ScotPHO
Public Health Information for Scotland

Hospital admissions, deaths and overall burden of disease attributable to alcohol consumption in Scotland

Supplementary appendix

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Method

1. Evidence base for inclusion of conditions attributable to alcohol

The aim of this study was to update the Alcohol Attributable Fraction (AAF) estimates for Scotland and to apply these to the key metrics on mortality and morbidity in order to estimate the burden of disease attributable to alcohol consumption. The evidence for the inclusion/exclusion of diseases for this update was based on the review undertaken for the report "Updating England-specific Alcohol Attributable Fractions" (1). This was based on an electronic search of systematic reviews and meta-analyses in Medline, supplemented by reference searches. Full details are available from the original publication (1).

Table S1: Conditions wholly[1] and partially attributable to alcohol consumption included in the study

Condition	**ICD-10 code(s) 2017**
Wholly attributable conditions	
Alcohol-induced pseudo-Cushing's syndrome	E24.4
Mental and behavioural disorders due to use of alcohol	F10
Degeneration of nervous system due to alcohol	G31.2
Alcoholic polyneuropathy	G62.1
Alcoholic myopathy	G72.1
Alcoholic cardiomyopathy	I42.6
Alcoholic gastritis	K29.2
Alcoholic liver disease	K70
Alcohol-induced chronic pancreatitis	K86.0
Ethanol poisoning	T51.0
Methanol poisoning	T51.1
Toxic effect of alcohol, unspecified	T51.9
Accidental poisoning by and exposure to alcohol	X45

[1] The definition of wholly attributable conditions used in this report has five additional conditions not included in the revised Office for National Statistics definition of alcohol-specific deaths 2017: Ethanol poisoning (T51.0); Evidence of alcohol involvement determined by blood alcohol level (Y90); Evidence of alcohol involvement determined by level of intoxication (Y91); Methanol poisoning (T51.1); and Toxic effect of alcohol, unspecified (T51.9). Chronic hepatitis, not elsewhere classified (K73) and Fibrosis and cirrhosis of the liver (K74.0-K74.2, K74.6-K74.9) are combined in this study as unspecified liver disease (K73, K74)(29).

Condition	ICD-10 code(s) 2017
Intentional self-poisoning by and exposure to alcohol	X65
Poisoning by and exposure to alcohol, undetermined intent	Y15
Alcohol-induced acute pancreatitis	K85.2
Foetal alcohol syndrome (dysmorphic)	Q86.0
Excess alcohol blood levels	R78.0
Evidence of alcohol involvement determined by blood alcohol level	Y90
Evidence of alcohol involvement determined by level of intoxication	Y91
Partially attributable chronic conditions	
Infectious and parasitic diseases	
Tuberculosis	A15-A19
Malignant neoplasms	
Lip, oral cavity and pharynx	C00-C14
Oesophagus	C15
Colorectal	C18-C20
Liver and intrahepatic bile ducts	C22
Larynx	C32
Breast	C50
Diabetes Mellitus	
Diabetes mellitus (type II)	E11
Diseases of the nervous system	
Epilepsy and Status epilepticus	G40-G41
Cardiovascular disease	
Hypertensive diseases	I10-I15
Ischaemic/Coronary heart disease	I20-I25
Cardiac arrhythmias	I47-I48
Haemorrhagic stroke	I60-I62, I69.0-I69.2
Ischaemic stroke	I63-I66,I69.3-I69.4
Respiratory infections	
Pneumonia	J10.0, J11.0, J12-J15, J18
Digestive disease	
Unspecified liver disease	K73, K74
Cholelithiasis (gall stones)	K80
Acute and chronic pancreatitis	K85, K86.1

Condition	ICD-10 code(s) 2017
Oesophageal varices	I85
Pregnancy and childbirth	
Spontaneous abortion	O03
Low birth weight	†
Partially attributable acute condition	**ICD-10 codes 2017**
Unintentional injuries	
Road/pedestrian traffic accidents	††
Fall injuries	W00-W19
Fire injuries	X00-X09
Poisoning	X40-X49
Drowning	W65-W74
Other unintentional injuries	†††
Intentional injuries	
Intentional self-harm	X60-X84
Event of undetermined intent	Y10-Y34
Assault	X85-Y09

† Live singleton births < 2500g in 2015.

†† V021-V029, V031-V039, V041-V049, V092, V093, V123-V129, V133-V139, V143-V149, V194-V196, V203-V209, V213-V219, V223-V229, V233-V239, V243-V249,V253-V259, V263-V269, V273-V279, V283-V289, V294-V299, V304-V309, V314-V319, V324-V329, V334-V339, V344-V349, V354-V359, V364-V369, V374-V379,V384-V389, V394-V399, V404-V409, V414-V419, V424-V429, V434-V439, V444-V449, V454-V459, V464-V469, V474-V479, V484-V489, V494-V499, V504-V509,V514-V519, V524-V529, V534-V539, V544-V549, V554-V559, V564-V569, V574-V579, V584-V589, V594-V599, V604-V609, V614-V619, V624-V629, V634-V639,V644-V649, V654-V659, V664-V669, V674-V679, V684-V689, V694-V699, V704-V709, V714-V719, V724-V729, V734-V739, V744-V749, V754-V759, V764-V769,V774-V779, V784-V789, V794-V799, V803-V805, V811, V821, V830-V833, V840-V843, V850-V853, V860-V863, V870-V878, V892.

††† V01, V090, V091, V099, V100-V109, V110-V119, V120-122, V130-132, V140-V142, V150-V159, V160-V169, V170-V179, V180-V189, V191-V193, V20-V28: 0.1–0.2;V290-V293, V30-V38: 0.1–0.2; V390-V393, V40-V48: 0.1–0.2; V490-V493, V50-V58: 0.1–0.2; V590-V593, V60-V68: 0.1–0.2; V690-V693, V70-V78: 0.1–0.2; V790-V793,V800, V801, V806–V809, V810, V812–V819, V820, V822–V829, V834–V839, V844–V849, V854–V859, V864–V869, V879, V88, V890, V891, V893–V899, V90-V94,V95-V97, V98-V99, W20-W52, W75-W84, W85–W99, X10-X19, X20-X29, X30-X33, X50-X57, X58, X59, Y40-Y84 Y85, Y86, Y88, Y89.

2. Data sources

The following data sources were used in this study:

2.1 Alcohol consumption data

Self-reported alcohol consumption data by sex and 10 year age-group were obtained from the Scottish Health Survey 2015(2). The coverage rate of the Scottish Health survey data, estimated from triangulation with sales data, was obtained from page 12 of the report “Monitoring and Evaluating Scotland’s Alcohol Strategy (MESAS)” (3).

2.2 Patient hospital admission data

Data on the number of patients admitted to hospital in 2015 (at least once with a wholly or partially alcohol attributable diagnosis) were based on the first admission occurring in 2015 for one of the conditions listed in Table S1. Where there were more than one alcohol-attributable diagnoses in the same admission, the diagnosis in the highest diagnostic position was used. Data were obtained by information request to ISD Scotland and extracted from the Scottish Morbidity Record 01 (SMR01) – General acute inpatient and day cases for calendar year 2015 (4).

Data on the number of mothers giving birth to low birth weight babies in NHS hospitals in Scotland in 2015 was derived from the number of live singleton babies born in Scotland in the calendar year 2015. These data were requested from ISD Scotland and extracted from the Scottish Morbidity record 02 (SMR02) – Maternity inpatient and day-cases calendar year 2015 (5).

2.3 Deaths in adults aged 16 years and over in 2015

Data on the total number of deaths in Scotland in the calendar year 2015 amongst adults aged 16 years and over were obtained from the National Records of Scotland (NRS) website – Deaths data 2015 in Table DT.3 (6). Data on the number of deaths by disease category (primary diagnostic position) were requested from ISD Scotland for the calendar year 2015.

2.4 Disability Adjusted Life Years in 2015

Data on the number of Disability Adjusted Life Years (DALYs) in 2015 by disease were obtained from the Scottish Burden of Disease, Injuries and Risk Factors study section of the ScotPHO website (7).

3. Estimating alcohol consumption

3.1 Conversion of alcohol consumption in units to grams per day

The Scottish Health Survey reports self-reported alcohol consumption data as “the mean number of units of alcohol consumed per week amongst current drinkers” i.e. amongst individuals who have consumed alcohol in the last 12 months (2). For the

purposes of this study, the mean number of units of alcohol consumed per week in 2015 was converted into grams consumed per day; the standard alcohol measurement used in epidemiological research on alcohol related health outcomes (8). Weekly alcohol consumption in units was converted to grams per day as shown below:

Grams of alcohol consumed per day = (X*8) / 7

Where X is the average weekly consumption of alcohol in units, eight is the number of grams in one unit of alcohol and division by seven creates a daily consumption value in grams.

3.2 Modelling alcohol consumption using a gamma distribution

The continuous alcohol distribution was categorised into very fine gradations of consumption (0.1g intervals) to represent a discrete form of the continuous distribution. The alcohol consumption distribution was then modelled by age and sex using a gamma distribution which has been shown to provide a good approximation (1). The mean (μ) and standard deviation (σ) was determined for each age-sex-specific grouping and were used to calculate the shape (α) and rate (β) parameters of each sex- and age-specific gamma distribution as per the method described by Jones and Bellis (1). The following formulae were used to estimate the shape and rate parameters:

1) Formula for the shape of the gamma distribution: $\alpha = \frac{\mu^2}{\sigma^2}$

2) Formula for the rate of the gamma distribution: $\beta = \frac{\mu}{\sigma^2}$

The age-sex specific alcohol consumption distribution was modelled from 0g of alcohol per day and capped at 150g per day in line with international guidelines (9).

3.3 Adjusting the self-reported alcohol consumption values

Alcohol consumption was adjusted for under-reporting in self-reported survey data (2). This was based on the coverage rate for the Scottish Health Survey 2015 which is an estimation of the percentage of all alcohol sold in 2015 captured by the survey data. This coverage rate is estimated by triangulating survey alcohol consumption data with alcohol sales data for Scotland (3).

In order to calculate this adjustment, the inverse of 90% of the coverage rate (52%) was estimated (i.e. 52/90 = 0.578). This was to account for alcohol purchased but not consumed due to wastage. The adjusted mean and standard deviation were calculated as shown below using the method devised by Rehm and colleagues (9) and used by Jones and Bellis (1). Figure S1 shows the impact that adjustment had on alcohol consumption by age group and sex.

1) Adjusted mean: $\mu\ shifted = \frac{\mu_{survey}}{0.578}$

2) Adjusted standard deviation: $\sigma\ shifted = 1.174 * \mu\ shifted + 1.003 * sex^{\dagger}$

†Where sex = 0 for men and 1 for women

Figure S1: Mean daily alcohol consumption of adult men in Scotland 2015 (original and adjusted consumption levels), by age group

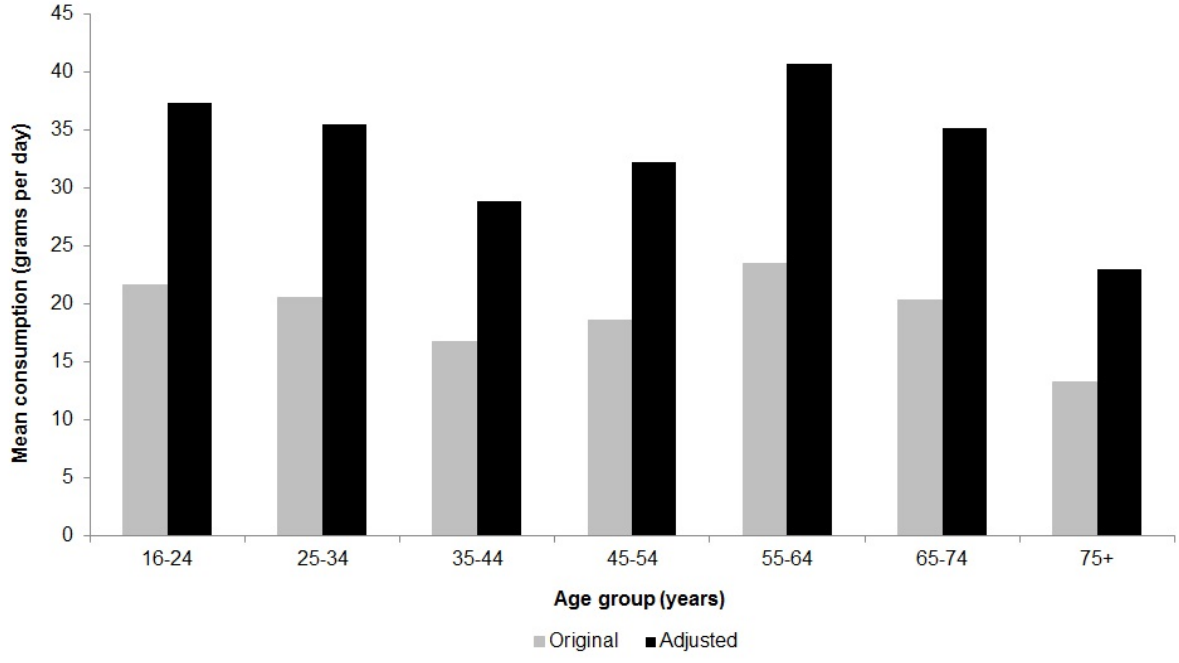
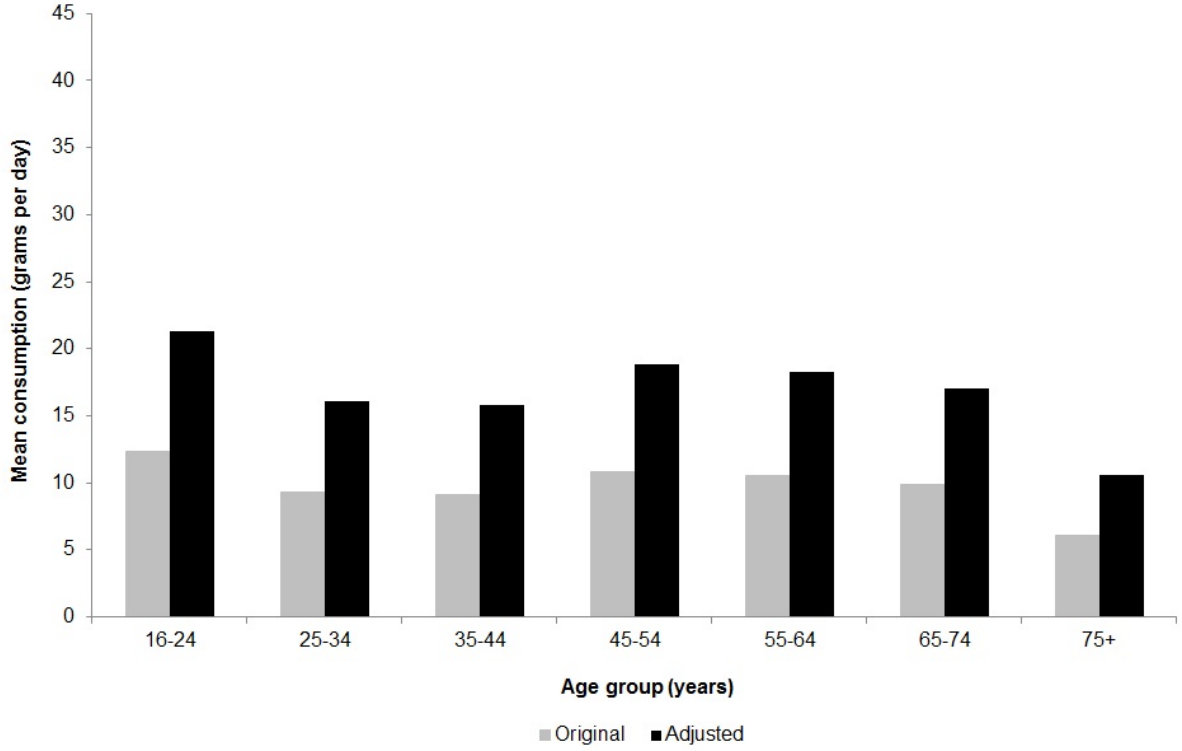


Figure S2: Mean daily alcohol consumption of adult women in Scotland 2015 (original and adjusted consumption levels), by age group



3.4 Estimating the proportion of life-time abstainers and ex-drinkers

Using Stata 13.1, the proportion of life-time abstainers and ex-drinkers was obtained from the “dnevr” variable that asks if a non-drinker was “always a non-drinker” or “used to drink, but stopped”. A former drinker was an individual who used to drink but had not had a drink in at least 12 months.

3.5 Estimating alcohol consumption in pregnant women

It is difficult to accurately estimate alcohol consumption levels in pregnant women due to insufficient data. From the Infant Feeding Survey 2010 (10), 49% of women in the UK reported stopping drinking alcohol while pregnant. We followed the same approach as Jones and Bellis (1) who reclassified 49% of female current drinkers as former drinkers. In addition, the original consumption estimates (unadjusted) were used to model a lower consumption distribution overall.

4. Estimating relative risk functions

Relative risk (RR) functions were obtained for average alcohol consumption from the report “Updating England-Specific Alcohol-Attributable Fractions” (1). These were superseded by Rehm et al (2017) (11) where more recent RRs were available. We did not incorporate patterns of alcohol consumption into the current method due to a lack of data on the frequency of binge drinking among adults in Scotland.

Two RR functions were used in each calculation where possible:

1. The RR function for a current drinker versus a person who had never drunk alcohol (life-time abstainer)
2. The RR function for a former drinker versus a person who had never drunk alcohol (life-time abstainer)

RR functions were either reported for all adults or stratified by sex where available (age specific RRs were not available). RR functions for each condition are detailed in Table S2 and in the supplementary data tables.

Table S2: Relative risk functions for chronic partially attributable conditions included in this report

Condition	**Dose-response relationship** **(LnRR = log-relative risk)**	**RR former drinker vs life-time abstainer**
Tuberculosis ALL (12)	$LnRR = 0.0179695*alc$	1.0[2]
Neoplasm of lip, oral cavity & pharynx ALL (13)	$LnRR = 0.02474*alc - 0.00004*alc^2$	1.20 Source: (11,14)
Neoplasm of the oesophagus ALL (13)	$LnRR = 0.05593*alc - 0.00789*alc*\log(alc)$	1.16 Source: (11,14)
Neoplasm of the colon and rectum ALL (13)	$LnRR = 0.006279*alc$	Women: 1.05 Men: 2.19 Source: (11,15)
Neoplasm of the liver and intrahepatic bile ducts ALL (13)	$LnRR = 0.00017*alc^2 - 0.00069*alc^{0.5}$	Women: 2.28 Men: 1.54 Source: (11,15)

[2] No increased risk for former drinkers due to disease being attributable to the acute consequences of alcohol consumption (11,12)

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
Neoplasm of larynx ALL (13)	$LnRR = 0.01462*alc-0.00002*alc^2$	1.18 Source: (11,14)
Neoplasm of the breast[1] WOMEN (13)	$LnRR = 0.01018*alc$	1.00[3]
Diabetes mellitus MEN (16)	$\ln RR = \begin{cases} -0.109786 \cdot y + 0.0614931 \cdot y \cdot \log(y), < 80\ g/day \\ 0.1447109, \geq 80\ g/day \end{cases}$ $\text{where } y = \frac{alc + 0.003570556640625}{10}$	1.18 Source: (11,17)
Diabetes mellitus WOMEN (16)	$\ln RR = \begin{cases} -0.4002597 \cdot \sqrt{y} + 0.0076968 \cdot y^3, < 52\ g/day \\ 0.1696907, \geq 52\ g/day \end{cases}$ $\text{where } y = \frac{alc + 0.003570556640625}{10}$	1.14 Source: (11,17)

[3] The RR function as reported by Schütze (15) was 1.03. This fell within the range of 0.95 and 1.05 when the former drinkers were not modelled. The RR was therefore set as 1.0 (11).

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
Epilepsy & status epilepticus ALL (18)	$\ln RR = 1.22861 * \left(\frac{alc + 0.5}{100}\right)$	1.00[4]
Hypertensive diseases MEN (11)	$LnRR = \begin{cases} 0.0150537*alc - 0.0156155*alc^3/75^2, & <21\ g/day \\ 0.0150537*alc - 0.0156155*((alc^3-(alc-21)^3*75/(75-21))/75^2) & 21 - <75\ g/day \\ 0.0150537*alc - 0.0156155*((alc^3-(alc-21)^3*75-(alc-75)^3*21/(75-21))75^2) & >75\ g/day \end{cases}$	1.05 Source: (11)
Hypertensive diseases WOMEN (11)	$lnRR = \begin{cases} 0 & <18.9\ g/day \\ -0.0154196*alc + 0.0217586*((alc^3-(alc-10)^3*20-(alc-20)^3*10)/(20-10))/20^2) & 18.9-<75\ g/day \\ 0.9649937 & \geq 75\ g/day \end{cases}$	1.0[5]

[4] The RR functions reported by Leone (30) were 0.9 for women and 0.9 for men however Rehm et al (11) notes that there is a lack of robust evidence that former drinking is correlated with epilepsy.

[5] The RR reported for women by Rehm et al (11) (Roerecke et al, personal communication) of 1.03 fell inside the range of 0.95 and 1.05 when former drinkers were not modelled. The RR for former drinkers was therefore set to 1.0.

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
Ischaemic heart disease MEN (19)	$$\ln RR = \begin{cases} \square\left[\beta_1 * \left(\frac{x+0.0099999997764826}{100}\right)^{0.5} + \beta_4 * \left(\frac{x+0.0099999997764826}{100}\right)^{3}\right], < 60\text{g/day} \\ 0.0412119 + \square\left[\beta_1 * \left(\frac{60+0.0099999997764826}{100}\right)^{0.5} + \beta_4 * \left(\frac{60+0.0099999997764826}{100}\right)^{3}\right], \geq 60 < 100\text{g/day} \\ \square[\beta_5 * (x-100)] + 0.0412119 + \square\left[\beta_1 * \left(\frac{60+0.0099999997764826}{100}\right)^{0.5} + \beta_4 * \left(\frac{60+0.0099999997764826}{100}\right)^{3}\right] \geq 100\text{g/day} \end{cases}$$ $$\begin{pmatrix}\beta_1 \\ \beta_4 \\ \beta_5\end{pmatrix} = \begin{pmatrix}-0.4870068 \\ 1.550984 \\ 0.012\end{pmatrix}$$	1.21 Source: (11,20)
Ischaemic heart disease WOMEN (19)	$$\ln RR = \begin{cases} (\beta_2 \frac{alc+0.0099999997764826}{100} + \beta_4 \frac{alc+0.0099999997764826}{100} \ln\left(\frac{alc+0.0099999997764826}{100}\right)), < 30.4\text{ g/day} \\ (\beta_2 \frac{30.38+0.0099999997764826}{100} + \beta_4 \frac{30.38+0.0099999997764826}{100} \ln\left(\frac{30.38+0.0099999997764826}{100}\right)) \geq 30.4\text{ g/day} \end{cases}$$ $$\begin{pmatrix}\beta_2 \\ \square \\ \beta_4\end{pmatrix} = \begin{pmatrix}1.832441 \\ \square \\ 1.538557\end{pmatrix}$$	1.39 Source: (11,20)
Cardiac arrhythmias ALL (21)	$$LnRR = 0.0074*alc$$	1.0[6]

[6] The RR reported by Samokhvalov (21) of 1.01 fell inside the range of 0.95 and 1.05 when former drinkers were not modelled. The RR for former drinkers was therefore set to 1.0.

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
Haemorrhagic stroke (mortality) MEN (22), Patra J, personal communication	$\ln RR = 0.6898937 * x$ $(\text{where } x = (\text{alc} + .0028572082519531)/100)$	1.33 Source: (1,22)
Haemorrhagic stroke (mortality) WOMEN (22), Patra J, personal communication	$\ln RR = 1.466406 * x$ $(\text{where } x = (\text{alc} + .0028572082519531)/100)$	1.15 Source: (1,22)
Haemorrhagic stroke (morbidity) MEN (22), Patra J, personal communication	$\ln RR = 0.7695021 * x$ $(\text{where } x = (\text{alc} + .0028572082519531)/100)$	1.33 Source: (1,22)
Haemorrhagic stroke (morbidity) WOMEN (22), Patra J, personal communication	$\ln RR = 0.9396292 * x^{0.5} + 0.944208 * x^{0.5} * \ln(x)$ $(\text{where } x = (\text{alc} + .0028572082519531)/100)$	1.15 Source: (1,22)
Ischaemic stroke (mortality) MEN (22), Patra J, personal communication	$\ln RR = 0.4030081 * x^{0.5} + 0.3877538 * x^{0.5} * \ln(x)$ $(\text{where } x = (\text{alc} + .0028572082519531)/100)$	1.33 Source: (1,22)

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
Ischaemic stroke (mortality) WOMEN (22), Patra J, personal communication	$\ln RR = -2.48768 * x^{0.5} + 3.7087240 * x$ $(\text{where, } x = (\text{alc} + .0028572082519531)/100)$	1.15 Source: (1,22)
Ischaemic stroke (morbidity) MEN (22), Patra J, personal communication	$\ln RR = 0.3645802 * x^{0.5} + 0.3677422 * x^{0.5} * \ln(x)$ $(\text{where, } x = (\text{alc} + .0028572082519531)/100)$	1.33 Source: (1,22)
Ischaemic stroke (morbidity) WOMEN (22), Patra J, personal communication	$\ln RR = -1.14287 * x^{0.5} + 1.680936 * x$ $(\text{where, } x = (\text{alc} + .0028572082519531)/100)$	1.15 Source: (1,22)
Unspecified liver disease (Mortality) MEN (23)	$\ln RR = \begin{cases} \ln\left(1 + \text{alc} * (1.033224 - 1)\right), \text{alc} \leq 1 \text{ g/day} \\ 2.793524 * \dfrac{\text{alc} + 0.1699981689453125}{100}, \text{alc} > 1 \text{ g/day} \end{cases}$	1.31 Source: (1,23)

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
Unspecified liver disease (Mortality) WOMEN (23)	$\ln RR = \begin{cases} \ln(1 + alc * (1.421569 - 1)) & , alc \leq 1 \text{ g/day} \\ 3.252035 \cdot \sqrt{\frac{alc + 0.1699981689453125}{100}} & , alc > 1 \text{ g/day} \end{cases}$	6.50 Source: (1,23)
Unspecified liver disease (morbidity) (23) MEN	Grams RR 0-12g 1.3 12-24g 1.3 24-36g 1.7 36-48g 2.0 48-60g 2.3 >60g 5.0	1.31 Source: (1,23)
Unspecified liver disease (Morbidity) (23) WOMEN	Grams RR 0-12g 1.4 12-24g 1.0 24-36g 2.4 36-48g 1.9 48-60g 5.9 >60g 6.1	6.50 Source: (1,23)
Low birth weight (mother's giving birth to low birth		N/A

Condition	Dose-response relationship (LnRR = log-relative risk)	RR former drinker vs life-time abstainer
weight babies) (24)	$$\ln RR = \begin{cases} \beta_1\left(\frac{0.007143020629883 + 9.7628}{10}\right)^{1/2} + \beta_2\left(\frac{0.007143020629883 + 9.7628}{10}\right) & if\ x < 9.7628 \\ \beta_1\left(\frac{0.007143020629883 + x}{10}\right)^{1/2} + \beta_2\left(\frac{0.007143020629883 + x}{10}\right) & if\ 9.7628 \leq x \end{cases}$$ $$\begin{pmatrix}\beta_1\\ \beta_2\end{pmatrix} = \begin{pmatrix}-0.2319626\\ 0.2346789\end{pmatrix}$$	
Spontaneous abortion WOMEN (25)	LnRR (Low): 1.20 LnRR (Hazardous): 1.76 LnRR (Harmful): 1.76	N/A

5. Calculation of Alcohol Attributable Fractions

5.1 Chronic partially attributable condition

Alcohol Attributable Fractions (AAFs) for chronic partially attributable conditions were based on the adjusted mean alcohol consumption in grams per day. Recent studies have used a continuous measure of alcohol consumption to estimate AAFs based on Formula 1 below. Our estimates were based on a Microsoft Excel model developed by Kelly et al (2009) (26) and adapted by Jones and Bellis (1), allowing for a discrete approximation of the continuous approach (Formula 2). We updated the Excel template obtained from Lisa Jones at Liverpool John Moores University to take account of revised RR functions where these were used in our study.

Formula 1

$$AAF = \frac{P_{abs} + P_{former} RR_{former} + \int_0^{150} P_{current}(x) RR_{current}(x) dx - 1}{P_{abs} + P_{former} RR_{former} + \int_0^{150} P_{current}(x) RR_{current}(x) dx}$$

- P_{abs} represents lifetime abstainers
- P_{former} is the prevalence of former drinkers
- RR_{former} is the RR for former drinkers
- $P_{current}$ is the prevalence of current drinkers who consume an average daily amount (x) of alcohol
- $RR_{current}$ is the RR given an average daily consumption of x

Due to the discrete categorisation of alcohol consumption into 0.1g gradations, the formula used in this study reduced to:

Formula 2

$$AAF = \frac{\sum P_i RR_i - 1}{\sum P_i RR_i}$$

- P_i = Proportion of adults in each exposure stratum *i* from 0.1 to 150g of alcohol per day.
- *RRi* = Relative risk for each exposure stratum *i* from 0.1g to 150g of alcohol per day.

We were unable to incorporate estimates of uncertainty around the AAF estimates due to a lack of information on variance estimates around RR estimates.

5.2 Acute partially attributable conditions

Alcohol is associated with an increased risk of injury and death. This is likely to be a combination of average alcohol consumption levels but also patterns of drinking and occasions of heavy drinking (8). Due to a lack of data on the number of occasions of binge drinking in a 12 month period in Scotland, it was decided not to estimate AAFs for injuries using our chosen methodological approach.

The “Global Burden of Disease, Risk Factors and Injuries study” for 2015 (GBD 2015) (27) reported AAFs for injuries attributable to alcohol for Scotland. GBD 2015 modelled the relationship between average consumption and patterns of consumption by country, year, age and sex using the DisMod-MR 2.1 modelling tool. In this study, we directly reported the GBD estimates of AAFs for injuries in Scotland in 2015. Full details of this method can be found in the GBD 2015 supplementary appendix (27).

6. Estimation of patients admitted to hospital due to alcohol

The AAF estimates were used to calculate the number of individuals aged 16 years and over who had been admitted to hospital at least once in 2015 with a condition wholly or partially attributable to alcohol. This was estimated by recording the first admission for an individual in 2015 with a diagnosis from the list of causally related conditions in Table S1 (this ensured an individual was only counted once). The total number of patients admitted for each condition were then multiplied by the respective AAF for each age-sex grouping.

7. Estimation of alcohol attributable deaths

The AAF estimates were used to calculate the number of deaths in individuals aged 16 years and over in 2015 due to conditions which were wholly or partially attributable to alcohol. AAF estimates were multiplied by the number of deaths in 2015 (January to December) for each condition, by age group and sex. For more detail see the supplementary data tables.

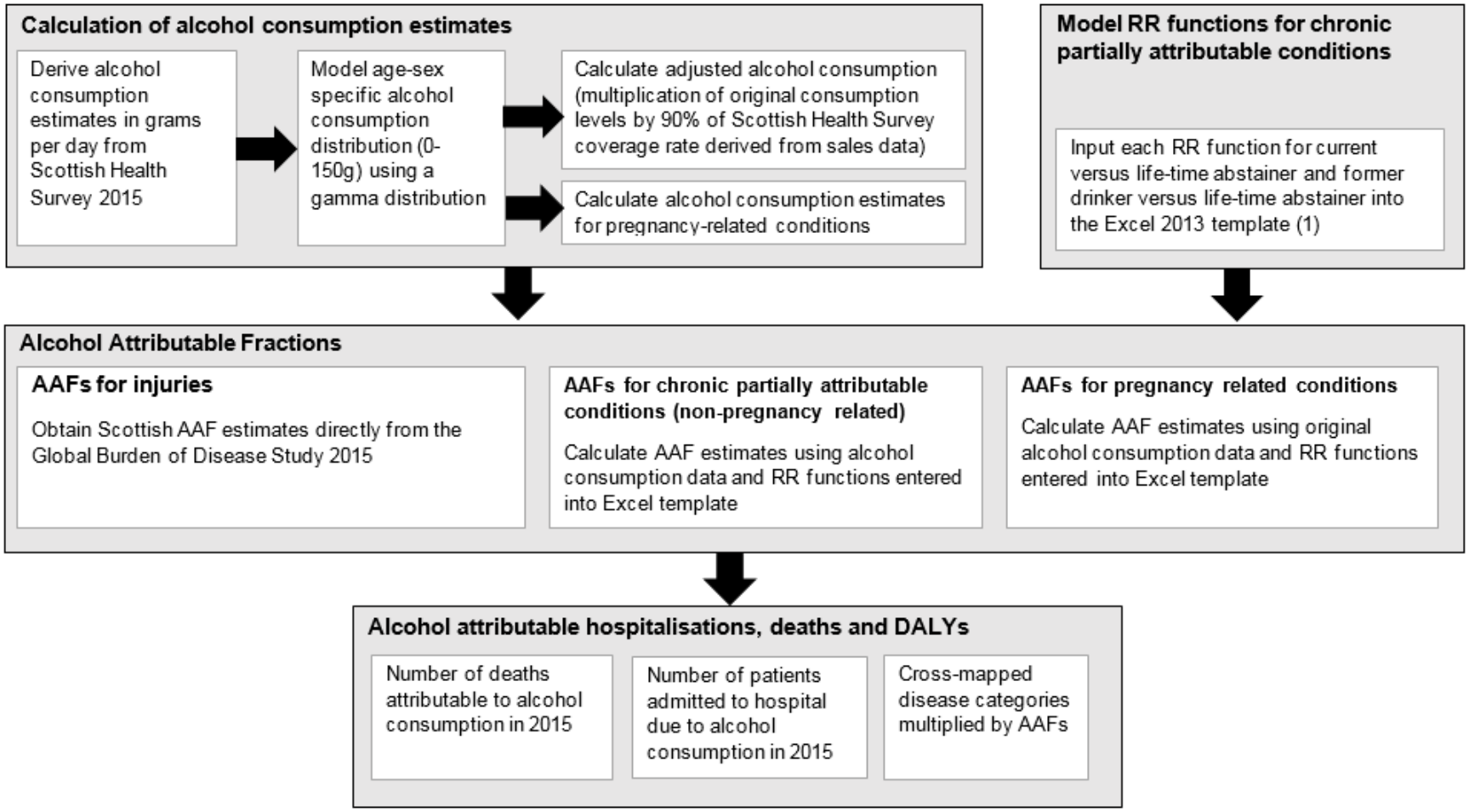
8. Estimation of alcohol attributable Disability Adjusted Life Years (DALYs)

The Scottish Burden of Disease study (SBoD) (28) uses a composite measure which combines the fatal burden of disease i.e. years of life lost due to early death (Years of Life Lost (YLL)) and the non-fatal burden of disease i.e. the number of years of healthy life lost through living with the consequences of disease (Years Lived with Disability (YLD)). The SBoD disease classifications were cross-mapped with the disease classifications used for the current study (see supplementary data tables). The total DALYs for each of the cross-mapped categories by sex and age-group were then calculated.

The total DALYs by sex and age-group for each cross-mapped condition were multiplied by the relevant AAF for each condition and sex-age grouping. This provided the attributable DALYs for each cross-mapped condition. The attributable DALYs for each condition were then aggregated to give the total alcohol attributable DALYs by each sex-age grouping. DALYs include adults from age 15 years upwards due to different age-bandings applied.

9. Summary of method

The following diagram summarises the key stages of the method used to estimate the number of patients admitted to hospital due to alcohol consumption, the number of deaths due to alcohol consumption and the number of years of life lost due to ill health or death (DALY) in 2015.



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