A comparison of alcohol sales and alcohol-related mortality in Scotland and Northern England

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Authors

Mark Robinson, Public Health Information Manager, Public Health Science Directorate, NHS Health Scotland.
Dr Deborah Shipton, Public Health Research Specialist, Glasgow Centre for Population Health.
David Walsh, Public Health Programme Manager, Glasgow Centre for Population Health.
Bruce Whyte, Public Health Programme Manager, Glasgow Centre for Population Health.
Dr Gerry McCartney, Public Health Consultant, Public Health Science Directorate, NHS Health Scotland.


For further information about this publication please contact: Mark Robinson, Public Health Information Manager, Public Health Science Directorate, NHS Health Scotland. Email: markrobinson1@nhs.net

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Alcohol sales data are copyrighted to Nielsen or CGA Strategy.
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Summary

Introduction
The rate of alcohol-related mortality in Scotland is substantially higher than other countries in the UK. Yet, data from self-report surveys generally show similar levels and patterns of alcohol consumption. Alcohol sales data enable a more objective estimate of alcohol consumption and show higher population consumption levels in Scotland compared with England & Wales. However, comparisons at country level can mask important regional variations, with both consumption and harm likely to vary across different types of areas. Estimates of self-reported consumption in northern English cities have been shown to be comparable to similarly deprived Scottish urban areas, yet alcohol deaths were more than twice as high in the latter. The aim of this brief report was to use alcohol retail sales data to assess population levels of alcohol consumption in regions of Scotland and Northern England, and to compare these with levels of alcohol-related mortality.

Methods
Pure alcohol sales data derived from electronic sales records and retail outlet sampling were obtained from market research specialists Nielsen and CGA Strategy. These data were used to estimate population levels of alcohol consumption (litres of pure alcohol per capita) in Central Scotland, North East (NE) England and North West (NW) England. National estimates for Scotland and for England & Wales combined were also calculated. Alcohol-related mortality data for the same regions were also analysed.

Results
In 2011, 23% more alcohol was sold per capita in Scotland (9.0L) than in England & Wales (7.3L). At regional level, per capita sales were 13% and 12% higher in Central Scotland (9.0L) than in NE England (7.9L) and NW England (8.0L), respectively. Compared with England & Wales, per capita sales in NE England and NW England were 8% and 10% higher, respectively. Consistent with national comparisons, spirits accounted for a much higher market share in Central Scotland than the regions in Northern England.

In 2011, alcohol-related mortality was 80% higher in Scotland than in England & Wales. At regional level, alcohol-related mortality in Central Scotland was 14% higher than the Scotland average, 67% higher than NE England, and 47% higher than NW England. Alcohol-related mortality rates in NE and NW England were 23% and 40% higher than the England & Wales average, respectively.

The summary figure on the next page compares levels of alcohol consumption and alcohol-related mortality in Scotland and England & Wales and among the three sub-national regions. It shows that alcohol-related mortality is generally higher in areas with higher per capita alcohol consumption levels.

Discussion
Regional comparisons showed that similar levels of alcohol-related mortality in NE and NW England were matched by similar levels of alcohol consumption. Consumption levels in the Northern English regions were lower than in Central Scotland, where alcohol-related harms were highest. Higher alcohol-related mortality rates in NE and NW England were also consistent with higher levels of consumption than in England & Wales. These results provide support for the well-established link between population alcohol consumption and alcohol-related mortality. However, the volume of pure alcohol sold per capita in Central Scotland was comparable to that sold in Scotland overall, despite higher alcohol-related mortality. Other factors are therefore likely to be important in explaining the higher alcohol-related mortality in Central Scotland over and above mean alcohol consumption.
Summary Figure: Alcohol-related mortality (age/sex standardised) and per capita alcohol consumption, 2011
Introduction

The harmful use of alcohol results in 2.5 million deaths worldwide each year and is the third largest contributor to the global disease burden.\(^1\) Alcohol-related deaths are an important cause of premature mortality and health inequalities in many countries across the world.\(^2\) In the UK, there was a dramatic rise in alcohol-related deaths in the 1990s and early 2000s\(^3\) and it has recently been suggested that alcohol is the most harmful substance to UK society once all of the health, social and economic costs are accounted for.\(^4\)

Within the UK, there are marked differences in levels of alcohol-related harm among the constituent countries.\(^3\) Scotland has one of the highest rates of alcohol-related harm in Western Europe\(^5\) and in 2010 alcohol-related deaths were double those in England \& Wales.\(^6\) However, disparate levels of deprivation between Scotland and England \& Wales are likely to explain part of this disparity and comparisons at country level can mask important regional variations. It is therefore more appropriate to compare Scotland, and relevant parts of Scotland, with smaller geographical areas across the UK. In an ongoing programme of research, premature mortality in Glasgow has been shown to be 30% higher than in Liverpool and Manchester, cities in Northern England with similar levels of deprivation and industrial histories; almost a third of the ‘excess’ premature deaths were directly attributable to alcohol.\(^7\)

Population levels of alcohol-related harm are linked to population levels of alcohol consumption.\(^1\) However, there can be substantial variation between countries with similar levels of alcohol consumption which suggests that other factors are also important.\(^1\) Despite the aforementioned differences in alcohol-related mortality, self-reported estimates of alcohol consumption suggest that levels and patterns of drinking are similar between UK constituent countries.\(^3\,6\) Furthermore, survey based estimates do not indicate a large change in consumption over the time period when alcohol-related harms rose rapidly.\(^8\) Part of the reason for this disconnect between self-reported alcohol consumption and harms is likely to be due to biases pertaining to sampling, response rates, social desirability and recall, which can often lead to substantial underestimations of consumption.\(^8\) The World Health Organization therefore recommends the use of objective data based on alcohol sales or production when estimating consumption at a population level.\(^8\)

Consumption estimates based on retail sales data in Great Britain indicate that the volume of pure alcohol sold per adult increased by 16% between 1994 and 2005, a result of off-trade sales (i.e. alcohol sold for consumption off the premises, including supermarkets and other off-licenses) increasing at a faster rate than declining on-trade sales (i.e. alcohol sold for consumption on the premises including pubs, clubs and restaurants).\(^10\) Sales estimates also show that in 2011 per adult consumption was a fifth higher in Scotland than in England \& Wales, which was largely attributable to higher sales of spirits through the off-trade sector in Scotland.\(^10\) Therefore, alcohol sales data provide a more plausible explanation for the higher mortality in Scotland compared to England \& Wales and the secular trends in alcohol-related harm.

In order to strengthen the overall MESAS evaluation, data were sought for regional areas within the UK with relatively high levels of alcohol-related harm. The aim of this brief report was to assess population levels of alcohol consumption based on retail sales data within these regions, comparing with levels of alcohol-related mortality.
Data and methods

Alcohol retail sales

Annual and four-weekly data on alcohol retail sales for two full calendar years, 2010 and 2011, were obtained from market research specialists Nielsen and CGA Strategy (CGA) (hereafter ‘Nielsen/CGA’). Off-trade alcohol sales estimates were provided by Nielsen and produced from electronic sales records from most large, multiple retailers (retailers with 10 or more retail shops operating under common ownership) and a weighted stratified random sample of smaller ‘impulse’ retailers (retailers in which the consumer mainly uses the store for impulse or top-up purchases i.e. not the main grocery shop). Large, multiple retailers account for approximately three-quarters of total off-trade alcohol sales. On-trade alcohol sales estimates were provided by CGA who use a stratified sampling frame to obtain data on deliveries, electronic sales records and store audits, which are subsequently weighted to provide a representative estimate of on-trade alcohol sales. A more detailed description of the methods used by Nielsen/CGA to collect alcohol sales data is provided elsewhere.11

The natural volume of alcohol sold (litres) was provided by Nielsen/CGA across eight drink categories: spirits, wine, beer, cider, ready-to-drink beverages (RTDs), perry, fortified wine and an ‘other’ category (comprising British-made wine and fermented fruit drinks). The volume of each drink category sold was converted into pure alcohol volumes (litres of pure alcohol) using a category-specific percentage alcohol by volume (ABV). The ABV used was based on the typical strength of drinks sold in that category and was provided by the data suppliers. Per capita alcohol sales were calculated by dividing pure alcohol volumes (litres of pure alcohol) by the total mid-year population.1215

From September 2011, Nielsen was no longer able to estimate off-trade sales by discount retailers Aldi and Lidl. As such, all off-trade alcohol sales data analysed for this report exclude these discount retailers. Sensitivity analyses to assess the exclusion of these retailers were performed by applying adjustment factors to off-trade sales data. The adjustment factors were based on the estimated market share of these discounters drawn from Nielsen’s HomeScan consumer panel data, which were provided separately for Scotland and England & Wales and, where possible, for individual drink categories. More detail is provided in the MESAS August update report.13 The sensitivity analyses assumed that the market share of discounters at regional level was the same as at country level.

Defining geographies

Nielsen/CGA provided national data for Scotland and for England & Wales combined, as well as regional data for Central Scotland, NE England and NW England. Regions were defined by Nielsen/CGA according to postcode districts (e.g. G1, EH47, DH9; Figure 1). A full list of the postcode districts included in each region is provided in Appendix 1.

North East and North West England
An output area to postcode district lookup file14 was used to aggregate population and mortality data to postcode district level. Data were then aggregated to a regional level based on the postcode districts included in the Nielsen/CGA definition.

Central Scotland
The bespoke Central Scotland geography was defined by Nielsen/CGA using a list of postcode districts (Appendix 1). Using Geographic Information System software (Arc GIS version 10.1, Aylesbury, UK), this was then compared to the boundaries of Scottish ‘data
zones’, the smallest administrative geography for which required mortality and population denominator data were available. The geographies are not coterminous meaning that a small number of data zones overlapped postcode districts that were on the boundary of Central Scotland. Analyses of population data showed that the net effect of these overlapping data zones was negligible and an acceptable ‘best-fit’ geography was achieved (Appendix 1).

**Alcohol-related mortality and population data**

Alcohol-related mortality data and mid-year population estimates for Scotland were obtained from National Records of Scotland.\(^{12}\) Data were obtained for 2010 and 2011 at data zone level to enable aggregation to the Central Scotland region. In 2011, the population of Central Scotland (3.7 million) accounted for 70% of Scotland’s total population (5.3 million).

Alcohol-related mortality data for England & Wales, NE and NW England for 2010 and 2011 were provided by the Office for National Statistics (ONS). Population data were drawn from the 2011 census.\(^ {15}\) It was not possible to calculate 2010 population estimates for the bespoke NE and NW regions; mortality and consumption rates for 2010 in these regions were therefore calculated using 2011 population data. In 2011, the population of NE England was 2.9 million, 5% of the total population of England & Wales (56.1 million), while the population of NW England was 7.3 million, 13% of the total population of England & Wales.

Alcohol-related mortality was defined as those causes of death which are wholly attributable to alcohol using the standard ONS definition (Table 1).\(^ {16}\) Inclusion was based on one of these diagnoses appearing as the underlying cause (rather than secondary diagnosis) on the death record. Data were directly age- and sex-standardised to the 1976 European standard population. Most of the analyses presented in this report are based on 2011 data. Sensitivity analyses considered the impact of combining data for 2010 and 2011 to address year-on-year variability.

**Table 1: National Statistics definition of alcohol-related deaths (ICD-10)**

<table>
<thead>
<tr>
<th>ICD-10 code</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>F10</td>
<td>Mental and behavioural disorders due to use of alcohol</td>
</tr>
<tr>
<td>G31.2</td>
<td>Degeneration of nervous system due to alcohol</td>
</tr>
<tr>
<td>G62.1</td>
<td>Alcoholic polynuropathy</td>
</tr>
<tr>
<td>I42.6</td>
<td>Alcoholic cardiomyopathy</td>
</tr>
<tr>
<td>K29.2</td>
<td>Alcoholic gastritis</td>
</tr>
<tr>
<td>K70</td>
<td>Alcoholic liver disease</td>
</tr>
<tr>
<td>K73</td>
<td>Chronic hepatitis, not elsewhere classified</td>
</tr>
<tr>
<td>K74</td>
<td>Fibrosis and cirrhosis of liver (Excluding K74.3-K74.5 - Billiary cirrhosis)</td>
</tr>
<tr>
<td>K86.0</td>
<td>Alcohol induced chronic pancreatitis</td>
</tr>
<tr>
<td>X45</td>
<td>Accidental poisoning by and exposure to alcohol</td>
</tr>
<tr>
<td>X65</td>
<td>Intentional self-poisoning by and exposure to alcohol</td>
</tr>
<tr>
<td>Y15</td>
<td>Poisoning by and exposure to alcohol, undetermined intent</td>
</tr>
</tbody>
</table>

Source: Office for National Statistics
Figure 1: Map showing regions included in this study: Central Scotland, North East England and North West England (as defined by Nielsen/CGA)

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This work is based on data provided through EDINA UKBORDERS with the support of the ESRC and JISC and uses boundary material which is copyright of the Crown.
Results

Alcohol retail sales
In 2011, 23% more alcohol was sold per capita in Scotland (9.0L) than in England & Wales (7.3L). At regional level, per capita sales were 13% and 12% higher in Central Scotland (9.0L) than in NE England (7.9L) and NW England (8.0L), respectively. Compared with England & Wales, per capita sales in NE and NW England were 8% and 10% higher, respectively (Figure 2).

There were some notable differences between regions in the volume of specific drink types sold per capita in 2011. In Central Scotland, per capita sales of spirits (2.6L) were 66% higher than in NE England (1.6L) and 59% higher than in NW England (1.7L). In contrast, compared with Central Scotland (3.0L), per capita beer sales were 12% and 9% higher in NE (3.4L) and NW England (3.3L), respectively (Figure 2). These differences are reflected in the market share of different drink types (Table 2).

Figure 2: Total volume of pure alcohol (L) sold per capita, by drink type and region, 2011

Note: The ‘Other’ category is not shown as it accounts for less than 3% of total alcohol sales in each region.
Table 2: Percentage market share within region of main drink types sold (L pure alcohol per capita) in Central Scotland, NE England and NW England, 2011.

<table>
<thead>
<tr>
<th>%</th>
<th>Central Scotland</th>
<th>NE England</th>
<th>NW England</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beer</td>
<td>34</td>
<td>43</td>
<td>41</td>
</tr>
<tr>
<td>Spirits</td>
<td>30</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>Wine</td>
<td>27</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>Cider/perry</td>
<td>7</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Other category includes ready-to-drink beverages (RTDs), fortified wine and other minor drink types (British-made wine and fermented fruit drinks). Columns may not add to 100% because of rounding.

Across all regions, off-trade sales accounted for 65-70% of total alcohol sales in 2011. Of the additional volume of alcohol sold in Scotland compared with England & Wales, 80% was attributable to higher off-trade sales, most of which was higher spirits (Table 3). A similar pattern is seen at regional level, although higher spirits sales in Central Scotland are partly offset by higher beer sales in NE and NW England, particularly off-trade beer sales. When compared with England & Wales, off-trade sales accounted for most of the additional volume of alcohol sold in NW England (87%) and for all of the additional volume sold in NE England. This was mostly due to higher off-trade sales of beer and spirits. There were higher on-trade sales in NW England than in NE England in 2011, mostly attributable to higher on-trade wine sales.

Table 3: Volume of pure alcohol sold per capita, by market sector, drink type and region, 2011

<table>
<thead>
<tr>
<th>Off-trade</th>
<th>Scotland</th>
<th>Central Scotland</th>
<th>England &amp; Wales</th>
<th>NE England</th>
<th>NW England</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spirits</td>
<td>2.0</td>
<td>2.0</td>
<td>1.1</td>
<td>1.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Wine</td>
<td>2.0</td>
<td>2.0</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Beer</td>
<td>1.4</td>
<td>1.4</td>
<td>1.3</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Cider/perry</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Other</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>All</td>
<td>6.1</td>
<td>6.2</td>
<td>4.7</td>
<td>5.5</td>
<td>5.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>On-trade</th>
<th>Scotland</th>
<th>Central Scotland</th>
<th>England &amp; Wales</th>
<th>NE England</th>
<th>NW England</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spirits</td>
<td>0.6</td>
<td>0.6</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Wine</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>Beer</td>
<td>1.5</td>
<td>1.6</td>
<td>1.6</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Cider/perry</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Other</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>All</td>
<td>2.9</td>
<td>2.8</td>
<td>2.6</td>
<td>2.4</td>
<td>2.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combined</th>
<th>Scotland</th>
<th>Central Scotland</th>
<th>England &amp; Wales</th>
<th>NE England</th>
<th>NW England</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spirits</td>
<td>2.6</td>
<td>2.6</td>
<td>1.4</td>
<td>1.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Wine</td>
<td>2.5</td>
<td>2.4</td>
<td>2.2</td>
<td>2.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Beer</td>
<td>2.9</td>
<td>3.0</td>
<td>2.9</td>
<td>3.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Cider/perry</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Other</td>
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<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>All</td>
<td>9.0</td>
<td>9.0</td>
<td>7.3</td>
<td>7.9</td>
<td>8.0</td>
</tr>
</tbody>
</table>
Figure 3 shows 4-weekly alcohol sales per capita for the three regions during 2010 and 2011. There is clear seasonality in alcohol sales with a peak in the last 4 weeks of the year and a trough in the first 4 weeks of the year. Sales generally increase over the year into the summer and then tail off in the autumn before increasing again as December approaches. Despite differences in the absolute volume of alcohol sold per capita in each region, the seasonal trends are very similar. Per capita alcohol sales declined in all regions between 2010 and 2011.

**Figure 3: Volume of pure alcohol (L) sold per by region, 2010-2011 (4-week periods)**

![Graph showing alcohol sales per capita by region](image)

**Alcohol-related mortality**

Figure 4 shows that in 2011 alcohol-related mortality rates for both men and women were approximately 80% higher in Scotland than in England & Wales. At regional level, alcohol-related mortality in Central Scotland was 14% higher than the Scotland average for both sexes. Compared with NE and NW England, male rates in Central Scotland were 66% and 52% higher and female rates 44% and 47% higher, respectively. Alcohol-related mortality rates in NE and NW England were 23% and 40% higher than the England & Wales average, respectively.

Figure 5 compares levels of alcohol-related mortality and alcohol consumption in Scotland and England & Wales and among the three sub-national regions. For the small number of regions and nations analysed, there was a general pattern of higher alcohol-related mortality in areas with higher alcohol consumption. The relationship in Scotland is more complicated: Central Scotland has a higher level of alcohol-related mortality than Scotland as a whole despite similar consumption levels.

**Sensitivity analyses**

Adjustment factors were applied to off-trade alcohol sales data in 2011 to account for the exclusion of discount retailers. This increased the volume of off-trade alcohol sold per capita, but had a negligible impact on differences between areas. Similarly, comparing consumption and mortality estimates based on 2010/11 combined averages led to small changes in the
level of consumption and mortality across regions and countries, but the general pattern presented in Figure 5 remained (not shown).

**Figure 4:** Age-standardised alcohol-related mortality rates, by sex and region, 2011

![Age-standardised alcohol-related mortality rates](image)

**Figure 5:** Alcohol-related mortality (age/sex standardised) and per capita alcohol consumption, 2011

![Alcohol-related mortality and per capita alcohol consumption](image)
Discussion

Main findings
The present study has, for the first time, used alcohol sales data to present objective estimates of population consumption levels at selected sub-national geographies in Great Britain. It has shown that alcohol-related mortality is generally higher in areas with higher per capita alcohol consumption levels. Regional comparisons showed that similar levels of alcohol-related harm in NE and NW England were matched by comparable levels of consumption. Consumption levels in the Northern English regions were lower than in Central Scotland, where alcohol-related harms were highest. Higher alcohol-related mortality rates in NE and NW England were also consistent with higher levels of consumption than in England & Wales. However, the volume of pure alcohol sold per capita in Central Scotland was similar to that sold in Scotland overall, despite higher alcohol-related mortality. The most apparent difference in consumption between regions was the substantially higher level of spirits consumption in Central Scotland, which was partly offset by higher levels of beer consumption in the Northern English regions.

Strengths and limitations
The main strength of this study was the use of sub-national alcohol retail sales data to estimate population consumption. The retail sales data used in this study have been shown to provide a valid and reliable estimate of consumption. The majority of alcohol sold in Great Britain is sold through the off-trade and approximately three-quarters of all off-trade alcohol is sold through supermarkets and other large grocers. Data from most of these retailers are collected by store-census which means that every alcohol product that is scanned at the checkout is captured and a precise estimate of total off-trade sales can be estimated. Data from a large sample of the entire sampling frame is also a feature of the methods used to estimate on-trade sales.

The alcohol retail sales data are therefore less vulnerable to the biases inherent in self-report methods, such as sampling bias, response bias and under-reporting, which often lead to considerable underestimation. Indeed, mean weekly consumption derived from survey data accounted for only 51% derived from retail sales data in Scotland in 2011. In NE and NW England, survey based estimates accounted for 71% and 60% of sales based estimates (adjusted to account for discounters), although the data sources use slightly different regional boundaries. Furthermore, the pattern of higher alcohol-related mortality in areas with higher alcohol consumption would not be supported. In contrast to the present findings, survey data ranks NE England as having the highest level of self-reported weekly alcohol consumption, followed by NW England, with the lowest level being observed in Scotland.

The alcohol retail sales data are also available by drink type and trade sector, thereby providing useful insights into consumer preferences and how these differ between areas. The availability of such robust data at regional geographies will be particularly important for future evaluations of alcohol policy interventions that are specific to Scotland (by providing more comparator areas).

A number of limitations should also be noted. First, it is plausible that the mean population consumption estimates used in this study mask important differences in the distribution of alcohol consumption between regions. This highlights one of the major challenges in alcohol epidemiological research. Aggregate sales data provide the most reliable source of consumption estimates in the UK, estimates which are crucial for monitoring trends and assessing policy impacts. Unfortunately, such estimates do not allow analyses of consumption levels and drinking patterns by different population subgroups (e.g. age, gender, social class, moderate/heavy drinkers) which, in the current study, precludes further insights into why, for example, a different harm response exists in Scotland and Central
Scotland for the same level of average consumption, and what factors lie behind this difference. Currently such insights can only be obtained from surveys. While some survey methods have been shown to produce consumption estimates comparable to those based on sales, consumption among the heaviest drinkers, for example, is never likely to be fully captured. As such, attempting to quantitatively analyse these nuanced differences at a population level, particularly between a relatively small number of large geographical areas, is a challenging endeavour. Attempts have been made to adjust self-report consumption estimates to address unrecorded consumption and a methodological approach to produce better survey consumption estimates has recently been published. These are positive advances, but additional knowledge accumulated from a combination of sales and mortality data, surveys and primary research (both quantitative and qualitative) would help to better understand the relationship between consumption and harm.

Second, sales estimates at smaller geographies would have been beneficial. The regions included in this study were large and included areas with very different health, social and deprivation profiles. Indeed, Central Scotland as defined in this study contained 70% of Scotland’s total population. Consumption estimates at city level for Glasgow, Liverpool and Manchester would have been particularly instructive for the programme of research exploring the reasons for Glasgow’s unexplained excess mortality despite comparable levels of deprivation. Unfortunately, due to the sampling design used by the data providers, estimates at smaller geographies are not currently possible. Sales data over a longer time period would also have been useful to compare changes in consumption with changes in mortality. While data are available for Scotland and England & Wales from 1994, they are not available at sub-national geographies.

Third, although alcohol sales data are considered the most valid and reliable source of data for estimating consumption, this approach is subject to its own biases and limitations. These have been explored in a previous MESAS report and include: alcohol sold to tourists; unrecorded alcohol; non-response; wastage and spillage; and non-inclusion of some alcohol sales outlets. The overall impact of these biases is such that actual population levels of consumption are likely to be underestimated. However, there is no obvious reason to suggest that the impact of these biases would be meaningfully different between Scotland and England & Wales. It is possible that these biases may be more or less important at this smaller geographical level (e.g. tourism sales may account for a higher or lower proportion of sales within a smaller area); however, each of the geographies analysed here contains a large population and variety of sales outlets which makes this less likely, and the proportion of total sales subject to the various sources of over- and underestimation is small.

Finally, the regional per capita consumption levels were calculated as crude estimates and so did not take into account any differences in age and sex distributions. This is potentially important because consumption levels and patterns vary widely across age groups and between sexes. However, supplementary analyses of population data indicated that, for the regions analysed, the population structures were broadly similar. This limitation is therefore unlikely to have altered the interpretations of the study results.

**Interpretation**

The selected regions were chosen on the basis that they had high alcohol-related mortality rates compared with the rest of Great Britain. They are also regions with relatively high levels of deprivation and a history of deindustrialisation. By comparing these regions (albeit a small number) using the best available data, the results provide support for the well-established link between population alcohol consumption and related mortality. However, despite Central Scotland having similar levels of per capita alcohol consumption to the rest of Scotland, alcohol-related harms were higher. It is possible that the higher deaths attributable to alcohol in Central Scotland might have resulted from the drinking behaviours of a particular population cohort. In their investigation into the potential causes of the
relatively poor mortality outcomes in Scotland, McCartney et al posited that Scotland (and particularly West Central Scotland) was particularly vulnerable to the neoliberal economic policies of the 1980s. The resultant unemployment, particularly among young working-age men, was hypothesised to have increased their risk to alcohol misuse and associated harms (including the steep increase in death rates during the 1990s and early 2000s). If the men and women exposed to the negative aspects of this period effect of the 1980s form a larger proportion of the population in Central Scotland compared to the rest of Scotland, then this might result in higher alcohol-related mortality rates (accumulated over the life course) and might partially explain current disparities in harms despite similar levels of current consumption. Work currently underway as part of MESAS aims to further assess whether past changes in economic context can help explain trends in alcohol-related consumption and harm both within and between Scotland and England & Wales.

Other unmeasured factors must also be considered in attempting to explain different rates of alcohol-related deaths between areas with similar consumption levels (working as effect modifiers). For example, individuals infected with hepatitis C infection who consume high levels of alcohol are at a higher risk of liver failure-related deaths, the biggest contributor to overall alcohol-related mortality. The prevalence of Hepatitis C is likely to be higher in Central Scotland than the rest of Scotland, but this is unlikely to account for a large proportion of Central Scotland’s excess alcohol-related deaths. Obesity can also compound the risk of exposure to alcohol misuse, but the prevalence of adult obesity does not differ greatly across Scotland according to the Scottish Health Survey.

It is interesting to note that for those geographical comparisons which show clear differences in population consumption levels (e.g. Scotland vs. England & Wales; NE/NW England vs. England & Wales), it is off-trade sales that account for the differences. The price of alcohol sold through the off-trade is much lower than through the on-trade. Indeed, the increased affordability of alcohol since the 1980s has been largely attributable to a change in purchasing patterns of consumers from on-trade to off-trade. It is also known that heavier drinkers are more likely to consume cheaper alcohol. In a recent study of patients with serious alcohol problems in Edinburgh, vodka (particularly cheap vodka) was found to account for the largest proportion of total consumption. Previous MESAS reports have shown that cheap spirits (particularly vodka) account for much of the additional volume of alcohol sold in Scotland compared with England & Wales. Data on the price distribution of alcohol sold at regional level would have provided valuable additional insights into the price of the alcohol that was responsible for the differential in volume sales.

In this study, the higher alcohol consumption levels in Scotland/Central Scotland compared with Northern England were almost entirely due to higher spirits sales. It has been suggested that the association between population levels of alcohol consumption and alcohol-related harm, particularly in Northern European countries, is mostly attributable to levels of spirits consumption. However, the large increase in alcohol-related mortality in Scotland and England & Wales during the 1990s was concurrent with increased consumption of wine, not spirits, and so the consumption of spirits does not easily explain the secular trends. A better understanding of the relationship between beverage specific alcohol consumption and alcohol-related harm in Great Britain, as well as the role of drink preference across different types of drinker, would therefore be useful.

Conclusion
Regional comparisons of alcohol-related mortality and previously unavailable alcohol retail sales data in Scotland and Northern England show that alcohol-related mortality is generally higher in areas with higher per capita alcohol consumption levels. However, for Central Scotland the relationship is more complicated; the region has a higher level of alcohol-related mortality than Scotland as a whole despite similar consumption levels.
References

All web links were verified as working on 26th November 2013.


18. NHS Health Scotland analyses of 2011 Scottish Health Survey and Health Survey for England data.


Appendix 1 Further details on methods

Definition of regions
Regions were defined by Nielsen/CGA according to postcode districts that aggregate to standard British Audience Research Board (BARB) regions. A full list of the postcode districts included in each region is provided in Table A1.

Table A1: Postcode districts included in regions defined by Nielsen/CGA

<table>
<thead>
<tr>
<th>Region</th>
<th>Postcode districts</th>
</tr>
</thead>
</table>

Estimating the population of Central Scotland
As described in the methods section, the population of Central Scotland (as defined by Nielsen/CGA) was estimated using a two-step process. First, data zone population estimates were aggregated to postcode districts. Second, population estimates of postcode districts within Central Scotland (see Table A1) were aggregated. A limited number of data zones overlapped the boundary between postcode districts that were either included or excluded in the Central Scotland geography. Assuming that the majority of a data zone’s population live in the postcode sector that contains the majority of the data zone’s geographical area, such overlap can result in either an under- or overestimation of the Central Scotland population. However, analysis showed that the net effect of these instances was negligible, providing reassurance that the approach provided an acceptable ‘best-fit’ (Table A2).
<table>
<thead>
<tr>
<th>Data zone</th>
<th>Description of problem</th>
<th>Impact</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>S01004981</td>
<td>Population of data zone assigned to FK14, which is within Central Scotland, but contains only 18% of the data zone’s geographical area. Population should be assigned to KY13, which is outside Central Scotland.</td>
<td>Overestimation</td>
<td>858</td>
</tr>
<tr>
<td>S01005466</td>
<td>Population of data zone assigned to EH37, which is within Central Scotland, but contains only 1% of the data zone’s geographical area. Population should be assigned to TD1, which is outside Central Scotland.</td>
<td>Overestimation</td>
<td>908</td>
</tr>
<tr>
<td>S01005476</td>
<td>Population of data zone assigned to EH26, which is within Central Scotland, but contains only 18% of the data zone’s geographical area. Population should be assigned to EH46, which is outside Central Scotland.</td>
<td>Overestimation</td>
<td>847</td>
</tr>
<tr>
<td>S01003721</td>
<td>Population of data zone assigned to PA39, which is outside Central Scotland, but contains only 3% of the data zone’s geographical area. Population should be assigned to PH49, which is within Central Scotland.</td>
<td>Underestimation</td>
<td>682</td>
</tr>
<tr>
<td>S01005394</td>
<td>Population of data zone assigned to EH45, which is outside Central Scotland, but contains only 4% of the data zone’s geographical area. Population should be assigned to ML12, which is within Central Scotland.</td>
<td>Underestimation</td>
<td>729</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Net effect</th>
<th>Overestimation</th>
<th>1202</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.04% of the total Central Scotland population)</td>
<td></td>
</tr>
</tbody>
</table>