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Understanding policy amenable risk factors: Alcohol consumption and long-term care use among people over 65 years old

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ABSTRACT

Objectives: This study aims to explore the effect of past alcohol consumption frequency on formal and informal long-term care (LTC) use in old age and explore the different channels through which it may affect LTC use.
Motivation: The existing literature has mainly focused on risk factors associated with a nursing home entry, but this evidence is outdated, not UK-focused, and does not look into other types of care, such as informal care. The results of this study will help in modelling the future demand for various types of care and the corresponding public spending.
Methods: We use the English Longitudinal Study of Ageing (ELSA) (2002–2017) dataset to conduct longitudinal, individual-level analysis. We explore how the previous frequency of alcohol consumption affects formal and informal care use. We focus on people aged 65 and over with no previous LTC use and run regressions with and without instrumental variables (IV) to estimate how alcohol consumption patterns in the previous wave (2 years before) affect formal and informal care use. For IV regressions, we use the polygenic score for alcohol use, available for a subsample of ELSA respondents, as an instrument while also accounting for sociodemographic characteristics, lifestyle choices, and health conditions.
Results: The main IV estimates suggest that *frequent* alcohol consumption has a weakly significant positive effect on the onset of formal LTC care use compared to none/rare drinking. This relationship diminishes and is not statistically significant when we directly control for health status. We find no statistically significant effect towards informal LTC use. These results contrast with the estimates without IV, which suggest that frequent alcohol consumption is negatively associated with informal care use and no or weakly negative association with formal care use.
Discussion: Our findings suggest that unobserved confounding is important when studying the relationship between alcohol consumption and LTC. We hypothesise that primarily alcohol effects LTC through its adverse effect on health. In addition, unobserved factors like preferences towards seeking care, social behaviour may be related to alcohol consumption and affect access to care. We speculate alcohol may have a damaging effect on personal relationships and could indicate the burden eventually falling on formal care. In as far as the polygenic score IV can account for *unobserved* preference-behaviour differences, the results (weakly) support the hypothesis that these latter processes are relevant, especially for informal care use.

1. Introduction

Health-related behaviours, such as smoking, drinking, and lack of physical exercise, might impact long-term care (LTC) utilisation in older populations, known as social care in the UK. Where these behaviours lead to chronic health conditions that generate physiological and cognitive impairment – sufferers may need (or benefit from) LTC to help manage the consequences. This route is one potential causal mechanism linking such behaviours and care use. There are likely to be others, with this relationship overall being more complex and nuanced, especially where LTC includes care provided by families and others on an unpaid basis (informal care). In particular, the links between such behaviours, chronic disease prevalence and impairment are unclear. The supply of LTC might also be affected where the need for care arises from behaviours that attract certain, often unfavourable, social attitudes. Furthermore, where people have choices about LTC use, their preferences (and

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those of their families) for using such care can be linked with their preferences associated with undertaking behaviours which could lead to worse health.

This study concerns the relationship between alcohol consumption and the onset of LTC use and the investigation of the channels through which alcohol could impact LTC. We use a broad definition of LTC to cover forms of care that help people manage the consequences of poor health, disability, and frailty, such as personal care. The literature covering this relationship is scarce. A study on Canadians over 50 found that moderate drinking (defined as less than 14 drinks per week, with less than three/four drinks per day for women/men) is negatively associated with receiving LTC compared to non-drinkers or infrequent drinkers (Kaplan et al., 2014). In a scoping review of 60 peer-reviewed studies regarding alcohol and drug abuse and end-of-life care, the authors concluded that people under 40 who use substances require greater access to palliative and end-of-life care in the future while acknowledging that this literature lacked depth and quality (Witham et al., 2019). There is no convincing evidence that this relationship is similar in the UK.

The evidence on the relationship between alcohol consumption and health is extensive, but the findings are not unidirectional. There appears to be a consensus that more frequent or heavy drinking is overall related to worse health outcomes, such as increased dementia risk and a quicker decline in cognitive function (Langballe et al., 2015; Handing et al., 2015; Kim et al., 2016; Rehm et al., 2019; Sabia et al., 2018; Xu et al., 2017), as well as a higher risk of all-cause and cancer-related mortality (Xi et al., 2017; Bergmann et al., 2013; Rehm et al., 2020). However, it is also frequently observed that moderate alcohol use may have a 'protective' or a J- or U-shaped effect towards cardiovascular health (Yu et al., 2021; Bell et al., 2017; Xi et al., 2017; Sayed and French, 2016; Bergmann et al., 2013), dementia and cognitive impairment risk (Peters et al., 2008; Rehm et al., 2019; Sabia et al., 2018; Weyerer et al., 2011; Xu et al., 2017), and other overall beneficial health effects (Balsa et al., 2008, Chen and Hardy, 2009). There appears to be no answer if those who tend to not take alcohol are naturally of worse health and that is the reason why they avoid alcohol, or if small doses of alcohol may indeed have a statistically significant favourable causal impact on health. However, while we consider the importance of health channel for long-term care use, it is outside the scope of our study to explore the relationship between alcohol use and health in detail.

When thinking about alcohol it is also important to consider its social aspect. Research suggests there is a strong relationship between lower alcohol use and higher social desirability (Lee et al., 2021). A similar idea reflected in a study showing those with alcohol abuse issues were less likely to be offered a liver transplant, as it was considered they caused their own problems (Ubel et al., 2001). This could also explain why patients with alcohol abuse issues may not always be offered the treatment they need (Lieberman et al., 2014). Similar evidence about care seeking of those with alcohol abuse issues is lacking, but it is generally known many do not seek help and often drop out from self-help groups, for instance, dropping out from mutual-help groups like Alcoholics Anonymous was found to be due to two main reasons: "no perceived need/lack of motivation" and by "social anxiety barriers" (Kelly et al., 2010). Alcohol abuse may also impact personal relationships, a study finds that partners who do not consume similar amounts of alcohol report lower relationship satisfaction (Mattson et al., 2017), which could affect willingness to provide informal care. Overall, such topics as social implications, internal motivation or physical resilience of alcohol abuse are scarcely covered by research.

The main aim of this study is to explore whether previous alcohol consumption, defined as the number of days alcohol was consumed in a week, has a causal impact on subsequent (a) formal and (b) informal LTC use. The paper further aims to investigate whether the effect of alcohol consumption on care use is mediated by a person's health and personal relationships with family and friends. We aim to contribute to the knowledge regarding alcohol's impact on later life outcomes, which touches on health, personal relationships, and care needs, and offer insight into any possible differences between the uptake of formal and informal care. It should be relevant to policy makers as it can help understand if LTC needs are determined by alcohol use, and in case they are, it would help predict those needs and consider preventative policies.

In the next section, we outline the conceptual arguments and our hypotheses, considering the potential mechanisms of the effect of alcohol consumption on LTC use. The third section details the methods and data, with results presented in the following section. A discussion follows in the last section.

2. Relationship between alcohol consumption and long-term care use

There are several possible channels through which alcohol consumption may impact LTC use. We summarise these channels in stylised form in Fig. 1. The main argument is that more frequent alcohol use would result in worse health outcomes and, thus, a greater need for LTC, compared to less frequent drinking. We hypothesise that this is the primary channel (1) through which alcohol affects LTC use. However, the relationship between alcohol consumption and LTC use is likely to be affected in other ways.

Being less socially acceptable, frequent alcohol consumption could adversely impact a person's relationships with others (2), affecting the availability of informal care. For example, frequent alcohol consumption could signal or cause alienation from friends and family who would otherwise have been potential informal caregivers.

Furthermore, heavy alcohol use may also reflect underlying preferences towards medical care or social engagement that simultaneously affect a person's demand for LTC (3). However, such preferences, are difficult to observe and account for in an estimation process. Those with alcohol abuse issues may be less likely to seek professional help or care for several reasons: i) assuming they do not deserve care as their problems are likely self-caused; ii) not considering any health concerns and issues as serious; iii) lacking confidence in professional help or ability to access it. Alternatively, people who are less concerned about the health effects of frequent drinking may be less likely to seek care for the same underlying reasons (so a non-causal process). Since we cannot separate the effects of preferences and behaviours associated with the choice for heavier alcohol intake from the effect of alcohol use, this would result in a negative bias on alcohol use effect size (omitted variables bias). All of the mentioned channels except for the health channel would reduce the use of LTC.

The analysis of the relationship between alcohol consumption and LTC use also needs to account for potential simultaneity and selection issues. We argue that the causal relationship between alcohol consumption and LTC use could be bi-directional (4). For example, being in care may prevent one from accessing alcohol. Alternatively, being in sufficiently poor health to require LTC may also affect a person's willingness or ability to consume alcohol. Regarding selection, there are two possible concerns. First, there may be self-selection into frequent alcohol consumption based on health (5). Specifically, people who are less sensitive to alcohol (i.e. those with a milder disagreeable response to alcohol) may consume more of it. Second, attrition from the sample may be linked to health and alcohol use (6). i.e. only those with more robust overall health amongst heavy drinkers would survive to age 65+ and heavy drinkers may not partake in the survey. In both of the latter cases, ignoring the selection issues would likely lead to an underestimation of the effect of alcohol consumption on LTC use, since higher alcohol use in these cases relate to either lower use of LTC or no use at all.

Consequently we hypothesise that:

- Overall, the frequent drinking increases the LTC use in the future.
- The effect of drinking on care use is primarily (but not entirely) due to the effects of drinking on health. Therefore, controlling for health

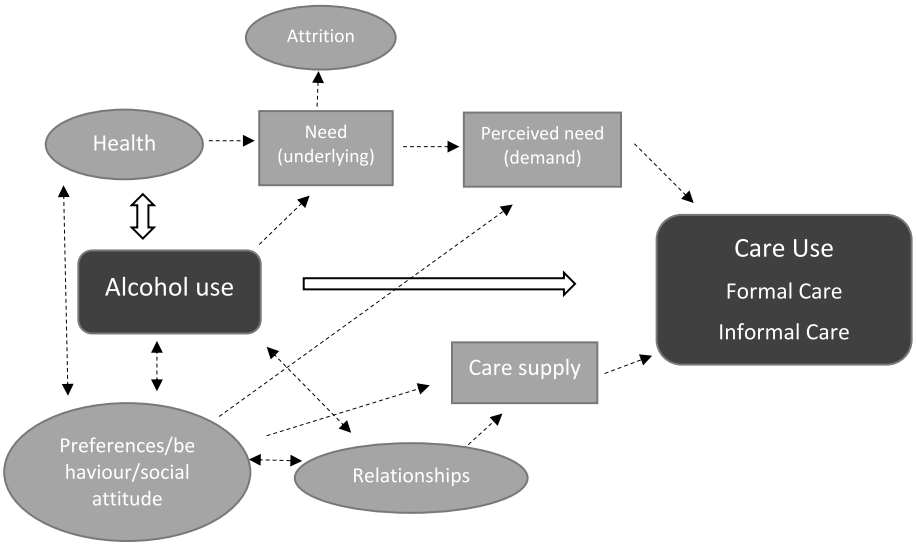

Fig. 1. Conceptual issues of the relationship between alcohol consumption and care use.

directly should reduce the positive effect of frequent drinking on LTC use.

- The link between drinking and formal or informal care use is mediated by preferences towards medical care and social engagement. In particular, frequent drinking could be associated with preferences that also correspond to a lower care seeking, as explained earlier. Furthermore, frequent drinking may be associated with reduced willingness to provide care by others. These processes correspond to a negative/offsetting component to the overall effect size.
- The effect differs by the type of care – the effect on informal care might be different (negative) because informal carers may be less willing to offer care support where the cause of care needs is drinking, while formal carers may have less choice if care is allocated.

In summary, it is highly likely that the relationship between alcohol consumption and LTC use is not straightforward and involves endogeneity concerns. With this research, we contribute to filling this gap in knowledge and adding clarity as to how previous alcohol consumption relates to LTC use in old age in the UK.

3. Methods

We draw on the English Longitudinal Study of Aging (ELSA) dataset (Banks et al., 2021), a longitudinal household survey of older people. Regression analysis is used to identify the relationship between respondents' reported alcohol consumption and their subsequent LTC use. The rich set of individual-level information in ELSA allows for controlling for various confounding factors. Furthermore, we exploit the longitudinal nature of the data and implement a lagged regression structure to mitigate possible bias arising from the simultaneity between alcohol consumption and LTC use. In addition, we implement an instrumental variables (IV) approach to account for the remaining unobserved confounders (omitted variables bias). Our IV is a composite indicator of genetic markers associated with a person's propensity to consume alcohol. Genetic endowment has been shown to contribute to explaining alcohol consumption behaviour (Sudharsanan et al., 2016) As genetic drivers are randomly distributed from parental gene pool to individuals, instrumenting in this way should help to mitigate bias from correlation with unobserved factors in estimating the causal effect of alcohol use. In particular, a genetic IV should reduce biases arising from unobserved behavioural factors.

The English Longitudinal Study of Ageing (ELSA) is a biennial longitudinal survey of individuals aged 50 and over. It is sampled initially from the pool of respondents to the Health Survey for England (1998, 1999, and 2001). It collects a rich set of data on individual and family circumstances and the quality of life of older people. As alcohol use variables are only available from Wave 2 onwards, we use data from Waves 2 to 8 of ELSA. Although alcohol consumption affects people of all ages, we restrict the analytical sample to people aged 65+ who would have a higher probability of LTC use. This sample selection helps identify groups of individuals that may require more support and attention for preventative purposes. We include only observations with zero formal and informal care use in the previous wave, i.e. we exclude continuous LTC users after the first recorded care use, so our analysis estimates the new emerging LTC use associated with previous alcohol consumption.

To estimate the effect of different patterns of alcohol consumption on LTC use, we formulate the following regression specification:

$$Y_{jit} = \beta_{j0} + A_{it-1}\beta_{j1} + X_{it}\beta_{jx} + \varepsilon_{jit}, \quad (1)$$

where i denotes the individual, t is time, and j is the type of LTC. X_{it} are observable covariates. The dependent variable Y_{jit} represents either a binary indicator for formal or informal care use.

Using ELSA data, the indicator for informal care use equals one when respondents report receiving help with ADLs, IADLs or mobility limitations from spouses/partners, parents, children, grandchildren, relatives or non-relatives. Similarly, the indicator for formal care equals one when the respondent receives help from home care workers, personal assistants, care home staff or unpaid volunteers.

The error term, ε_{it}, captures all other factors affecting care use not observed and controlled for in our model. All regressions are run with standard errors clustered at the individual level. Regressions are run on the entire sample and then separately by gender since alcohol consumption and LTC use differ between males and females (Wilsnack et al., 2000).

3.1. Alcohol consumption

The term A_{it-1} is reported alcohol consumption in the previous wave (2 years ago). It is a categorical variable representing the frequency of alcohol use in the past 12 months with levels: none and infrequent (once or twice a year to once or twice a month); regular use (once to four days a week) and frequent (five days a week to every day). Descriptive analysis of ELSA data shows more frequent alcohol use is related to higher intake of all alcohol types, even more pronounced in wine and

spirits than in beer use, suggesting an increased risk of binge drinking (Appendix Table A1).

We take 'none and infrequent' as the base category in all our analyses. Thus, β_{j1} reflects the effect of regular or frequent alcohol use at $t-1$ on LTC use of type j at time t. This lagged structure allows for the mitigation of possible simultaneity between contemporaneous alcohol consumption and LTC use.

3.2. Instrumental variable estimation

We employ an instrumental variables (IV) approach to address the potential alcohol endogeneity concern due to omitted variables, such as behavioural and lifestyle preferences. We use as our IV a measure of individuals' genetic propensity for alcohol consumption. Large-scale genome-wide association studies (GWAS) have identified collections of genetic variants that are predictive of specific health-related, behavioural and emotional traits. In particular, recent research found that certain genes regulate alcohol consumption in people (Schumann et al., 2016).

The predictive power of individual genetic variants uncovered in GWAS are typically combined into polygenic scores (PGS) – weighted sums of specific genetic variants associated with a specific traits. In our context, PGS for alcohol consumption, is available for a subset of ELSA respondents from the ELSA Polygenic Scores dataset (NatCen Social Research, 2021). The ELSA PGSs are based on a single, replicated GWAS (Ajnakina and Steptoe, 2020). Genotyping was performed at University College London (UCL) Genomics in 2013–2014 and involved the genotyping of 7412 ELSA participants of European ancestry.

We use the ELSA PGS for daily alcohol intake as our IV. The available alcohol intake PGS also takes into account age cohort, gender, weight, behavioural and experiential characteristics, and population structure. ELSA-based PGS have been used in quantitative health research as credible instruments (Gaggero, 2022; Ajnakina et al., 2022a; Ajnakina et al., 2022b).

$$A_{it} = \alpha_0 + Z_i\alpha_1 + X_{it}\alpha_x + \varepsilon_{it} \quad (2)$$

Equation (2) represents the first-stage IV equation, where Z_i stands for the PGS for alcohol use, which is time-invariant.

We argue that this IV is suitable. First, by construction, the PGS is a combination of genetic variants that are known to be robustly associated with an individual's alcohol consumption behaviour and, thus, satisfies the instrument relevance condition. Second, we have no reason to believe that the set of genetic markers explicitly related to alcohol consumption would be directly associated with LTC use later in life after controlling for the set of covariates. Finally, since one's genes are (essentially) exogenously allocated at conception from the available parental gene pool, the PGS would not be related to the confounding factors discussed above. The second and third properties suggest that the PGS would satisfy the exclusion condition for an IV. We have also explored a few other instruments presented in Appendix B.

We implemented this IV approach using a pooled probit regression with an endogenous covariate – using the eprobit Stata command. Standard errors clustered at the individual level were used to account for the panel structure of the dataset. As a comparator, a pooled probit regression without IV was run. This allows the most direct way to gauge the effects of instrumenting.

In all cases, models were estimated for formal and informal care separately. As such we are estimating partial reduced-form models, recognising the potential inter-dependency of formal and informal care choices. In this way, we focus on endogeneity issues as they affect the alcohol and LTC relationship.

3.3. Control variables

The baseline specification for both formal and informal care models included educational qualifications, ethnicity, age, number of female children, home ownership, and wave indicators. Additionally, for formal care, we also included relationship information, defined as the reported ability to rely on friends or family members in case of a problem (0–12, higher values indicating perception of more supportive relationships). This information is important as eligibility for public LTC takes into account the availability of informal carers, i.e. those with no family or friends to offer informal care are more likely to qualify for formal care.

Additional controls used in extended specifications, added sequentially, included: (i) the above relationship information (for informal care); (ii) behavioural variables (employment, any physical activity, being a smoker now); (iii) mental health – using the eight-item version of the Center for Epidemiological Studies-Depression (CES-D 8), with higher values indicating more severe mental issues (Karim et al., 2015, Van de Velde et al., 2009); (iv) marital indicators (being married, alone); (v) health indicators (high blood pressure, diabetes, cancer, lung disease, heart condition, stroke, psychiatric conditions, arthritis).

Covariates like employment, marital status, and health conditions may be partially determined by alcohol consumption and were hence excluded from the base specification. Instead, these sets of additional controls were introduced progressively to the base specification to assess how the estimated effect of alcohol changes. Health indicators allow us to explore the hypothesis that the impact of alcohol consumption on LTC use occurs primarily through the health channel. For example, health conditions partially indicate the overall health 'stock' and how it was affected over the lifetime and marital status partially indicates the availability of informal caregivers. Health conditions were introduced last as we expect the impact of controlling for health to be larger than the other factors.

3.4. Sensitivity analysis

3.4.1. Probit estimation – IV sample

As the PGS were only available for individuals of European ancestry, our IV analysis is restricted to a sample of almost exclusively white individuals (Ajnakina and Steptoe, 2020). To explore if the (reduced-form) relationship between alcohol consumption and LTC use differs between this restricted sample and the wider population, we estimated probit regressions (without IV) of equation (1) twice: i) using all available observations; ii) using our IV analysis sample.

To allow for a meaningful comparison, we estimated equation (1) using the same approach as in the main analysis and restricting the sample to include only the observations contributing to the IV estimation. This allows us to compare the results with the estimates from the main analysis based on the full available sample (which takes into account ethnicity) and the IV results based on the sample restricted by ethnicity.

3.5. Alternative measures of alcohol consumption

Alcohol consumption frequency in the last 12 months was not the only alcohol variable we trialled. Other alcohol consumption variables used included alcohol consumption frequency in the last seven days (number of days consumed), number of measures of beer, wine, and spirits consumed in the last seven days, and based on this information grams of pure ethanol in the last seven days. Breakdown of these measures by alcohol frequency categories available in Appendix Table A1. However, we decided against reporting these results and pursuing a different estimation strategy due to a more significant observation loss associated with their use and a lack of significant difference from the results with using alcohol consumption frequency in the last 12 months.

4. Results

4.1. Descriptive statistics

Our two main samples for instrumented regressions are 6378 male

Table 1
Descriptive statistics by formal and informal care use.

Variables	Overall [SD]	Receiving formal care	Not receiving formal care	Receiving informal care	Not receiving informal care
Pooled:					
Formal Care (FC)	0.033 [0.178]				
Informal Care (IC)	0.095 [0.293]				
Lagged alcohol use:					
-None/Rare	0.376 [0.484]	0.483 [0.5]	0.372 [0.483]	0.487 [0.5]	0.364 [0.481]
-Regular	0.377 [0.485]	0.263 [0.441]	0.381 [0.486]	0.309 [0.462]	0.385 [0.486]
-Frequent	0.247 [0.431]	0.254 [0.436]	0.247 [0.431]	0.205 [0.404]	0.251 [0.434]
PGS for Daily Alcohol Intake	2642.354 [6.759]	2642.49 [6.755]	2642.35 [6.76]	2642.166 [6.662]	2642.374 [6.769]
Female	0.523 [0.499]	0.696 [0.461]	0.517 [0.5]	0.623 [0.485]	0.513 [0.5]
No qualifications D	0.266 [0.442]	0.302 [0.460]	0.265 [0.441]	0.387 [0.487]	0.253 [0.435]
Non-white D	0.0004 [0.021]	0 [0]	0.0004 [0.022]	0 [0]	0.0005 [0.022]
Age	73.482 [6.655]	80.151 [8.518]	73.257 [6.464]	77.005 [7.961]	73.113 [6.392]
Nr. of female children	2.236 [1.445]	1.977 [1.54]	2.245 [1.44]	2.383 [1.507]	2.221 [1.437]
Relationships	7.838 [3.07]	5.950 [3.334]	7.902 [3.04]	7.144 [3.372]	7.911 [3.027]
Own home	0.818 [0.386]	0.773 [0.419]	0.820 [0.385]	0.760 [0.427]	0.824 [0.381]
Employed	0.051 [0.22]	0.002 [0.048]	0.053 [0.223]	0.018 [0.133]	0.054 [0.227]
Phys. Act.	0.902 [0.297]	0.712 [0.454]	0.909 [0.288]	0.765 [0.424]	0.917 [0.276]
Smoker	0.077 [0.266]	0.080 [0.271]	0.077 [0.266]	0.087 [0.282]	0.076 [0.265]
Mental health	1.120 [1.646]	2.090 [2.024]	1.088 [1.623]	2.057 [2.062]	1.024 [1.566]
Married	0.577 [0.494]	0.297 [0.458]	0.586 [0.493]	0.521 [0.5]	0.582 [0.493]
Alone	0.241 [0.248]	0.284 [0.451]	0.239 [0.427]	0.213 [0.409]	0.244 [0.429]
Nr. Obs.	13,377	437	12,940	1270	12,107
Males:					
Formal Care (FC)	0.021 [0.143]				
Informal Care (IC)	0.075 [0.264]				
Lagged alcohol use:					
-None/Rare	0.266 [0.442]	0.323 [0.47]	0.265 [0.441]	0.367 [0.483]	0.258 [0.437]
-Regular	0.426 [0.495]	0.308 [0.464]	0.428 [0.495]	0.361 [0.481]	0.431 [0.495]
-Frequent	0.308 [0.462]	0.368 [0.484]	0.307 [0.461]	0.271 [0.445]	0.311 [0.463]
PGS for Daily Alcohol Intake	2642.37 [6.667]	2643.11 [6.434]	2642.35 [6.672]	2642.43 [6.58]	2642.36 [6.675]
No qualifications D	0.204 [0.403]	0.248 [0.434]	0.203 [0.402]	0.317 [0.466]	0.195 [0.396]
Non-white D	0 [0]	0 [0]	0 [0]	0 [0]	0 [0]
Age	73.454 [6.585]	80.917 [8.547]	73.295 [6.444]	77.699 [8.114]	73.110 [6.322]
Nr. of female children	2.269 [1.485]	2.286 [1.574]	2.269 [1.483]	2.380 [1.573]	2.260 [1.477]
Relationships	7.875 [3.066]	6.150 [3.667]	7.911 [3.041]	6.806 [3.481]	7.961 [3.013]
Own home D	0.829 [0.377]	0.850 [0.359]	0.828 [0.377]	0.795 [0.404]	0.831 [0.374]
Employed D	0.057 [0.231]	0.008 [0.087]	0.058 [0.233]	0.019 [0.136]	0.060 [0.237]
Phys. Act. D	0.894 [0.308]	0.684 [0.467]	0.898 [0.302]	0.714 [0.452]	0.908 [0.288]
Smoker D	0.075 [0.263]	0.101 [0.302]	0.074 [0.262]	0.092 [0.289]	0.073 [0.261]
Mental health	0.851 [1.421]	1.683 [1.956]	0.835 [1.404]	1.802 [1.969]	0.777 [1.341]
Married D	0.662 [0.473]	0.526 [0.501]	0.665 [0.472]	0.628 [0.484]	0.665 [0.472]
Alone D.	0.232 [0.422]	0.241 [0.429]	0.232 [0.422]	0.215 [0.411]	0.234 [0.423]
Nr. Obs.	6378	133	6245	479	5899
Females:					
Formal Care (FC)	0.043 [0.204]				
Informal Care (IC)	0.113 [0317]				
Lagged alcohol use:					
-None/Rare	0.476 [0.499]	0.553 [0.498]	0.473 [0.499]	0.559 [0.497]	0.466 [0.499]
-Regular	0.333 [0.471]	0.243 [0.43]	0.337 [0.473]	0.277 [0.448]	0.340 [0.474]
-Frequent	0.191 [0.393]	0.204 [0.404]	0.190 [0.392]	0.164 [0.371]	0.194 [0.396]
PGS for Daily Alcohol Intake	2642.34 [6.842]	2642.22 [6.884]	2642.346 [6.841]	2642.005 [6.709]	2642.384 [6.859]
No qualifications D	0.322 [0.467]	0.326 [0.469]	0.322 [0.467]	0.430 [0.495]	0.308 [0.462]
Non-white D	0.001 [0.293]	0 [0]	0.001 [0.03]	0 [0]	0.001 [0.032]
Age	73.507 [6.719]	79.816 [8.498]	73.221 [6.483]	76.584 [7.842]	73.115 [6.458]
Nr. of female children	2.207 [1.407]	1.842 [1.507]	2.223 [1.4]	2.386 [1.467]	2.184 [1.397]
Relationships	7.805 [3.073]	5.862 [3.18]	7.893 [3.039]	7.349 [3.289]	7.863 [3.04]
Own home D	0.808 [0.394]	0.740 [0.439]	0.812 [0.391]	0.738 [0.44]	0.817 [0.386]
Employed D	0.046 [0.209]	0 [0]	0.048 [0.213]	0.018 [0.132]	0.049 [0.217]
Phys. Act. D	0.910 [0.286]	0.724 [0.448]	0.918 [0.274]	0.795 [0.404]	0.925 [0.264]
Smoker D	0.079 [0.269]	0.070 [0.255]	0.079 [0.27]	0.084 [0.277]	0.078 [0.268]
Mental health	1.365 [1.792]	2.259 [2.031]	1.325 [1.771]	2.207 [2.103]	1.258 [1.72]
Married D	0.498 [0.5]	0.197 [0.399]	0.512 [0.5]	0.456 [0.498]	0.504 [0.5]
Alone D.	0.249 [0.432]	0.303 [0.46]	0.246 [0.431]	0.211 [0.408]	0.253 [0.435]
Nr. Obs.	6999	304	6695	791	6208

Note: Standard Deviation [SD] in square parentheses; variables in grey-shaded areas correspond to smaller samples. D – indicates binary dummy variables.

observations and 6999 female observations, of which 2.1% and 4.3% respectively receive formal care (FC), and 7.5% and 11.3% respectively receive informal care (IC). Table 1 gives descriptive statistics for the main covariates for the whole sample, by the use of formal care, and by the use of informal care. We also report the corresponding statistics for each gender subsample. A larger share of those receiving any care report None/Rare previous alcohol consumption. Conversely, a larger share of those *not* receiving care report Regular alcohol consumption. No systematic pattern is evident for reports of Frequent consumption. A naïve comparison of group means would therefore suggest a possible negative

relationship between alcohol consumption and subsequent LTC use, at least for moderate levels of consumption. However, as argued above, various observable and unobservable factors may confound this relationship. For example, Table 1 also shows that compared to those who do not receive care, care users, on average, have worse mental health, and are less likely to be physically active, or employed. They tend to be older, and more likely to smoke and have no qualifications. Those receiving formal care are less likely to be married. There is no difference between groups in home ownership.

4.2. The effect of alcohol consumption on long-term care use

Table 2 shows the results from the uninstrumented regressions of equation (1) for formal and informal care use based on all available observations (Column 1) and for the restricted IV estimation sample. As noted above, the baseline covariate specification for FC includes controls for relationships while the specification for IC does not. Table 2, Columns 1 and 2 show a negative association between regular alcohol consumption and subsequent formal care use. While these estimates are statistically significant at the five percent level in the unrestricted sample (Column 1), they are not statistically significant in the IV estimation sample (Column 2). The corresponding estimates for frequent alcohol consumption are close to zero and statistically insignificant across both samples. The results are similar but less precisely estimated when separating by gender. For informal care, there is a statistically significant negative association between frequent and regular alcohol consumption and subsequent care use across all samples. Taken at face value, these results suggest no (or some negative) association between alcohol consumption and incidence of future formal care use and a negative association between alcohol consumption and incidence of informal care use. However, as argued above, these estimates are likely to be biased by various unobserved confounding factors.

To address potential endogeneity in the relationship between alcohol consumption and LTC use, we use the PGS as an instrument for alcohol consumption. Table 3 presents the instrumented probit coefficient estimates for the pooled sample. To aid interpretation, Table 4 presents average marginal effects alongside coefficient estimates for the pooled sample and for gender subgroups. The first stage of the estimations consistently shows that the PGS for alcohol use (IV) is highly statistically significant at 1% level for all the samples and is positively associated with alcohol consumption frequency in the last 12 months. These results alongside IV's Z-values reported in the Appendix tables being above 2 suggest PGS is a strong instrument.

For formal care use, the IV estimates show weak evidence of a positive effect (significant at the 10 percent level) of frequent alcohol consumption on subsequent formal care use, while the effect of regular consumption is positive but statistically insignificant (Table 3, Columns 1 and 2). Separate IV regressions by gender yield estimates of the same sign and similar magnitude as the pooled regression but are not statistically significant (Table 4, Columns 1 and 2). For informal care, the coefficients are negative but not statistically significant in all subsamples (Columns 3 and 4 of Tables 3 and 4).

These results are consistent with our hypothesis of a downward effect/bias in the uninstrumented estimation results. Specifically, the negative and statistically significant association between alcohol consumption and informal care use is no longer statistically significant after accounting for endogeneity through the IV approach. Similarly, the statistically insignificant relationship between frequent alcohol consumption and subsequent formal care use becomes positive after

Table 2
Uninstrumented regression output: Formal and informal care use (raw coefficients).

Variables	Formal care use		Informal care use	
	Full sample	IV sample	Full sample	IV sample
Pooled				
Lagged alcohol use: Regular	−0.106**	−0.087	−0.152***	−0.139***
Lagged alcohol use: Frequent	0.011	0.061	−0.134***	−0.124***
Female	0.350***	0.349***	0.167***	0.189***
No qualifications D	−0.134***	−0.101*	0.170***	0.182***
Non-white D	−0.089	–	0.134	–
Age	0.051***	0.050***	0.039***	0.038***
Nr. of female children	−0.020	−0.025	0.040***	0.038***
Relationships	−0.063***	−0.060***	–	–
Own home D	−0.130***	−0.060	−0.153***	−0.143***
Constant	−5.262***	−5.358***	−4.207***	−4.179***4
Nr. Obs.:	19,086	13,371	19,086	13,371
Males				
Lagged alcohol use: Regular	−0.100	−0.065	−0.140***	−0.170***
Lagged alcohol use: Frequent	0.019	0.112	−0.146***	−0.160**
No qualifications. D	−0.035	0.025	0.211***	0.224***
Non-white D	−0.061	–	−0.040	–
Age	0.050***	0.053***	0.044***	0.043***
Nr. of female children	−0.003	0.011	0.028**	0.014
Relationships	−0.063***	−0.062***	–	–
Own home D	−0.113	0.107	−0.127**	−0.106
Constant	−5.437***	−6.107***	−4.597***	−4.529***
Nr. Obs.:	9118	6378	9118	6378
Females				
Lagged alcohol use: Regular	−0.112*	−0.094	−0.164***	−0.117**
Lagged alcohol use: Frequent	0.001	0.034	−0.118**	−0.100
No qualifications D	−0.179***	−0.148**	0.146***	0.157***
Non-white D	−0.109	–	0.321**	–
Age	0.051***	0.047***	0.035***	0.034***
Nr. of fem. children.	−0.028	−0.044*	0.048***	0.056***
Relationships	−0.062***	−0.060***	–	–
Own home D	−0.135**	−0.126*	−0.174***	−0.177***
Constant	−4.830***	−4.615***	−3.771***	−3.758***
Nr. Obs.:	9968	6993	9968	6993

Note: significance level * - $p < 0.1$, ** - $p < 0.05$, ***- $p < 0.01$. All regressions include wave indicators.

Table 3
Instrumented regression output: formal and informal care use (raw coefficients).

Variables	Formal care use		Informal care use	
	Coef.	R.Std. Err.	Coef.	R.Std. Err.
2nd stage				
Lagged alcohol use: Regular	0.579	0.422	−0.296	0.207
Lagged alcohol use: Frequent	1.223*	0.671	−0.431	0.462
Female	0.481***	0.069	0.142*	0.081
No qualifications D	0.018	0.086	0.147**	0.067
Non-white D	−3.199***	0.226	−4.138***	0.289
Age	0.049***	0.004	0.036***	0.004
Nr. of female children	−0.022	0.017	0.038***	0.011
Relationships	−0.064***	0.007	–	–
Own home D	−0.114*	0.062	−0.121**	0.054
Constant	−5.473***	0.270	−4.021***	0.478
1st stage				
PGS for Daily Alcohol Intake	0.011***	0.003	0.011***	0.003
Female	−0.446***	0.036	−0.445***	0.036
No qualifications D	−0.326***	0.040	−0.334***	0.040
Non-white D	−5.924***	0.181	−5.765***	0.187
Age	−0.010***	0.002	−0.012***	0.002
Nr. of female children	−0.004	0.012	0.005	0.012
Relationships	0.025***	0.005	–	–
Own home D	0.187***	0.043	0.209***	0.042
Nr. Obs.: 13,377				

Note: significance level * - $p < 0.1$, ** - $p < 0.05$, ***- $p < 0.01$. All regressions include wave indicators.

Table 4
Instrumented regression output: formal and informal care use by gender (raw coefficients and average marginal effects AME).

Variables	Formal care use		Informal care use	
	Coef.	AME	Coef.	AME
Pooled				
Lagged alcohol use: Regular	0.579	0.057	−0.296	−0.046
Lagged alcohol use: Frequent	1.223*	0.190	−0.431	−0.062
Nr. Obs.: 13,377				
Males				
Lagged alcohol use: Regular	0.592	0.042	−0.122	−0.017
Lagged alcohol use: Frequent	1.311	0.169	−0.0651	−0.009
Nr. Obs.: 6378				
Females				
Lagged alcohol use: Regular	0.570	0.069	−0.375	−0.065
Lagged alcohol use: Frequent	1.156	0.207	−0.591	−0.090
Nr. Obs.: 6999				

Note: significance level * - $p < 0.1$, ** - $p < 0.05$, ***- $p < 0.01$. All regressions include covariates from our base specification, which controls for: educational qualifications, ethnicity, age, number of female children, home ownershipand wave indicators, additionally FC regressions include relationships with family and friends.

instrumenting.

4.3. Mechanisms of the effect of alcohol consumption on LTC use

To explore the mechanism behind the relationship between alcohol consumption and LTC use, we progressively add additional covariates to the baseline specifications. First, we control for relationship quality which was previously omitted from the IC baseline specification. Second, we include behavioural information: employment, smoking, and physical activity. Third, we add mental health status. Fourth, we control for marital status and living alone. Finally, we control for various health conditions. The results are reported in Appendix Tables A2–A3. All mentioned specifications were re-run twice: a) allowing for a full available sample based on the variables used, and b) restricting the sample to the one determined by using all control variables mentioned. This would allow observing how the results change and comparing them based on these restrictions.

For both formal and informal care the estimated effect sizes (particularly on frequent alcohol consumption) do not change the results in a qualitative way. For example, when estimated for male and female populations separately, the effects were insignificant for all specifications – see Table A2 for formal care and A3 for informal care.

We observe that the positive effect sizes are reduced for FC (both genders) when health indicators were included (compared to the base estimation), i.e. when we account for the health channel the increase in probability of starting FC related to alcohol is reduced. This finding is consistent with the hypothesised effect of alcohol consumption on health and consequent future LTC needs. It tentatively suggests the importance of the health channel through which alcohol consumption impacts LTC use. Table B2 shows a breakdown of the prevalence of health conditions by alcohol use frequency between the baseline period and the future period. We should note that we do not test for the 'survivor' effect and health resilience to alcohol (even if this information is partially accounted for with the inclusion of health variables) since it is outside of the scope of this article. Finally, the marginal effect tends to be larger for frequent alcohol consumption compared to regular (where the former is significant at the 10% level in the pooled model), which is consistent, after controlling for health, with the argument that those with more frequent previous alcohol use are more likely to use formal care.

In the case of IC, even if the marginal effects are not statistically significant, further inclusion of control variables, i.e. accounting for possible reasons why LTC is needed, normally resulted in the negative relationship between alcohol use and the start of IC use becoming stronger, i.e. receipt of IC was less likely, this was, in particular, more pronounced for females. This is consistent with our hypothesis of alcohol being potentially related to lower care seeking and/or care being offered, indicating a tentatively damaging effect towards informal care receipt, which is also captured by increased coefficients after accounting for respondents' perception of relationships' quality. These findings also support our hypotheses that alcohol use may affect the probability of receiving formal and informal care differently.

We have trialled a range of other instruments and ways to model which are summarised and briefly discussed in Appendix B.

5. Discussion

This study was aimed at answering the question of how alcohol consumption relates to the onset of formal and informal care use. We conjectured that there are three main channels by which frequent alcohol consumption can affect the subsequent use of LTC: drinking may cause ill health and impairment and so a LTC need (positive-signed effect); drinking may affect people's willingness to seek LTC, e.g. arising from shame/discounting, (negative-signed effect); and drinking may change the attitudes of care providers about offering care, e.g. due to a breakdown of personal relationships between carer and cared-for person (negative-signed effect).

In addition to these mechanisms, there may be a other associations between drinking and care need. A person's lifestyle preferences may prompt both frequent consumption and low care-seeking (compared to people with preferences such that they are more concerned about lifestyle choice consequences). Relatedly, there may be 'self-selection' into drinking of people who can process alcohol relatively well, and this resilience also means they have a reduced care need. When not accounted for, these negatively-signed relationships may bias estimates of the relationship between alcohol consumption and LTC use. There is also the possibility of a *reverse* process whereby people using LTC have less opportunity or willingness to drink.

To mitigate the reverse causality issue, our analysis focused on individuals' alcohol consumption when not in care on their risk of future care use. This means our estimates capture the effect of alcohol consumption on *emerging* LTC use. To address the confounding effects of the unobserved care-related preferences, carer attitudes and lifestyle preferences (omitted variables bias), we implemented both a direct regression estimation and an instrumental variable approach in our analysis. The latter uses polygenic risk scores which predict individuals' alcohol consumption but are arguably unrelated to lifestyle preferences and care-seeking.

5.1. Key finding 1: unobserved confounders

The findings from the uninstrumented approach indicated that regular alcohol consumption had a statistically significant *negative* association with both formal and informal care use. Frequent alcohol use showed a positive but statistically insignificant association with FC. The negative association between alcohol consumption and LTC mirrors previous findings in the literature, which suggested that moderate alcohol intake, defined as 1–14 drinks per week in the last 12 months (with ≤3 drinks per day for women and ≤4 drinks per day for men), is related to lower LTC use (Kaplan et al., 2014). However, as argued above, these estimates are likely to be biased. Findings from the instrumental variable approach support our conjecture. Specifically, in contrast to the uninstrumented estimates, we found a *positive* relationship between frequent drinking and FC use, and no statistically significant relationship between alcohol use and IC. The contrasting results from these two approaches highlight that alcohol consumption is likely influenced by unobservable factors that also drive care use, like preferences towards seeking care, social behaviour, as described in more detail in the explanation of our conceptual model. In particular, they

show that direct (uninstrumented) estimation is subject to a negative bias, which IV estimation helps correct at least partially.

5.2. Key finding 2: health channel

We hypothesised that a key mechanism through which alcohol affects LTC use is the health channel. The results of the instrumented estimations support this hypothesis – we observe changes in effect sizes before and after we include health indicators. In the case of *formal* care, the increase in care use attributed to alcohol consumption is smaller and insignificant after controlling for health. If drinking causes the development of chronic health conditions, this would be a direct route to needing LTC (positive causal effects). We suspect that alcohol consumption may also impact mobility, the ability to take care of oneself, and the probability of accidents and falls (irrespective of the development of chronic health conditions).

5.3. Alcohol use and informal care

We did not find a statistically significant relationship between alcohol consumption and *informal* care use in our IV regressions. Taken together with the finding that (frequent) alcohol consumption increases formal care use, this suggests that care needs associated with alcohol use are more likely to be met through formal care providers. To the extent that alcohol use does not induce care needs that can only be met by formal care, the asymmetric pattern of formal and informal care uptake would be consistent with a difference in the availability of informal carers. This line of argument supports our hypothesis that alcohol may damage relationships with family and friends, resulting in less informal care provision. While we cannot test this formally, we observe that the accounting for respondents' perceived quality of their personal relationships tended to increase the magnitude of the negative relationship between alcohol use and informal care. As respondents' evaluation of their relationships is subjective, this change estimate size may be due to the residual impact that alcohol has on potential carers' willingness to provide informal care. These findings support our conjecture that alcohol use may effect FC and IC differently.

5.4. Alcohol and gender

In general, because men usually drink and tolerate higher quantities of alcohol, we ran the analyses separated by gender (and pooled). Although there was some indication of differences, we did not find evidence of significant gender differences in the relationships between alcohol consumption and formal or informal care use.

5.5. Study limitations

A key limitation of our analysis is that the findings relate only to the uptake of LTC (i.e., extensive margin) and do not study possible implications for the intensity of care required. This was driven by data limitations, and we believe that our findings are relevant in their own right and also provide motivation for future studies on alcohol use and care intensity.

Our main variable of interest, alcohol frequency measure, does not offer information on the type or amount of alcohol taken. While alcohol type information is available and we calculate our own grams of ethanol measure, we do not use them in our main analysis as they reduce the number of available observations and waves of data. We offer a breakdown of alcohol frequency categories by alcohol type and ethanol in the Appendix Table A1 and it shows how higher frequency reflects higher amounts of all types of alcohol consumed, suggesting that more frequent drinking likely corresponds with binge drinking.

During our analysis we trialled a large number of various specifications, estimation strategies, instruments, inclusion of different sets of control variables etc., we believe that our main estimation strategy was fitting and adequate for this research question, and the genetic information proved to be a good and strong instrument. We cannot completely reject the possibility that genes may affect some preferences and social behaviours that would impact both alcohol intake and LTC, but there is no such current evidence we are aware of.

We cannot fully eliminate all possible biases that may impact our results. One potential source of bias is the differential response rate/attrition/misreporting that may be related to frequent alcohol consumption. To investigate the effect of alcohol related mortality on LTC would require a different estimation strategy, which is outside the scope of the present paper. This would affect a small number of respondents in our sample, and we do not expect a substantial change in results. We also cannot assess how precise is self-reporting by respondents with respect to alcohol use, which may affect the estimates. In addition, our IV was available for only white population of European descent, which then would render our results inapplicable to any other populations. This may also signal our study not representing the impact of alcohol in more deprived circumstances.

5.6. Implications for policy and research

Our findings have the following potential policy implications: First, we find evidence that higher alcohol intake could lead to higher subsequent FC use, potentially via negative effects on health. This finding advocates for more research into the reasons of alcohol use in older age and ways this population could be supported to avoid alcohol abuse. Second suggestive finding is that frequent alcohol consumption may reduce the availability of informal care and may shift the burden on formal care. Third, while the impact of alcohol consumption on health outcomes and healthcare systems has received much attention (Bergmann et al., 2013; Rehm et al., 2019; Sabia et al., 2018; Xi et al., 2017), our findings suggest that detrimental effects of frequent alcohol consumption extend to long-term care needs and the wider care sector. Analyses of the societal-level impact of policies targeting alcohol consumption should thus account for these effects.

From a research perspective, we contribute to knowledge about how alcohol may impact LTC use in older population. This topic is generally under-researched, lacking for the UK context, which also offers relevant insights for any country with universal health and social care, and so far has not considered implications to informal care. Additionally, we contribute to the methodology of answering this question: i) we show that alcohol variable is prone to endogeneity and the results not accounting for it should be viewed with caution, which could explain why findings to date suggested alcohol could reduce the need for LTC; ii) we trialled a range of IVs and offer using polygenic scores as a viable instrument.

Declaration of competing interest

The authors declare that there are no conflicts of interest.

Disclaimer

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CRediT authorship contribution statement

Gintare Malisauskaite: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Olena Nizalova:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Data

curation. **Katerina Gousia:** Writing – review & editing. **Hansel Teo:** Writing – review & editing. **Julien Forder:** Writing – review & editing, Methodology, Funding acquisition.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.116746.

Appendix

Table A1
The breakdown of different alcohol types and grams of ethanol in last 7 days by alcohol consumption frequency

Alcohol consumption frequency:	Beer	Wine	Spirit	Ethanol
None-Rare	0.093	0.256	0.12	7.882
Regular	1.427	2.531	1.318	90.272
Frequent	2.642	7.446	4.069	232.169
Obs.	10,648	10,674	10,595	10,727

Note: alcohol types indicate use in last 7 days: pints of beer, glasses of wine, and measures of spirit.
Ethanol measure was constructed using the number of measures of beer, wine and spirits consumed in last 7 days. To calculate grams of pure ethanol for each alcohol type, beer measure was assumed to be equal to a pint, 568 ml, which was assumed to be of 4% alcohol strength; wine measure was assumed to be of a 150 ml size and 11.5% alcohol strength; spirit measure was assumed to be of 30 ml size and 38% alcohol strength. Final measure of grams of pure ethanol was the sum of the three alcohol types consumed expressed as pure ethanol.

Table A2
Instrumented estimations (eprobit) – Formal care for individuals aged 65+ – average marginal effects Endog: Alcohol frequency 12 months (0 = None, rare (base), 1 = Regular, 2 = Frequent) IV: PGS for daily alcohol intake; lagged alcohol, no care previously

Specification	Regular	Frequent	IV Z value	IV signf.	No. Obs.
Male:					
Base	0.059	0.238	2.90	***	6378
+relationships	0.042	0.169	2.97	***	6378
+behaviour	0.034	1.129	3.05	***	6047
+mental health	0.030	0.129	3.00	***	6001
+marital	0.026	0.113	3.02	***	5998
+health	0.011	0.045	3.33	***	4890
Base	0.002	0.023	3.36	***	4890
+relationships	0.003	0.034	3.40	***	4890
+behaviour	0.001	0.012	3.39	***	4890
+mental health	0.004	0.020	3.30	***	4890
+marital	0.003	0.018	3.32	***	4890
+health	0.011	0.045	3.33	***	4890
Female:					
Base	0.074	0.230	2.95	***	6999
+relationships	0.069	0.207	2.98	***	6999
+behaviour	0.017	0.058	3.20	***	6424
+mental health	0.024	0.072	3.18	***	6385
+marital	0.030	0.087	3.18	***	6383
+health	0.021	0.057	3.18	***	5194
Base	0.049	0.159	2.97	***	5194
+relationships	0.043	0.135	3.07	***	5194
+behaviour	0.021	0.068	3.22	***	5194
+mental health	0.018	0.058	3.21	***	5194
+marital	0.026	0.081	3.17	***	5194
+health	0.021	0.057	3.18	***	5194

Note: significance level * - $p < 0.1$, ** - $p < 0.05$, ***- $p < 0.01$..
Base regressions – 65+, socio-economic characteristics, wave dummies, robust standard errors..

Table A3
Instrumented estimations (eprobit) – Informal care for individuals aged 65+ – average marginal effects Endog: Alcohol frequency 12 months (0 = None, rare (base), 1 = Regular, 2 = Frequent) IV: PGS for daily alcohol intake; lagged alcohol, no care previously

Specification	Regular	Frequent	IV Z value	IV signf.	No. Obs.
Male:					
Base	−0.017	−0.009	2.87	***	6378
+relationships	−0.023	−0.025	2.91	***	6378
+behaviour	−0.035	−0.051	2.99	***	6047
+mental health	−0.039	−0.055	2.81	***	6001
+marital	−0.055	−0.078	2.62	***	5998
+health	−0.014	−0.017	3.30	***	4890
Base	0.004	0.041	3.37	***	4890
+relationships	0.003	0.034	3.40	***	4890
+behaviour	−0.027	−0.039	3.39	***	4890
+mental health	−0.027	−0.038	3.24	***	4890
+marital	−0.033	−0.047	3.22	***	4890
+health	−0.014	−0.017	3.30	***	4890
Female:					
Base	−0.065	−0.090	3.22	***	6999
+relationships	−0.068	−0.094	3.20	***	6999
+behaviour	−0.076	−0.111	3.31	***	6424
+mental health	−0.098	−0.137	3.29	***	6385
+marital	−0.098	−0.138	3.31	***	6383
+health	−0.075	−0.114	3.04	***	5194
Base	−0.033	−0.045	3.25	***	5194
+relationships	−0.033	−0.045	3.25	***	5194
+behaviour	−0.048	−0.072	3.23	***	5194
+mental health	−0.086	−0.126	3.10	***	5194
+marital	−0.093	−0.133	3.06	***	5194
+health	−0.075	−0.114	3.04	***	5194

Note: significance level * - $p < 0.1$, ** - $p < 0.05$, ***- $p < 0.01$..
Base regressions – 65+, socio-economic characteristics, wave dummies, robust standard errors..

Table A4
Uninstrumented estimations – average marginal effects of Alcohol frequency in 12 months (lagged) on formal and informal care use for individuals aged 65+, no previous care

Specification	Formal care		Informal care		No. Obs.
	Regular	Frequent	Regular	Frequent	
Male:					
Base	−0.004	0.004	−0.024***	−0.022**	6378
+relationships	−0.003	0.005	−0.021**	−0.020**	6378
+behaviour	−0.001	0.007	−0.016*	−0.016*	6047
+mental health	−0.002	0.008*	−0.014	−0.010	6001
+marital	−0.002	0.008*	−0.013	−0.009	5998
+health	−0.001	0.006	−0.010	−0.010	4890
Female:					
Base	−0.010*	0.001	−0.021**	−0.018*	6993
+relationships	−0.007	0.003	−0.021**	−0.018	6993
+behaviour	−0.007	0.001	−0.018*	−0.022*	6418
+mental health	−0.006	0.001	−0.019**	−0.023**	6379
+marital	−0.005	0.003	−0.019**	−0.025**	6377
+health	−0.001	0.008	−0.010	−0.016	5189

Note: significance level * - $p < 0.1$, ** - $p < 0.05$, ***- $p < 0.01$.
Base regressions – 65+, waves, behavioural, socio-economic, clustered (by individual) robust standard errors.

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