Alcohol-specific Deaths in Northern Ireland: Socio-Demographic Analyses

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Introduction

Northern Ireland has observed notable increases in alcohol deaths in the last two decades[1] despite increased awareness of, and the public being more educated on, the dangers of excessive alcohol consumption. In Northern Ireland, problematic alcohol use is acknowledged as being a major healthcare problem[2]. Northern Ireland has the second highest alcohol-specific death rate in the UK after Scotland[3]. Since 2012/13, there have been over 10,000 alcohol-related hospital admissions per year[4] in Northern Ireland.

The aim of this research is to advance understanding of alcohol-specific deaths in Northern Ireland, over and above annually published official statistics. The key objectives are:

- to examine recent trends in alcohol-specific[A] mortality;
- to ascertain the socio-demographic profile of alcohol-specific mortality; and
- to determine the associations of socio-demographic, health and area characteristics with alcohol-specific mortality in the Northern Ireland population.

Key Findings

- Between 2001 and 2019, male (m) mortality rates for alcohol-specific deaths have been approximately two times higher than female (f) rates. However, mortality rates for females have risen more sharply than for males since 2001, both where alcohol is the underlying cause of death (+41% m, +64% f) and where it is a contributory cause (+76% m, +124% f)
- Since 2001, the greatest increases in alcohol-specific death rates (combined underlying and contributory causes) were in persons aged 55-64 years (+64% m, +109% f) and in persons aged 65 and above (+92% m, +90% f).
- For contributory alcohol deaths in younger persons (aged 16-44 years), the main underlying causes of death were drug-related (38%) and transport accidents (18%). Older adults (aged 45+ years) with alcohol as a contributory factor in deaths had most commonly a chronic condition as the underlying cause of death e.g. circulatory (29%) and respiratory illness (16%).
- There was notable geographic variation in alcohol deaths (combined underlying and contributory causes) with higher age-standardised mortality rates (ASMRs) (per 100,000) in Belfast (59.9) and Derry and Strabane (49.2) Local Government Districts.
- There was a five-fold greater alcohol-specific (combined underlying and contributory causes) ASMR in the most deprived areas compared to the least deprived areas.
- Alcohol deaths (combined underlying & contributory causes) are observed across a range of socio-economic groups, however, after taking account of other factors, the most at-risk groups are those in households without access to a car, males, those living alone having been separated/divorced or widowed, and persons aged 45-64 years.
- After taking into account other factors, an excess risk of alcohol death (combined underlying and contributory causes) was associated with urban residence (22%) and with an indication of mental illness (20%).
- Females aged 65-74 years (compared to females aged 16-44 years) had a 42% reduced likelihood of alcohol death while males aged 65-74 years had a 23% increased likelihood of alcohol death (compared to males aged 16-44 years).

[A] See definitions on page 3

- For males, there was an increased alcohol mortality risk associated with living alone, living in socially rented accommodation, being economically inactive and urban residence. For females, limiting illness increased alcohol mortality risk while living in private rented accommodation reduced alcohol mortality risk.

Section 1 of this report examines recent trends in alcohol-specific mortality rates and assesses how mortality is distributed by age, sex and area. Section 2 uses a linked research dataset, the Northern Ireland Mortality Study[5] (NIMS), to examine how socio-demographic, health and area factors affect alcohol-specific mortality. The study aims to inform the development and evaluation of current and future public health policies and interventions, including preventive strategies in response to alcohol-specific harm. Information on methods and definitions is included in Section 2 and Annex 2.

Key Definitions

Alcohol-specific deaths are deaths resulting from health conditions that are a direct consequence of problematic alcohol use, e.g. alcoholic liver disease. This is the National Statistics definition (See Annex 2).

Alcohol deaths extend beyond those deaths which can be directly attributed to alcohol. To gain a greater understanding of the overall alcohol mortality burden in Northern Ireland, as well as reporting on where alcohol was the underlying cause of death, **contributory alcohol** deaths where an alcohol-specific ICD code (see Annex 2) was recorded anywhere on the death certificate (but not listed as the underlying cause) have been included in the analyses.

All figures and rates in this report are based on **year of occurrence** of the alcohol-specific death, as this was an appropriate means to undertake modelling based analyses. Official statistics on alcohol-specific deaths are not directly comparable to any figures included in this report, as official deaths data for all UK countries are counted on the basis of the calendar year in which the death is registered rather than the year in which the death occurred. For all alcohol deaths (underlying & contributory causes) occurring in 2018 & 2019, the median time between occurrence and registration was 9 days.

Mortality rates are used when making comparisons between population groups (for example, comparing sexes or geographies) or when comparing trends over time. Mortality rates are a measure of the frequency of occurrence of death in a particular population at risk during a particular time period.

An age-specific mortality rate allows comparison between specified age groups; it is expressed as the number of deaths per 100,000 population at risk. Five- or ten-year age group categories are commonly used (see Figure 4).

Mortality rates generally increase with age. A population with a greater proportion of older people is expected to have more deaths per population. To adjust for different age profiles in different populations (e.g. different regions or countries), statistical techniques are used to <u>adjust or 'standardise'</u> mortality rates among populations to be compared.

Age-standardised mortality rates (ASMRs) are presented per 100,000 people and are standardised to the 2013 European Standard Population.

ASMRs in Figures 1, 2A, 2B, 5 & 6 are based on ages 15-74. All other analysis (i.e. not ASMR) is based on ages 16-74 years or for all ages (Figure 4).

1 Assessing Trends in Alcohol-Specific[B] Deaths
UK Comparison

Figure 1 shows age standardised mortality rates (ASMRs) of alcohol-specific deaths[C], for UK countries in each year from 2001-2018 as well as 2019 rates for Northern Ireland and Scotland only[D].

Between 2001 and 2018, there was a 31% increase in alcohol-specific ASMRs in Northern Ireland, the biggest increase since 2001 of any UK[E] country. Over the same time period, Scotland was the only UK country to have recorded a decrease in ASMR with a 26% reduction. ASMRs for alcohol-specific deaths occurring in UK countries (per 100,000 population) for ages 15-74 years were[F]:

➢ 20.7 in 2018 for Northern Ireland, compared with 15.8 in 2001 (**+31%**);
➢ 24.7 in 2018 for Scotland, compared to 33.5 in 2001 (**-26%**);
➢ 16.6 in 2018 for Wales, compared to 13.3 in 2001 (**+25%**); and
➢ 13.3 in 2018 for England, compared to 11.0 in 2001 (**+21%**).

By 2019, Northern Ireland (23.4) had a higher rate of alcohol-specific deaths (per 100,000) than Scotland (22.6), although this difference was not statistically significant. It is noteworthy that there is considerable geographic variation within countries, e.g. higher alcoholic-specific mortality rates are observed in the North East of England compared to London[6].

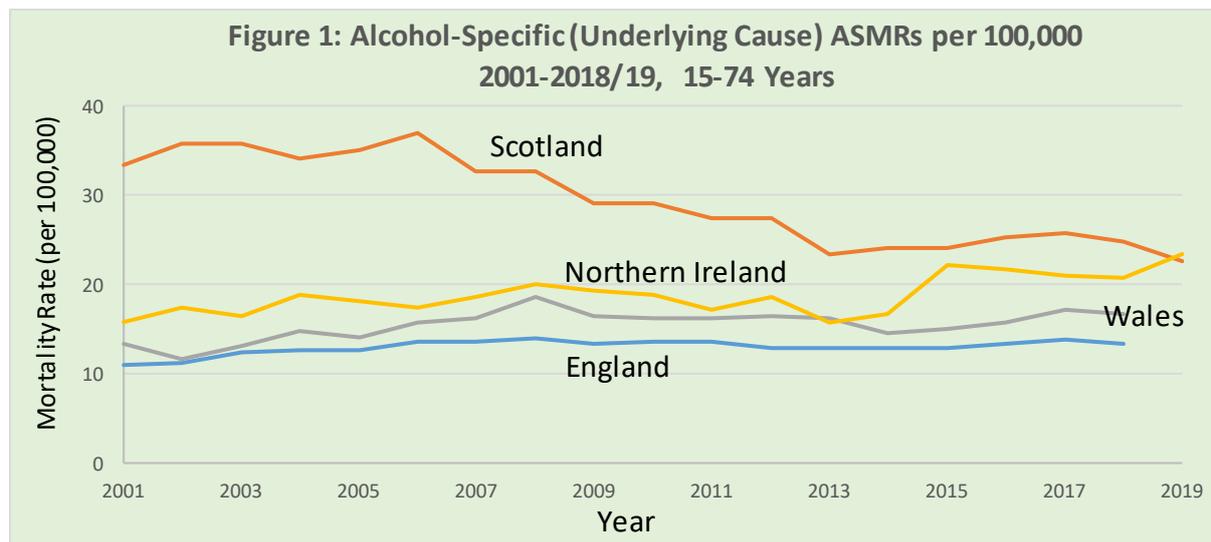**Figure 1: Alcohol-Specific (Underlying Cause) ASMRs per 100,000 2001-2018/19, 15-74 Years**

Figure 2A shows directly age standardised alcohol-specific[C] mortality rates, by sex in Northern Ireland for each year from 2001 to 2019. In 2019, alcohol-specific mortality rates were considerably higher than in 2001 for both sexes. ASMRs for alcohol-specific deaths in Northern Ireland (per 100,000 population) for ages 15-74 years were[F]:

[B] The methodology for selecting alcohol-specific deaths was revised following a consultation led by the Office for National Statistics (ONS) in 2017.
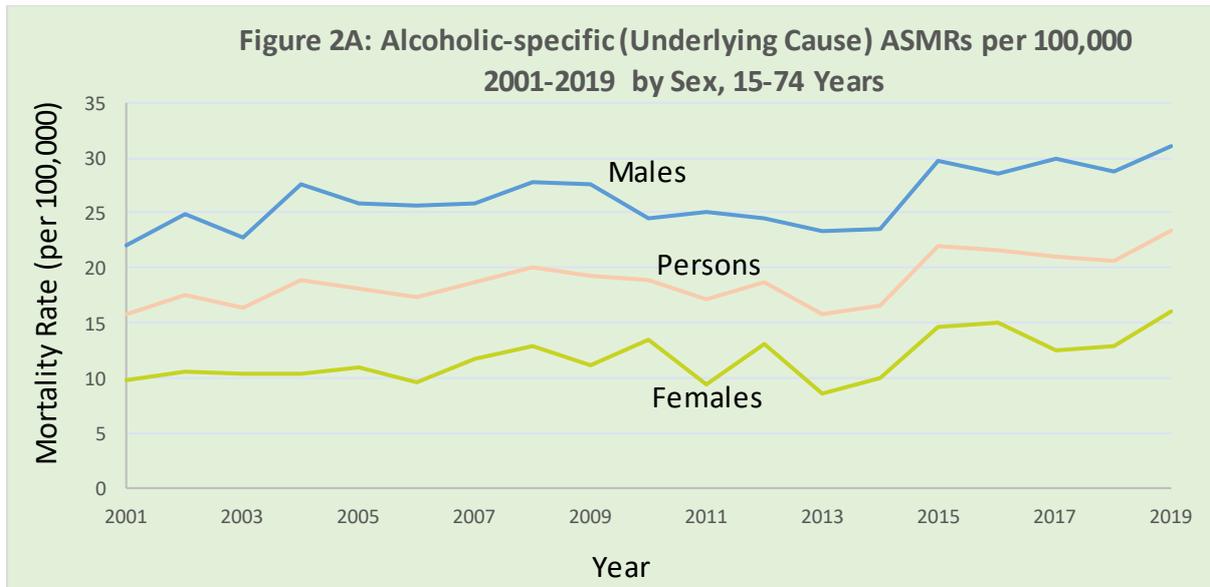[C] Where an alcohol specific death was the main underlying cause of death
[D] At the time of writing, 2019 occurrences were not available for England and Wales.
[E] Northern Ireland mid-year population estimates produced by NISRA. England and Wales data was provided by the Office for National Statistics. Data for Scotland was provided by the National Records of Scotland.
[F] All differences were statistically significant

- 23.4 in 2019 for Northern Ireland overall, compared to 15.8 in 2001 **(+48%)**;
- 31.1 in 2019 for males, compared to 22.1 in 2001 **(+41%)**; and
- 16.1 in 2019 for females, compared to 9.8 in 2001 **(+64%)**.

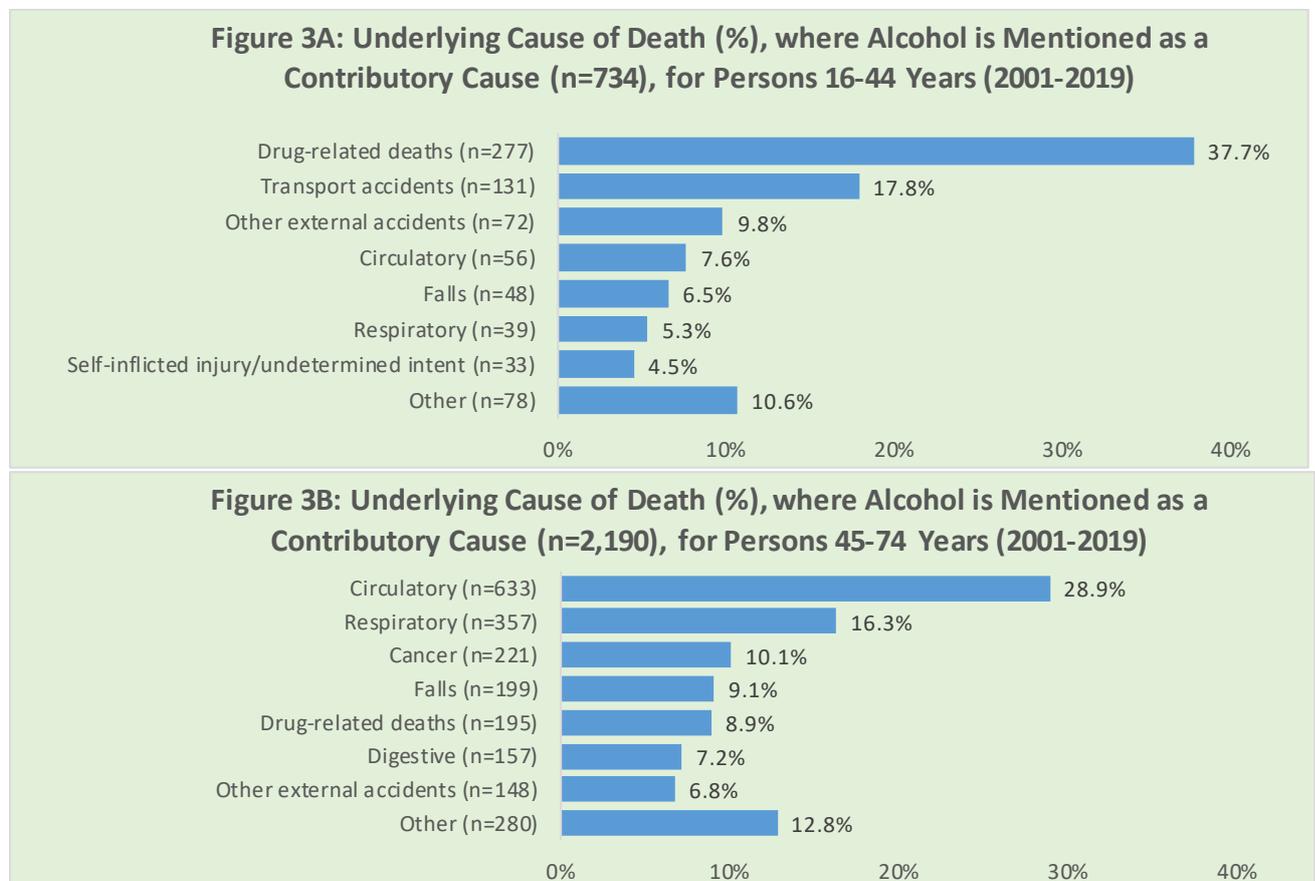Figure 2A: Alcoholic-specific (Underlying Cause) ASMRs per 100,000 2001-2019 by Sex, 15-74 Years

Deaths Identifying Alcohol as a Contributory Factor

A previous study[7] advocated consideration of a number of different mortality metrics to gain a fuller understanding of alcohol linked deaths in Northern Ireland. Northern Ireland ASMRs (per 100,000) (Figure 2B) for alcohol-specific deaths where alcohol was recorded on the death certificate as a contributory factor for ages 15-74 years were[F]:
- 16.7 in 2019 for Northern Ireland overall, compared to 8.9 in 2001 **(+88%)**;
- 25.3 in 2019 for males, compared to 14.4 in 2001 **(+76%)**; and
- 8.4 in 2019 for females, compared to 3.8 in 2001 **(+124%)**.

Figure 2B: Alcohol-specific (Contributory Cause) ASMRs per 100,000: 2001-2019 by Sex, 15-74 years
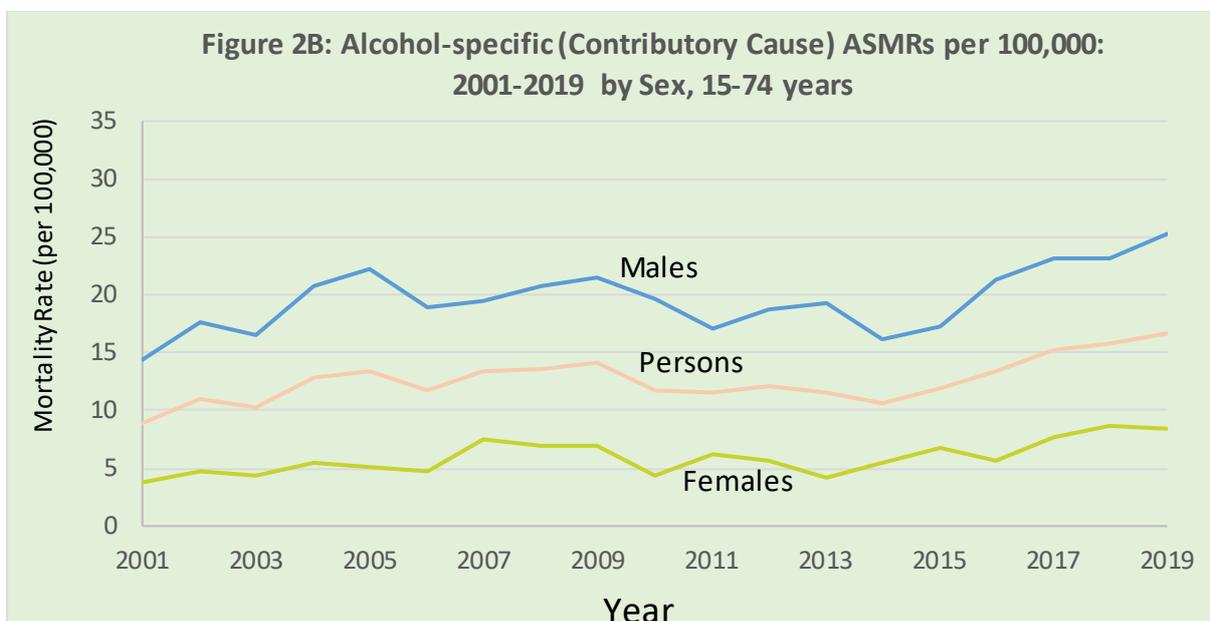
There are a wide range of diseases and injuries in which alcohol may be a contributory factor, such as cardiovascular disease, some cancers and external causes of death (accidents and self-inflicted injuries). For deaths of younger adults aged 16-44 years where alcohol was a contributory factor, the underlying causes of deaths were drug-related [G] (37.7%), transport accidents (17.8%) and other external accidents (9.8%). Older persons, aged 45-74 years, with alcohol as a contributory factor to death (Figure 3B) were more likely to have died of a chronic condition, including circulatory conditions (28.9%) (e.g. ischaemic heart disease) and respiratory illness (16.3%) (e.g. chronic obstructive pulmonary disease (COPD)).

Figure 3A: Underlying Cause of Death (%), where Alcohol is Mentioned as a Contributory Cause (n=734), for Persons 16-44 Years (2001-2019)

Cause	%
Drug-related deaths (n=277)	37.7%
Transport accidents (n=131)	17.8%
Other external accidents (n=72)	9.8%
Circulatory (n=56)	7.6%
Falls (n=48)	6.5%
Respiratory (n=39)	5.3%
Self-inflicted injury/undetermined intent (n=33)	4.5%
Other (n=78)	10.6%

Figure 3B: Underlying Cause of Death (%), where Alcohol is Mentioned as a Contributory Cause (n=2,190), for Persons 45-74 Years (2001-2019)

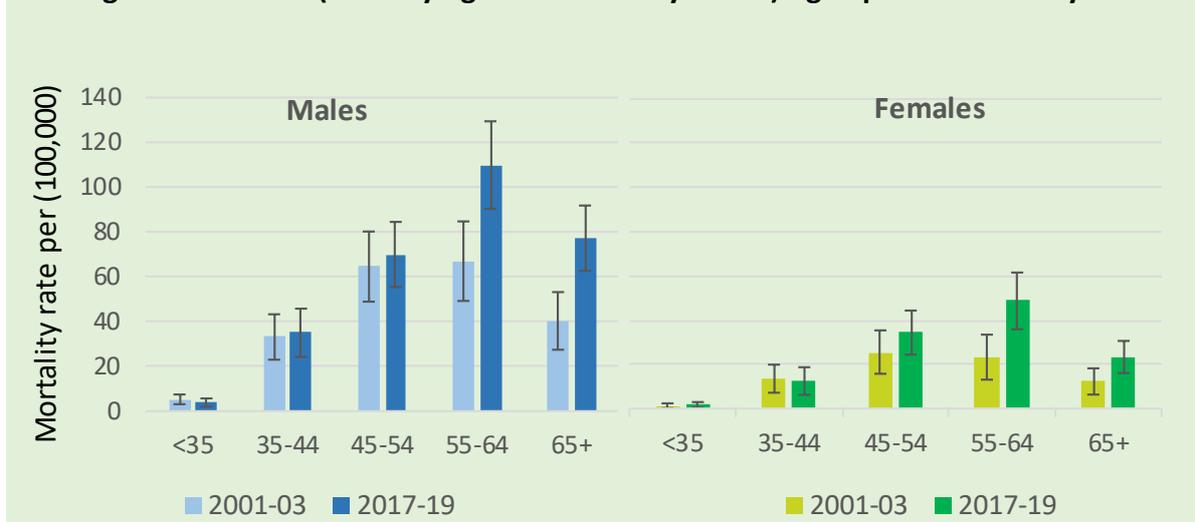| Cause	%
Circulatory (n=633)	28.9%
Respiratory (n=357)	16.3%
Cancer (n=221)	10.1%
Falls (n=199)	9.1%
Drug-related deaths (n=195)	8.9%
Digestive (n=157)	7.2%
Other external accidents (n=148)	6.8%
Other (n=280)	12.8%

Mortality Rates by Age group

Figure 4 compares age-specific rates for underlying and contributory alcohol deaths combined, by age group for 2001-03 [H] and 2017-19. In both time periods and each age group, mortality rates were higher for males than females. For both sexes, mortality rates (per 100,000) were highest among 55-64 year-olds in 2017-19 (109.9 males, 48.7 females). Between 2001-03 and 2017-19, rates in the younger age groups (<35 years and 35-44 years) remained relatively stable while there were noticeable increases for persons aged 45 years

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[G] It is worth noting that recently published official statistics[8] indicated that the proportion of all drug-related deaths that also mentioned alcohol on the death certificate decreased from 23.3% in 2018 to 16.2% in 2019. This percentage is lower than the average proportion over the previous decade, 2009-2018 (24.1%).

[H] For some sex specific age-groups, the number of deaths is too small to report a rate with reliability; therefore, rates are based on deaths occurring over three aggregated years.

and over. The biggest mortality rate increases were evident in persons aged 55-64 years (males +64%, females +109%) and in persons aged 65 and above (males+92%, females +90%).
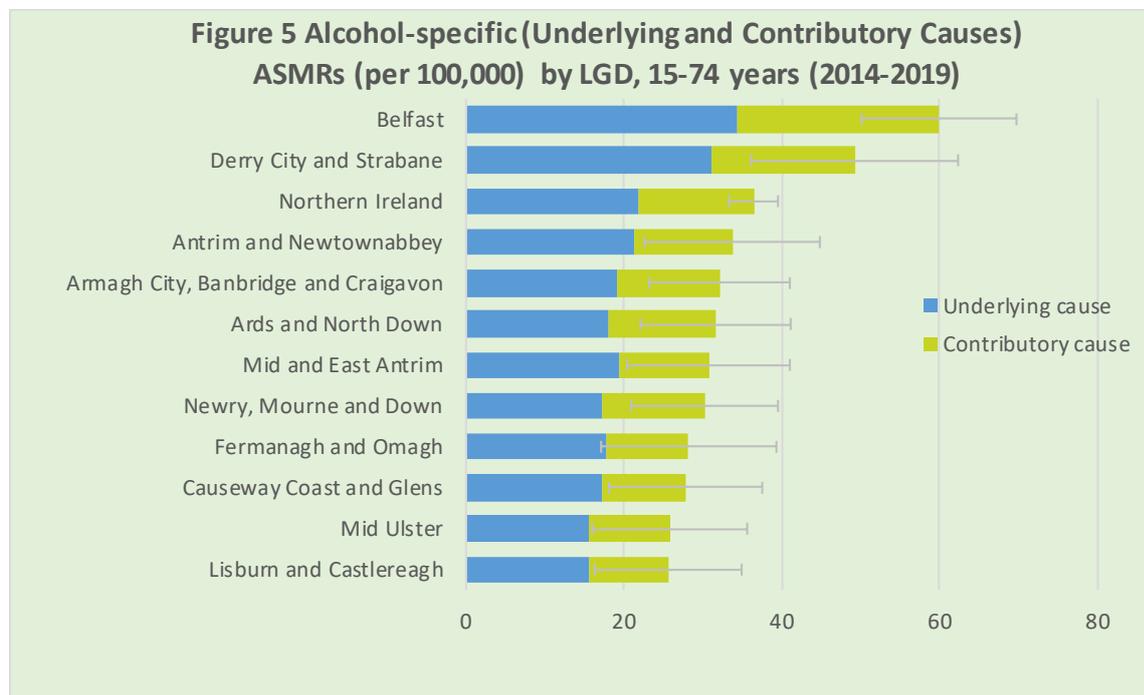
Figure 4: Alcohol (Underlying & Contributory Cause) Age-specific Mortality Rates

## Geographical Variation – Underlying and Contributory Cause

There are notable regional differences in combined underlying and contributory cause alcohol ASMRs within Northern Ireland (Figure 5) in the past 5 years, with Belfast and Derry City and Strabane Local Government Districts[9] (LGDs) recording the highest rates of 59.9 and 49.2 per 100,000 respectively, followed by Antrim and Newtownabbey LGD at 33.7. Lisburn and Castlereagh (25.6), Mid Ulster (25.8) and Causeway Coast and Glens (27.9) LGDs had the lowest alcohol-specific mortality rates. LGD-level mortality rates for both underlying and contributory causes followed broadly similar patterns with Belfast and Derry City and Strabane recording the highest rates and Lisburn and Castlereagh and Mid Ulster LGDs having the lowest mortality rates.

Figure 5 Alcohol-specific (Underlying and Contributory Causes) ASMRs (per 100,000) by LGD, 15-74 years (2014-2019)

By Area Deprivation[i]

In the last 5 years, alcohol-specific ASMRs were higher in the 20% most deprived areas in Northern Ireland for both underlying & contributory causes (5 times) and underlying causes only (4.3 times) compared to the 20% least deprived areas (Figure 6). For both underlying and contributory alcohol deaths, there were decreasing rates of mortality with decreasing levels of area level deprivation.

Figure 6: Alcohol-specific ASMRs (per 100,000) by Area Deprivation Quintile, 15-74 Years (2014-2019)
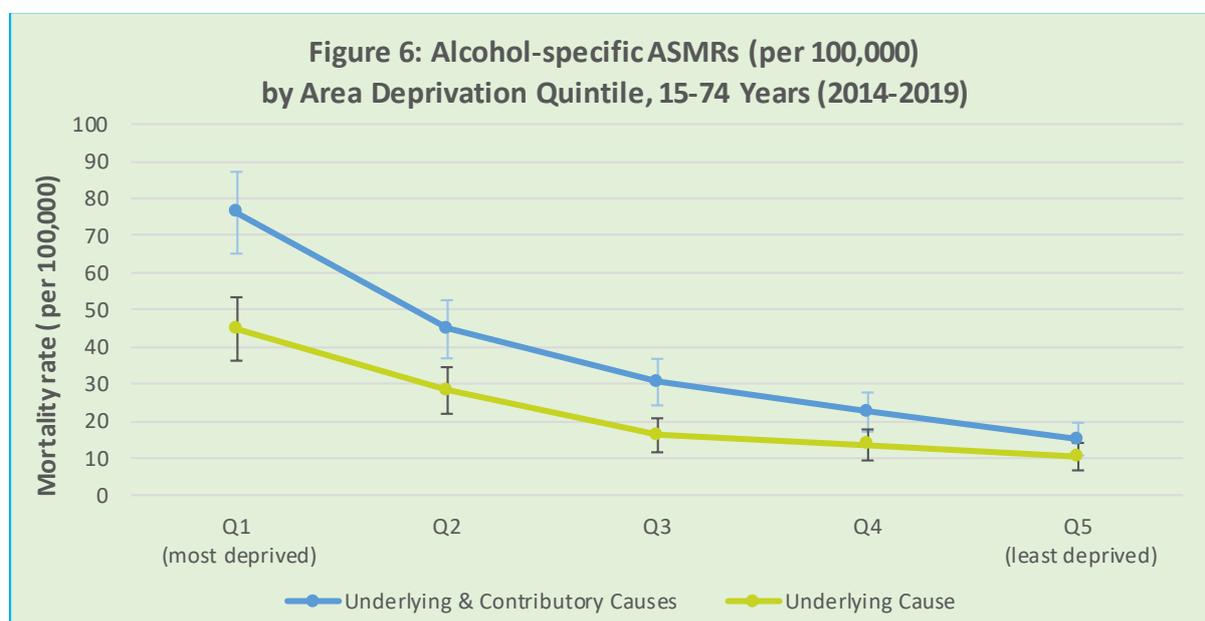
This section has examined trends in alcohol-specific deaths in recent years and shows the variation in deaths by age, sex and area. There is an established social gradient in health in Northern Ireland; lower socio-economic groups are more likely to experience poor health outcomes and die prematurely than those who are more advantaged[10]. Research quantifying the relationship between socio-economic status and alcohol-specific mortality is much less prevalent and typically based on single socio-economic indicators (e.g. age, sex and area deprivation). Little is known about the relationship between alcohol-specific deaths and other socio-economic parameters such as educational status, housing tenure and living arrangements, as these data are not collected as part of death registrations. This will be examined in Section 2.

In Section 2, a research dataset linking the Census 2011 population to subsequent deaths from 2011 through 2017 is assessed to provide further insights into alcohol deaths in Northern Ireland. Multivariate regression techniques are constructed to assess the relative contribution of individual, household and area effects on alcohol mortality in Northern Ireland. Marked increases in alcohol deaths in the last 10 years, coupled with definitional changes impacting how alcohol deaths are recorded (Annex 2) warrant an analysis of the interplay between socio-demographic factors, area and alcohol mortality.

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[i] In Figure 5, the most recently available Multiple Deprivation Measure[11] (NIMDM 2017) was used as it fell within the time period of interest (2014-2019), see Annex 2 for further detail.

Assessing Socio-demographic Associations of Alcohol-specific Mortality

Design and Setting

Analyses were undertaken using the Northern Ireland Mortality Study (NIMS[5]), a large-scale research dataset linking 2011 Census data to subsequent registered deaths from April 2011 to December 2017. The Office for Research Ethics Committees Northern Ireland (ORECNI[12]) has ratified the usage of NIMS for approved research. The NIMS dataset was accessed in the NISRA safe setting and records were rendered anonymous for analysis purposes.

The study population comprised persons aged 16-74 years, enumerated in the Census on 27 March 2011, linked to deaths registered in Northern Ireland up until December 2017 (a follow-up period of 6.75 years). Only individuals living in households were considered in order to assess the role of household-level variables, such as tenure, household composition and access to a car. Individuals in communal establishments, prisons, homeless hostels, hospitals and prisons, were therefore excluded. The study population for analyses consisted of 1.23 million records, of which 2,120 had died of alcohol-specific causes by the end of the study period. This represented 76% (2,120 out of 2,799[j]) of all alcohol-specific deaths (either main underlying cause or contributory) that occurred during this period.

Study variables

The definition of alcohol specific deaths used in the NIMS-based analyses included all deaths that were directly (underlying cause of death ~ 61%) and indirectly (contributory cause of death ~39%) alcohol-specific. This definition was chosen to capture the wider burden of alcohol mortality. Codes from the International Classification of Diseases (10th Revision, ICD-10 codes), used in UK Official Statistics, were the basis of identifying alcohol-specific deaths. Data on socio-demographic characteristics at baseline originated from Census 2011. Annex 2 provides further details on definitions and study variables. An indicator based on the official Northern Ireland Multiple Deprivation Measure[11] (NIMDM 2010 – see Annex 2 for further detail) was included in the analyses as a measure of area disadvantage.

Descriptive Analyses

The study population for analyses comprised 1,229,783 individuals aged 16-74 years at the time of Census 2011. Within this group, 2,120 people were identified as having died from an alcohol-specific death by December 2017. Data on socio-demographic, household and area factors of those who died of an alcohol specific death can provide useful insights into risk

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[j] Total underlying & contributory alcohol-specific deaths occurring during the period received from NISRA Vital Statistics Unit – see Annex 3 for additional information.

factors of alcohol-specific mortality. Table 1 provides a descriptive summary of the individual, household and area level variables among the study population at baseline compared with those who died from an alcohol specific death during the follow up period of the study. Using official mortality data, weighted proportions (Annex 3) were generated for alcohol-specific deaths to take account of under-representation of deaths for sex-specific age groups during the study period (April 2011 – December 2017) [K]. It found that:

➢ Alcohol deaths were over-represented for males (71.3% of alcohol deaths were males compared with 48.6% of males in the NI population), and for persons aged 45-64 years [L] (60.3% compared with 34.6% in the NI population).

➢ People with no qualifications (50.9% of alcohol deaths compared with 25.6% of the NI population) and the economically inactive (65.0% compared with 27.9% of the NI population) were more likely to die from an alcohol-specific cause.

➢ Higher proportions of alcohol deaths were evident in those who indicated a mental illness (27.9% versus 7.4%) and a limiting illness (61.0% versus 20.6%).

➢ In terms of household characteristics, there was a higher prevalence of alcohol deaths compared to the NI population for those living alone (46.6% versus 12.1%), those in social rented accommodation (40.1% versus 13.1%) and for those in households without access to a car (52.4% versus 14.2%).

➢ Higher proportions of alcohol deaths were evident for those who lived in urban areas (78.0% versus 63.4%), for individuals living in the top 20% of deprived areas (35.0% versus 18.9%) and for residents of Greater Belfast [M] Local Government District (41.3% versus 33.7%).

Living Arrangements

Living arrangements were derived by combining marital status (married, never married, separated, divorced, widowed) with living status (living in a couple, living alone, or live 'other'). The live 'other' category includes cohabiting individuals not part of a couple, for example, living with friends or with other family members (e.g. as part of a multi-generational household). The derived living arrangements variable comprised 6 groups:

1) Live in a couple (either married or never married)
2) Live in a couple (separated/divorced or widowed)
3) Live alone (never married)
4) Live alone (separated/divorced or widowed)
5) Live with friends/family (married or never married)
6) Live with friends/family (separated/divorced or widowed)

Lone parents could be included in either group 5 or 6 depending on reported marital status. In a multi-generational household - a married grandparent would be included in group 5 while a widowed grandparent would be included in group 6.

[K] Weighted proportions are generated using age at death for the research dataset and official mortality data
[L] Age groups presented reflect age at baseline.
[M] Greater Belfast encompasses Belfast, Antrim & Newtownabbey and Lisburn & Castlereagh Local Government Districts[8]

Table 1 Distribution of Socio-demographic and Health Determinants of the (i) Study Population and (ii) Among those who Died of an Alcohol-specific Cause, Ages 16-74 Years

			(i) Study Population (%) (n=1,229,783)	(ii) Weighted [N] Alcohol specific deaths (%) (n=2,120)
Demographic	Sex	Male	48.6	71.3
		Female	51.4	28.7
	Age	16-44	53.9	27.2
		45-64	34.6	60.3
		65+	11.4	12.5
	Religious Affiliation	Catholic	44.6	47.8
		Protestant	50.1	47.8
		Other/none/unknown	5.2	4.4
Individual	Educational Attainment	Degree level or higher	24.9	12.3
		School level or other (intermediate [O])	49.5	36.8
		No qualifications	25.6	50.9
	Economic Activity	Employed incl. student	67.1	26.5
		Unemployed	4.9	8.5
		Inactive	27.9	65.0
	Mental Illness	No	92.6	72.1
		Yes	7.4	27.9
	Limiting Illness	No	79.4	39.0
		Yes	20.6	61.0
Household and Area Level	Living Arrangements	Live in couple - married/ never married	53.3	27.7
		Live in couple - separated/divorced/widowed	1.7	2.9
		Live alone – never married	6.3	20.0
		Live alone - separated/divorced/widowed	5.8	26.6
		Live with friends/family - married/never married	27.0	12.3
		Live with friends/family - separated/divorced/widowed	5.9	10.5
	Housing Tenure	Owner occupied	73.9	44.7
		Private rental	13.0	15.2
		Social rental	13.1	40.1
	Number of Cars [P]	None	14.2	52.4
		1	35.4	31.5
		2 or more	50.4	16.0
	Local Government District [Q]	Greater Belfast	33.7	41.3
		Derry City and Strabane	8.1	10.5
		Rest of Northern Ireland	58.3	48.2
	Urban Residence [R]	Urban	63.4	78.0
		Rural	36.6	22.0
	Area Deprivation [S]	Quintile 1 (Most deprived)	18.9	35.0
		Quintile 2	20.1	23.9
		Quintile 3	20.5	18.3
		Quintile 4	21.1	12.8
		Quintile 5 (Least deprived)	19.4	10.0

There were some notable sex differences in mortality attributed to some socio-demographic factors (Annex 4, Table 4). There were higher proportions of alcohol deaths in males (compared to females) for those who were single & living alone (23.9% versus 10.4%), living in private rented accommodation (16.7% versus 11.5%), living in households without access to a car (53.9% versus 48.8%) and among those who had no formal qualifications (52.4%

[N] Weighted by age and sex to take account of under-representation of alcohol-specific deaths in the research dataset (Annex 3).
[O] School level qualification or other vocational qualification or apprenticeship.
[P] A proxy for income.
[Q] Greater Belfast encompasses Belfast, Antrim & Newtownabbey and Lisburn & Castlereagh Local Government Districts[9].
[R] Based on official NISRA settlement report[13].
[S] Derived from the Multiple Deprivation Measure (NIMDM 2010[11]).

versus 47.3%). There were higher proportions in females (compared to males) for, ages 45-64 years (64.4% versus 58.6%), degree-level educated (16.1% versus 10.8%), living in owner occupied accommodation (51.8% versus 41.9%), those living in a couple [T] (37.0% versus 28.1%), and for females who were either separated, divorced or widowed and who were living with friends/family (16.9% versus 7.9%).

Assessing the Impact of Individual, Household and Area Factors on Alcohol-specific Deaths - Regression Analyses

Cox regression (proportional hazards regression) methods[14], a standard approach for analysing NIMS data, were used to estimate the risk of mortality from an alcohol-specific cause. The main advantage of regression models is their ability to assess the effect of several variables simultaneously on an outcome. An initial analysis examined the impact of each individual predictor variable, adjusted for age and sex[15]. Weaker predictor variables (p>0.2) were then removed and the model was re-run for Northern Ireland overall (Model 1) and separately for males and females (Model 2).

Results

Significant predictors from Model 1 are summarised in Figure 7 with full results presented in tabular form in Table 5 (Annex 5). For Northern Ireland overall, after adjusting for all predictor variables in the model:
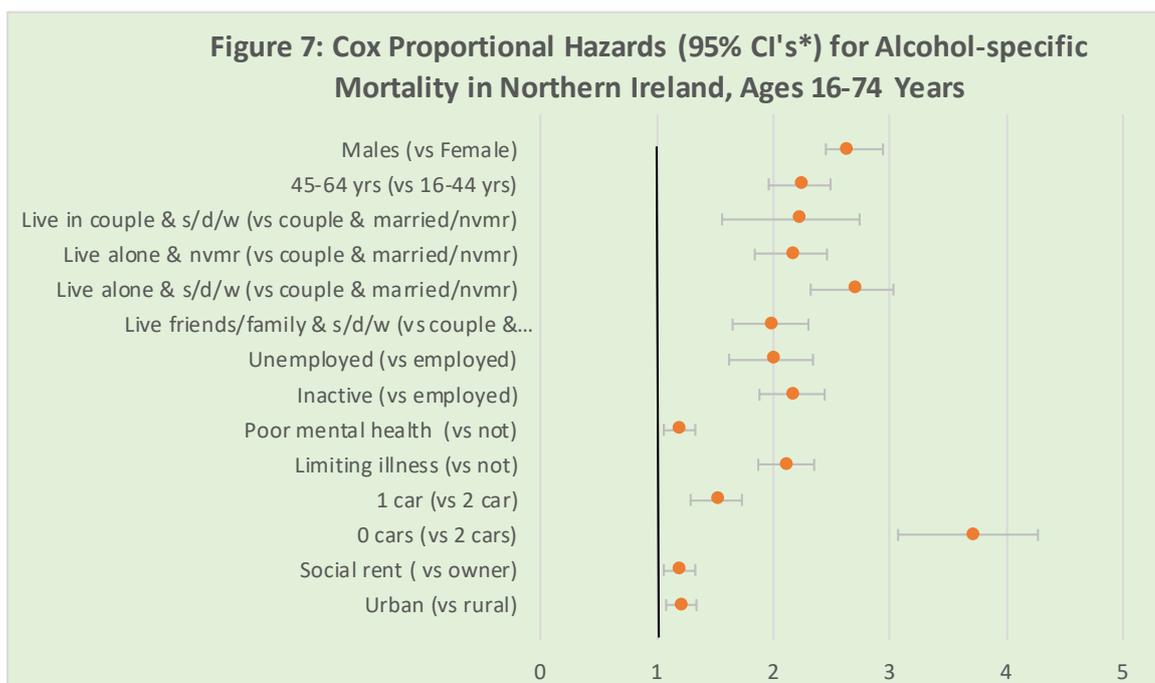
➢ Males had over two times greater risk (HR: 2.64) of alcohol-specific death compared with females.
➢ Compared with persons 16-44 years, there was a two-fold greater likelihood of alcohol-specific death for persons aged 45-64 years (HR: 2.24).
➢ Relative to being employed, there was a two-fold increased risk of alcohol specific death for those who were inactive (HR: 2.18) or unemployed (HR: 2.01).
➢ An indication of limiting illness (HR: 2.12 times) and of a self-reported mental illness (20%) increased the likelihood of alcohol-specific death.
➢ Compared with two or more cars, having no access to a car carried over three times (HR: 3.72) greater risk of alcohol death while those having access to one car had a 53% greater likelihood of alcohol-specific death.
➢ Urban residence (compared to rural residence) and social renting (compared to owner occupied accommodation) indicated a 22% and 20% respective greater likelihood of an alcohol-specific death.

Compared to living in a couple (either married or never married)
➢ There was a greater risk of alcohol-specific-death for never married persons living alone (HR 2.17).
➢ There was a two-fold greater likelihood of alcohol specific death associated with being separated/divorced/widowed (s/d/w) when combined with living alone (HR: 2.70), living in a couple (HR 2.23), or living with friends/family (HR: 2.00).

[T] Proportions reflect all marital status categories included married, never married, separated, divorced and widowed

Figure 7: Cox Proportional Hazards (95% CI's*) for Alcohol-specific Mortality in Northern Ireland, Ages 16-74 Years

*Confidence Intervals that do not cross 1 are statistically significant.
Nvmr – never married. S/d/w = separated/divorced/widowed.

The hazard ratio (HR) is a likelihood ratio from the Cox proportional hazards modelling. The other categories of the variable are compared against the reference category to derive the hazard ratio(s). The reference category is typically selected as being the category with the lowest proportion of alcohol-specific deaths and will always have a HR of 1.

- A HR of 1 for the comparison group indicates no difference between the reference category and the comparison group.
- A HR of greater than 1 indicates that the comparison group is more likely to experience an alcohol-specific death compared to the reference group.
- A HR of less than 1 indicates that the comparison group is less likely to experience an alcohol-specific death compared to the reference group.

Sensitivity analyses A sensitivity analysis was performed by running a separate Cox Proportional Hazard model to examine risk of alcohol as underlying cause of death only. The sensitivity analyses yielded very similar results to the model for combined underlying and contributory alcohol-specific causes (Model 1, Figure 7) with comparable HRs for all predictor variables (results available from authors on request).

Sex Differences in Alcohol-Specific Mortality

Separate models for males and females were run as significant interaction effects between gender and socio-economic factors has been previously shown to be important when analysing alcohol-mortality risk[16]. After <u>adjusting for all predictor variables in the model</u>, results for females and males were broadly similar to the Northern Ireland (NI) model, however, there were some notable [U] differences between sexes (Figure 8). Full modelling results are presented in tabular form in Table 5, Annex 5.
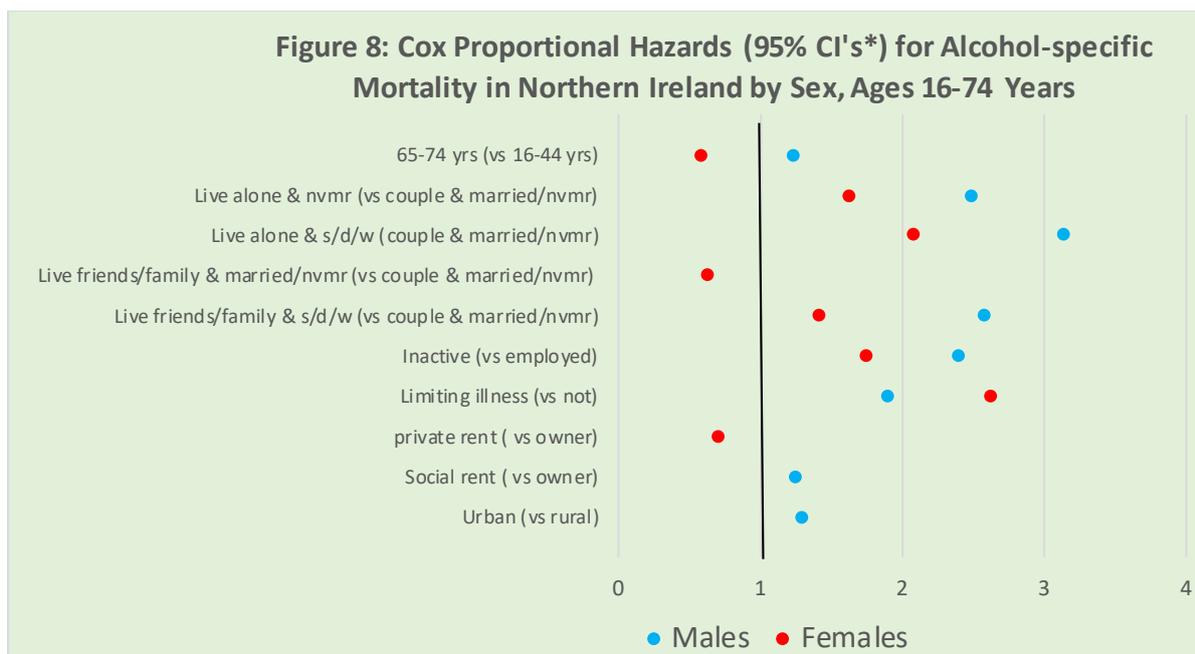
- Compared to females aged 16-44 years, females aged 65-74 years had a 42% reduced likelihood of alcohol-specific death (HR: 0.58). In contrast, males aged 65-74 years had a 23% increased likelihood (HR 1.23) of alcohol-specific death (compared to males aged 16-44 years).

- An indication of limiting illness had a greater risk of alcohol-specific death for females compared to males (HRs: 2.62 versus 1.90). Males indicated a higher risk of alcohol death compared to females associated with being economically inactive (HRs: 2.39 versus 1.74).

- Urban residence (compared to rural residence) and social renting (compared to owner occupied accommodation) indicated a 29% and 24% respective greater likelihood of an alcohol-specific death in males only. Private renting (compared to owner occupied accommodation) indicated a 30% reduction in alcohol-specific deaths for females only (HR: 0.7).

<u>Compared to living in a couple (either married or never married)</u>
- There was a greater risk of alcohol-specific-death for never married males who lived alone (HRs: 2.48 males, 1.62 females).

- Males who were either separated, divorced or widowed had a greater likelihood of alcohol-specific death if living alone (HRs: males 3.14, females 2.07) or living with friends/family (HRs: males 2.58, females 1.41)

- Being married or never married and living with friends/family indicated a 37% reduction in alcohol-specific deaths for females only (HR: 0.63)

[U] Significant differences in effects by sex were tested by including interaction terms between sex (male/female) and all other predictor variables in separate models (results available form authors on request).

Figure 8: Cox Proportional Hazards (95% CI's*) for Alcohol-specific Mortality in Northern Ireland by Sex, Ages 16-74 Years

Nvmr – never married. s/d/w = separated/divorced/widowed.

Age-stratified Analyses

Section 1 (Figures 3A & 3B) showed that where alcohol was a contributory factor, drug-related deaths, transport accidents and other external accidents accounted for nearly two-thirds (65.4%) of deaths for persons younger than 45 years of age. For persons aged 45 years and above, alcohol contributory deaths were closely associated with the presence of chronic conditions likely to have developed over time. Results from Models 1&2 highlighted the magnitude of alcohol mortality risk across all age groups. To further examine the impact of age on alcohol mortality risk, modelling (Model 3) was undertaken to assess the influence of individual, household and area factors on alcohol mortality for (i) persons aged 16-44 and persons aged 45-74 years. Significant predictors from Model 3 are presented in Figures 9A & 9B (See Annex 6).

For persons under 45 years, the most significant predictors for alcohol-specific mortality were:

Living alone & separated/divorced/widowed (versus living in a couple & married / never married) HR: 3.59; having no access to a car (versus having two or more cars) HR: 3.57; living alone & never married (versus living in a couple & married/ never married) HR: 3.07; economic inactivity (versus in employment) HR: 2.44; & male (versus female) HR: 2.22.

For persons aged 45 years and over, the most significant predictors for alcohol-specific mortality were:

Having no access to a car (versus having two or more cars) HR: 3.77; male (versus female) HR: 2.67; Living alone & separated/divorced/widowed (HR: 2.58) & living in a couple & separated/divorced/widowed (HR: 2.16); limiting illness HR: 2.04 & never married persons living alone HR 2.02.

Conclusion

Alcohol-specific mortality rates in Northern Ireland in 2019 have increased by nearly 50 per cent in Northern Ireland since 2001. While males are approximately twice as likely to die from an alcohol-specific cause compared to females, mortality rates for females have risen more sharply than males since 2001. The greatest increases in alcohol mortality rates were evident among persons aged 45-64 years.

Both alcohol-specific mortality rates, where each death is a direct consequence of alcohol misuse, and mortality rates for deaths where alcohol has been identified as a contributory factor, have generally been increasing over the last twenty years in Northern Ireland. Younger adults (aged 16-44 years) were more likely to have alcohol recorded as a contributory factor to death associated with potential risk taking behaviour involving drugs, road traffic accidents and other external accidents. In older adults (45-74 years), alcohol as a contributory factor to death was often associated with presence of a chronic condition including circulatory and respiratory illness and cancer which can be linked to harmful alcohol consumption[17].

After simultaneously examining a range of factors as independent predictors of alcohol mortality, many indicated an increased mortality risk. These included individual factors (age, being male, economic inactivity & unemployment), household factors (social renting, having no access to a car (both proxies for low income) and living arrangements), and an area factor (urban residence). Limiting illness was also strongly associated with alcohol-specific death, however, the direction of the relationship is unclear, as limiting illness can contribute to increased alcohol consumption[18] while individuals who have problematic alcohol use have a known increased risk of limiting illness[19].

Age is a major determinant of alcohol mortality with those aged 45-64 years at greatest risk. Older males aged 65-74 indicated an excess mortality risk while females aged 65-74 years had a reduced mortality risk. Age-stratified analyses (comparing individuals aged 16-44 years with those aged 45-74 years) indicated that being previously separated, divorced or widowed was an important risk factor for younger adults (16-44 years) living alone. For older adults (45-74 years) being separated, divorced or widowed was associated with increased alcohol risk irrespective of living status, although problematic alcohol use can also precede relationship breakup[20].

A social gradient has been observed in alcohol harm across the UK despite similar levels of alcohol consumption across different socio-economic groups[21]. Lower socio-economic groups are disproportionately impacted by the damaging effects of alcohol[21,22] which are linked to a range of social factors including poverty and loneliness, often prevalent in later life, as well as environmental factors including diet, smoking and access to health services. Alcohol-specific mortality rates in Northern Ireland's most deprived areas are more than five times higher than in the least deprived areas, however, our research findings confirm earlier work in Northern Ireland[7] showing that higher levels of alcohol mortality in deprived areas can be attributed to the characteristics of individuals living in the most deprived areas.

Research findings are based on a time period prior to the Covid-19 pandemic, however, Covid-19 related restrictions and the heightened economic uncertainty resulting from the pandemic have presented unique social challenges and may have exacerbated existing social inequalities in Northern Ireland. Reducing inequalities and addressing high levels of economic inactivity, poverty and social disadvantage are all central to the draft Programme for Government in Northern Ireland[23] which sets out to achieve positive outcomes and life chances for the people of Northern Ireland.

Reducing the harmful consequences of alcohol dependence through prevention of harm has been central to the Northern Ireland New Strategic Direction for Alcohol and Drugs Phase 2[24], and the publication of a successor strategy is outlined as a priority for the NI Executive in the 'New Decade, New Approach' deal[25]. In the year following publication of the successor strategy [v], the Health Minister in Northern Ireland has committed to a public consultation on the introduction of minimum unit pricing (MUP). Following the introduction of MUP [w] in Scotland in 2018, alcohol deaths decreased by 10% between 2018 and 2019[26], however, yearly fluctuations in mortality are commonplace and it will take a number of years to accurately evaluate the impact of MUP in Scotland[27].

This study has several **strengths**. The study used high quality data from a large cohort study linked to deaths registrations, allowing a robust examination of sub-populations and geographical variability in relation to alcohol-specific deaths in Northern Ireland. The study is longitudinal and based on the general population, and therefore results reflect population level impact and social differentials in alcohol-specific mortality.

This study has a few **limitations**. Firstly, the study didn't take into account any changes in socio-economic and household factors after Census 2011. Official registration data on alcohol-specific mortality in Northern Ireland is considered accurate, although it cannot be ruled out that death certificates can sometimes fail to record the contribution of drinking to cause of death. The linked coverage of alcohol-specific deaths over the study period is 76% and individuals living in communal establishments, including hostels, hospitals, and prisons were excluded. Study results are, therefore, likely to understate the role of socio-economic determinants on alcohol-specific deaths as hard-to-reach groups and some of those with the most harmful alcohol consumption patterns may have been excluded. Despite these limitations, the results extend our understanding of alcohol-specific mortality risk in the Northern Ireland population.

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[v] At the time of writing, the successor strategy, 'Preventing Harm & Empowering Recovery' is open for public consultation (30 October 2020.- 05 February 2021)
[w] A minimum price of 50p per unit was introduced in Scotland on 1 May 2018

There are further record linkage opportunities for researching alcohol related outcomes in Northern Ireland involving data on hospital admissions, prescriptions, offending, and social security benefits. Understanding the long term impact of the Covid-19 lockdown on alcohol consumption and on the relationship between poverty and alcohol dependence is required, while achieving a greater understanding of the factors associated with alcohol, drugs and suicide deaths in persons under 45 years is also warranted. This report quantifies the socio-economic determinants of alcohol-specific deaths in Northern Ireland and should assist policy makers in their ongoing development of prevention strategies.

About ADR UK[30] and ADR-NI

ADR UK (Administrative Data Research UK) is a partnership transforming the way researchers access the UK's wealth of public sector data, to enable better informed policy decisions that improve people's lives. ADR UK is made up of three national partnerships (ADR Scotland, ADR Wales, and ADR NI) and the Office for National Statistics (ONS). It is funded by the Economic & Social Research Council which is part of the UK Research and Innovation.

Administrative Data Research Northern Ireland (ADR NI) is a partnership between the Administrative Data Research Centre Northern Ireland (ADRC NI, comprising Queen's University Belfast and Ulster University), and the Northern Ireland Statistics and Research Agency (NISRA). Together they support the acquisition, linking and analysis of administrative data sets, developing cutting-edge research to improve knowledge, policymaking and public service delivery.

Feedback: Your comments and suggestions are welcome and will assist ADR NI in continuously developing research outputs. Please send your comments to:

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Annex 2 Data and Definitions

All figures in this document refer to **Alcohol-specific deaths** defined using the 10th edition of the International Classification of Disease Codes[31] (ICD-10 codes). The methodology for selecting alcohol deaths was revised in 2017, following a consultation led by the Office for National Statistics (ONS) to develop a UK-wide definition. ICD-10 codes included in the new and old definitions are outlined below.

Table 2A Conditions Included in the New Definition of Alcohol-specific Deaths and the Previous Definition of Alcohol-related Deaths

Condition	ICD-10 Code	Alcohol-specific (new definition)	Alcohol-related (old definition)
Wholly attributable conditions			
Alcohol-induced pseudo-Cushing's syndrome	E24.4	X	
Mental and behavioural disorders due to use of alcohol	F10	X	X
Degeneration of nervous system due to alcohol	G31.2	X	X
Alcoholic polyneuropathy	G62.1	X	X
Alcoholic myopathy[2]	G72.1	X	
Alcoholic cardiomyopathy	I42.6	X	X
Alcoholic gastritis	K29.2	X	X
Alcoholic liver disease	K70	X	X
Alcohol-induced acute pancreatitis[2]	K85.2	X	
Alcohol-induced chronic pancreatitis	K86.0	X	X
Fetal alcohol syndrome (dysmorphic)[2]	Q86.0	X	
Excess alcohol blood levels[2]	R78.0	X	
Accidental poisoning by and exposure to alcohol	X45	X	X
Intentional self-poisoning by and exposure to alcohol	X65	X	X
Poisoning by and exposure to alcohol, undetermined intent	Y15	X	X
Chronic hepatitis, not elsewhere classified	K73		X
Fibrosis and cirrhosis of liver	K74.0-K74.2, K74.6-K74.9		X

Table 2B ICD-10 Codes Used to Categorise Main Underlying Cause of Death Categories where Alcohol was a Contributory Cause (Figures 3A & 3B)

Condition	ICD-10 Code
Drugs	F11-F16, F18-F19, X40-X44, X60-X64, X85, Y10-Y14
Self-inflicted Injury (excluding drugs)	X66-X84, Y87.0
Undetermined Intent (excluding drugs)	Y15-Y34, Y87.2
Road Transport Accidents	V01-V99
Other external Accidents	W20-W99 & X00-X39, X46-X59
Cancer	C00-D48
Circulatory	I00 – I99
Respiratory	J00 – J99
Digestive System	K00-K93
Falls	W00-W19

Cox Proportional Hazards Regression is a time-to-event analysis (or survival analysis) assessing the time from the start of a study to an event (e.g. alcohol-specific death). The Cox proportional hazards model is a multiple regression analysis method employed in time-to-event or survival analysis to estimate the effect of a number of covariates or predictor variables on the time until death[14]. The Cox proportional hazards model is more appropriate than a logistic regression[32] to model the risk of death from a given cause as it accounts not only for whether the individual dies from this disease but also the timing of the death, and death from other causes. Very similar hazard ratios were obtained when running the analyses using logistic regression models.

Censoring involves an alcohol specific death coded as 0 if the respondent did not die or died from other causes. Time to death or to 'censoring' was defined as the number of months from baseline (Census 2011) to death or to the end of the year 2017.

Variable Selection: All Northern Ireland residents were initially analysed to examine the impact of each individual predictor variable, adjusted for age and sex. Weaker predictor variables ($p > .05$) were then removed from the initial selection of models and the model was rerun to examine all remaining predictors variables simultaneously.

Hazard Ratio is a likelihood ratio from the Cox proportional hazards modelling. The other categories of the variable are compared against the reference category to derive the hazard ratio(s). The reference category will always have a HR of 1.

- A HR of 1 for the comparison group indicates no difference between the reference category and the comparison group.
- A HR of greater than 1 indicates that the comparison group is more likely to experience an alcohol-specific death compared to the reference group. For example, a HR of 1.64 for living alone (compared to living in a couple) indicates that there is a 64% greater likelihood of an alcohol-specific death from living alone compared to living in a couple.
- A HR of less than 1 indicates that the comparison group is less likely to experience an alcohol-specific death compared to the reference group. For example, a HR of 0.6 for students (compared to being employed) would indicate that there is a 40% less likelihood of an alcohol-specific death among students compared to being employed.

The hazard ratios shown in the '*fully adjusted model*' where each explanatory variable had been examined or adjusted for the other explanatory variables i.e. the effect of one individual variable on alcohol mortality when all other explanatory variables are held constant.

95% Confidence Intervals (CI's) are a range of likely values around the hazard ratio. CI's that do not cross 1 are statistically significant while CI's that do cross 1 are not statistically significant.

Proportionality assumption: Proportional hazard assumptions were graphically checked for each explanatory variable included in the models. When deriving a hazard ratio, it is assumed that the ratio of the rates of death between the two categories is constant, that is, that they are proportional during follow-up.

Limiting Illness was derived from the following questions "Are day-to-day activities limited because of a health problem or disability which has lasted, or is expected to last, at least 12 months?". The available responses were; 'No', 'limited a little' and 'limited a lot'.

The presence of **mental ill health** was based on the following question in the 2011 Northern Ireland Census: "*Do you have any of the following conditions which have lasted, or are expected to last, at least 12 months*?". Respondents ticked all categories from the list provided and mental health status was identified if respondents ticked the category, '*an emotional, psychological or mental health condition (such as depression or schizophrenia)*".

Local Government District (LGD) is an area of residence variable. Greater Belfast included residency at baseline in Belfast, Antrim & Newtownabbey and Lisburn and Castlereagh Local Government Districts[9].

The **Northern Ireland Multiple Deprivation Measure (NIMDM)** identifies seven separate domains of deprivation and an overall summary measure. In section 1, to report on the trend in alcohol deaths from 2014-2019, the overall NIMDM 2017[11] domain for was used to assign individuals into one of five equal groups (or quintiles) ranging from most deprived to least deprived, based on their usual address of residence. In section 2, the NIMDM 2010[10] income domain was used to assign individuals to equivalent quintiles. The 2010 based NIMDM measure was included in the modelling analyses in Section 2 given it was based on data sources relating to a time period aligned with Census 2011 (i.e. the source for baseline characteristics in the modelling analysis).

Urban/Rural Residence: Eight Settlement Bands (A-H) based on the 2011 Census population were used to classify settlements[13]. Settlements with a population of greater than or equal to 5,000 people were classified as 'urban' while settlements with a population of less than 5,000 people were classified as 'rural'.

Economic Activity comprised 3 groups: employed (including students), unemployed and the economically inactive. The economically inactive included those who are long term sick, people looking after their family and home, a small number of people who are retired before 65 and people who are inactive for other reasons such as temporarily sick, injured and discouraged workers. There were an insufficient number of deaths to provide analyses in the report for each of the economic activity classifications.

Annex 3- Exclusions

Individuals living in communal establishments were excluded from the analyses due to non-response at the household level and they would be little influenced by area level factors. Other individuals were excluded due to non-response (either missing or edited) in the variables limiting long term illness, urban residency or highest level of education. These exclusions resulted in 82 alcohol-specific deaths (main underlying or contributory cause) being omitted from the analytical dataset. The resulting cohort available for analyses comprised 1,229,783 individuals aged 16-74 years at the time of the Census 2011.

Official statistics indicated that there were a total of 2,799 alcohol-specific deaths occurring between April 2011 and December 2017, either directly (main underlying cause of death was alcohol-specific) or indirectly (contributory cause of death was alcohol-specific) alcohol-specific. On the research dataset, 2,120 people were identifiable as having died from an alcohol-specific death between April 2011 and December 2017. The difference (679 deaths) between the registered number of alcohol-specific deaths and alcohol-specific deaths identified on the research dataset is due to a number of reasons including migration and differences in personal attributes (e.g. name, date of birth and address) as well as non-enumeration of Census 2011 records. A weighting adjustment was therefore applied to Tables 1 & 4 to allow for the extent of underrepresentation of Alcohol-specific deaths in each sex-specific age group. Weights were obtained by dividing the number of official Alcohol-specific deaths in each sex-specific age group by the corresponding number of deaths in the research dataset (Table 3).

Table 3: Sex and Age Specific Weights Applied to Alcohol-specific Deaths

Age-group	Weights	
	Males	*Females*
16-34	1.92	1.60
35-44	1.63	1.28
45-54	1.37	1.18
55-64	1.26	1.15
65-74	1.32	1.18

Annex 4- Characteristics by Sex

Table 4 Sex-specific Distribution of Socio-demographic and Health Determinants of the (i) Study Population and (ii) Among Those Who Died of an Alcohol-specific Cause, Ages 16-74 Years.

			(i) Study Population (%)		(ii) Alcohol specific deaths (%)	
			Male 597,954	*Female* 631,829	*Male* 1,446	*Female* n=674
Demograp	Age	16-44	54.0	53.9	27.9	25.5
		45-64	34.9	34.4	58.6	64.4
		65-74	11.2	11.7	13.5	10.1
	Religious Affiliation	Catholic	43.9	45.3	47.3	48.9
		Protestant	50.2	50.1	48.1	47.3
		Other/none/unknown	5.9	4.6	4.6	3.8
Individual	Educational Attainment	Degree level or higher	22.3	27.4	10.8	16.1
		School level or other (intermediate [X])	51.3	47.8	36.9	36.6
		No qualifications	26.5	24.8	52.4	47.3
	Economic Activity	Employed incl. student	70.5	64.0	25.9	27.8
		Unemployed	6.8	3.2	9.9	5.0
		Inactive	22.8	32.8	64.2	67.2
	Mental Illness	No	93.8	91.4	73.1	69.6
		Yes	6.2	8.6	26.9	30.4
	Limiting Illness	No	79.9	78.8	39.4	37.8
		Yes	20.1	21.2	60.6	62.2
Household and Area Level	Living Arrangements	Live in couple – married/ never married	53.9	52.7	25.4	33.6
		Live in couple – separated/divorced/widowed	1.7	1.8	2.7	3.4
		Live alone – never married	7.6	5.0	23.9	10.4
		Live alone - separated/divorced/widowed	5.3	6.2	27.0	25.5
		Live with friends/family - married/never married	28.4	25.7	13.2	10.2
		Live with friends/family - separated/divorced/widowed	3.0	8.7	7.9	16.9
	Housing Tenure	Owner occupied	75.1	72.8	41.9	51.8
		Private rental	12.6	13.4	16.7	11.5
		Social rental	12.3	13.8	41.4	36.7
	Number of Cars [Y]	None	12.9	15.4	53.9	48.8
		1	34.3	36.5	30.9	33.1
		2 or more	52.8	48.1	15.2	18.1
	Local Government District [Z]	Greater Belfast	33.1	34.2	42.1	39.2
		Derry City and Strabane	8.0	8.2	9.9	12.0
		Rest of Northern Ireland	58.9	57.6	48.0	48.8
	Urban Residence [AA]	Urban	62.3	64.5	78.6	76.4
		Rural	37.7	35.5	21.4	23.6
	Area Deprivation [BB]	Quintile 1 (Most deprived)	18.3	19.4	35.8	32.9
		Quintile 2	20.1	20.1	24.7	22.0
		Quintile 3	20.6	20.3	17.4	20.3
		Quintile 4	21.4	20.9	12.8	12.8
		Quintile 5 (Least deprived)	19.6	19.3	9.3	12.0

[X] School level qualification or other vocational qualification or apprenticeship.
[Y] A proxy for income.
[Z] Greater Belfast encompasses Belfast, Antrim & Newtownabbey and Lisburn & Castlereagh Local Government Districts[9].
[AA] Based on official NISRA settlement report[13].
[BB] Derived from the Multiple Deprivation Measure (NIMDM 2010[11]).
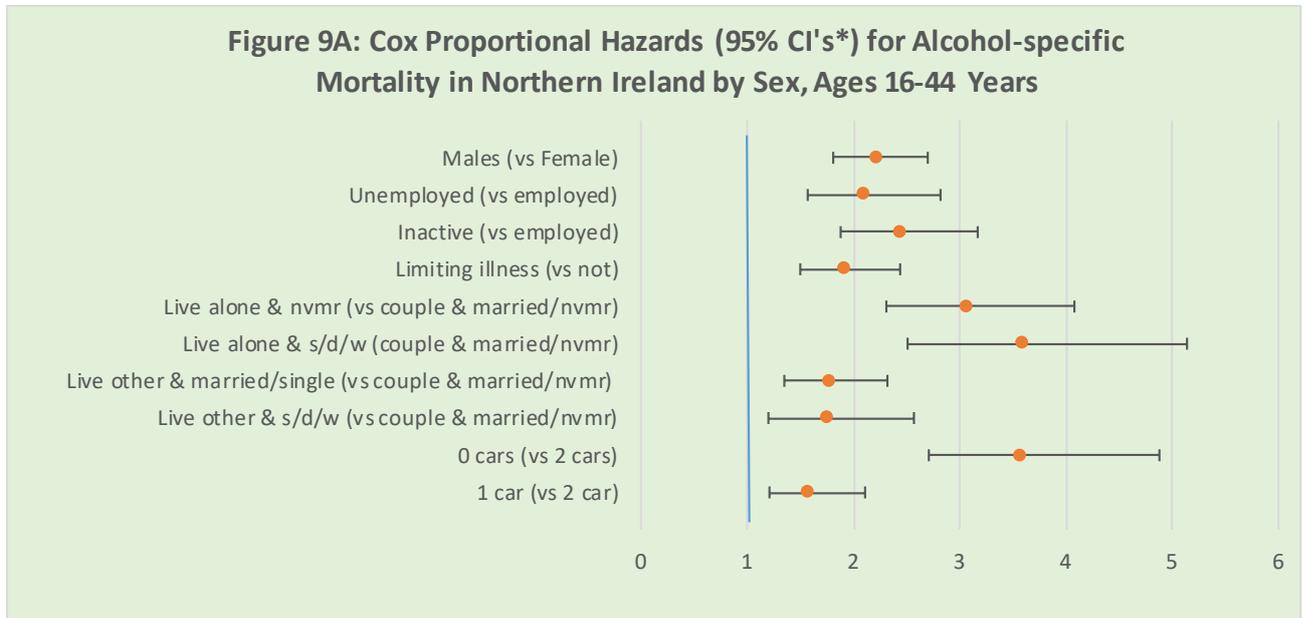
Annex 5- Results from Models 1-2

Table 5 Hazard Ratios (HR) ^{CC} with 95% Confidence Intervals for Socio-demographic and Health Factors Among 16-74 year Olds, Comparing Males and Females

|		Model 1	Model 2	
		Persons	Males	Females
Sex	Female (ref)	1		
	Male	2.64 (2.40, 2.90)		
Age	16-44 (ref)	1	1	1
	45-64	2.24 (1.99, 2.52)	2.29 (1.99, 2.64)	2.09 (1.70,2.59)
	65-74	0.96 (0.81, 1.14)	1.23 (1.00 1.50)	0.58 (0.42,0.81)
Economic Activity	Employed incl. student (ref)	1	1	1
	Unemployed	2.01 (1.68, 2.40)	1.97 (1.61,2.41)	2.21 (1.51, 3.22)
	Inactive	2.18 (1.92,2.48)	2.39 (2.03, 2.80)	1.74 (1.40, 2.15)
Mental Illness	No (ref)	1	1	1
	Yes	1.20 (1.08, 1.34)	1.18 (1.03, 1.34)	1.25 (1.04, 1.51)
Limiting Illness	No (ref)	1	1	1
	Yes	2.12 (1.89, 2.37)	1.90 (1.65, 2.19)	2.62 (2.15, 3.20)
Living Arrangements	Live in couple – married/ never married (ref)	1	1	1
	Live in couple – separated/divorced/widowed	2.23 (1.72, 2.90)	2.38 (1.72, 3.29)	1.97 (1.28, 3.04)
	Live alone – never married	2.17 (1.89, 2.51)	2.48 (2.09, 2.93)	1.62 (1.21, 2.17)
	Live alone - separated/divorced/widowed	2.70 (2.37, 3.08)	3.14 (2.68, 3.69)	2.07 (1.64, 2.62)
	Live with friends/family- married/never married	0.90 (0.76, 1.06)	1.08 (0.89, 1.32)	0.63 (0.47, 0.86)
	Live with friends/family - separated/divorced/widowed	2.00 (1.70, 2.35)	2.58 (2.08, 3.19)	1.41 (1.11, 1.80)
Housing Tenure	Owner occupied (ref)	1	1	1
	Private rental	0.90 (0.84, 1.11)	0.99 (0.84, 1.17)	0.70 (0.54, 0.92)
	Social rental	1.20 (1.09, 1.37)	1.24 (1.08, 1.43)	1.09 (0.89, 1.33)
Number of Cars	2 or more (ref)	1	1	1
	1 or more	1.53 (1.30, 1.73)	1.52 (1.27, 1.81)	1.59 (1.25, 2.03)
	none	3.72 (3.09, 4.29)	3.80 (3.12, 4.63)	3.82 (2.89, 5.06)
Urban Residence	Rural (ref)	1	1	1
	Urban	1.22 (1.11, 1.38)	1.29 (1.13, 1.47)	1.07 (0.89, 1.29)

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^{CC} Unadjusted estimates are available from authors on request.

Annex 6- Assessing Variation in Alcohol-specific mortality by Age Group

Model 3 [DD]: Cox Proportional Hazards (95% confidence Intervals*) for Alcohol-specific Mortality, for persons 16-44 years (Figure 9A) and persons 45-74 years (Figure 9B).

Figure 9A: Cox Proportional Hazards (95% CI's*) for Alcohol-specific Mortality in Northern Ireland by Sex, Ages 16-44 Years

Nvmr – never married. S/d/w = separated/divorced/widowed.

Figure 9B: Cox Proportional Hazards (95% CI's*) for Alcohol-specific Mortality in Northern Ireland by Sex, Ages 45-74 Years
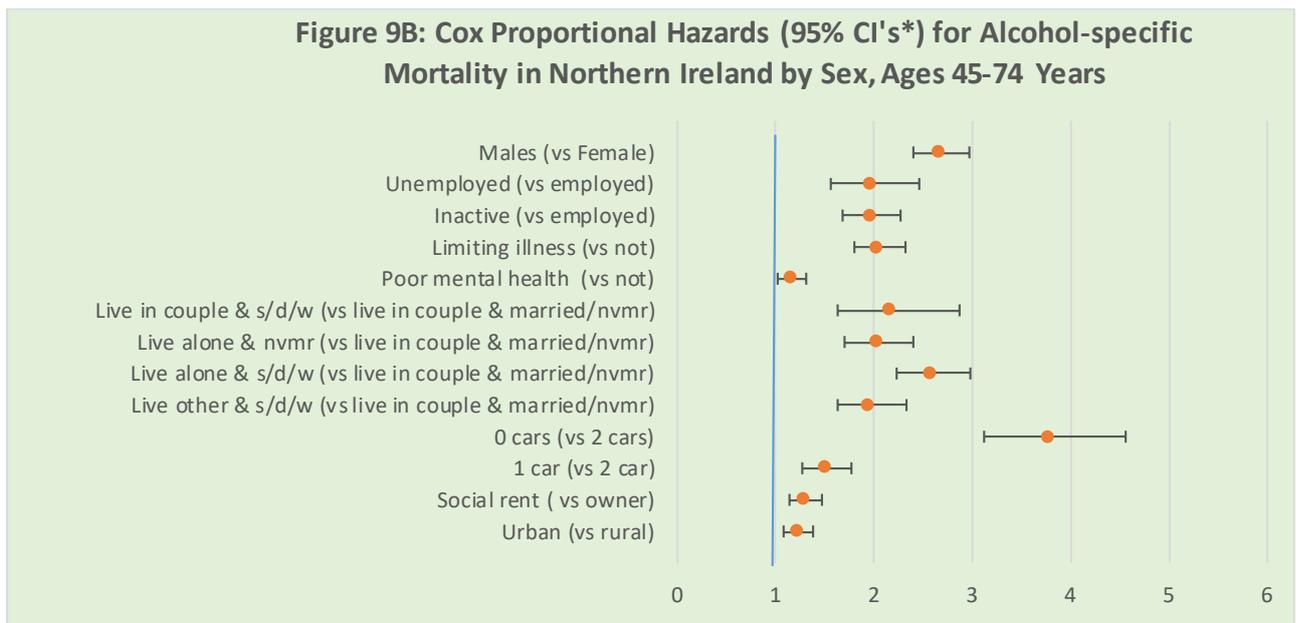
Nvmr – never married. S/d/w = separated/divorced/widowed.

[DD] Full results available from authors on request