumption such as holidays or celebrations, when consumption can be considerably higher, and so they will inevitably under-report consumption (Bellis et al., 2015). This section discusses a series of innovative nightlife and holiday-based surveys, which have provided an important way of engaging with this at-risk group and of understanding higher consumption environments.

Submitted articles:

Calafat, A., Bellis, M.A., Fernandez del Rio, E., Juan, M., Hughes, K., **Morleo, M.** et al. (2013). Nightlife verbal and physical violence among young Europeans holidaying: what are the triggers to violence? *Public Health*. 127:908-915.

Supporting evidence:

Hughes, K., Anderson, Z., **Morleo, M.**, Bellis, M.A. (2008). Alcohol, nightlife and violence: the relative contributions of drinking before and during nights out to negative health and criminal justice outcomes. *Addiction*, 103(1), 60-65.

Hughes K, Anderson Z, Bellis, M.A., **Morleo, M.**, Jarman, I, Lisboa, P. (2009). Blood alcohol levels and drunkenness amongst people visiting nightlife in the North West. Centre for Public Health Research Directorate, Liverpool John Moores University, Liverpool.

Bellis, M.A., Hughes, K., Quigg, Z., **Morleo, M.**, Jarman, I. and Lisboa, P. (2010). Cross-sectional measures and modelled estimates of blood alcohol levels in UK nightlife and their relationships with drinking behaviours and observed signs of inebriation. *Substance Abuse Treatment, Prevention and Policy* [online], 5, 5.

I contributed to the design, fieldwork, analysis and/or report writing of a number of surveys aiming to understand alcohol consumption and related risks in nightlife (Bellis et al., 2010a, Hughes et al., 2008a). In the first of these (Hughes et al., 2008a), data were analysed from a

cross-sectional survey of 380 young people (18–35y) conducted in bars and nightclubs in a large city centre in the North West. Participants who reported drinking alcohol prior to attending nightlife (e.g. at their own/friend's home, pre-loading) were over four times more likely to report drinking >20 units on a usual night out and 2.5 times more likely to have been involved in a fight in the last 12 months than those drinking only in nightlife areas. In our next study, to promote validity and reliability, we added a breath alcohol test to the survey (Bellis et al., 2010a). We interviewed 214 nightlife patrons from three North West cities on alcohol consumed so far and intended drinking patterns for that the night. At the point of interview, 49.5% of individuals reported themselves as drunk and 79.4% intended to consume more alcohol before going home. Approximately one in ten (15.4% males; 4.4% females) intended to consume >40 units. No follow-up interview was performed to assess the accuracy of their intentions as it would have been too difficult to re-engage with the same individuals. Higher blood alcohol levels at the point of the interview were related to intentions to drink later into the night. Alcohol consumption in nightlife and holiday environments is strongly related to experience of negative alcohol-related consequences (Calafat et al., 2013, Hughes et al., 2008a). Following a survey of tourists (16-35y) at seven airports in Southern Europe, I ran a data analysis of 6,502 questionnaires from British and German tourists (Calafat et al., 2013). The project managers planned the analytical approach. In total, 71.0% reported drunkenness on their holiday, 12.4% had been in an argument and 2.9% in a fight. Males, those who used illicit drugs, those who had been in fights at home in the last year and those who had been frequently drunk abroad were more likely to report both violence and arguments on their holiday.

The findings from these outputs highlight the very high levels of consumption and harm being reported by nightlife users and young tourists abroad, which underlines the importance of providing interventions before individuals reach their drinking destinations whether this destination is a local nightlife spot or a holiday destination. Preloading is a significant factor in consumption overall and once drinkers are in the destination itself, it could already be too late to reduce consumption and/or a expectations of a night out to a safer level. Such interventions could include: pricing strategies to control price differences between on and off licenced premises to discourage preloading; better training for bar staff to reduce incidents of serving alcohol to individuals who are already drunk (and mandatory enforcement of their responsibilities); prevention of sales to those who are underage; reducing outlet density;

enforcing restrictions on holiday, nightlife and alcohol advertisers to modify expectations around consumption surrounding holidays and nights out (Bellis et al., 2010a, Calafat et al., 2013, Hughes et al., 2008a).

4. Understanding data limitations

Much of the data presented as part of this thesis originated from survey data. Surveys can represent a relatively convenient way of accessing a large sample, for example, through schools or via a telephone-based survey. However, survey data in a sensitive field such as alcohol consumption are problematic as they dramatically underestimate actual consumption (Casswell et al., 2002, Stockwell et al., 2004). Other issues including recall, variation in drink size definitions and social desirability can also play a part in response reliability.

Submitted article:

Bellis, M.A., Hughes, K., Jones, L., **Morleo, M.**, Nicholls, J., McCoy, E. et al. (2015). Holidays, celebrations, and commiserations: measuring drinking during feasting and fasting to improve national and individual estimates of alcohol consumption. *BMC Public Health*. 13:113.

Supporting evidence:

Bellis, M.A., Hughes, K., Cook, P.A., **Morleo, M.** (2009). Off measure: how we underestimate the amount we drink. Liverpool: Centre for Public Health, Liverpool John Moores University.

Morleo, M., Cook, P.A., Bellis, M.A. (2011). Improving accuracy in recording alcohol consumption: a survey in Greater Manchester. Liverpool: Centre for Public Health, Liverpool John Moores University.

I contributed to a secondary data analysis to understand the discrepancy between reported consumption and actual consumption in the UK (Bellis et al., 2009a). By comparing survey data with sales data, we identified that the discrepancy equated to 430 million units/week. A new average weekly number of the total units consumed per adult drinker was calculated at 22 units per adult ($\geq 16y$) compared with 13.5 units per adult using traditional survey methods (Goddard, 2008). However, we were not able to account for alcohol consumed abroad, personally imported alcohol (legally or illegally) or alcohol brewed at home. Because sales data were used (which have no link to demography), no details are available on how sales for $<18y$ (and/or proxy sales) compare with their reports of alcohol consumed. Further, such surveys (typically household-based) do not tend to involve, for example, those in student

halls, homeless people or people in army barracks. Yet these individuals may drink more than the general population (Bray et al., 1991, Deacon et al., 2010, Fazel et al., 2008).

Further, I led the development and analysis of a context-specific questionnaire designed to elicit more accurate survey responses via a randomised household telephone survey in Greater Manchester ($\geq 16y$; $n=2,000$) (Morleo et al., 2011a). This was based on a survey from New Zealand (Casswell et al., 2002) and compared responses from context-specific questions (CSQs) with those from standard questions. Whilst the CSQs did elicit higher levels of alcohol consumption reported than standard questions, these are still likely to underrepresent total consumption across the whole population. For example, we felt the survey needed further adaptation to English participants by contextualising consumption in terms of occasions (such as parties or weddings) rather than drinking locations (at home, in pubs) (Morleo et al., 2011a). I contributed significantly to the substantial remodelling of the Greater Manchester and New Zealand surveys which was the premise of the survey (Bellis et al., 2015, Jones et al., 2015) from which I extracted a first cut of the data to analyse alcohol initiation (Morleo et al., 2014). Since the survey has been completed, I have contributed to the editing of the final paper published (as well as contributing to the cleaning and coding of the data used in the paper), which explores how the inclusion of special occasion or atypical consumption data affects normal consumption data (Bellis et al., 2015). The analysis of the final sample ($n=6,085$ drinkers) showed that accounting for atypical/special occasion drinking added a mean of 2.3 units to individuals' weekly consumption. Another issue with the Greater Manchester survey was that it did not target groups such as students who are likely to be under-sampled and likely to be drinking at higher levels than the general population (Morleo et al., 2008).

Very little is known about how demography affects recall or honesty in alcohol consumption surveys. In a survey of American college students (mean age: 20.1y), researchers compared survey-based data on alcohol consumed that night with blood alcohol concentration (Clapp et al., 2006). Age was not included in the model. Elsewhere, studies have reported a relationship between age and alcohol consumption reports (Gruenewald and Johnson, 2006, Heeb and Gmel, 2001). However, none of these studies have looked at $>18y$ specifically, and so it is not known to what extent their findings are comparable to this age group in England. Yet, the

effect of demography in recall or honesty in surveys is vital in understanding alcohol consumption in those aged >18y who might have increased motivation to hide their consumption due to the illegal nature of alcohol purchase for this age group.

4.1 School surveys

Schools offer a convenient location to capture data from large numbers of young people. To promote honesty, for all school-based surveys discussed here, pupils completed the surveys themselves, surveys were kept short, and pupils were assured that all responses would be confidential. However, a survey in a mainstream school environment will not engage with truants, those attending special needs schools or those who are home educated. Further, our dyad survey operated during school events, recruiting those engaged with the school. Because it required both the parent and child to be present, it is not known to what extent those who attended in this fashion represented the children attending the school overall (Morleo et al., 2013a). Thus, our surveys were unable to explore the experiences of all families, particularly those in vulnerable groups. Instead they reflect the experiences of ordinary families to inform general practice. With 90.0% of those approached in the dyad survey being willing to participate, it was highly representative of those approached. Participation was considerably higher than other surveys attempting a parent-child dyad format (Fulkerson et al., 2008, Mares et al., 2011, O' Donnell et al., 2008, O' Donnell et al., 2010, Stace and Roker, 2005, van der Vorst et al., 2005). The dyad survey presented unique methodological issues. For example, the dyads, whilst separated, completed the survey in the same room. Young people reported alcohol consumption unknown to their parent(s) but consumption estimates may be an underestimate. None of the schools surveys were representative randomised samples but convenience samples, based in areas with high levels of alcohol misuse amongst young people (NWPFO, 2012), limiting generalisability. Nevertheless, these studies combined show the important role played by parents in the alcohol behaviours of their children, and the experiences of the children involved.

4.2 Nightlife surveys

In a survey of US college students attending a party, researchers compared survey-based data on alcohol consumed that night with blood alcohol concentration (Clapp et al., 2006). Discrepancies between the two research methods were associated with numbers of drinks consumed, time spent drinking and party size. Such factors are bound to affect the reliability

of surveys performed in nightlife areas where often alcohol has already been consumed. In our survey of nightlife drinkers (n=375), 57.6% had preloaded (Hughes et al., 2008a). A breath alcohol test included in a subsequent project aimed to promote accuracy in data collection by obtaining a reliable understanding of alcohol consumed to date (Bellis et al., 2010a). Participants were also asked to estimate how much alcohol they would consume over the remainder of the evening, enabling us to at least partly overcome interview timing issues whereby early evening interviews inevitably miss subsequent consumption. However, intoxicated people cannot provide informed consent and could not be included in either survey. All findings in relation to alcohol consumed are inevitably underestimates. Further, we were not able to follow the participants across their night out in order to confirm their consumption.

4.3 Telephone surveys

Our telephone survey used both landline and mobile phone numbers in order to overcome demographic biases inherent in landline only surveys (Bellis et al., 2015, Morleo et al., 2014). For example, landline users are likely to be older than mobile only users (Link et al., 2007). At the time of publishing the alcohol initiation analysis and because it was a first cut from an ongoing survey, a final participation rate was not available. At that time, 32,645 calls had been made to landline numbers and 29,732 to mobiles (Morleo et al., 2014). In total, 11.6% of landline (n=2,325) and 1.9% of mobile (n=362) users had participated. In a German survey comparing landlines versus mobiles, 1.7% of landline phone numbers resulted in an interview and 5.0% of mobile users (Callegaro et al., 2011). Here, researchers distributed a text message to a sub-section of mobile users prior to calling the mobile users. The other sub-section received no such text message and users were called directly: 4.3% of numbers led to an interview where no message had been sent compared with 5.5% where a message had been sent. We followed this methodology in order to maximise recruitment rates. Now that our survey has been concluded, final participation rates have been calculated. In total, 23.3% of those informed about the study participated (Bellis et al., 2015).

4.4 Workplace surveys

Of 37 workplaces contacted, 13 took part (Cook et al., 2015). Employers declined for a range of reasons: employees not able to leave their desks; uncertain economic climate (going into administration); co-occurrence of similar projects; perceiving alcohol to be too sensitive; and

predominant employment of <35y (the lower bound for PrevAIL). From the 13 workplaces, 363 people participated. Where data were available, 1.8-5.5% of employees were screened. Although the sample size and response rate were low, response rates were higher than in other community settings (Cook et al., 2014, Sheron et al., 2010) but lower than a similar Swedish study (~15% of ~6,000 staff were recruited), which also collected blood samples in workplaces as part of a brief intervention (Hermansson et al., 2010). However, participation (for example, in an online alcohol workplace intervention) can vary dramatically from 2-12% in local authorities to 35% in a petro-chemical company (Khadjesari et al., 2015). Despite our best efforts to emphasise confidentiality, anecdotally we heard that some employees had avoided participation due to fear of disclosure. Of those in the online intervention, 40% were not confident about confidentiality (Khadjesari et al., 2015). For some PrevAIL participants, the opportunity to have a liver screen without the involvement their doctor was attractive: 13.5% (n=21) of our participants did not provide their doctor's contact details. Despite these challenges, of those attending the free health assessment, participation in the full liver screen amongst employees identified as drinking at risky levels was very high, at 99%.

4.5 Secondary data

Secondary data such as hospital admissions can provide information on a total population (for example, service users) rather than a sample of a population, as is typically achieved with a survey. However, our analysis of FAS-related admission evidences gaps in the data whereby established regional patterns of admission for alcohol-attributable conditions in women (15-44y) were not reflected in admission data for FAS-related conditions, suggesting significant under-reporting (Morleo et al., 2011d). The reasons for this under-reporting are manifold: difficulties in obtaining a valid understanding of consumption during pregnancy (Sampson et al., 1997); specialist training required to identify FASD (Chandrasena et al., 2009, Sampson et al., 1997); and individuals having other diagnosable disorders (Chandrasena et al., 2009). Furthermore, hospital admissions data rely on correct diagnosis by a large number of different medical practitioners (May and Gossage, 2001), which may be influenced by differential access and changes in service provision (Bellis et al., 2008). Further, they rely on individuals to have a reason to require hospital admission. Nevertheless, the hospital admission analysis provides a useful starting point for further analysis, and identifies that despite the evident issues, individuals with FASD-related conditions were identified in this way, paving the way for further research.

5. Summary

This submission presents published findings on alcohol experiences and the evidence base for prevention. The studies have been implemented through a collaborative research programme that was undertaken during my employment at Liverpool John Moores University. The key findings include:

- Alcohol consumption was commonplace by 15y. Those drinking outside the CMO guidance were particularly at risk of alcohol-related harm. Whilst reports of risky behaviour decreased from 2009 to 2011, individual groups continued to be at risk. These included those with a higher expendable income, and/or who drank due to boredom were particularly at risk.
- Parents represent a key access route to alcohol for <18y. Parental provision of alcohol has been linked with lower incidence of risky drinking behaviours and related harm; consuming alcohol without parental knowledge increases risk of harm.
- Early intervention is key. Not only because those who start drinking before the age of 18y could be more at risk of alcohol-related harm but also because of the inherent difficulties in effectively engaging with large numbers of adults. Our analysis of FASD-related hospital admissions and our PrevAIL feasibility study both evidence the unmistakable difficulties in identifying and engaging with older individuals.
- Surveys dramatically underestimate actual alcohol consumption. They can be designed to elicit more accurate survey responses but further work is needed to maximise their validity.

The findings from my study support guidance in England and Wales advising that children should not drink regularly <18y (Donaldson, 2009) and international legislation that typically bans the purchase of alcohol by those <18y (ICAP, 2010, WHO, 2014). Because considerable numbers of young people in England/UK and Europe continue to drink underage (Bellis et al., 2010b, Hibell et al., 2012), effective and evidence based interventions are required to delay or prevent alcohol initiation in young people in order to prevent significant harms in later life. Currently, evidence of effectiveness is available for universal and developmental prevention strategies that aim to prevent the onset of alcohol misuse in young people (Toumbourou et al., 2007).

The publications presented here show how, through original research, I have made a significant contribution to developing intelligence regarding the importance of early intervention in reducing alcohol misuse. In effectively communicating my findings to a range of audiences, my work has supported policymakers and practitioners in developing interventions to effectively reduce alcohol-related risky behaviour.

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7. Appendices: submitted papers

Morleo, M., Jones, L., Bellis, M.A. (2014). Alcohol age of initiation and long-term impact: a cross sectional survey of adults in England. *Journal of Substance Use*. 1-7.

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