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Socio-Economic Determinants of Risk of Alcohol Abuse among People aged 50 or over in England

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2015-007684
Article Type:	Research
Date Submitted by the Author:	15-Jan-2015
Complete List of Authors:	Iparraguirre, Jose; Age UK, Research
Primary Subject Heading:	Addiction
Secondary Subject Heading:	Public health, Research methods, Epidemiology
Keywords:	EPIDEMIOLOGY, GERIATRIC MEDICINE, PUBLIC HEALTH

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Socio-Economic Determinants of Risk of Alcohol Abuse among People aged 50 or over in England

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Keywords: Alcohol, Older People, Lifestyle

Word count: 3,533

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Abstract

Background: this paper looks into the socio-economic determinants of risk of alcohol abuse and of the transitions between risk categories over time among the population aged 50 or over in England.

Methods: statistical analysis of the English Longitudinal Study of Ageing Waves 4 and 5. We used Firth corrected logistic and ordinal logistic models and Markov processes.

Results:

- Higher-risk drinking falls with age and there is a non-linear association between age and risk for men, but not for women
- Economic inactivity and Income are positively associated with a higher risk for women but not for men
- Education, Depression and Smoking are positively associated for both sexes. Loneliness is negatively associated
- Caring responsibilities and religion reduce risk among men
- For women, being lonely, being younger and having a higher income at baseline increase the probability of becoming a higher-risk alcohol drinker over time
- For men, not eating healthily, being younger, and having a higher income increase the probability of becoming a higher-risk alcohol drinker but the presence of children living in the household, being lonely, being older, and having a lower income are associated with ceasing to be a higher-risk alcohol drinker over time

Conclusions: several socio-economic factors would be associated with high risk alcohol consumption behaviour among older people which must be factored in when designing and evaluating interventions

Article summary

Strengths and limitations of this study

Strengths:

- Longitudinal analysis
- Transitions across alcohol abuse risks
- Representative sample of older people

Limitations:

- Possible cohort effects not accounted for
- No comparisons with the rest of the United Kingdom

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What is already known on this subject?

A number of socio-economic factors have been associated with alcohol abuse in later life, some of which present contradictory findings.

What this study adds?

Despite a large and increasing literature on the topic, an in-depth statistical analysis based on a large representative survey in England also looking into transitions across risk categories over time was missing. This is precisely what this study adds, contributing thus to more effective policy design and interventions.

Data sharing statement

No additional data available

Ethics

This is a secondary analysis of publicly available data. No ethical approval was required.

Funding

The study was fully funded internally.

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1. Introduction

This paper looks into the socio-economic determinants of alcohol abuse among the population aged 50 or over in England. It also investigates what may be driving transitions between risk categories over time.

Since the first study that examined alcohol consumption among older people living in the community,[1] a large literature has developed –a summary of the early literature is found in, [2]; for present comprehensive updates of the main issues, see,[3-5].

A number of papers have examined specific aspects, including: general health consequences (eg, [6]), quantity and frequency (eg,[7]), measuring tools,[8], attitudes,[9],co-morbidities,[10], screening,[11], economic cost,[12], demand for health and social care services,[13], mortality,[14-17], etc. Besides, a sizable literature has looked into the psycho-social determinants of both consumption and changes in risks over time. This paper contributes to the latter category: it investigates statistical associations between alcohol risk categories and transitions between them over time and psycho-social characteristics of the population aged 50 or over in England. It will not focus upon the health, financial or psycho-social consequences of alcohol abuse.

The structure of the paper is as follows. A brief description of the academic literature on the psychological and social drivers behind alcohol abuse in later life is included in section 2. Section 3 presents the data and Section 4 describes the statistical methods used. Sections 5 and 6 set out the results of the analysis of the determinants of alcohol abuse and of its transitions over time, respectively. Section 7 concludes.

2. Determinants of alcohol abuse in old age. A synopsis of the literature

A recent literature review of alcohol use and alcohol-use disorders among older adults in India report significant statistical associations between alcohol consumption in old age and a higher educational status, younger age, better health status, lower chronic morbidity, employment status, socioeconomic status, auditory/locomotor impairment and asthma,[18].

Some of these variables (e.g. age, income, education, and gender) have been consistently found associated with risk of alcohol abuse in old age across the literature at least since the late 1980s (eg,[19]). Albeit, some studies are based on such small samples,[eg 20] that low statistical power may have affected the standard errors and consequently, the significance of the results. A study based on a sample large enough for statistical purposes found that age is not a significant predictor,[21]. Two recent papers also report significant findings among alcohol consumption and these four variables, as well as with other covariates: significant associations have been found between alcohol consumption and education, age, subjective health status, and gender among the older population in Sweden,[22]; in turn, the following list of characteristics were reported to be associated with unhealthy drinking among older people in Belgium: age, gender, social contacts, education, health status and socio-economic status,[23].

Similarly, the literature on transitions has identified some recurring associations, such as declining risk with advanced age (e.g.,[24]). Using data from the United States, [25] found that increasing alcohol

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consumption among the older population was more likely among the more affluent, better educated, white, males, unmarried, less religious and in better self-reported health. Furthermore, a longitudinal study with US data on people aged 53 and 64 years found that changes in drinking categories were associated with gender, health, and education, adolescent IQ, income, lifetime history of alcohol-related problems, religious service attendance, depression, debt, and changes in employment,[26]. A study into changes in alcohol consumption among people aged 55-76 in the United States found that they were associated with gender, ethnicity, smoking, use of substances to reduce tension, and social connectedness (and whether their contacts approved of heavy drinking or not),[27]. More recently, a 10-year study of alcohol use transitions among men aged between 50 and 65 in the United States reported that the different trajectories of risk were associated with age, education, smoking, binge drinking, depression, pain, and self-reported health,[28].

Some culturally relevant aspects have also been identified: for example, a study on changing in drinking consumption among older people in Japan found that apart from gender, education, age, and depression, a related factor is employment status: consumption tends to drop significantly with retirement, which the authors ascribed to the role of alcohol consumption in Japanese work culture,[29].

The following table presents a summary of the main findings in the literature.

<Insert Table 1 here>

3. Data

This paper is based on data from the English Longitudinal Study of Ageing (ELSA) -a longitudinal multidisciplinary data from a representative sample of men and women aged 50 years and over living in private households in England,[48]. To study the determinants of alcohol abuse, we used the latest wave (Wave 5) of the English Longitudinal Study of Ageing (ELSA), corresponding to the years 2010-2011 (sample size: 9,251) and, for the transitions analysis, the last two waves (Wave 4 corresponds to the years 2008-2009).

We defined risk of alcohol abuse following the guidelines set out by the National Institute for Health and Care Excellence (NICE). NICE has defined the following levels of risk of alcohol abuse:

- Lower-risk drinking: ≤ 21 units per week (adult men) or ≤ 14 units per week (adult women).
- Increasing-risk drinking: 22 ≤ 50 units per week (adult men) or 15 ≤ 35 units per week (adult women).
- Higher-risk drinking: > 50 alcohol units per week (adult men) or > 35 units per week (adult women).

The literature on alcohol abuse in old age distinguishes between people who consume low quantities of alcohol and abstainers,[49-51]. Our data do not allow us to make such a distinction, but we have separated those respondents who said they had not drunk any alcohol at all during the previous week from those who did. Therefore, in this paper, we have included a fourth risk category –which we have

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termed the “abstainers”-, but we emphasise the individuals in this category may not necessarily be teetotal but consistent infrequent drinkers,[28], and therefore there may be some overlap between this group and the lower-risk drinkers. Nevertheless, because in our models we focused on higher-risk drinkers, this distinction between abstainers and lower-risk drinkers is inconsequential for our results.

The literature has also introduced a distinction between early-onset and late-onset cases,[52-54] as well as that between having a history of problem drinking or not,[25,45]. However, the data do not allow us to distinguish between early and late onsets or about individual lifetime alcohol consumption patterns, so the paper considers current abuse risk and changes across risk categories in relation to covariates measured at baseline with disregard of alcohol ingest patterns at early ages.

Finally, the literature that focuses upon the relation between stressful life events and changes in alcohol consumption in old age distinguishes between events with short-term effects and those with long-term implications,[55]. In order to discern between short- and long-term effects of life events we would need data that covered longer than two years as in this paper –furthermore, we would also need data from years before the events took place to account for simultaneous causality and unobserved individual endogeneity,[56]; hence we are not going to investigate whether this distinction holds for our sample.

ELSA contains questions about weekly consumption of spirits, wine and beer. In order to use NICE guidelines, we used the conversion tables in the drinkaware website (www.drinkaware.co.uk):

- spirits -- 1 measure = 1 unit
- wine -- 1 glass = 3 units
- beer -- 1 pint = 3 units

Table 2 presents the data on risk for those respondents surveyed in both waves, which is also the starting point for the transitions analysis.

<Insert Table 2 here>

We included the following variables in our models:

Age

Income: equivalised household net income per week (truncated at 1 penny). The equivalisation was done by the OECD equivalence scale. Income is imputed net of taxes, and there may be records with negative incomes due to, for example, self-employment losses. We set any negative incomes one penny, but not exactly to zero as in,[57], to allow the logarithmic transformation.

Education: we categorised this variable in four levels:

- No Qualifications
- NVQ1/CSE other grade equivalent

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- NVQ2/NVQ3/GCE A/GCE O Level or equivalent and Foreign
- NVQ4/NVQ5/Degree or Higher education below degree

Smoking: Number of cigarettes smoked per day

Physical Activity: We categorised this variable into four levels:

- Sedentary
- Low
- Moderate
- High

Depression: Whether felt depressed much of the time during past week

Loneliness: four-item scale based on the 20-item Revised UCLA loneliness scale,[58]

- How often do you feel you lack companionship?
- How often do you feel isolated from others?
- How often do you feel left out?
- How often do you feel in tune with the people around you?

(For the first three questions, categorised as lonely if responded 'some of the time' or 'often'; for the last question, if responded 'hardly ever' or 'never').

Self-Reported Health: categorised into Poor, Fair, Good, Very Good, Excellent

Ethnicity: whether respondent is white (=0) or not (=1)

Gender: Female=0; Male=1

Marital Status: three categories:

- Single, Legally separated, Divorced
- Married, first and only marriage, Remarried, Civil partner
- Widowed

Caring responsibilities: Whether respondent looked after anyone in the past week (=1) or not (=0)

Children in Household: Total number of children inside the household

Religion: How important religion is in respondent's daily life. Four levels:

- Very important
- Somewhat important

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- Not very important
- Not at all important

We excluded this variable from the transitions section, because we detected potential errors in the categorisation of the questions about religion in Wave 4.

Economic Activity: Three categories:

- Employed
- Inactive (including unemployed, due to low number of cases)
- Retired (including semi-retired)

Social Detachment - If detached in three or more of the following four domains. Source:,[59]

Civic participation: Not a member of neither a political party, a trade union, an environmental group, a tenants' or neighbourhood group or neighbourhood watch, a church or religious group, nor a charitable association; and did not do voluntary work at least once in the last year.

Leisure activities: Not a member of neither an education, arts or music group or evening class, a social club, a sports club, gym or exercise class, nor of other organisation, club or society.

Cultural engagement: neither went to a cinema, an art gallery, a museum, a theatre, a concert nor an opera performance at least once in the last year.

Social networks: Do not have neither any friends, children nor other immediate family or if they have friends, children or other immediate family but have contact with all of them (meeting, phoning or writing) less than once a week.

Healthy Diet – whether respondent consume five or more portions of vegetables (excluding potatoes) or fruit a day

Table 3 presents the descriptive statistics for each variable for Wave 5.

<Insert Table 3 here>

For Wave 5, Table 4 presents the distribution of the sample by risk category and gender and Figure 1 presents the density distribution of consumption of alcohol units (excluding abstainers) by gender. We notice the largest gender discrepancy among abstainers: 65 per cent of abstainers are women –besides, 49 per cent of women are abstainers (against 33 per cent of men).

<Insert Table 4 here>

<Insert Figure 1 here>

Both Table 3 and Figure 1 suggest that we should run separate models for women and men, further confirmed by a *chi* square test of independence applied to Table 3: there is a significant statistical association between risk and gender (χ^2= 266.84, df = 3, p-value=0).

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4. Statistical methods

To identify variables associated with the probability of being or not being in the higher-risk category, we used a logistic regression model. Given the small proportion of respondents in this category, we applied the Firth correction to account for any bias introduced by zero-inflation.

We included age squared as a term in the regression models to account for any non-linearity in the association between age and risk.

Heavy drinking in old age is associated with short-term mortality,[12,15, 60-64], hence the sample could suffer from an over-representation of moderate drinkers at higher ages as heavy drinkers might have died earlier. Therefore we checked for this possible selection bias: given that this is a cross-sectional study and that the data do not include any information about past drinking behaviour, we ran models with age truncated at 70. We compare the results with those from the full sample and we failed to find any significant differences, so preliminarily we can rule out the presence of selection bias in our sample. Comparing logistic models fitted on different groups or samples is not straightforward and there is no one accepted method. We applied the heterogeneous choice model procedure,[65], for which we fitted heteroskedastic binary response models via maximum likelihood and ran likelihood tests to compare both models (results can be requested from the author).

Future work as part of this research programme is to map alcohol abuse by lower super output area (LSOA) in order to identify 'hotspots' where higher risk is more prevalent. In this regard, we ran preliminary mixed effects models to identify whether there were any differences across the nine regions (formerly, government office regions) and the 433 local authorities in England (comprising 27 county councils, 55 unitary authorities, 32 London boroughs, 36 Metropolitan boroughs, and 201 districts). We failed to find any (results can be requested from the author). It is worth highlighting that in spite of very few observations per local authority (and eventually, in a second stage of this research programme, by lower super output area, of which there are 32,844 in England), precisely the large number of geographical units (which in a multilevel modelling setting are equivalent to groups) would ensure fairly robust results,[66-68].

With regards to the transition analysis, we carried out a Markov chain model assuming continuous and homogeneous time fitted by maximum likelihood, with the same number of regressors as in the previous models (except religion, as indicated above). We used the package 'msm' in R,[69].

Markov chains are stochastic processes according to which, for each respondent, the risk of being in any one particular state in one wave depends solely on the state the person was in the previous wave, plus a number of characteristics observed also in the previous wave,[70-71].

In this paper, we ran models for two and four states. The two-state models fitted transitions between being and not being in the higher-risk category; the four-state models allowed for transitions across any of the four risk categories. However, due to sample limitations the four-state models could not be computed: with four states, none of them irreversible, there are sixteen possible transitions, which proved too many for our samples. Consequently, we only report the results for the two-state models.

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Our two-state models, separately for women and men, estimates the probability of a respondent becoming a higher-risk alcohol abuser in Wave 5 given they were not a higher-risk alcohol abuser in Wave 4, and the probability of becoming a not at-higher risk alcohol abuser in Wave 5 given they were a higher-risk alcohol abuser in Wave 4 –conditional on a number of personal characteristics such as age, education attainment, marital status, etc., measured in Wave 4.

5. Results

Table 5 presents the statistical associations of the different covariates with the probability of being in the higher-risk drinking category in Wave 5. In other words, the table answers the research question 'who would be more likely to be classified as a higher risk alcohol abuser'.

<Insert Table 5 here>

The probability of being in the higher-risk drinking category reduces with age. Moreover, there is a non-linear association between age and risk for men, but not for women (except for the older subgroup of women). Figure 2 presents the probability of being in the higher-risk drinking category by age conditional on all the other variables included in the model. The conditional probability plot in Figure 2 shows that the confidence interval of the regression line for females crosses the non-significant level (= -1) between ages 50 and 68, whereas for men the non-significant section spans across a more narrow age range – between 72 and 76 years. Given these results, we ran separate models for women aged 68 or under and for women aged over 68, and we found a non-linear relation between age and risk for the latter (Age: 1.865; p-value=0.05. Age^2: -0.013; p-value 0.05. Full results can be requested from the author).

<Insert Figure 2 here>

Income is positively associated with a higher risk for women but not for men, whist the number of cigarettes consumed is positively associated for both sexes.

Being depressed is positively associated with a higher risk of alcohol abuse. In contrast, being lonely is inversely associated, which may suggest drinking may be driven by social opportunity,[73-74].

Higher-risk drinking is more likely among white women.

Having caring responsibilities and considering that their religion is very important for their lives reduce the probability of being a higher-risk drinker among men, but present no significant association among women.

Both for men and women, a higher risk is positively associated with higher educational attainment.

Retired women tend to be more at risk than employed women, but economic activity is not significantly associated with risk among men.

None of the other variables included in the models presented statistically significant associations with risk.

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It is important, once a model has been fitted, to estimate whether any predictions stemming from it can be validly extended to other samples or to the same subjects in the future. This is known as the validation stage. Validation can be external or internal –that is, it can resort to data not used in the fitting of the model (external) or to the data included in the estimation stage (internal). We opted for an internal validation of our models, for which we applied the bootstrap method,[75-77].

Table 6 presents the tests of internal validation of the logistic regression models for men and women. The *c*-statistic measures the discriminative ability of the model: the concordance between predicted and observed responses. The slope statistic (also known as the shrinkage factor) is a measure of the amount of over-fitting likely to be present.

< Insert Table 6 here>

The *c*-statistic ranges between 0.5 (no predictive discrimination) and 1 (perfect separation power between respondents with different alcohol abuse risk levels). We note the models discriminate slightly better among women than men, but in both cases we obtain acceptable concordance. With regards to the shrinkage factor, it should be of concern if the slope coefficient fell below 0.85,[76]. In our case, the results indicate a mild over-fitting: about 12 per cent (for women) and 14 per cent (for men) of the model fit is statistical noise –i.e. within acceptable levels.

Transitions

Table 7 presents the results for the Markov chain models, which estimate the associations between being or not being classified as a higher risk drinker in Wave 4 and the risk classification in Wave 5 conditional on a number of personal characteristics measured in Wave 4.

<Insert Table 7 here>

For women who were not classified as higher-risk drinkers in Wave 4, our findings suggest that being lonely, being younger and having a higher income in Wave 4 are all associated with a higher probability of becoming a higher-risk alcohol drinker in Wave 5. No variables were significantly associated with ceasing to be in the higher-risk category by Wave 5 for those women who were classified as such in Wave 4.

For men who were not classified as at higher-risk in Wave 4, a higher probability of becoming a higher-risk alcohol drinker in Wave 5 is associated with not eating healthily, being younger and having a higher income. Furthermore, we also found that the presence of children living in the household, being lonely, being older, and having a lower income increases the likelihood of ceasing to be at higher risk by Wave 5. The last two findings are worth a further explanation: we found that, for men, the older they are the less likely it is they may become higher-risk drinkers and for those at a higher-risk category, the more likely it is that they may cease to be so. Similarly for income levels: the higher the income, the more likely that men may become higher-risk drinkers if they were not so, and the less likely that they cease to be higher-risk drinkers if they happened to be classified as such.

Apart from the associations with covariates at baseline (i.e. Wave 4), we also investigated whether the transitions into and out of the higher-risk category between both waves were associated with having widowed, retired during this period, taken on caring responsibilities, or the 'empty nest' syndrome (i.e. if there were any children living in the household in Wave 4 and they had all left by Wave 5). We failed to find any significant associations (results can be requested from the author).

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6. Conclusions

Several socio-economic factors would be associated with high risk alcohol consumption behaviour among older people which must be factored in when designing and evaluating preventative interventions.

For men, in particular, the finding that some variables are also associated with dropping out of the higher risk category can guide interventions towards driving older people out of this harmful behavioural pattern.

7. References

[1] Bridgewater R, Leigh S, James O and Potter J. (1987). Alcohol consumption and dependence in elderly patients in an urban community. BMJ, 295(6603): 884-885.

[2] Liberto J, Oslin D and Ruskin P. (1992). Alcoholism in Older Persons: A Review of the Literature. Psychiatric Services, 43(10).

[3] Sorocco K and Ferrell S. (2006). Alcohol Use Among Older Adults. The Journal of General Psychology, 133:4, 453-467.

[4] St John P, Snow W and Tyas S. (2010). Alcohol use among older adults. Reviews in Clinical Gerontology, 20(1):56-68.

[5] Kalapatapu R, Paris P and Neugroschl J. (2010). Alcohol Use Disorders in Geriatrics. The International Journal of Psychiatry in Medicine, 40(3):321-337.

[6] Pontes Ferreira M and Suzy Weems M. (2008). Alcohol Consumption by Aging Adults in the United States: Health Benefits and Detriments. Journal of the American Dietetic Association, 108(10):1668-1676.

[7] Breslow R and Smothers B. (2004). Drinking Patterns of Older Americans: National Health Interview Surveys, 1997-2001. Journal of Studies on Alcohol and Drugs, 65(2).

[8] Moore A, Beck J, Babor T, Hays R and Reuben DB. (2002). Beyond alcoholism: identifying older, at-risk drinkers in primary care. J Stud Alcohol. 63(3):316-24.

[9] San Jose B, Bongers I, Garretsen H. (1999). Drinking Patterns and Attitudes toward Drinking in the Late-Middle-Aged. Subst Use Misuse, 34(8):1085-100.

[10] Kim K, Choi E, Lee S, Park J, Lee J, Huh Y, Youn J, Jhoo J, Choo I, Kim M, Lee D and Woo J. (2009). Prevalence and neuropsychiatric comorbidities of alcohol use disorders in an elderly Korean population. Int J Geriatr Psychiatry, 24(12):1420-8.

[11] Fink A, Hays R, Moore A and Beck J. (1996). Alcohol-Related Problems in Older Persons. Determinants, Consequences, and Screening. Arch Intern Med., 156(11):1150-1156.

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[12] Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. The Lancet, 373:2223–2233.

[13] Tait R, French D, Burns R, Byles J, and Anstey K. (2013). Alcohol, hospital admissions, and falls in older adults: a longitudinal evaluation. International Psychogeriatrics, 25(6):901-912.

[14] Thun M, Peto R, Lopez A, Monaco J, Henley S, Heath Jr. C and Doll R. (1997). Alcohol Consumption and Mortality among Middle-Aged and Elderly U.S. Adults. N Engl J Med; 337:1705-1714.

[15] Di Castelnuovo A, Costanzo S, Bagnardi V, Donati MB, Iacoviello L, de Gaetano G. (2000). Alcohol dosing and total mortality in men and women: An updated meta-analysis of 34 prospective studies. Arch Intern Med;166:2437-2445.

[16] Holahan C, Schutte K, Brennan P, Holahan C, Moos B and Moos R. (2010). Late-Life Alcohol Consumption and 20-Year Mortality. Alcoholism: Clinical and Experimental Research, 34(11).

[17] Shen C, Schooling M, Chan W, Xu L, Lee S and Lam T. (2013). Alcohol intake and death from cancer in a prospective Chinese elderly cohort study in Hong Kong. J Epidemiol Community Health, 67(10):813-820.

[18] Nadkarni A, Murthy P, Crome I and Rao, R. (2013). Alcohol use and alcohol-use disorders among older adults in India: a literature review. Aging & Mental Health, 17(8): 979-991.

[19] Goodwin JS, Sanchez C, Thomas P, Hunt C, Garry P and Goodwin, JM. (1987). Alcohol intake in a healthy elderly population. American journal of public health, 77(2), 173-177.

[20] Iliffe S, Haines A, Booroff A, Goldenberg E, Morgan P and Gallivan S. (1991). Alcohol consumption by elderly people: a general practice survey. Age and Ageing, 20: 120-3.

[21] Peltzer K and Phaswana-Mafuya N. (2013). Problem drinking and associated factors in older adults in South Africa. African Journal of Psychiatry, 16(2).

[22] Fornazar R, Spak, F, Dahlin-Ivanoff S and Wilhelmson K. (2013). Alcohol Consumption among the Oldest Old and How It Changes during Two Years. ISRN Geriatrics, ID 671218. doi:10.1155/2013/671218.

[23] Hoeck, S and Van Hal, G. (2013). Unhealthy drinking in the Belgian elderly population: prevalence and associated characteristics. European Journal of Public Health, 23(6):1069-1075.

[24] Adams W, Garry P, Rhyne R, Hunt C, and Goodwin J. (1990). Alcohol intake in the healthy elderly. Changes with age in a cross-sectional and longitudinal study. J Am Geriatr Soc. 38(3):211-6.

[25] Platt A, Sloan F and Costanzo P. (2010). Alcohol-Consumption trajectories and associated characteristics among adults older than age 50. Journal of Studies on Alcohol and Drugs, 71(2):169-179.

[26] Molander R, Yonker J and Krahn D. (2010). Age-Related Changes in Drinking Patterns From Mid- to Older Age: Results From the Wisconsin Longitudinal Study. Alcoholism: Clinical and Experimental Research, 34(7):1182–1192.

[27] Brennan P, Schutte K and Moos R. (2010). Patterns and predictors of late-life drinking trajectories: A 10-year longitudinal study. Psychology of Addictive Behaviors, Vol 24(2): 254-264.

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[28] Bobo J, Greek A, Klepinger D and Herting J. (2013). Predicting 10-Year Alcohol Use Trajectories Among Men Age 50 Years and Older. The American Journal of Geriatric Psychiatry, 21(2):204-213.

[29] Gee G, Liang J, Bennett J, Krause N, Kobayashi E, Fukaya T and Sugihara Y. (2007). Trajectories of Alcohol Consumption among Older Japanese Followed from 1987-1999. Research on Aging, 29(4), 323-347.

[30] Bristow M and Clare A. (1992). Prevalence and characteristics of at risk drinkers among elderly acute medical inpatients. Br J Addiction, 87: 291-4.

[31] Mirand A and Welte J. (1996). Alcohol consumption among the elderly in a general population, Erie county, New York. Am. J. Public Health 86(7): 978-894.

[32] Ruchlin H. (1997). Prevalence and Correlates of Alcohol Use among Older Adults. Preventive Medicine, 26(5):651-657.

[33] Dent O, Grayson D, Waite L, Cullen J, Creasey H, and Broe G. (2000). Alcohol consumption in a community sample of older people. Australian and New Zealand Journal of Public Health, 24(3): 323–326.

[34] Ganry O, Joly J, Queval M and Dubreuil A. (2000). Prevalence of alcohol problems among elderly patients in a university hospital. Addiction, 95: 107-113.

[35] Ganry O, Baudoin C, Fardellone P, Dubreuil A and the EPIDOS Group. (2001). Alcohol consumption by non-institutionalised elderly women: The EPIDOS Study, Public Health, 115(3):186-191.

[36] Leeson G. (2007). The alcohol behaviour of independent older people in Denmark. International Journal of Health Promotion and Education, 45(2): 49-52.

[37] Merrick E, Horgan C, Hodgkin D, Garnick D, Houghton S, Panas L, Saitz R, and Blow F. (2008). Unhealthy drinking patterns in older adults: prevalence and associated characteristics. Journal of the American Geriatrics Society, 56(2):214-223.

[38] Kirchner J, Zubritsky C, Cody M, Coakley E, Chen H, Ware J, Oslin D, Sanchez H, Durai U, Miles K, Llorente M, Costantino G and Levkoff S. (2007). Alcohol consumption among older adults in primary care. Journal of General Internal Medicine, 22(1):92-97.

[39] Castro-Costa E, Ferri C, Lima-Costa M, Zaleski M, Pinsky I, Caetano R, and Laranjeira R. (2008). Alcohol consumption in late-life — The first Brazilian National Alcohol Survey. Addictive Behaviors, 33(12):1598-1601.

[40] Hirata S, Nakano Y, Arrais Pinto Jr J, Litvoc J and Bottino C. (2009). Prevalence and correlates of alcoholism in community-dwelling elderly living in São Paulo, Brazil. International Journal of Geriatric Psychiatry, 24(10):1045–1053.

[41] Sacco P, Bucholz K and Spitznagel E. (2009). Alcohol Use Among Older Adults in the National Epidemiologic Survey on Alcohol and Related Conditions: A Latent Class Analysis. Journal of Studies on Alcohol and Drugs, 70(6):829-38.

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[42] Immonen S, Valvanne J, and Pitkala K. (2011). Prevalence of at-risk drinking among older adults and associated socio-demographic and health-related factors. The Journal of Nutrition, Health & Aging, 15(9):789-794.

[43] Sacco P, Bucholz K and Harrington D. (2014). Gender differences in stressful life events, social support, perceived stress, and alcohol use among older adults: results from a National Survey. Subst Use Misuse. 49(4):456-65.

[44] Busby W, Campbell A, Borrie M and Spears G. (1988). Alcohol use in a community-based sample of subjects aged 70 years and older. J Am Geriatr Soc., 36(4):301-5.

[45] Moos R, Schutte K, Brennan P and Moos B. (2010). Late-life and life history predictors of older adults' high-risk alcohol consumption and drinking problems. Drug Alcohol Depend. 108(1-2):13-20.

[46] Liew H-P. (2011). Trajectories of alcohol consumption among the elderly widowed population: A semi-parametric, group-based modeling approach. Advances in Life Course Research, 16(3):124–131.

[47] Borok J, Galier P, Dinolfo M, Welgreen S, Hoffing M, Davis J, Ramirez K, Liao D, Tang L, Karno M, Sacco P, Lin J, and Moore, A. (2013). Why Do Older Unhealthy Drinkers Decide to Make Changes or Not in Their Alcohol Consumption? Data from the Healthy Living as You Age Study. Journal of the American Geriatrics Society, 61(8): 1296-1302.

[48] Cheshire H, Hussey D, Phelps A and Wood N (2012). Methodology, in: The Dynamics of Ageing. Evidence from the English Longitudinal Study of Ageing 2002–10 (Wave 5), J Banks, J Nazroo and A Steptoe (eds.). The Institute for Fiscal Studies, London: UK.

[49] Lang I, Wallace R, Huppert F and Melzer D. (2007). Moderate alcohol consumption in older adults is associated with better cognition and well-being than abstinence, Age and Ageing, 36(3):256–261.

[50] Poli A, Marangoni F, Avogaro A, Barba G, Bellentani S, Bucci M, Cambieri R, Catapano AL, Costanzo S, Cricelli C, de Gaetano G, Di Castelnuovo A, Faggiano P, Fattirolli F, Fontana L, Forlani G, Frattini S, Giacco R, La Vecchia C, Lazzaretto L, Loffredo L, Lucchin L, Marelli G, Marrocco W, Minisola S, Musicco M, Novo S, Nozzoli C, Pelucchi C, Perri L, Pieralli F, Rizzoni D, Sterzi R, Vettor R, Violi F and Visioli F. (2013). Moderate alcohol use and health: A consensus document. Nutrition, Metabolism and Cardiovascular Diseases, 23(6):487-504.

[51] Rogers R, Krueger P, Miech R, Lawrence E, and Kemp R. Nondrinker (2013). Mortality Risk in the United States. Population Research and Policy Review, 32(3): 325-352.

[52] Schonfeld L and Dupree L. (1991). Antecedents of Drinking for Early- and Late-Onset Elderly Alcohol Abusers. Journal of Studies on Alcohol and Drugs, 52(6),

[53] Liberto J and Oslin D. (1995) Early versus late onset of alcoholism in the elderly. Int. J. Addiction 30(13, 14):1799-1818.

[54] Dar K. (2006). Alcohol use disorders in elderly people: fact or fiction? Advances in Psychiatric Treatment, 12:173-181.

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[55] Tamers S, Okechukwu C, Bohl A, Guéguen A, Goldberg M, and Zins M. (2014). The Impact of Stressful Life Events on Excessive Alcohol Consumption in the French Population: Findings from the GAZEL Cohort Study. PLoS One. 9(1): e87653. Published online Jan 27, 2014. doi: 10.1371/journal.pone.0087653.

[56] Iparraguirre J. (2014). Physical Functioning in work and retirement: commentary on age-related trajectories of physical functioning in work and retirement –the role of sociodemographic factors, lifestyle and disease by Stenholm et al. J Epidemiol Community Health. doi:10.1136/jech-2014-203945.

[57] Muriel A and Oldfield Z. (2010). Financial circumstances and consumption. In: Financial circumstances, health and well-being of the older population in England: ELSA 2008 (Wave 4). J Banks, C Lessof, J Nazroo, N Rogers, M Stafford and A Steptoe (eds) (Chapter 3). Institute for Fiscal Studies.

[58] Demakakos P, Nunn S and Nazroo J. (2006). Loneliness, relative deprivation and life satisfaction, in: Retirement, health and relationships of the older population in England: The 2004 English Longitudinal Study of Ageing (Wave 2). J Banks, E Breeze, C Lessof and Nazroo, J (eds.) The Institute for Fiscal Studies: London, UK.

[59] Jivraj S, Nazroo J and Barnes M. Change in social detachment in older age in England, in: The Dynamics of Ageing: Evidence from the English Longitudinal Study of Ageing 2002-10 (Wave 5). J Banks, J Nazroo and A Steptoe (eds.) The Institute for Fiscal Studies: London, UK.

[60] Keil U, Chambless L, Döring A, Filipiak B and Stieber J. (1997). The relation of alcohol intake to coronary heart disease and all-cause mortality in a beer-drinking population. Epidemiology, 8(2):150-6.

[61] Bagnardi V, Blangiardo M, La Vecchia C, and Corrao G. (2001). Alcohol consumption and the risk of cancer: A meta-analysis. Alcohol Res Health;25:263-270.

[62] Wellmann J, Heidrich J, Berger K, Döring A, Heuschmann P and Keil U. (2004). Changes in alcohol intake and risk of coronary heart disease and all-cause mortality in the MONICA/KORA-Augsburg cohort 1987-97. European Journal of Cardiovascular Prevention & Rehabilitation, 11(1):48-55.

[63] Sadakane A, Gotoh T, Ishikawa S, Nakamura Y, Kayaba K and Jichi Medical School (JMS). Cohort Study Group. (2009). Amount and frequency of alcohol consumption and all-cause mortality in a Japanese population: the JMS Cohort Study. Journal of Epidemiology, 19(3):107-115.

[64] Ruf E, Baumert J, Meisinger C, Döring A and Ladwig, K. (2014). Are psychosocial stressors associated with the relationship of alcohol consumption and all-cause mortality? BMC public health, 14(1):312.

[65] Williams R. (2009). Using Heterogeneous Choice Models to Compare Logit and Probit Coefficients Across Groups. Sociological Methods & Research, 37(4), 531–559.

[66] Mass C and Hox J. (2005). Sufficient sample sizes for multilevel modeling. Methodology, 1(3):86–92.

[67] Bell B, Morgan G, Kromrey J and Ferron J. (2010). The impact of small cluster size on multilevel models: a Monte Carlo examination of two-level models with binary and continuous predictors. 2010 Joint Statistical Meeting. JSM Proceedings, Survey Research Methods Section, 4057-4067.

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[68] Marshall A, Jivraj S, Mazroo J, Tampubolon G and Vanhoutte B. (2014). Does the level of wealth inequality within an area influence the prevalence of depression amongst older people? Health & Place, 27:194-204.

[69] Jackson, C. (2011). Multi-State Models for Panel Data: The msm Package for R. Journal of Statistical Software, 38(8):1-29.

[70] Bartolucci F, Farcomeni A and Pennoni F. (2012). Latent Markov models: a review of a general framework for the analysis of longitudinal data with covariates. MPRA Paper 39023, Munich Personal RePEc Archive. University Library of Munich, Germany.

[71] Pardoux, E. (2008). Markov processes and applications : algorithms, networks, genome, and finance. John Wiley & Sons Ltd.

[73] Hanson B. (1994). Social network, social support and heavy drinking in elderly men-a population study of men born in 1914, Malmö, Sweden. Addiction, 89(6):725-732.

[74] Wilkinson C, Dare J, Waters S, Allsop S and McHale S. (2012). An exploration of how social context and type of living arrangement are linked to alcohol consumption amongst older Australians. Foundation for Alcohol Research and Education.

[75] Harrell Jr F. (2001). Regression Modeling Strategies: with applications to linear models logistic regression and survival analysis. Springer Series in Statistics. Springer. New York: USA.

[76] Harrell Jr F, Lee K and Mark D. (1996). Multivariable prognostic models: issues in developing models, evaluation assumptions and adequacy, and measuring and reducing errors. Statistics in Medicine, 15:361-387.

[77] Steyerberg, E, Harrell Jr, F, Borsboom, G, Eijkemans, M, Vergouwe, Y and Habbema, J. (2001). Internal validation of predictive models: efficiency of some procedures for logistic regression analysis. Journal of clinical epidemiology, 54(8), 774-781.

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Table 1 – Main Findings in Relevant Literature

Determinants of Alcohol use and abuse in Old Age																	
Paper	**Gender**	**Age**	**Education**	**Income**	**Health status**	**Smoking**	**Marital status**	**Economic activity**	**Ethnicity**	**Religion**	**Depression**	**Social connectedness**	**History of problem drinking**	**Anxiety (and related factors)**	**Weight**	**Beliefs about health effects of excessive drinking**	**Other covariates**
[19]	x	x	x														
[30]	x					x	x										Mobility
[31]	x			x	x	x		x		x							Living in a suburb
[32]	x	x	x		x				x						x	x	City size, Diabetes
[33]	x						x										
[34]	x		x	x			x						x				
[35]			x	x		x	x										
[36]	x	x					x										
[37]	x	x	x	x	x	x	x		x		x						
[38]					x						x	x		x			
[39]	x	x		x													
[40]	x	x	x		x	x			x								
[41]	x	x	x		x	x			x		x						Being the adult child of an alcoholic
[10]	x	x				x											
[42]	x	x	x	x	x	x	x										
[43]	x	x	x	x	x		x										
[23]	x	x		x	x							x					
[21]	x					x			x						x		
Determinants of Transitions between Alcohol Abuse Risk in Old Age																	

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Paper	Gender	Age	Education	Income	Health status	Smoking	Marital status	Economic activity	Ethnicity	Religion	Depression	Social connectedness	History of problem drinking	Anxiety (and related factors)	Weight	Beliefs about health effects of excessive drinking	Other covariates
[44]	x			x	x							x					Time
[29]	x	x			x			x									
[27]	x					x			x			x		x			
[25]	x		x	x	x		x		x	x			x				
[45]	x	x		x		x				x		x	x	x			Friends' approval of drinking
[16]	x	x		x		x	x						x				Avoidance coping, physical activity
[26]	x	x	x	x	x			x		x							Indebtedness
[46]	x				x						x		x				Health of deceased spouse
[47]																x	Environment
[22]	x		x		x	x					x						Frailty, cohabitation
[28]		x	x		x	x					x		x				Pain

Note: (x) *significant association*

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Table 2
Alcohol abuse by risk – ELSA Waves 4 and 5

		Wave 5					
		Abstainer	**Lower**	**Increasing**	**Higher**	**Total**	
Wave 4	**Abstainer**	2,768	658	210	59	3,695	*42.3%*
	Lower	787	1,546	339	30	2,702	*31.0%*
	Increasing	156	459	925	166	1,706	*19.5%*
	Higher	44	40	194	346	624	*7.2%*
	Total	3,755	2,703	1,668	601	8,727	
		43.0%	*31.0%*	*19.1%*	*6.9%*		

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Table 3
Descriptive statistics – Wave 5

Variable	Mean	St. Dev.	Min	Max
Higher Risk (=1)	0.072	0.259	0	1
Alcohol Units	12.726	21.474	0	686
Age	66.639	9.031	50	89
Gender (Male=1)	0.445	0.497	0	1
Income (in logs)(*)	5.657	0.6978	-4.605	8.80
Smoking	2.687	10.079	0	210
Physical activity	2.808	0.834	1	4
Depression	0.143	0.35	0	1
Loneliness	0.476	0.499	0	1
Self-reported health status	3.196	1.114	1	5
Ethnicity (Non-white=1)	0.031	0.174	0	1
Social detachment	0.135	0.342	0	1
Religion	1.352	1.245	0	3
Children in household	0.327	0.679	0	3
Caring responsibilities	0.105	0.307	0	1
Healthy Diet	0.517	0.5	0	1

(*) Equivalent to £286.3, £2, £0.01 and £6,634 per week, respectively

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Table 4
Distribution of Sample by Risk and Gender
Wave 5

	Female		Male	Total
Abstainer	2516	*65.2%*	1344	3860
Lower	1489	*50.9%*	1436	2925
Increasing	828	*46.1%*	969	1797
Higher	300	*44.8%*	369	669
Total	5133	*55.5%*	4118	9251

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Table 5
Wave 5 - Logistic Regression Results (Firth bias-corrected)
Probability of being in the Higher-Risk Drinking Category (People aged 50 or over)

Dependent variable: whether respondent is in the higher-risk category	Women		Men	
	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)
Intercept	-4.854	0.000	-15.423	0.000
Age	-0.055	0.000	0.386	0.002
Age Squared			-0.003	0.001
Income (logs)	0.664	0.000	0.056	0.500
Smoking	0.013	0.026	0.016	0.001
Physically Active	-0.025	0.796	-0.097	0.205
Self-reported health	0.174	0.439	-0.239	0.263
Children in household	-0.109	0.533	0.155	0.291
Depression (Yes=1)	0.248	0.001	0.223	0.000
Loneliness (Yes=1)	-2.966	0.000	-1.833	0.000
Ethnicity (Non-White=1)	-0.280	0.014	-0.119	0.163
Social Detachment (Yes=1)	0.126	0.586	0.156	0.400
Religion Important (Yes=1)	0.082	0.148	-0.080	0.082
Caring Responsibilities (Yes=1)	-0.050	0.802	-0.555	0.019
Healthy Diet (Yes=1)	-0.100	0.496	-0.082	0.495
Education attainment				
No Qualifications	1.000		1.000	
NVQ1/ CSE other grade	0.971	0.059	0.650	0.034
NVQ2/GCE O Level / NVQ3/ GCE A Level / Foreign	0.870	0.000	0.377	0.066
Higher below degree / NVQ4/ NVQ5/ Degree	1.136	0.000	1.028	0.000
Marital status				
Married / Co-habiting	1.000		1.000	
Single, Separated or Divorced	0.073	0.684	0.180	0.253
Widowed	-0.146	0.553	0.269	0.303
Economic activity				
Employed	1.000		1.000	
Inactive	0.030	0.903	0.059	0.826
Retired	0.446	0.019	-0.056	0.727
Likelihood ratio test	*192.9395 df=20 p=0 n=4,430*		*153.917 df=21 p=0 n=3,934*	

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Table 6 Resampling Validation of Logistic models (Bootstrap n=200)			
Females			
	Original sample	**Optimism**	**Corrected index**
c statistic	0.735	0.021	0.719
Slope	1.000	0.119	0.881
Males			
c statistic	0.689	0.029	0.669
Slope	1.000	0.143	0.857

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Table 7
Transitions between Risks - Wave 4 and Wave 5 - Markov Chain Models

	Females				Males			
	No-No	**No-Hi**	**Hi-No**	**Hi-Hi**	**No-No**	**No-Hi**	**Hi-No**	**Hi-Hi**
Baseline	-0.09649 (-0.11015, -0.08453)	0.09649 (0.08453, 0.11015)	0.43406 (0.38493, 0.48945)	-0.43406 (-0.4894, -0.3849)	-0.1559 (-0.1760, -0.1381)	0.1559 (0.1381, 0.1760)	0.3535 (0.3152, 0.3964)	-0.3535 (-0.3964, -0.3152)
Single, Separated or Divorced		0.9241 (0.6743, 1.266)	1.14 (0.8299, 1.566)			1.0127 (0.7387, 1.389)	0.8908 (0.6349, 1.250)	
Widowed		1.127 (0.7744, 1.640)	1.126 (0.7825, 1.622)			1.344 (0.8448, 2.138)	1.016 (0.6587, 1.566)	
Inactive		0.7314 (0.4893, 1.093)	0.9961 (0.6631, 1.496)			0.8626 (0.5203, 1.430)	0.922 (0.4707, 1.806)	
Retired		1.283 (0.9042, 1.819)	1.066 (0.7759, 1.464)			1.099 (0.7778, 1.553)	1.149 (0.8516, 1.551)	
Social detachment		1.4889 (0.9389, 2.361)	0.6835 (0.4551, 1.027)			1.4042 (0.9277, 2.126)	0.9494 (0.6271, 1.438)	
Healthy Diet		0.8198 (0.6427, 1.046)	0.9525 (0.7578, 1.197)			0.729 (0.5734, 0.9269)	0.98 (0.7816, 1.228)	
Children in Household		0.9218 (0.7754, 1.096)	0.9585 (0.7886, 1.165)			1.104 (0.9439, 1.291)	1.251 (1.0629, 1.473)	
Care responsibilities		0.7929 (0.5355, 1.174)	1.1294 (0.8004, 1.594)			0.9888 (0.6467, 1.512)	0.8356 (0.5116, 1.365)	
Depression		1.0287 (0.7338, 1.442)	0.8689 (0.6010, 1.256)			1.205 (0.8440, 1.720)	1.176 (0.7988, 1.733)	
Loneliness		0.7656 (0.5999, 0.9771)	1.0833 (0.8583, 1.3674)			0.8675 (0.6827, 1.102)	1.3229 (1.0511, 1.665)	
Age		0.9406 (0.9204, 0.9614)	1.01 (0.9910, 1.0293)			0.9694 (0.9494, 0.9899)	1.023 (1.0040, 1.0423)	
Income		1.2826 (1.0608, 1.551)	0.9196 (0.8155, 1.037)			1.1909 (1.0010, 1.4167)	0.8862 (0.7884, 0.9961)	

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Figure 1 – Wave 5

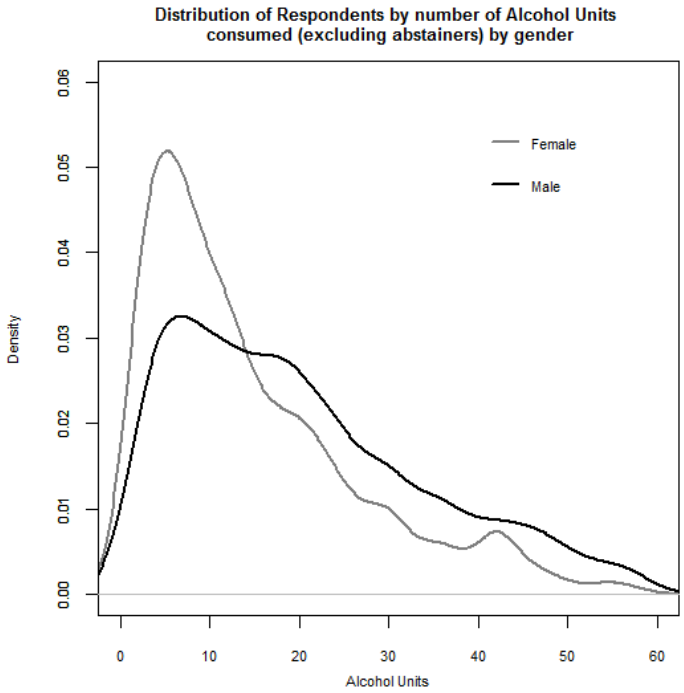

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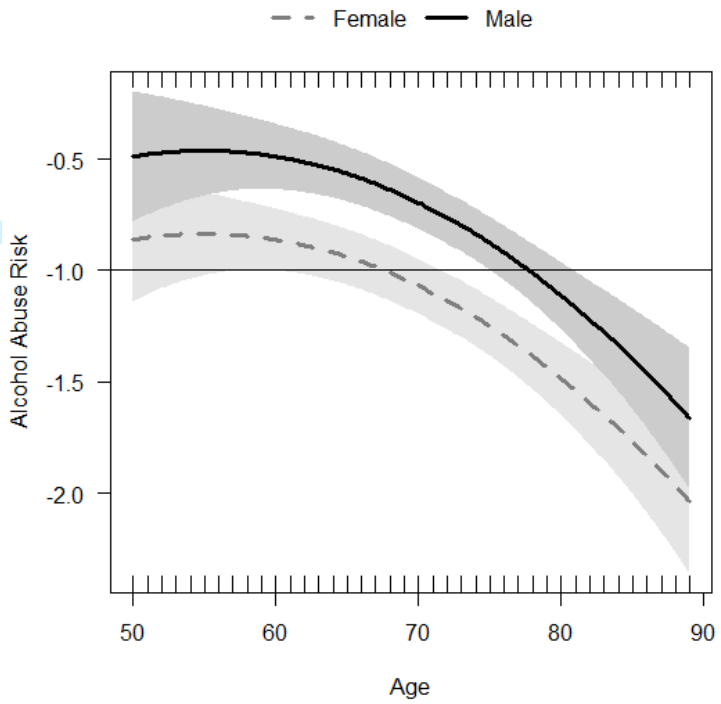
Figure 2 – Wave 5

Conditional probability plot of being at higher-risk drinking category by age



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BMJ Open

Socio-Economic Determinants of Risk of Alcohol Abuse among People aged 50 or over in England

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2015-007684.R1
Article Type:	Research
Date Submitted by the Author:	18-Feb-2015
Complete List of Authors:	Iparraguirre, Jose; Age UK, Research
Primary Subject Heading:	Addiction
Secondary Subject Heading:	Public health, Research methods, Epidemiology
Keywords:	EPIDEMIOLOGY, GERIATRIC MEDICINE, PUBLIC HEALTH

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Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

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Keywords: Alcohol, Older People, Lifestyle

Word count: 3,533

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Abstract

Objectives: This paper looks into the socio-economic determinants of risk of harmful alcohol drinking and of the transitions between risk categories over time among the population aged 50 or over in England.

Setting: Community-dwellers across England

Participants: Respondents to the English Longitudinal Survey of Ageing, Waves 4 and 5.

Results: (Confidence level at 95% or higher, except when stated):

- Higher-risk drinking falls with age and there is a non-linear association between age and risk for men, peaking in their mid-sixties
- Retirement and Income are positively associated with a higher risk for women but not for men
- Education and Smoking are positively associated for both sexes.
- Loneliness and depression are not associated
- Caring responsibilities reduce risk among women
- Single, separated or divorced men show a greater risk of harmful drinking (at 10% confidence level)
- For women, being younger and having a higher income at baseline increase the probability of becoming a higher-risk alcohol drinker over time
- For men, not eating healthily, being younger, and having a higher income increase the probability of becoming a higher-risk alcohol drinker. Furthermore, the presence of children living in the household, being lonely, being older, and having a lower income are associated with ceasing to be a higher-risk alcohol drinker over time

Conclusions: Several socio-economic factors found to be associated with high risk alcohol consumption behaviour among older people would align with those promoted by the 'successful ageing' policy framework.

Article summary

Strengths and limitations of this study

Strengths:

- Longitudinal analysis
- Transitions across risks of harmful alcohol drinking
- Representative sample of older people

Limitations:

- Possible cohort effects not accounted for
- No comparisons with the rest of the United Kingdom

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What is already known on this subject?

A number of socio-economic factors have been associated with harmful drinking in later life, some of which present contradictory findings.

What this study adds?

Despite a large and increasing literature on the topic, an in-depth statistical analysis based on a large representative survey in England also looking into transitions across risk categories over time was missing. This is precisely what this study adds, contributing thus to more effective policy design and interventions.

Data sharing statement

No additional data available

Ethics

This is a secondary analysis of publicly available data. No ethical approval was required.

Funding

The study was fully funded internally.

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Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

1. Introduction

This paper looks into the socio-economic determinants of harmful alcohol drinking among the population aged 50 or over in England. It also investigates what may be driving transitions between risk categories over time.

Since the first study that examined alcohol consumption among older people living in the community,[1] a large literature has developed –a summary of the early literature is found in, [2]; for present comprehensive updates of the main issues, see,[3-5].

A number of papers have examined specific aspects, including: general health consequences (eg, [6]), quantity and frequency (eg,[7]), measuring tools,[8], attitudes,[9],co-morbidities,[10], screening,[11], economic cost,[12], demand for health and social care services,[13], mortality,[14-17], etc. Besides, a sizable literature has looked into the psycho-social determinants of both consumption and changes in risks over time. This paper contributes to the latter category: it investigates statistical associations between alcohol risk categories and transitions between them over time and psycho-social characteristics of the population aged 50 or over in England. It will not focus upon the health, financial or psycho-social consequences of harmful drinking.

The structure of the paper is as follows. A brief description of the academic literature on the psychological and social drivers behind harmful drinking in later life is included in section 2. Section 3 presents the data and Section 4 describes the statistical methods used. Sections 5 and 6 set out the results of the analysis of the determinants of harmful drinking and of its transitions over time, respectively. Section 7 concludes.

2. Determinants of harmful drinking in old age. A synopsis of the literature

A recent literature review of alcohol use and alcohol-use disorders among older adults in India report significant statistical associations between alcohol consumption in old age and a higher educational status, younger age, better health status, lower chronic morbidity, employment status, socioeconomic status, auditory/locomotor impairment and asthma,[18].

Some of these variables (e.g. age, income, education, and gender) have been consistently found associated with risk of harmful drinking and alcohol abuse[1] in old age across the literature at least since the late 1980s (eg,[22]). Albeit, some studies are based on such small samples,[eg 23] that low statistical power may have affected the standard errors and, consequently, the significance of the results. A study based on a sample large enough for statistical purposes found that age is not a significant predictor,[24]. Two recent papers also report significant findings among alcohol consumption and these four variables, as well as with other covariates: significant associations have been found between alcohol consumption

[1] Harmful drinking is defined as a pattern of psychoactive alcohol consumption causing health problems [19-20]. In turn, alcohol abuse is akin to alcohol dependence, which is characterised "by craving, tolerance, a preoccupation with alcohol, and continued drinking in spite of harmful consequences" (p. 754, [21])

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and education, age, subjective health status, and gender among the older population in Sweden,[25]; in turn, the following list of characteristics were reported to be associated with unhealthy drinking among older people in Belgium: age, gender, social contacts, education, health status and socio-economic status,[26].

Similarly, the literature on transitions has identified some recurring associations, such as declining risk with advanced age (e.g.,[27]). Using data from the United States, [28] found that increasing alcohol consumption among the older population was more likely among the more affluent, better educated, white, males, unmarried, less religious and in better self-reported health. Furthermore, a longitudinal study with US data on people aged 53 and 64 years found that changes in drinking categories were associated with gender, health, and education, adolescent IQ, income, lifetime history of alcohol-related problems, religious service attendance, depression, debt, and changes in employment,[29]. A study into changes in alcohol consumption among people aged 55-76 in the United States found that they were associated with gender, ethnicity, smoking, use of substances to reduce tension, and social connectedness (and whether their contacts approved of heavy drinking or not),[30]. More recently, a 10-year study of alcohol use transitions among men aged between 50 and 65 in the United States reported that the different trajectories of risk were associated with age, education, smoking, binge drinking, depression, pain, and self-reported health,[31].

Some culturally relevant aspects have also been identified: for example, a study on changing in drinking consumption among older people in Japan found that apart from gender, education, age, and depression, a related factor is employment status: consumption tends to drop significantly with retirement, which the authors ascribed to the role of alcohol consumption in Japanese work culture,[32]. This paper used data from England where, along with the rest of the United Kingdom, drinking patterns are shifting towards a Nordic-European pattern, “characterised by non-daily drinking, irregular heavy and very heavy drinking episodes (such as during weekends and at festivities) and a higher level of acceptance of drunkenness in public” (p. 11, [33]). Therefore consideration needs to be given to its results as applicable to a particular cultural milieu with evolving drinking patterns.

Table 1 presents a summary of the main findings in the literature.

<Insert Table 1 here>

3. Data

This paper is based on data from the English Longitudinal Study of Ageing (ELSA) -a longitudinal multidisciplinary data from a representative sample of men and women aged 50 years and over living in private households in England,[34]. To study the determinants of harmful drinking, we used the latest wave (Wave 5) of ELSA corresponding to the years 2010-2011 (sample size: 9,251) and, for the transitions analysis, the last two waves (Wave 4 corresponds to the years 2008-2009).

We defined risk of harmful drinking following the guidelines set out by the National Institute for Health and Care Excellence (NICE). NICE has defined the following levels of risk of harmful drinking:

- Lower-risk drinking: ≤ 21 units per week (adult men) or ≤ 14 units per week (adult women).

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- Increasing-risk drinking: 22 ≤ 50 units per week (adult men) or 15 ≤ 35 units per week (adult women).

- Higher-risk drinking: > 50 alcohol units per week (adult men) or > 35 units per week (adult women).

This definition is part of the classification adopted by NICE to set guidelines and public health guidance in England -see also [35]. It is consistent with a 1995 report by the Department of Health on 'sensible' drinking [36], which had set daily, not weekly guidelines. Albeit, it is not without problems –see [37-38], for a discussion. Several hundred estimation measures and instruments –primarily designed as screening tools- are available (the most widely used include the Severity of Alcohol Dependence Questionnaire; the Alcohol Use Disorders Identification Test, the CAGE test, the Michigan Alcoholism Screening Test, the FAST alcohol screening test, etc.), [39] . Furthermore, we carried out a sensitivity analysis and relatively minor changes in the cut-off points for higher risk drinking were found to alter the significance of our regression results (see Annex 1)[2].

Two additional considerations regarding the definitions of risk by NICE merit a comment here: the use of a weekly, instead of daily, guideline may mask episodic heavy drinking –a non-negligible and increasing issue among middle-aged people in England [40-41]- and the lack of specific guidelines for older people (e.g. for people aged 65 or older) is problematic in the light of evidence on physiological and metabolic changes in alcohol absorption and effects associated with individual ageing, [42] which led the Royal College of Psychiatrists to recommend reduced thresholds for older people, [43].

However, we have used this definition of risk given that this paper is based on English data and that one of the objectives of the paper is to inform and influence policy-makers and practitioners in England, who have to follow NICE's guidelines.

The literature on alcohol abuse in old age distinguishes between people who consume low quantities of alcohol and abstainers,[44-46]. Our data do not allow us to make such a distinction, but we have separated those respondents who said they had not drunk any alcohol at all during the previous week from those who did. Therefore, in this paper, we have included a fourth risk category –which we have termed the "abstainers"-, but we emphasise the individuals in this category may not necessarily be teetotal but consistent infrequent drinkers,[31], and therefore there may be some overlap between this group and the lower-risk drinkers. Nevertheless, because in our models we focused on higher-risk drinkers, this distinction between abstainers and lower-risk drinkers is inconsequential for our results.

The literature has also introduced a distinction between early-onset and late-onset cases,[47-49] as well as that between having a history of problem drinking or not,[28,50]. However, the data do not allow us to distinguish between early and late onsets or about individual lifetime alcohol consumption patterns, so the paper considers current abuse risk and changes across risk categories in relation to covariates measured at baseline with disregard of alcohol ingest patterns at early ages.

Finally, the literature that focuses upon the relation between stressful life events and changes in alcohol consumption in old age distinguishes between events with short-term effects and those with long-term implications,[51]. In order to discern between short- and long-term effects of life events we would need

[2] We are grateful to one of the reviewers for this suggestion.

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data that covered longer than two years as in this paper –furthermore, we would also need data from years before the events took place to account for simultaneous causality and unobserved individual endogeneity,[52]; hence we are not going to investigate whether this distinction holds for our sample.

ELSA contains questions about weekly consumption of spirits, wine and beer. In order to use NICE guidelines, we used the conversion tables in the 'alcohol unit calculator' produced by the NHS to help find out how many units there are in the most popular glass sizes and measures in the country[3]. According to this tool, 1 glass of wine is equivalent to 2.1 units, 1 pint of beer to 2.8 units and 1 measure of spirits to 1 unit.

Following the suggestions by one of the reviewers, we estimated the effect on our results of changing the conversion ratios for wine and beer. Thus, we calculated consumption according to the conversion measures introduced in 2007 to the General Lifestyle Survey (GLS)[4]: one pint of a normal strength beer is equivalent to 2 units, a 175 ml glass of wine is equivalent to 2 units and a 250 ml glass of wine is equivalent to 3 units. Furthermore, we also applied the conversion tables in the drinkaware website (www.drinkaware.co.uk): 1 glass of wine, equivalent to 3 units, and 1 pint of beer, equal to 3 units.

Table 2 presents the data on risk for those respondents surveyed in both waves, which is also the starting point for the transitions analysis. It also presents the transitions using the two other alternative conversion measures –the widest variations are found using the drinkaware definitions.

<Insert Table 2 here>

We included the following variables in our models:

Age

Income: equivalised household net income per week (truncated at 1 penny). The equivalisation was done by the OECD equivalence scale. Income is imputed net of taxes, and there may be records with negative incomes due to, for example, self-employment losses. We set any negative incomes one penny, but not exactly to zero as in,[53], to allow the logarithmic transformation.

Education: we categorised this variable in four levels:

- No Qualifications
- NVQ1/CSE other grade equivalent
- NVQ2/NVQ3/GCE A/GCE O Level or equivalent and Foreign
- NVQ4/NVQ5/Degree or Higher education below degree

[3] See http://www.nhs.uk/Tools/Pages/Alcohol-unit-calculator.aspx. Retrieved on 6 February 2015.

[4] General Lifestyle Survey 2011. Office for National Statistics 2013. Available at: http://www.ons.gov.uk/ons/rel/ghs/general-lifestyle-survey/2011/index.html

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Smoking: Number of cigarettes smoked per day

Physical Activity: We categorised this variable into four levels:

- Sedentary
- Low
- Moderate
- High

Depression: Whether felt depressed much of the time during past week

Loneliness: four-item scale based on the 20-item Revised UCLA loneliness scale,[54]

- How often do you feel you lack companionship?
- How often do you feel isolated from others?
- How often do you feel left out?
- How often do you feel in tune with the people around you?

(For the first three questions, categorised as lonely if responded 'some of the time' or 'often'; for the last question, if responded 'hardly ever' or 'never').

Self-Reported Health: categorised into Poor, Fair, Good, Very Good, Excellent

Ethnicity: whether respondent is white (=0) or not (=1)

Gender: Female=0; Male=1

Marital Status: three categories:

- Single, Legally separated, Divorced
- Married, first and only marriage, Remarried, Civil partner
- Widowed

Caring responsibilities: Whether respondent looked after anyone in the past week (=1) or not (=0)

Children in Household: Total number of children inside the household

Religion: How important religion is in respondent's daily life. Four levels:

- Very important
- Somewhat important
- Not very important
- Not at all important

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We excluded this variable from the transitions section, because we detected potential errors in the categorisation of the questions about religion in Wave 4.

Economic Activity: Three categories:

- Employed
- Inactive (including unemployed, due to low number of cases)
- Retired (including semi-retired)

Social Detachment - If detached in three or more of the following four domains. Source:,[55]

Civic participation: Not a member of neither a political party, a trade union, an environmental group, a tenants' or neighbourhood group or neighbourhood watch, a church or religious group, nor a charitable association; and did not do voluntary work at least once in the last year.

Leisure activities: Not a member of neither an education, arts or music group or evening class, a social club, a sports club, gym or exercise class, nor of other organisation, club or society.

Cultural engagement: neither went to a cinema, an art gallery, a museum, a theatre, a concert nor an opera performance at least once in the last year.

Social networks: Do not have neither any friends, children nor other immediate family or if they have friends, children or other immediate family but have contact with all of them (meeting, phoning or writing) less than once a week.

Healthy Diet – whether respondent consume five or more portions of vegetables (excluding potatoes) or fruit a day

Table 3 presents the descriptive statistics for each variable for Wave 5.

<Insert Table 3 here>

For Wave 5, Table 4 presents the distribution of the sample by risk category and gender and Figure 1 presents the distribution of consumption of alcohol units (excluding abstainers) by gender. We notice the largest gender discrepancy among abstainers: 64 per cent of abstainers are women –besides, 50 per cent of women are abstainers (against 34 per cent of men).

<Insert Table 4 here>

<Insert Figure 1 here>

Both Table 4 and Figure 1 suggest that we should run separate models for women and men, further confirmed by a *chi* square test of independence applied to Table 4: there is a significant statistical association between risk and gender (χ^2= 259.07, df = 3, p-value=0).

For the transition analysis, we used a balanced panel –that is, only respondents in both waves were included. This could in principle introduce bias if dropping out of the survey was to any extent contingent to drinking levels. Therefore we checked for a significant association between attrition and consumption

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levels[5]. To this purpose, we fitted an OLS regression with dropping out as the outcome variable on age (and age squared), gender, smoking, health status, and alcohol consumption units. Alcohol consumption units are not significant. Further, we compared the statistical distributions of alcohol consumption units among respondents in wave 4 who took part in the survey in wave 5 and those who did not, for men and women separately, by means of the consistent univariate entropy density equality test bootstrapped with 100 replications[6]. Again, we failed to find an association between alcohol consumption in wave 4 and attrition by wave 5[7]. Therefore, our results would not suffer from 'sick quitter' bias. It is worth noting that studies of attrition by alcohol consumption patterns report inconsistent findings across waves. For example, [57] found that the odds for dropping out at one wave was higher among respondents with high alcohol intake, but that abstainers had increased odds for dropping out at other waves. Furthermore, a literature review, [58], failed to find any association between attrition and alcohol consumption levels.

4. Statistical methods

To identify variables associated with the probability of being or not being in the higher-risk category, we used a logistic regression model. Given the small proportion of respondents in this category, we applied the Firth correction to account for any bias introduced by zero-inflation.

We included age squared as a term in the regression models to account for any non-linearity in the association between age and risk.

Heavy drinking in old age is associated with short-term mortality,[12,15, 59-63], hence the sample could suffer from an over-representation of moderate drinkers at higher ages as heavy drinkers might have died earlier. Therefore we checked for this possible selection bias: given that this is a cross-sectional study and that the data do not include any information about past drinking behaviour, we ran models with age truncated at 70. We compare the results with those from the full sample and we failed to find any significant differences, so preliminarily we can rule out the presence of selection bias in our sample. Comparing logistic models fitted on different groups or samples is not straightforward and there is no one accepted method. We applied the heterogeneous choice model procedure,[64], for which we fitted heteroskedastic binary response models via maximum likelihood and ran likelihood tests to compare both models (results can be requested from the author).

With regards to the transition analysis, we carried out a Markov chain model assuming continuous and homogeneous time fitted by maximum likelihood, with the same number of regressors as in the previous models (except religion, as indicated above). We used the package 'msm' in R,[65].

Markov chains are stochastic processes according to which, for each respondent, the risk of being in any one particular state in one wave depends solely on the state the person was in the previous wave, plus a number of characteristics observed also in the previous wave,[66-67].

We computed discrepancy scores,[68] for consumption of wine, spirits, and beer and for number of drinking days, for men and women, separately, as the difference between units in waves 4 and 5. We failed to find any systematic or consistent patterns and the correlation coefficients between the

[5] We are grateful to one reviewer for highlighting this possibility.

[6] We ran the np package in R [56].

[7] Results available from the corresponding author.

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discrepancy scores of each type of alcoholic drink and the number of drinking days were all very low (max=0.33, for consumption of beer and drinking days for women). Therefore, we can rule out inconsistency in the answers.

In this paper, we ran models for two and four states. The two-state models fitted transitions between being and not being in the higher-risk category; the four-state models allowed for transitions across any of the four risk categories. However, due to sample limitations the four-state models could not be computed: with four states, none of them irreversible, there are sixteen possible transitions, which proved too many for our samples. Consequently, we only report the results for the two-state models.

Our two-state models, separately for women and men, estimates the probability of a respondent becoming a higher-risk alcohol drinker in Wave 5 given they were not a higher-risk alcohol drinker in Wave 4, and the probability of becoming a not at-higher risk alcohol drinker in Wave 5 given they were a higher-risk alcohol drinker in Wave 4 –conditional on a number of personal characteristics such as age, education attainment, marital status, etc., measured in Wave 4.

5. Results

Table 5 presents the statistical associations of the different covariates with the probability of being in the higher-risk drinking category in Wave 5. In other words, the table answers the research question 'who would be more likely to be classified as a higher risk alcohol drinker'.

<Insert Table 5 here>

The probability of being in the higher-risk drinking category decreases with age for men and women. Moreover, there is a non-linear association between age and risk for men, but not for women –hence, we re-ran the model for women with only a linear specification of the variable age –Table 5 shows both sets of results. . Figure 2 presents the probability of being in the higher-risk drinking category by age conditional on all the other variables included in the model. The conditional probability plot in Figure 2 shows that the risk for men becomes highest in the early-sixties. For women, the conditional probability of drinking at harmful levels exhibits a linear negative slope with age. The non-linear association with age and the associated finding that, for men, the probability of being in the higher-risk category peaks in the mid-sixties could give empirical support to the hypothesis that current cohorts of older people are carrying on the relatively higher consumption levels they exhibited earlier on in their lives into older age compared to previous cohorts [40]. However, we can only express the possibility here as we could not distinguish between age, cohort and period effects with the data under study to explore this hypothesis in full.<Insert Figure 2 here>

Income is positively associated with a higher risk for women but not for men, whist the number of cigarettes consumed is positively associated for both sexes.

Reporting better health is positively associated with the probability of drinking at harmful levels.

Neither being depressed nor feeling lonely are associated with a higher risk of harmful drinking

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Higher-risk drinking is more likely among white men, but ethnicity is not significant for women.

Having caring responsibilities reduces the probability of being at higher risk for women. Considering that their religion is very important for their lives is not significantly associated with the probability of being a higher-risk drinker neither for men nor women.

Both for men and women, a higher risk is positively associated with higher educational attainment.

Economic activity is not significantly associated with risk, except retirement for females which increases the likelihood of drinking at higher risk levels.

Single, separated or divorced men show a greater risk of harmful drinking.

None of the other variables included in the models presented statistically significant associations with risk.

Annex 1 presents a sensitivity analysis of the estimates in Table 5 after modifying the threshold for higher risk from NICE guidelines. Annex 2 presents the results using the alternative conversion tables. These sensitivity analyses show that alternative definitions of cut-off levels and conversion units do not introduce substantial changes to the results. Only coefficients significant at 10 per cent level present variations across the choices of thresholds and conversion units. By and large, our results are robust to these methodological changes.

It is important, once a model has been fitted, to estimate whether any predictions stemming from it can be validly extended to other samples or to the same subjects in the future. This is known as the validation stage. Validation can be external or internal –that is, it can resort to data not used in the fitting of the model (external) or to the data included in the estimation stage (internal). We opted for an internal validation of our models, for which we applied the bootstrap method,[68-70].

Table 6 presents the tests of internal validation of the logistic regression models for men and women. The *c*-statistic measures the discriminative ability of the model: the concordance between predicted and observed responses. The slope statistic (also known as the shrinkage factor) is a measure of the amount of over-fitting likely to be present.

< Insert Table 6 here>

The *c*-statistic ranges between 0.5 (no predictive discrimination) and 1 (perfect separation power between respondents with different harmful drinking risk levels). We note the models discriminate slightly better among women than men, but in both cases we obtain acceptable concordance. With regards to the shrinkage factor, it should be of concern if the slope coefficient fell below 0.85,[69]. In our case, the results indicate a mild over-fitting: about 11 per cent (for women) and 13 per cent (for men) of the model fit is statistical noise –i.e. within acceptable levels.

Transitions

Table 7 presents the results for the Markov chain models, which estimate the associations between being or not being classified as a higher risk drinker in Wave 4 and the risk classification in Wave 5 conditional on a number of personal characteristics measured in Wave 4. For completeness, it includes the results from the alternative conversion measures already described (i.e. the drinkaware and the GLS measures).

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<Insert Table 7 here>

For women who were not classified as higher-risk drinkers in Wave 4, our findings suggest that being lonely, being younger and having a higher income in Wave 4 are all associated with a higher probability of becoming a higher-risk alcohol drinker in Wave 5. In turn, observing a healthy diet is associated with a lower probability of becoming a higher-risk alcohol drinker. No variables were significantly associated with ceasing to be in the higher-risk category by Wave 5 for those women who were classified as such in Wave 4.

For men who were not classified as at higher-risk in Wave 4, a higher probability of becoming a higher-risk alcohol drinker in Wave 5 is associated with not eating healthily, being younger and having a higher income. Furthermore, we also found that the presence of children living in the household, being lonely, being older, and having a lower income increases the likelihood of ceasing to be at higher risk by Wave 5. The last two findings are worth a further explanation: we found that, for men, the older they are the less likely it is they may become higher-risk drinkers and for those at a higher-risk category, the more likely it is that they may cease to be so. Similarly for income levels: the higher the income, the more likely that men may become higher-risk drinkers if they were not so, and the less likely that they cease to be higher-risk drinkers if they happened to be classified as such.

Apart from the associations with covariates at baseline (i.e. Wave 4), we also investigated whether the transitions into and out of the higher-risk category between both waves were associated with having widowed, retired during this period, taken on caring responsibilities, or the 'empty nest' syndrome (i.e. if there were any children living in the household in Wave 4 and they had all left by Wave 5). We failed to find any significant associations (results can be requested from the author).

When using the GLS conversion units, three variables result significant for the transition between not being at a higher-risk to becoming a higher-risk drinker among women, and with the same signs as before: age, loneliness and income. In turn, the drinkaware measures render age and healthy diet as the two significant variables regarding that same transition. Comparing the results in Tables 5 and 7 using alternative measures, we find that the changes in conversion units for wine and beer are less crucial to explain the factors associated with drinking at harmful levels in one point in time than to explain the factors associated with becoming a higher-risk drinker over time.

A final methodological point has to do with under-reporting. A recent study, [71], using data from the Health Survey of England (HSE), failed to find any association between under-reporting and age among people aged 50 or over. ELSA uses the same respondents as the HSE, therefore we are confident that our results are not contaminated by under-reporting. However, that study found that under-reporting is probably more to do with drinking pattern than demographic or social factors, which means that respondents classified as at higher-risk might be under-reporting their consumption more than those drinking at safer levels[8].

6. Conclusions

[8] We are grateful to Dr Sadie Boniface, Research Associate at UCL Epidemiology & Public Health, University College London, for this clarification in a personal communication.

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Several socio-economic factors are associated with high risk alcohol consumption behaviour among older people, which must be factored in when designing and evaluating preventative interventions. Without repeating the findings discussed above, we can sketch –at the risk of much simplification- the problem of harmful alcohol drinking among people aged 50 or over in England as a middle-class phenomenon: people in better health, higher income, with higher educational attainment, and socially more active are more likely to drink at harmful levels. This characterisation mirrors the main results from some studies among people of working age, [72-73].

Among the many policy frameworks around ageing –e.g. "active ageing",[74], "productive ageing",[75], etc.- "successful ageing",[43] is one of the most widely used and embraces components such as non-smoking, greater physical activity, more social contacts, better self-rated health, absence of depression, among others, [76].

Alcohol consumption is growing among older people in England, [77-78]. The results reported in this paper would allow us to conclude that, generally speaking, people aged 50 or over ageing 'successfully' in England are more at risk of drinking at harmful levels or of developing harmful drinking consumption patterns than those who fit less well into the paradigm of ageing 'successfully'. There is some evidence that to some extent this is a generational trait: current age cohorts of older people exhibited higher alcohol consumption levels in the past and would be carrying on their relatively higher levels into older age compared to older people in the past [40]. Nevertheless, it should give policy makers some pause for thought when designing information tools for the public as well as a greater incentive to advance toward a fully integrated approach across policy domains.

A number of limitations to this study need to be pointed out. First, we restricted the longitudinal study to two waves. A longer window would make the detection and analysis of trends possible. Second, the dataset used in this paper, ELSA, albeit representative of people aged 50 or over in England, is carried out every two years. Consequently, the transitions analysed in the paper comprised changes between two points in time two years apart, which is an important gap to study lifestyle changes and consumption patterns of frequently purchased goods such as alcoholic drinks. Third, an also related to ELSA, we mentioned in the text that it is not possible to obtain scores for other scales and instruments, and unfortunately the survey only records weekly consumption rather than daily. Fourth, we restricted the main results to the definitions of risk by NICE although, as mentioned earlier, there is some merit in defining levels of risk specifically for older people based on available physiological evidence.

7. References

[1] Bridgewater R, Leigh S, James O and Potter J. (1987). Alcohol consumption and dependence in elderly patients in an urban community. BMJ, 295(6603): 884-885.

[2] Liberto J, Oslin D and Ruskin P. (1992). Alcoholism in Older Persons: A Review of the Literature. Psychiatric Services, 43(10).

[3] Sorocco K and Ferrell S. (2006). Alcohol Use Among Older Adults. The Journal of General Psychology, 133:4, 453-467.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[4] St John P, Snow W and Tyas S. (2010). Alcohol use among older adults. Reviews in Clinical Gerontology, 20(1):56-68.

[5] Kalapatapu R, Paris P and Neugroschl J. (2010). Alcohol Use Disorders in Geriatrics. The International Journal of Psychiatry in Medicine, 40(3):321-337.

[6] Pontes Ferreira M and Suzy Weems M. (2008). Alcohol Consumption by Aging Adults in the United States: Health Benefits and Detriments. Journal of the American Dietetic Association, 108(10):1668-1676.

[7] Breslow R and Smothers B. (2004). Drinking Patterns of Older Americans: National Health Interview Surveys, 1997-2001. Journal of Studies on Alcohol and Drugs, 65(2).

[8] Moore A, Beck J, Babor T, Hays R and Reuben DB. (2002). Beyond alcoholism: identifying older, at-risk drinkers in primary care. J Stud Alcohol. 63(3):316-24.

[9] San Jose B, Bongers I, Garretsen H. (1999). Drinking Patterns and Attitudes toward Drinking in the Late-Middle-Aged. Subst Use Misuse, 34(8):1085-100.

[10] Kim K, Choi E, Lee S, Park J, Lee J, Huh Y, Youn J, Jhoo J, Choo I, Kim M, Lee D and Woo J. (2009). Prevalence and neuropsychiatric comorbidities of alcohol use disorders in an elderly Korean population. Int J Geriatr Psychiatry, 24(12):1420-8.

[11] Fink A, Hays R, Moore A and Beck J. (1996). Alcohol-Related Problems in Older Persons. Determinants, Consequences, and Screening. Arch Intern Med., 156(11):1150-1156.

[12] Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. The Lancet, 373:2223–2233.

[13] Tait R, French D, Burns R, Byles J, and Anstey K. (2013). Alcohol, hospital admissions, and falls in older adults: a longitudinal evaluation. International Psychogeriatrics, 25(6):901-912.

[14] Thun M, Peto R, Lopez A, Monaco J, Henley S, Heath Jr. C and Doll R. (1997). Alcohol Consumption and Mortality among Middle-Aged and Elderly U.S. Adults. N Engl J Med; 337:1705-1714.

[15] Di Castelnuovo A, Costanzo S, Bagnardi V, Donati MB, Iacoviello L, de Gaetano G. (2000). Alcohol dosing and total mortality in men and women: An updated meta-analysis of 34 prospective studies. Arch Intern Med;166:2437-2445.

[16] Holahan C, Schutte K, Brennan P, Holahan C, Moos B and Moos R. (2010). Late-Life Alcohol Consumption and 20-Year Mortality. Alcoholism: Clinical and Experimental Research, 34(11).

[17] Shen C, Schooling M, Chan W, Xu L, Lee S and Lam T. (2013). Alcohol intake and death from cancer in a prospective Chinese elderly cohort study in Hong Kong. J Epidemiol Community Health, 67(10):813-820.

[18] Nadkarni A, Murthy P, Crome I and Rao, R. (2013). Alcohol use and alcohol-use disorders among older adults in India: a literature review. Aging & Mental Health, 17(8): 979-991.

[19] WHO (1993). The ICD-10 Classification of Mental and Behavioural Disorders. Clinical descriptions and diagnostic guidelines. World Health Organization. Geneva: Switzerland.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[20] NICE (2011). Alcohol-Use Disorders Diagnosis, Assessment and Management of Harmful Drinking and Alcohol Dependence. National Clinical Practice Guideline 115. National Collaborating Centre for Mental Health. The British Psychological Society and The Royal College of Psychiatrists. London: UK.

[21] Flynn, N (2011). Harmful drinking and alcohol dependence: advice from recent NICE guidelines. The British Journal of General Practice, 61(593): 754–756.

[22] Goodwin JS, Sanchez C, Thomas P, Hunt C, Garry P and Goodwin, JM. (1987). Alcohol intake in a healthy elderly population. American journal of public health, 77(2), 173-177.

[23] Iliffe S, Haines A, Booroff A, Goldenberg E, Morgan P and Gallivan S. (1991). Alcohol consumption by elderly people: a general practice survey. Age and Ageing, 20: 120-3.

[24] Peltzer K and Phaswana-Mafuya N. (2013). Problem drinking and associated factors in older adults in South Africa. African Journal of Psychiatry, 16(2).

[25] Fornazar R, Spak, F, Dahlin-Ivanoff S and Wilhelmson K. (2013). Alcohol Consumption among the Oldest Old and How It Changes during Two Years. ISRN Geriatrics, ID 671218. doi:10.1155/2013/671218.

[26] Hoeck, S and Van Hal, G. (2013). Unhealthy drinking in the Belgian elderly population: prevalence and associated characteristics. European Journal of Public Health, 23(6):1069-1075.

[27] Adams W, Garry P, Rhyne R, Hunt C, and Goodwin J. (1990). Alcohol intake in the healthy elderly. Changes with age in a cross-sectional and longitudinal study. J Am Geriatr Soc. 38(3):211-6.

[28] Platt A, Sloan F and Costanzo P. (2010). Alcohol-Consumption trajectories and associated characteristics among adults older than age 50. Journal of Studies on Alcohol and Drugs, 71(2):169-179.

[29] Molander R, Yonker J and Krahn D. (2010). Age-Related Changes in Drinking Patterns From Mid- to Older Age: Results From the Wisconsin Longitudinal Study. Alcoholism: Clinical and Experimental Research, 34(7):1182–1192.

[30] Brennan P, Schutte K and Moos R. (2010). Patterns and predictors of late-life drinking trajectories: A 10-year longitudinal study. Psychology of Addictive Behaviors, Vol 24(2): 254-264.

[31] Bobo J, Greek A, Klepinger D and Herting J. (2013). Predicting 10-Year Alcohol Use Trajectories Among Men Age 50 Years and Older. The American Journal of Geriatric Psychiatry, 21(2):204-213.

[32] Gee G, Liang J, Bennett J, Krause N, Kobayashi E, Fukaya T and Sugihara Y. (2007). Trajectories of Alcohol Consumption among Older Japanese Followed from 1987-1999. Research on Aging, 29(4), 323-347.

[33] WHO (2012). Alcohol in the European Union. Consumption, harm and policy approaches. P. Anderson, L. Møller; and G. Galea (eds.) WHO Regional Office for Europe. World Health Organisation. Copenhagen: Denmark.

[34] Cheshire H, Hussey D, Phelps A and Wood N (2012). Methodology, in: The Dynamics of Ageing. Evidence from the English Longitudinal Study of Ageing 2002–10 (Wave 5), J Banks, J Nazroo and A Steptoe (eds.). The Institute for Fiscal Studies, London: UK.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[35] Royal College of Psychiatrists (1979). Alcohol and Alcoholism. The Report of a Special Committee of the Royal College of Psychiatrists. Tavistock. London: UK

[36] Department of Health (1995). Sensible Drinking: Report of an inter-departmental working group. London: UK.

[37] Keller, M. (1977). A lexicon of disablements related to alcohol consumption, in: Alcohol-Related Disabilities, G Edwards, MM Gross, M Keller, J Moser and R Room (eds). WHO Offset Publications N. 32. World Health Organisation. Geneva: Switzerland.

[38] Royal College of Physicians (2011). Royal College of Physicians' written evidence to the Science and Technology Select Committee Inquiry on alcohol guidelines. Royal College of Physicians, London: United Kingdom.

[39] National Institute on Alcohol Abuse and Alcoholism (2003). *Assessing Alcohol Problems: A Guide for Clinicians and Researchers*, 2d ed. NIH Pub. No. 03–3745. U.S. Department of Health and Human Services, Public Health Service. Washington, DC: United States of America.

[40] Smith, L. and Foxcroft, D. Drinking in the UK. An exploration of trends. Joseph Rowntree Foundation. York: United Kingdom.

[41] Gell, L.; Meier, P.S.; and Goyder, E. (2015). Alcohol Consumption Among the Over 50s: International Comparisons. Alcohol and Alcoholism; 50(1):1-10.

[42] Crome I, Li, T-K, Rao, R, and Wu, L-T (2012). Alcohol limits in older people, Addiction, 107(9): 1541-1543.

[43] Rowe, J. W.; Kahn, R. L. (1997). Successful Aging. The Gerontologist 37 (4): 433-40

[44] Lang I, Wallace R, Huppert F and Melzer D. (2007). Moderate alcohol consumption in older adults is associated with better cognition and well-being than abstinence, Age and Ageing, 36(3):256–261.

[45] Poli A, Marangoni F, Avogaro A, Barba G, Bellentani S, Bucci M, Cambieri R, Catapano AL, Costanzo S, Cricelli C, de Gaetano G, Di Castelnuovo A, Faggiano P, Fattirolli F, Fontana L, Forlani G, Frattini S, Giacco R, La Vecchia C, Lazzaretto L, Loffredo L, Lucchin L, Marelli G, Marrocco W, Minisola S, Musicco M, Novo S, Nozzoli C, Pelucchi C, Perri L, Pieralli F, Rizzoni D, Sterzi R, Vettor R, Violi F and Visioli F. (2013). Moderate alcohol use and health: A consensus document. Nutrition, Metabolism and Cardiovascular Diseases, 23(6):487-504.

[46] Rogers R, Krueger P, Miech R, Lawrence E, and Kemp R. Nondrinker (2013). Mortality Risk in the United States. Population Research and Policy Review, 32(3): 325-352.

[47] Schonfeld L and Dupree L. (1991). Antecedents of Drinking for Early- and Late-Onset Elderly Alcohol Abusers. Journal of Studies on Alcohol and Drugs, 52(6),

[48] Liberto J and Oslin D. (1995) Early versus late onset of alcoholism in the elderly. Int. J. Addiction 30(13, 14):1799-1818.

[49] Dar K. (2006). Alcohol use disorders in elderly people: fact or fiction? Advances in Psychiatric Treatment, 12:173-181.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[50] Moos R, Schutte K, Brennan P and Moos B. (2010). Late-life and life history predictors of older adults' high-risk alcohol consumption and drinking problems. Drug Alcohol Depend. 108(1-2):13-20.

[51] Tamers S, Okechukwu C, Bohl A, Guéguen A, Goldberg M, and Zins M. (2014). The Impact of Stressful Life Events on Excessive Alcohol Consumption in the French Population: Findings from the GAZEL Cohort Study. PLoS One. 9(1): e87653. Published online Jan 27, 2014. doi: 10.1371/journal.pone.0087653.

[52] Iparraguirre J. (2014). Physical Functioning in work and retirement: commentary on age-related trajectories of physical functioning in work and retirement –the role of sociodemographic factors, lifestyle and disease by Stenholm et al. J Epidemiol Community Health. doi:10.1136/jech-2014-203945.

[53] Muriel A and Oldfield Z. (2010). Financial circumstances and consumption. In: Financial circumstances, health and well-being of the older population in England: ELSA 2008 (Wave 4). J Banks, C Lessof, J Nazroo, N Rogers, M Stafford and A Steptoe (eds) (Chapter 3). Institute for Fiscal Studies.

[54] Demakakos P, Nunn S and Nazroo J. (2006). Loneliness, relative deprivation and life satisfaction, in: Retirement, health and relationships of the older population in England: The 2004 English Longitudinal Study of Ageing (Wave 2). J Banks, E Breeze, C Lessof and Nazroo, J (eds.) The Institute for Fiscal Studies: London, UK.

[55] Jivraj S, Nazroo J and Barnes M. Change in social detachment in older age in England, in: The Dynamics of Ageing: Evidence from the English Longitudinal Study of Ageing 2002-10 (Wave 5). J Banks, J Nazroo and A Steptoe (eds.) The Institute for Fiscal Studies: London, UK.

[56] Hayfield T, and Racine, JS (2008). Nonparametric Econometrics: The np Package. Journal of Statistical Software, 27(5). URL http://www.jstatsoft.org/v27/i05/.

[57] Thygesen, L, Johansen, C, Keiding, N, Giovannucci E, and Grønbæk, M. (2008). Effects of sample attrition in a longitudinal study of the association between alcohol intake and all-cause mortality. Addiction, 103, 1149-1159.

[58] Chatfield M, Brayne C, and Matthews F. (2005). A systematic literature review of attrition between waves in longitudinal studies in the elderly shows a consistent pattern of dropout between differing studies. Journal of Clinical Epidemiology, 58:13-19.

###

[59] Keil U, Chambless L, Döring A, Filipiak B and Stieber J. (1997). The relation of alcohol intake to coronary heart disease and all-cause mortality in a beer-drinking population. Epidemiology, 8(2):150-6.

[60] Bagnardi V, Blangiardo M, La Vecchia C, and Corrao G. (2001). Alcohol consumption and the risk of cancer: A meta-analysis. Alcohol Res Health;25:263-270.

[61] Wellmann J, Heidrich J, Berger K, Döring A, Heuschmann P and Keil U. (2004). Changes in alcohol intake and risk of coronary heart disease and all-cause mortality in the MONICA/KORA-Augsburg cohort 1987-97. European Journal of Cardiovascular Prevention & Rehabilitation, 11(1):48-55.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[62] Sadakane A, Gotoh T, Ishikawa S, Nakamura Y, Kayaba K and Jichi Medical School (JMS). Cohort Study Group. (2009). Amount and frequency of alcohol consumption and all-cause mortality in a Japanese population: the JMS Cohort Study. Journal of Epidemiology, 19(3):107-115.

[63] Ruf E, Baumert J, Meisinger C, Döring A and Ladwig, K. (2014). Are psychosocial stressors associated with the relationship of alcohol consumption and all-cause mortality? BMC public health, 14(1):312.

[64] Williams R. (2009). Using Heterogeneous Choice Models to Compare Logit and Probit Coefficients Across Groups. Sociological Methods & Research, 37(4), 531–559.

[65] Jackson, C. (2011). Multi-State Models for Panel Data: The msm Package for R. Journal of Statistical Software, 38(8):1-29.

[66] Bartolucci F, Farcomeni A and Pennoni F. (2012). Latent Markov models: a review of a general framework for the analysis of longitudinal data with covariates. MPRA Paper 39023, Munich Personal RePEc Archive. University Library of Munich, Germany.

[67] Pardoux, E. (2008). Markov processes and applications : algorithms, networks, genome, and finance. John Wiley & Sons Ltd.

[68] Harrell Jr F. (2001). Regression Modeling Strategies: with applications to linear models logistic regression and survival analysis. Springer Series in Statistics. Springer. New York: USA.

[69] Harrell Jr F, Lee K and Mark D. (1996). Multivariable prognostic models: issues in developing models, evaluation assumptions and adequacy, and measuring and reducing errors. Statistics in Medicine, 15:361-387.

[70] Steyerberg, E, Harrell Jr, F, Borsboom, G, Eijkemans, M, Vergouwe, Y and Habbema, J. (2001). Internal validation of predictive models: efficiency of some procedures for logistic regression analysis. Journal of clinical epidemiology, 54(8), 774-781.

[71] Boniface, S.; Kneale, J.; and Shelton, N. (2014). Drinking pattern is more strongly associated with under-reporting of alcohol consumption than socio-demographic factors: evidence from a mixed-methods study. BMC Public Health, 14:1297. http://www.biomedcentral.com/1471-2458/14/1297

[72] Ling, J.; Smith, K.; Wilson, G.; Brierley-Jones, L.; Crosland, A.; Kaner, E.; and Haighton, C. (2012). The 'other' in patterns of drinking: A qualitative study of attitudes towards alcohol use among professional, managerial and clerical workers. BMC Public Health, 12: 892. doi:10.1186/1471-2458-12-892

[73] Brierley-Jones, L.; Ling, J.; McCabe, K.; Wilson, G.; Crosland, A.; Kaner, E.; and Haighton, C. (2014). Habitus of home and traditional drinking: a qualitative analysis of reported middle-class alcohol use. Sociology of Health & Illness, 36(7): 1054-1076.

[74] Constança, P; Ribeiro, O. and Teixeira, L. (2012). Active Ageing: An Empirical Approach to the WHO Model. Current Gerontology and Geriatrics Research; article ID 382972, 10 pages, http://dx.doi.org/10.1155/2012/382972

[75] Morrow-Howell, N.; Hinterlong, J. and Sherraden, M. (2001). Productive aging: concepts and challenges. John Hopkins University Press, Baltimore: United States of America.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[76] Depp, C. A., and Jeste, D. V. (2006). Definitions and predictors of successful ageing: a comprehensive review of larger quantitative studies. American Journal of Geriatric Psychiatry, 14, 6-20.

[77] Knott, C.; Coombs, N.; Stamakis, E.; and Biddulph, J. (2015). All cause mortality and the case for age specific alcohol consumption guidelines: pooled analyses of up to 10 population based cohorts. British Medical Journal. BMJ 2015;350:h384

[78] Crome I, Dar K, Janikiewicz S, Rao T, Tarbuck A. (2011). Our invisible addicts. First report of the Older Persons' Substance Misuse Working Group of the Royal College of Psychiatrists. College Report CR165. Royal College of Psychiatrists. London: United Kingdom.

[76] Bristow M and Clare A. (1992). Prevalence and characteristics of at risk drinkers among elderly acute medical inpatients. Br J Addiction, 87: 291-4.

[77] Mirand A and Welte J. (1996). Alcohol consumption among the elderly in a general population, Erie county, New York. Am. J. Public Health 86(7): 978-894.

[78] Ruchlin H. (1997). Prevalence and Correlates of Alcohol Use among Older Adults. Preventive Medicine, 26(5):651-657.

[79] Dent O, Grayson D, Waite L, Cullen J, Creasey H, and Broe G. (2000). Alcohol consumption in a community sample of older people. Australian and New Zealand Journal of Public Health, 24(3): 323–326.

[80] Ganry O, Joly J, Queval M and Dubreuil A. (2000). Prevalence of alcohol problems among elderly patients in a university hospital. Addiction, 95: 107-113.

[81] Ganry O, Baudoin C, Fardellone P, Dubreuil A and the EPIDOS Group. (2001). Alcohol consumption by non-institutionalised elderly women: The EPIDOS Study, Public Health, 115(3):186-191.

[82] Leeson G. (2007). The alcohol behaviour of independent older people in Denmark. International Journal of Health Promotion and Education, 45(2): 49-52.

[83] Merrick E, Horgan C, Hodgkin D, Garnick D, Houghton S, Panas L, Saitz R, and Blow F. (2008). Unhealthy drinking patterns in older adults: prevalence and associated characteristics. Journal of the American Geriatrics Society, 56(2):214-223.

[84] Kirchner J, Zubritsky C, Cody M, Coakley E, Chen H, Ware J, Oslin D, Sanchez H, Durai U, Miles K, Llorente M, Costantino G and Levkoff S. (2007). Alcohol consumption among older adults in primary care. Journal of General Internal Medicine, 22(1):92-97.

[86] Castro-Costa E, Ferri C, Lima-Costa M, Zaleski M, Pinsky I, Caetano R, and Laranjeira R. (2008). Alcohol consumption in late-life — The first Brazilian National Alcohol Survey. Addictive Behaviors, 33(12):1598-1601.

[86] Hirata S, Nakano Y, Arrais Pinto Jr J, Litvoc J and Bottino C. (2009). Prevalence and correlates of alcoholism in community-dwelling elderly living in São Paulo, Brazil. International Journal of Geriatric Psychiatry, 24(10):1045–1053.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[87] Sacco P, Bucholz K and Spitznagel E. (2009). Alcohol Use Among Older Adults in the National Epidemiologic Survey on Alcohol and Related Conditions: A Latent Class Analysis. Journal of Studies on Alcohol and Drugs, 70(6):829-38.

[88] Immonen S, Valvanne J, and Pitkala K. (2011). Prevalence of at-risk drinking among older adults and associated socio-demographic and health-related factors. The Journal of Nutrition, Health & Aging, 15(9):789-794.

[89] Sacco P, Bucholz K and Harrington D. (2014). Gender differences in stressful life events, social support, perceived stress, and alcohol use among older adults: results from a National Survey. Subst Use Misuse. 49(4):456-65.

[90] Busby W, Campbell A, Borrie M and Spears G. (1988). Alcohol use in a community-based sample of subjects aged 70 years and older. J Am Geriatr Soc., 36(4):301-5.

[91] Liew H-P. (2011). Trajectories of alcohol consumption among the elderly widowed population: A semi-parametric, group-based modeling approach. Advances in Life Course Research, 16(3):124–131.

[92] Borok J, Galier P, Dinolfo M, Welgreen S, Hoffing M, Davis J, Ramirez K, Liao D, Tang L, Karno M, Sacco P, Lin J, and Moore, A. (2013). Why Do Older Unhealthy Drinkers Decide to Make Changes or Not in Their Alcohol Consumption? Data from the Healthy Living as You Age Study. Journal of the American Geriatrics Society, 61(8): 1296-1302.

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Table 1 – Main Findings in Relevant Literature

Determinants of Alcohol use and abuse in Old Age																	
Paper	**Gender**	**Age**	**Education**	**Income**	**Health status**	**Smoking**	**Marital status**	**Economic activity**	**Ethnicity**	**Religion**	**Depression**	**Social connectedness**	**History of problem drinking**	**Anxiety (and related factors)**	**Weight**	**Beliefs about health effects of excessive drinking**	**Other covariates**
[22]	x	x	x														
[76]	x					x	x	x									Mobility
[77]	x			x	x	x		x		x							Living in a suburb
[78]	x	x	x		x				x						x	x	City size, Diabetes
[79]	x						x										
[80]	x		x	x			x						x				
[81]			x	x		x	x										
[82]	x	x					x										
[83]	x	x	x	x	x	x	x		x		x						
[84]					x						x	x		x			
[85]	x	x		x													
[86]	x	x	x		x	x			x								
[87]	x	x	x		x	x			x		x						Being the adult child of an alcoholic
[10]	x	x				x											
[88]	x	x	x	x	x	x	x										
[89]	x	x	x	x	x		x										
[26]	x	x		x	x							x					
[24]	x					x			x						x		

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Determinants of Transitions between Alcohol Abuse Risk in Old Age																	
Paper	**Gender**	**Age**	**Education**	**Income**	**Health status**	**Smoking**	**Marital status**	**Economic activity**	**Ethnicity**	**Religion**	**Depression**	**Social connectedness**	**History of problem drinking**	**Anxiety (and related factors)**	**Weight**	**Beliefs about health effects of excessive drinking**	**Other covariates**
[90]	x			x	x							x					Time
[32]	x	x			x			x									
[30]	x					x			x			x		x			
[28]	x		x	x	x		x		x	x			x				
[50]	x	x		x		x				x		x	x	x			Friends' approval of drinking
[16]	x	x		x		x	x						x				Avoidance coping, physical activity
[29]	x	x	x	x	x			x		x							Indebtedness
[91]	x				x						x		x				Health of deceased spouse
[92]																x	Environment
[25]	x		x		x	x					x						Frailty, cohabitation
[31]		x	x		x	x					x		x				Pain

Note: (x) *significant association*

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Table 2
Alcohol consumption by risk – ELSA Waves 4 and 5
Alternative conversion measures

NHS calculator		Wave 5					
		Abstainer	Lower	Increasing	Higher	Total	
Wave 4	Abstainer	2,768	732	158	37	3,695	*42.3%*
	Lower	842	2,063	330	20	3,255	*37.3%*
	Increasing	117	403	806	114	1,440	*16.5%*
	Higher	28	33	106	170	337	*3.9%*
	Total	3,755	3,231	1,400	341	8,727	
		43.0%	*37.0%*	*16.0%*	*3.9%*		

drinkaware		Wave 5					
		Abstainer	Lower	Increasing	Higher	Total	
Wave 4	Abstainer	2,768	658	210	59	3,695	*42.34%*
	Lower	787	1,546	339	30	2,702	*30.96%*
	Increasing	156	459	925	166	1,706	*19.55%*
	Higher	44	40	194	346	624	*7.15%*
	Total	3,755	2,703	1,668	601	8,727	
		43.03%	*30.97%*	*19.11%*	*6.89%*		

GLS		Wave 5					
		Abstainer	Lower	Increasing	Higher	Total	
Wave 4	Abstainer	2,768	721	173	33	3,695	*42.34%*
	Lower	842	2,019	324	21	3,206	*36.74%*
	Increasing	120	419	825	109	1,473	*16.88%*
	Higher	25	32	129	167	353	*4.04%*
	Total	3,755	3,191	1,451	330	8,727	
		43.03%	*36.56%*	*16.63%*	*3.78%*		

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Table 3 Descriptive statistics – Wave 5				
Variable	**Mean**	**St. Dev.**	**Min**	**Max**
Higher Risk (=1)	0.041	0.198	0	1
Alcohol Units	12.726	21.474	0	686
Age	66.639	9.031	50	89
Gender (Male=1)	0.445	0.497	0	1
Income (in logs)(*)	5.657	0.6978	-4.605	8.80
Smoking	2.687	10.079	0	210
Physical activity	2.808	0.834	1	4
Depression	0.143	0.35	0	1
Loneliness	0.476	0.499	0	1
Self-reported health status	3.196	1.114	1	5
Ethnicity (Non-white=1)	0.031	0.174	0	1
Social detachment	0.135	0.342	0	1
Religion	1.352	1.245	0	3
Children in household	0.327	0.679	0	3
Caring responsibilities	0.105	0.307	0	1
Healthy Diet	0.517	0.5	0	1
(*) Equivalent to £286.3, £2, £0.01 and £6,634 per week, respectively				

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Table 4
Distribution of Sample by Risk and Gender
Wave 5

	Female		Male	Total
Abstainer	2400	*63.91%*	1355	3755
Lower	1633	*50.54%*	1598	3231
Increasing	653	*46.64%*	747	1400
Higher	109	*31.96%*	232	341
Total	4795	*54.94%*	3932	8727

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Table 5
Wave 5 - Logistic Regression Results (Firth bias-corrected)
Probability of being in the Higher-Risk Drinking Category (People aged 50 or over)

Dependent variable: whether respondent is in the higher-risk category	Women		Women (Linear on Age)		Men	
	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)
Intercept	-2.080	0.791	-4.541	0.003	-16.990	0.001
Age	-0.106	0.658	-0.056	0.001	0.437	0.004
Age Squared	0.000	0.859			-0.004	0.002
Income (logs)	0.435	0.011	0.466	0.002	0.035	0.714
Smoking	0.022	0.001	0.023	0.000	0.018	0.001
Physically Active	-0.094	0.507	0.064	0.622	-0.009	0.917
Self-reported health	0.302	0.006	0.266	0.007	0.131	0.074
Children in household	-0.540	0.004	-0.348	0.033	-0.142	0.158
Depression (Yes=1)	0.185	0.574	0.149	0.608	0.012	0.959
Loneliness (Yes=1)	0.308	0.212	0.163	0.465	0.083	0.632
Ethnicity (Non-White=1)	-1.912	0.059	14.767	0.976	-1.977	0.001
Social Detachment (Yes=1)	0.069	0.834	0.229	0.439	0.122	0.571
Religion Important (Yes=1)	-0.011	0.895	-0.048	0.518	-0.075	0.167
Caring Responsibilities (Yes=1)	0.007	0.981	0.122	0.625	-0.412	0.134
Healthy Diet (Yes=1)	-0.102	0.646	-0.159	0.413	-0.088	0.536
Education attainment						
No Qualifications	1.000		1.000		1.000	
NVQ1/ CSE other grade	0.321	0.685	0.142	0.854	0.312	0.390
NVQ2/GCE O Level / NVQ3/ GCE A Level / Foreign	0.700	0.023	0.688	0.025	0.206	0.367
Higher below degree / NVQ4/ NVQ5/ Degree	0.817	0.017	0.866	0.008	0.717	0.001
Marital status						
Married / Co-habiting	1.000		1.000		1.000	
Single, Separated or Divorced	-0.079	0.769	-0.108	0.657	0.297	0.096
Widowed	-0.528	0.189	-0.608	0.103	0.384	0.211
Economic activity						
Employed			1.000		1.000	
Inactive	-0.103	0.786	-0.041	0.904	-0.109	0.719
Retired	0.446	0.139	0.497	0.050	-0.166	0.380
Likelihood ratio test	*83.64* *df=21 p=0 n=4,423*		*84.19* *df=21 p=0 n=4,423*		*96.83* *df=21 p=0 n=3,927*	

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Table 6 Resampling Validation of Logistic models (Bootstrap n=200)			
Females			
	Original sample	**Optimism**	**Corrected index**
Concordance c-statistic	0.735	0.020	0.715
Slope	1.000	0.113	0.887
Males			
Concordance c-statistic	0.689	0.022	0.667
Slope	1.000	0.129	0.871

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Table 7
Transitions between Risks - Wave 4 and Wave 5 - Markov Chain Models

NHS calculator	Females				Males			
	No-No	No-Hi	Hi-No	Hi-Hi	No-No	No-Hi	Hi-No	Hi-Hi
Baseline	-0.1284 (-0.146, -0.1129)	0.1284 (0.1129, 0.146)	0.4099 (0.3631, 0.4628)	-0.4099 (-0.4628, -0.3631)	-0.07325 (-0.08495, -0.06316)	0.07325 (0.06316, 0.08495)	0.45714 (0.39835, 0.52462)	-0.45714 (-0.52462, -0.39835)
Single, Separated or Divorced		0.8872 (0.6308, 1.248)	0.8434 (0.5988, 1.188)			1.071 (0.7703, 1.489)	1.164 (0.8086, 1.675)	
Widowed		1.64 (1.0244, 2.625)	1.128 (0.7176, 1.772)			0.9054 (0.5809, 1.411)	1.0137 (0.6597, 1.558)	
Inactive		0.6145 (0.3337, 1.132)	1.244 (0.6817, 2.27)			0.8579 (0.562, 1.309)	1.1513 (0.7475, 1.773)	
Retired		1.131 (0.7928, 1.614)	1.28 (0.9365, 1.75)			1.298 (0.8913, 1.89)	1.017 (0.7068, 1.465)	
Social detachment		1.422 (0.9136, 2.212)	1.015 (0.6432, 1.601)			1.4434 (0.8713, 2.391)	0.7146 (0.4624, 1.105)	
Healthy Diet		0.701 (0.5451, 0.9014)	0.9571 (0.756, 1.2116)			0.8587 (0.6603, 0.997)	0.8458 (0.655, 1.092)	
Children in Household		0.9449 (0.7957, 1.122)	1.1568 (0.9798, 1.366)			0.9236 (0.7666, 1.113)	1.019 (1.006, 1.192)	
Care responsibilities		0.9425 (0.6036, 1.472)	0.6723 (0.3791, 1.193)			1.024 (0.695, 1.509)	1.119 (0.7619, 1.644)	
Depression		1.27 (0.8707, 1.853)	1.241 (0.8175, 1.883)			1.043 (0.7161, 1.518)	1.036 (0.6994, 1.534)	
Loneliness		1.339 (1.0513, 1.706)	0.956 (0.7434, 1.229)			0.703 (0.5397, 1.0158)	1.199 (1.009, 1.5631)	
Age		0.9553 (0.9346, 0.9765)	1.0063 (0.9861, 1.0269)			0.9372 (0.9149, 0.9601)	1.0089 (1.004, 1.02)	
Income		1.132 (1.0595, 1.336)	1.038 (0.8977, 1.201)			1.182 (1.0725, 1.436)	0.925 (0.8906, 0.994)	

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Drinkaware	Females				Males			
	No-No	No-Hi	Hi-No	Hi-Hi	No-No	No-Hi	Hi-No	Hi-Hi
Baseline	-0.05259 (-0.0634, -0.04362)	0.05259 (0.04362, 0.0634)	0.5712 (0.47439, 0.68777)	-0.5712 (-0.68777, -0.47439)	-0.03057 (-0.03853, -0.02425)	0.03057 (0.02425, 0.03853)	0.68763 (0.55616, 0.85019)	-0.68763 (-0.85019,-0.55616)
Single, Separated or Divorced		0.9057 (0.5652, 1.451)	0.6875 (0.413, 1.144)			0.7229 (0.4171, 1.253)	0.9928 (0.6098, 1.617)	
Widowed		1.4345 (0.7141, 2.882)	0.9938 (0.4726, 2.09)			1.0514 (0.5504, 2.008)	0.8398 (0.408, 1.728)	
Inactive		0.8234 (0.381, 1.78)	0.6979 (0.225, 2.165)			0.7967 (0.4215, 1.506)	0.9268 (0.5042, 1.704)	
Retired		0.9799 (0.595, 1.614)	1.024 (0.6472, 1.62)			1.0329 (0.587, 1.817)	0.9927 (0.5872, 1.678)	
Social detachment		1.2899 (0.6687, 2.488)	0.7697 (0.3952, 1.499)			1.9598 (0.8407, 4.568)	0.9514 (0.4915, 1.842)	
Healthy Diet		0.6579 (0.4613, 0.9384)	1.0043 (0.7052, 1.4303)			0.9161 (0.6166, 1.361)	1.1118 (0.7642, 1.618)	
Children in Household		0.9264 (0.7216, 1.189)	1.2061 (0.9336, 1.558)			0.7426 (0.5467, 1.009)	1.0267 (0.7604, 1.386)	
Care responsibilities		1.0629 (0.5575, 2.026)	0.9598 (0.4473, 2.06)			0.9351 (0.5207, 1.679)	0.894 (0.5063, 1.578)	
Depression		1.348 (0.7908, 2.298)	1.077 (0.5404, 2.147)			1.063 (0.5895, 1.916)	1.379 (0.8133, 2.337)	
Loneliness		0.875 (0.6125, 1.25)	1.216 (0.8404, 1.759)			1.188 (0.7972, 1.771)	1.248 (0.8561, 1.819)	
Age		0.9679 (0.9378, 0.999)	1.0238 (0.9902, 1.058)			0.9348 (0.9008, 0.97)	1.0158 (0.9824, 1.05)	
Income		1.2226 (0.9522, 1.57)	0.9997 (0.7827, 1.277)			1.1396 (0.8527, 1.523)	0.9005 (0.7337, 1.105)	

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GLS	Females				Males			
	No-No	No-Hi	Hi-No	Hi-Hi	No-No	No-Hi	Hi-No	Hi-Hi
Baseline	-0.03457 (-0.04375, -0.02731)	0.03457 (0.02731, 0.04375)	0.69281 (0.54746, 0.87675)	-0.69281 (-0.87675, -0.54746)	-0.02025 (-0.02771, -0.0148)	0.02025 (0.0148, 0.02771)	0.91466 (0.68949, 1.21338)	-0.91466 (-1.21338, -0.68949)
Single, Separated or Divorced		1.273 (0.736, 2.203)	1.068 (0.6276, 1.816)			1.096 (0.5616, 2.139)	1.562 (0.8658, 2.818)	
Widowed		1.526 (0.643, 3.624)	1.103 (0.4569, 2.662)			0.5722 (0.2113, 1.549)	0.9541 (0.3912, 2.327)	
Inactive		1.006 (0.3744, 2.705)	1.415 (0.417, 4.803)			0.6471 (0.2721, 1.539)	0.8418 (0.3536, 2.004)	
Retired		1.244 (0.6795, 2.279)	1.099 (0.6418, 1.883)			0.7033 (0.3443, 1.437)	0.7587 (0.3923, 1.467)	
Social detachment		0.9481 (0.438, 2.052)	0.6427 (0.2881, 1.434)			2.094 (0.7146, 6.137)	1.529 (0.5673, 4.123)	
Healthy Diet		0.7523 (0.4854, 1.166)	0.8406 (0.5396, 1.31)			0.8258 (0.4966, 1.373)	0.7078 (0.4352, 1.151)	
Children in Household		0.8265 (0.6051, 1.129)	0.9603 (0.6897, 1.337)			0.6799 (0.4455, 1.038)	1.149 (1.023, 1.57)	
Care responsibilities		0.6944 (0.2448, 1.97)	1.6489 (0.7734, 3.515)			1.0217 (0.5086, 2.053)	0.6739 (0.3038, 1.495)	
Depression		1.5815 (0.8629, 2.899)	0.6557 (0.2568, 1.675)			0.8389 (0.3616, 1.946)	1.3212 (0.6781, 2.574)	
Loneliness		1.11 (1.0729, 1.383)	1.325 (0.8505, 2.064)			1.051 (0.6321, 1.748)	1.07 (0.6529, 1.753)	
Age		0.9401 (0.9036, 0.978)	0.9878 (0.9486, 1.029)			0.9753 (0.9301, 1.023)	1.0318 (0.9844, 1.081)	
Income		1.199 (1.0947, 1.606)	1.111 (0.795, 1.554)			1.5299 (1.0274, 2.278)	0.8842 (0.6755, 1.157)	

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Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

Annex 1 – Sensitivity analysis of NICE's cut-off points for higher-risk drinking

Figures A1 and A2 below present a graphical representation of the logistic regression results (Firth bias-corrected)m for men and women, respectively, using NICE's definition of higher-risk drinking (i.e. > 50 alcohol units per week for men / > 35 units per week for women) –that is, the results in Table 5 above, in dashed lines- and two alternative definitions: > 48 alcohol units per week for men / > 33 units per week for women, and > 52 alcohol units per week for men / > 37 units per week for women. We find that the delimitation of higher-risk drinking has only minor implications for the statistical results.

<Insert Figure A1a here>

<Insert Figure A1b here>

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Annex 2 - Sensitivity analysis of changing conversion units for wine and beer

The results reported in Table 5 above are based on the conversion tables in the 'alcohol unit calculator' by the NHS –see text.

Figures A2a and A2b below compare the estimates with those obtained from using the conversion measures in the drinkaware website (www.drinkaware.co.uk) and in the 2007 General Lifestyle Survey (GLS).

<Insert Figure A2a here>

<Insert Figure A2b here>

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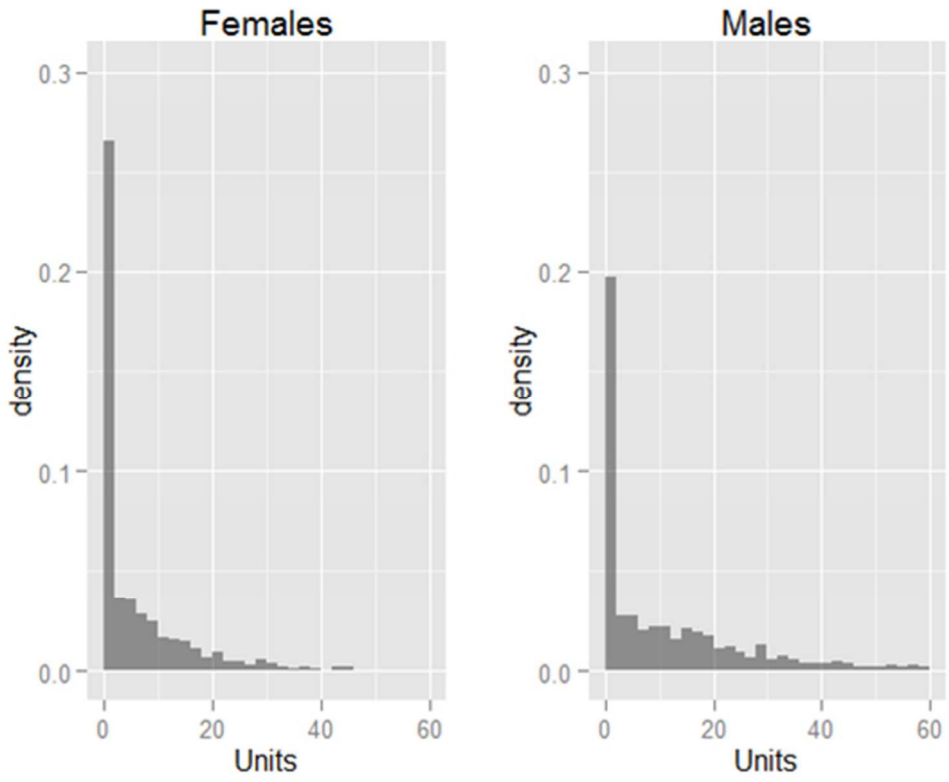
Figure 1 – Wave 5
Distribution of Respondents by number of alcohol units consumed



185x185mm (76 x 76 DPI)

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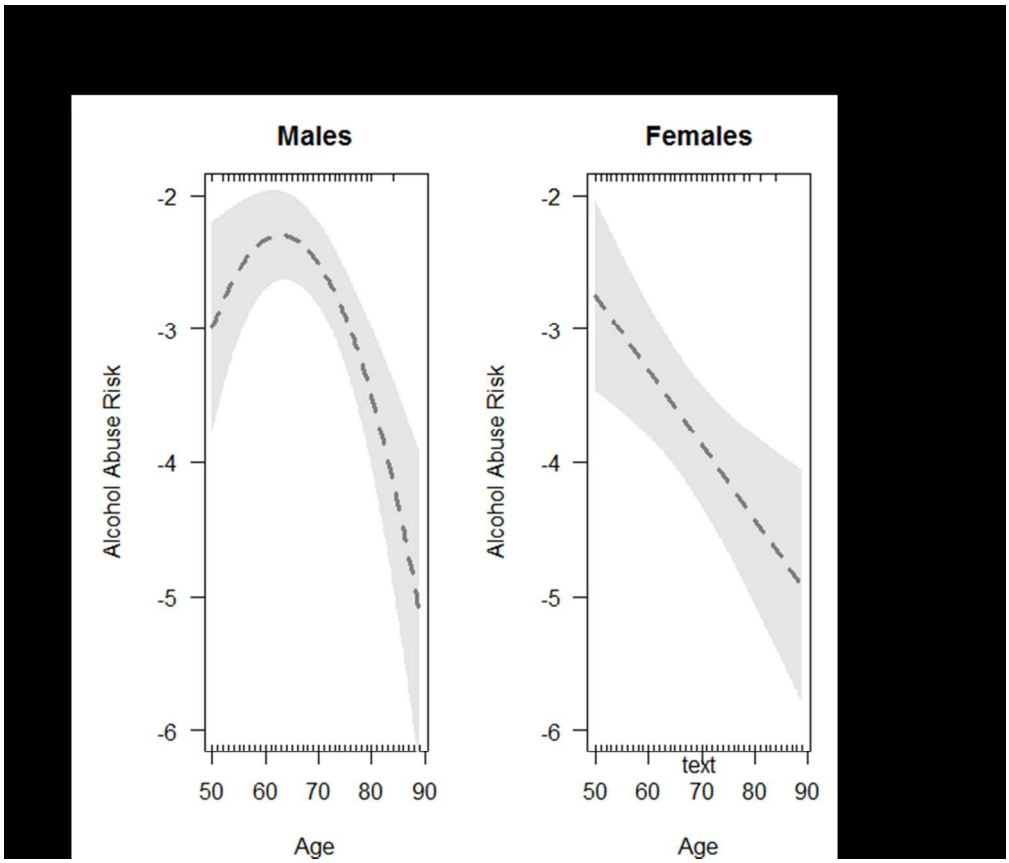

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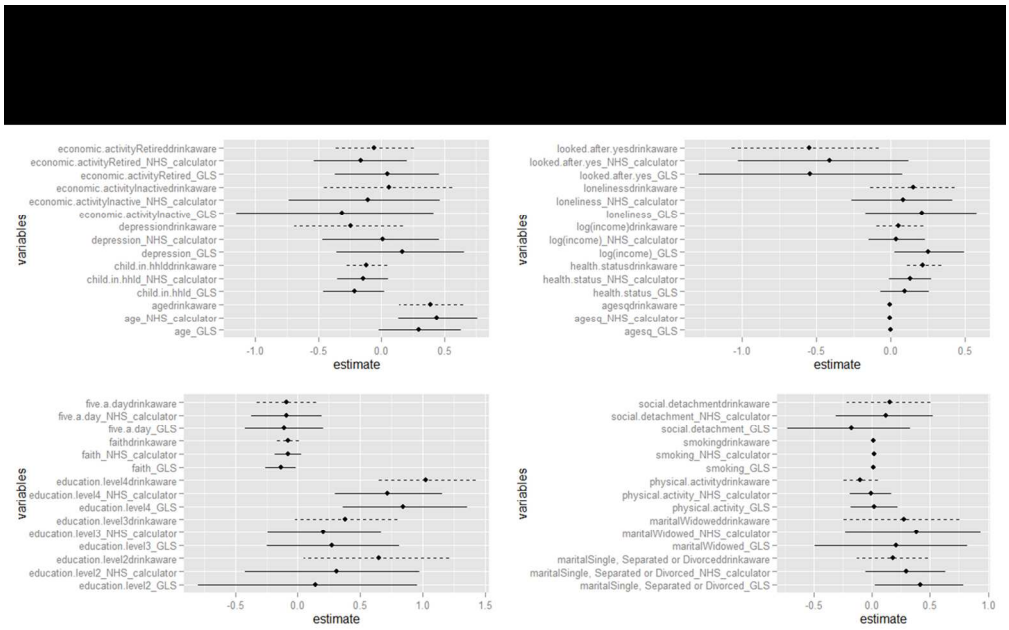

Sensitivity analysis of changes in cut-off points for higher-risk drinking
Males
255x160mm (150 x 150 DPI)

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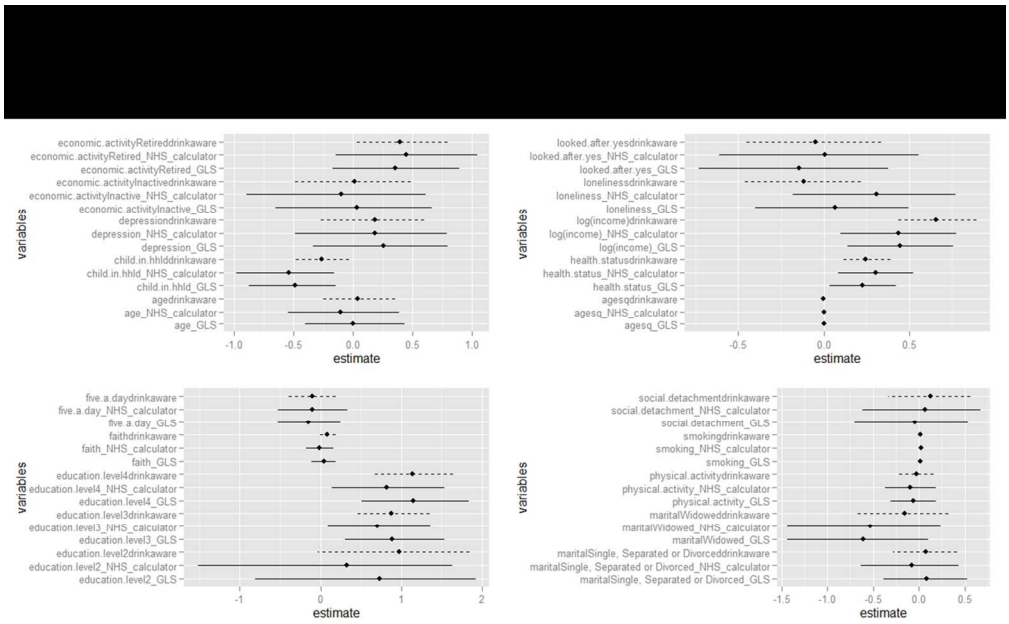

Sensitivity analysis of changes in cut-off points for higher-risk drinking
Females
257x160mm (150 x 150 DPI)

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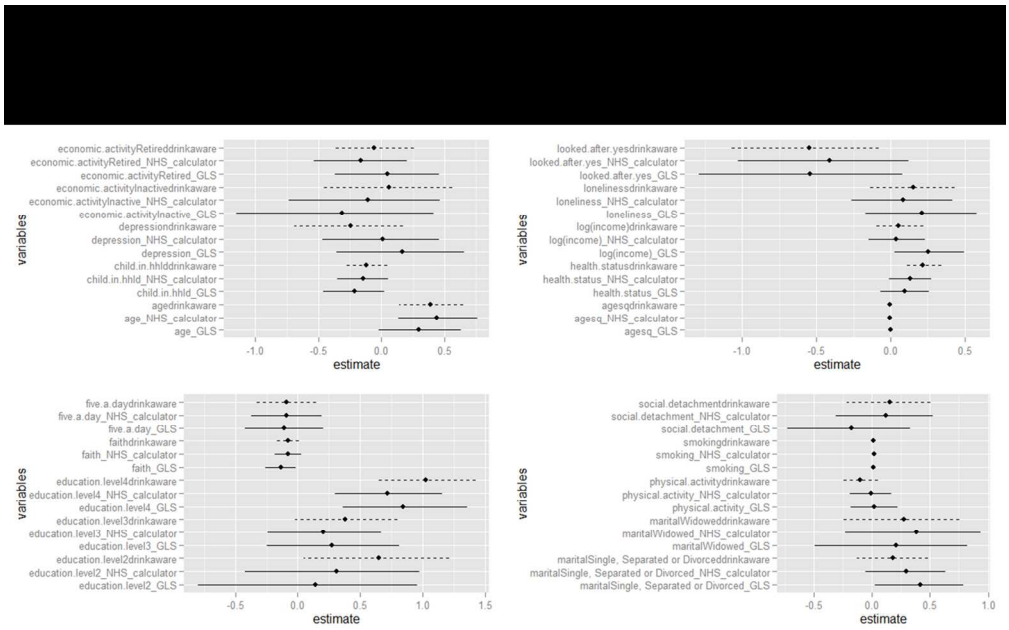

Sensitivity analysis of changes in conversion units for wine and beer
Males
255x160mm (150 x 150 DPI)

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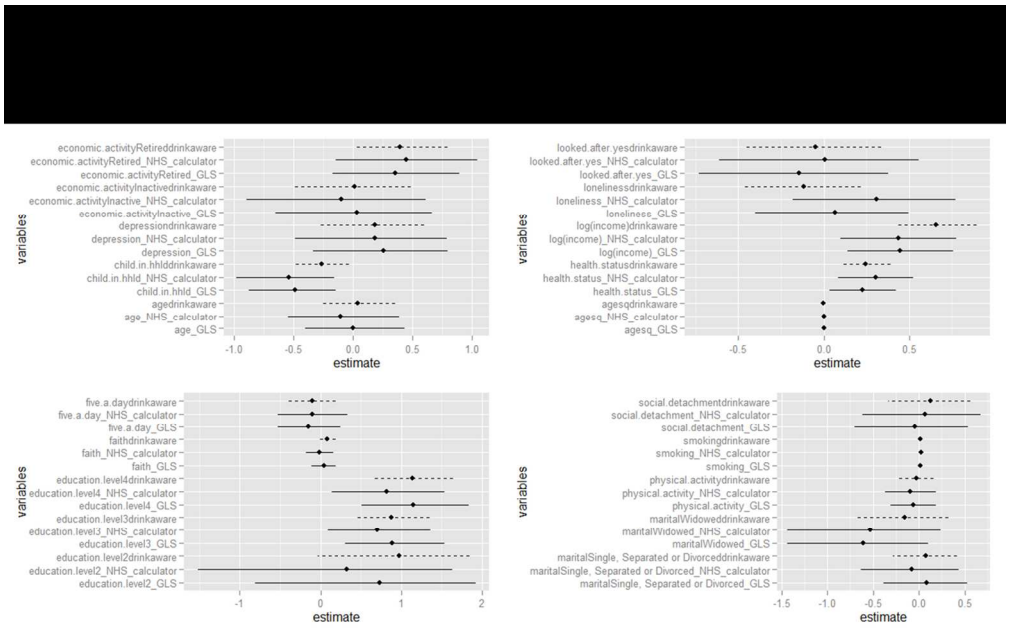

Sensitivity analysis of changes in conversion units for wine and beer
Females
255x160mm (150 x 150 DPI)

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BMJ Open

Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2015-007684.R2
Article Type:	Research
Date Submitted by the Author:	24-Mar-2015
Complete List of Authors:	Iparraguirre, Jose; Age UK, Research
Primary Subject Heading:	Addiction
Secondary Subject Heading:	Public health, Research methods, Epidemiology
Keywords:	EPIDEMIOLOGY, GERIATRIC MEDICINE, PUBLIC HEALTH

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Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

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Keywords: Alcohol, Older People, Lifestyle

Word count: 3,533

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Abstract

Objectives: This paper looks into the socio-economic determinants of risk of harmful alcohol drinking and of the transitions between risk categories over time among the population aged 50 or over in England.

Setting: Community-dwellers across England

Participants: Respondents to the English Longitudinal Survey of Ageing, Waves 4 and 5.

Results: (Confidence level at 95% or higher, except when stated):

- Higher-risk drinking falls with age and there is a non-linear association between age and risk for men, peaking in their mid-sixties
- Retirement and Income are positively associated with a higher risk for women but not for men
- Education and Smoking are positively associated for both sexes.
- Loneliness and depression are not associated
- Caring responsibilities reduce risk among women
- Single, separated or divorced men show a greater risk of harmful drinking (at 10% confidence level)
- For women, being younger and having a higher income at baseline increase the probability of becoming a higher-risk alcohol drinker over time
- For men, not eating healthily, being younger, and having a higher income increase the probability of becoming a higher-risk alcohol drinker. Furthermore, the presence of children living in the household, being lonely, being older, and having a lower income are associated with ceasing to be a higher-risk alcohol drinker over time

Conclusions: Several socio-economic factors found to be associated with high risk alcohol consumption behaviour among older people would align with those promoted by the 'successful ageing' policy framework.

Article summary

Strengths and limitations of this study

Strengths:

- Longitudinal analysis
- Transitions across risks of harmful alcohol drinking
- Representative sample of older people

Limitations:

- Possible cohort effects not accounted for
- No comparisons with the rest of the United Kingdom

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What is already known on this subject?

A number of socio-economic factors have been associated with harmful drinking in later life, some of which present contradictory findings.

What this study adds?

Despite a large and increasing literature on the topic, an in-depth statistical analysis based on a large representative survey in England also looking into transitions across risk categories over time was missing. This is precisely what this study adds, contributing thus to more effective policy design and interventions.

Data sharing statement

No additional data available

Ethics

This is a secondary analysis of publicly available data. No ethical approval was required.

Funding

The study was fully funded internally.

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Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

1. Introduction

This paper looks into the socio-economic determinants of harmful alcohol drinking among the population aged 50 or over in England. It also investigates what may be driving transitions between risk categories over time.

Since the first study that examined alcohol consumption among older people living in the community,[1] a large literature has developed –a summary of the early literature is found in, [2]; for present comprehensive updates of the main issues, see,[3-5].

A number of papers have examined specific aspects, including: general health consequences (eg, [6]), quantity and frequency (eg,[7]), measuring tools,[8], attitudes,[9],co-morbidities,[10], screening,[11], economic cost,[12], demand for health and social care services,[13], mortality,[14-17], etc. Besides, a sizable literature has looked into the psycho-social determinants of both consumption and changes in risks over time. This paper contributes to the latter category: it investigates statistical associations between alcohol risk categories and transitions between them over time and psycho-social characteristics of the population aged 50 or over in England. It will not focus upon the health, financial or psycho-social consequences of harmful drinking.

The structure of the paper is as follows. A brief description of the academic literature on the psychological and social drivers behind harmful drinking in later life is included in section 2. Section 3 presents the data and Section 4 describes the statistical methods used. Sections 5 and 6 set out the results of the analysis of the determinants of harmful drinking and of its transitions over time, respectively. Section 7 concludes.

2. Determinants of harmful drinking in old age. A synopsis of the literature

A recent literature review of alcohol use and alcohol-use disorders among older adults in India report significant statistical associations between alcohol consumption in old age and a higher educational status, younger age, better health status, lower chronic morbidity, employment status, socioeconomic status, auditory/locomotor impairment and asthma,[18].

Some of these variables (e.g. age, income, education, and gender) have been consistently found associated with risk of harmful drinking and alcohol abuse[1] in old age across the literature at least since the late 1980s (eg,[22]). Albeit, some studies are based on such small samples,[eg 23] that low statistical power may have affected the standard errors and, consequently, the significance of the results. A study based on a sample large enough for statistical purposes found that age is not a significant predictor,[24]. Two recent papers also report significant findings among alcohol consumption and these four variables, as well as with other covariates: significant associations have been found between alcohol consumption

[1] Harmful drinking is defined as a pattern of psychoactive alcohol consumption causing health problems [19-20]. In turn, alcohol abuse is akin to alcohol dependence, which is characterised "by craving, tolerance, a preoccupation with alcohol, and continued drinking in spite of harmful consequences" (p. 754, [21])

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and education, age, subjective health status, and gender among the older population in Sweden,[25]; in turn, the following list of characteristics were reported to be associated with unhealthy drinking among older people in Belgium: age, gender, social contacts, education, health status and socio-economic status,[26].

Similarly, the literature on transitions has identified some recurring associations, such as declining risk with advanced age (e.g.,[27]). Using data from the United States, [28] found that increasing alcohol consumption among the older population was more likely among the more affluent, better educated, white, males, unmarried, less religious and in better self-reported health. Furthermore, a longitudinal study with US data on people aged 53 and 64 years found that changes in drinking categories were associated with gender, health, and education, adolescent IQ, income, lifetime history of alcohol-related problems, religious service attendance, depression, debt, and changes in employment,[29]. A study into changes in alcohol consumption among people aged 55-76 in the United States found that they were associated with gender, ethnicity, smoking, use of substances to reduce tension, and social connectedness (and whether their contacts approved of heavy drinking or not),[30]. More recently, a 10-year study of alcohol use transitions among men aged between 50 and 65 in the United States reported that the different trajectories of risk were associated with age, education, smoking, binge drinking, depression, pain, and self-reported health,[31].

Some culturally relevant aspects have also been identified: for example, a study on changing in drinking consumption among older people in Japan found that apart from gender, education, age, and depression, a related factor is employment status: consumption tends to drop significantly with retirement, which the authors ascribed to the role of alcohol consumption in Japanese work culture,[32]. This paper used data from England where, along with the rest of the United Kingdom, drinking patterns are shifting towards a Nordic-European pattern, “characterised by non-daily drinking, irregular heavy and very heavy drinking episodes (such as during weekends and at festivities) and a higher level of acceptance of drunkenness in public” (p. 11, [33]). Therefore consideration needs to be given to its results as applicable to a particular cultural milieu with evolving drinking patterns.

Table 1 presents a summary of the main findings in the literature.

<Insert Table 1 here>

3. Data

This paper is based on data from the English Longitudinal Study of Ageing (ELSA) -a longitudinal multidisciplinary data from a representative sample of men and women aged 50 years and over living in private households in England,[34]. To study the determinants of harmful drinking, we used the latest wave (Wave 5) of ELSA corresponding to the years 2010-2011 (sample size: 9,251) and, for the transitions analysis, the last two waves (Wave 4 corresponds to the years 2008-2009).

We defined risk of harmful drinking following the guidelines set out by the National Institute for Health and Care Excellence (NICE). NICE has defined the following levels of risk of harmful drinking:

- Lower-risk drinking: ≤ 21 units per week (adult men) or ≤ 14 units per week (adult women).

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- Increasing-risk drinking: 22 ≤ 50 units per week (adult men) or 15 ≤ 35 units per week (adult women).

- Higher-risk drinking: > 50 alcohol units per week (adult men) or > 35 units per week (adult women).

This definition is part of the classification adopted by NICE to set guidelines and public health guidance in England -see also [35]. It is consistent with a 1995 report by the Department of Health on 'sensible' drinking [36], which had set daily, not weekly guidelines. Albeit, it is not without problems –see [37-38], for a discussion. Several hundred estimation measures and instruments –primarily designed as screening tools- are available (the most widely used include the Severity of Alcohol Dependence Questionnaire; the Alcohol Use Disorders Identification Test, the CAGE test, the Michigan Alcoholism Screening Test, the FAST alcohol screening test, etc.), [39] . Furthermore, we carried out a sensitivity analysis and relatively minor changes in the cut-off points for higher risk drinking were found to alter the significance of our regression results (see Annex 1)[2].

Two additional considerations regarding the definitions of risk by NICE merit a comment here: the use of a weekly, instead of daily, guideline may mask episodic heavy drinking –a non-negligible and increasing issue among middle-aged people in England [40-41]- and the lack of specific guidelines for older people (e.g. for people aged 65 or older) is problematic in the light of evidence on physiological and metabolic changes in alcohol absorption and effects associated with individual ageing, [42] which led the Royal College of Psychiatrists to recommend reduced thresholds for older people, [43].

However, we have used this definition of risk given that this paper is based on English data and that one of the objectives of the paper is to inform and influence policy-makers and practitioners in England, who have to follow NICE's guidelines.

The literature on alcohol abuse in old age distinguishes between people who consume low quantities of alcohol and abstainers,[44-46]. Our data do not allow us to make such a distinction, but we have separated those respondents who said they had not drunk any alcohol at all during the previous week from those who did. Therefore, in this paper, we have included a fourth risk category –which we have termed the "abstainers"-, but we emphasise the individuals in this category may not necessarily be teetotal but consistent infrequent drinkers,[31], and therefore there may be some overlap between this group and the lower-risk drinkers. Nevertheless, because in our models we focused on higher-risk drinkers, this distinction between abstainers and lower-risk drinkers is inconsequential for our results.

The literature has also introduced a distinction between early-onset and late-onset cases,[47-49] as well as that between having a history of problem drinking or not,[28,50]. However, the data do not allow us to distinguish between early and late onsets or about individual lifetime alcohol consumption patterns, so the paper considers current abuse risk and changes across risk categories in relation to covariates measured at baseline with disregard of alcohol ingest patterns at early ages.

Finally, the literature that focuses upon the relation between stressful life events and changes in alcohol consumption in old age distinguishes between events with short-term effects and those with long-term implications,[51]. In order to discern between short- and long-term effects of life events we would need

[2] We are grateful to one of the reviewers for this suggestion.

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data that covered longer than two years as in this paper –furthermore, we would also need data from years before the events took place to account for simultaneous causality and unobserved individual endogeneity,[52]; hence we are not going to investigate whether this distinction holds for our sample.

ELSA contains questions about weekly consumption of spirits, wine and beer. In order to use NICE guidelines, we used the conversion tables in the 'alcohol unit calculator' produced by the NHS to help find out how many units there are in the most popular glass sizes and measures in the country[3]. According to this tool, 1 glass of wine is equivalent to 2.1 units, 1 pint of beer to 2.8 units and 1 measure of spirits to 1 unit.

Following the suggestions by one of the reviewers, we estimated the effect on our results of changing the conversion ratios for wine and beer. Thus, we calculated consumption according to the conversion measures introduced in 2007 to the General Lifestyle Survey (GLS)[4]: one pint of a normal strength beer is equivalent to 2 units, a 175 ml glass of wine is equivalent to 2 units and a 250 ml glass of wine is equivalent to 3 units. Furthermore, we also applied the conversion tables in the drinkaware website (www.drinkaware.co.uk): 1 glass of wine, equivalent to 3 units, and 1 pint of beer, equal to 3 units.

Table 2 presents the data on risk for those respondents surveyed in both waves, which is also the starting point for the transitions analysis. It also presents the transitions using the two other alternative conversion measures –the widest variations are found using the drinkaware definitions.

<Insert Table 2 here>

We included the following variables in our models:

Age

Income: equivalised household net income per week (truncated at 1 penny). The equivalisation was done by the OECD equivalence scale. Income is imputed net of taxes, and there may be records with negative incomes due to, for example, self-employment losses. We set any negative incomes one penny, but not exactly to zero as in,[53], to allow the logarithmic transformation.

Education: we categorised this variable in four levels:

- No Qualifications
- NVQ1/CSE other grade equivalent
- NVQ2/NVQ3/GCE A/GCE O Level or equivalent and Foreign
- NVQ4/NVQ5/Degree or Higher education below degree

[3] See http://www.nhs.uk/Tools/Pages/Alcohol-unit-calculator.aspx. Retrieved on 6 February 2015.

[4] General Lifestyle Survey 2011. Office for National Statistics 2013. Available at: http://www.ons.gov.uk/ons/rel/ghs/general-lifestyle-survey/2011/index.html

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Smoking: Number of cigarettes smoked per day

Physical Activity: We categorised this variable into four levels:

- Sedentary
- Low
- Moderate
- High

Depression: Whether felt depressed much of the time during past week

Loneliness: four-item scale based on the 20-item Revised UCLA loneliness scale,[54]

- How often do you feel you lack companionship?
- How often do you feel isolated from others?
- How often do you feel left out?
- How often do you feel in tune with the people around you?

(For the first three questions, categorised as lonely if responded 'some of the time' or 'often'; for the last question, if responded 'hardly ever' or 'never').

Self-Reported Health: categorised into Poor, Fair, Good, Very Good, Excellent

Ethnicity: whether respondent is white (=0) or not (=1)

Gender: Female=0; Male=1

Marital Status: three categories:

- Single, Legally separated, Divorced
- Married, first and only marriage, Remarried, Civil partner
- Widowed

Caring responsibilities: Whether respondent looked after anyone in the past week (=1) or not (=0)

Children in Household: Total number of children inside the household

Religion: How important religion is in respondent's daily life. Four levels:

- Very important
- Somewhat important
- Not very important
- Not at all important

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We excluded this variable from the transitions section, because we detected potential errors in the categorisation of the questions about religion in Wave 4.

Economic Activity: Three categories:

- Employed
- Inactive (including unemployed, due to low number of cases)
- Retired (including semi-retired)

Social Detachment - If detached in three or more of the following four domains. Source:,[55]

Civic participation: Not a member of neither a political party, a trade union, an environmental group, a tenants' or neighbourhood group or neighbourhood watch, a church or religious group, nor a charitable association; and did not do voluntary work at least once in the last year.

Leisure activities: Not a member of neither an education, arts or music group or evening class, a social club, a sports club, gym or exercise class, nor of other organisation, club or society.

Cultural engagement: neither went to a cinema, an art gallery, a museum, a theatre, a concert nor an opera performance at least once in the last year.

Social networks: Do not have neither any friends, children nor other immediate family or if they have friends, children or other immediate family but have contact with all of them (meeting, phoning or writing) less than once a week.

Healthy Diet – whether respondent consume five or more portions of vegetables (excluding potatoes) or fruit a day

Table 3 presents the descriptive statistics for each variable for Wave 5.

<Insert Table 3 here>

For Wave 5, Table 4 presents the distribution of the sample by risk category and gender and Figure 1 presents the distribution of consumption of alcohol units (excluding abstainers) by gender. We notice the largest gender discrepancy among abstainers: 64 per cent of abstainers are women –besides, 50 per cent of women are abstainers (against 34 per cent of men).

<Insert Table 4 here>

<Insert Figure 1 here>

Both Table 4 and Figure 1 suggest that we should run separate models for women and men, further confirmed by a *chi* square test of independence applied to Table 4: there is a significant statistical association between risk and gender (χ^2= 259.07, df = 3, p-value=0).

For the transition analysis, we used a balanced panel –that is, only respondents in both waves were included. This could in principle introduce bias if dropping out of the survey was to any extent contingent to drinking levels. Therefore we checked for a significant association between attrition and consumption

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levels[5]. To this purpose, we fitted an OLS regression with dropping out as the outcome variable on age (and age squared), gender, smoking, health status, and alcohol consumption units. Alcohol consumption units are not significant. Further, we compared the statistical distributions of alcohol consumption units among respondents in wave 4 who took part in the survey in wave 5 and those who did not, for men and women separately, by means of the consistent univariate entropy density equality test bootstrapped with 100 replications[6]. Again, we failed to find an association between alcohol consumption in wave 4 and attrition by wave 5[7]. Therefore, our results would not suffer from 'sick quitter' bias. It is worth noting that studies of attrition by alcohol consumption patterns report inconsistent findings across waves. For example, [57] found that the odds for dropping out at one wave was higher among respondents with high alcohol intake, but that abstainers had increased odds for dropping out at other waves. Furthermore, a literature review, [58], failed to find any association between attrition and alcohol consumption levels.

4. Statistical methods

To identify variables associated with the probability of being or not being in the higher-risk category, we used a logistic regression model. Given the small proportion of respondents in this category, we applied the Firth correction to account for any bias introduced by zero-inflation.

We included age squared as a term in the regression models to account for any non-linearity in the association between age and risk.

Heavy drinking in old age is associated with short-term mortality,[12,15, 59-63], hence the sample could suffer from an over-representation of moderate drinkers at higher ages as heavy drinkers might have died earlier. Therefore we checked for this possible selection bias: given that this is a cross-sectional study and that the data do not include any information about past drinking behaviour, we ran models with age truncated at 70. We compare the results with those from the full sample and we failed to find any significant differences, so preliminarily we can rule out the presence of selection bias in our sample. Comparing logistic models fitted on different groups or samples is not straightforward and there is no one accepted method. We applied the heterogeneous choice model procedure,[64], for which we fitted heteroskedastic binary response models via maximum likelihood and ran likelihood tests to compare both models (results can be requested from the author).

With regards to the transition analysis, we carried out a Markov chain model assuming continuous and homogeneous time fitted by maximum likelihood, with the same number of regressors as in the previous models (except religion, as indicated above). We used the package 'msm' in R,[65].

Markov chains are stochastic processes according to which, for each respondent, the risk of being in any one particular state in one wave depends solely on the state the person was in the previous wave, plus a number of characteristics observed also in the previous wave,[66-67].

We computed discrepancy scores,[68] for consumption of wine, spirits, and beer and for number of drinking days, for men and women, separately, as the difference between units in waves 4 and 5. We failed to find any systematic or consistent patterns and the correlation coefficients between the

[5] We are grateful to one reviewer for highlighting this possibility.

[6] We ran the np package in R [56].

[7] Results available from the corresponding author.

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discrepancy scores of each type of alcoholic drink and the number of drinking days were all very low (max=0.33, for consumption of beer and drinking days for women). Therefore, we can rule out inconsistency in the answers.

In this paper, we ran models for two and four states. The two-state models fitted transitions between being and not being in the higher-risk category; the four-state models allowed for transitions across any of the four risk categories. However, due to sample limitations the four-state models could not be computed: with four states, none of them irreversible, there are sixteen possible transitions, which proved too many for our samples. Consequently, we only report the results for the two-state models.

Our two-state models, separately for women and men, estimates the probability of a respondent becoming a higher-risk alcohol drinker in Wave 5 given they were not a higher-risk alcohol drinker in Wave 4, and the probability of becoming a not at-higher risk alcohol drinker in Wave 5 given they were a higher-risk alcohol drinker in Wave 4 –conditional on a number of personal characteristics such as age, education attainment, marital status, etc., measured in Wave 4.

5. Results

Table 5 presents the statistical associations of the different covariates with the probability of being in the higher-risk drinking category in Wave 5. In other words, the table answers the research question 'who would be more likely to be classified as a higher risk alcohol drinker'.

<Insert Table 5 here>

The probability of being in the higher-risk drinking category decreases with age for men and women. Moreover, there is a non-linear association between age and risk for men, but not for women –hence, we re-ran the model for women with only a linear specification of the variable age –Table 5 shows both sets of results. . Figure 2 presents the probability of being in the higher-risk drinking category by age conditional on all the other variables included in the model. The conditional probability plot in Figure 2 shows that the risk for men becomes highest in the early-sixties. For women, the conditional probability of drinking at harmful levels exhibits a linear negative slope with age. The non-linear association with age and the associated finding that, for men, the probability of being in the higher-risk category peaks in the mid-sixties could give empirical support to the hypothesis that current cohorts of older people are carrying on the relatively higher consumption levels they exhibited earlier on in their lives into older age compared to previous cohorts [40]. However, we can only express the possibility here as we could not distinguish between age, cohort and period effects with the data under study to explore this hypothesis in full.<Insert Figure 2 here>

Income is positively associated with a higher risk for women but not for men, whist the number of cigarettes consumed is positively associated for both sexes.

Reporting better health is positively associated with the probability of drinking at harmful levels.

Neither being depressed nor feeling lonely are associated with a higher risk of harmful drinking

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Higher-risk drinking is more likely among white men, but ethnicity is not significant for women.

Having caring responsibilities reduces the probability of being at higher risk for women. Considering that their religion is very important for their lives is not significantly associated with the probability of being a higher-risk drinker neither for men nor women.

Both for men and women, a higher risk is positively associated with higher educational attainment.

Economic activity is not significantly associated with risk, except retirement for females which increases the likelihood of drinking at higher risk levels.

Single, separated or divorced men show a greater risk of harmful drinking.

None of the other variables included in the models presented statistically significant associations with risk.

Annex 1 presents a sensitivity analysis of the estimates in Table 5 after modifying the threshold for higher risk from NICE guidelines. Annex 2 presents the results using the alternative conversion tables. These sensitivity analyses show that alternative definitions of cut-off levels and conversion units do not introduce substantial changes to the results. Only coefficients significant at 10 per cent level present variations across the choices of thresholds and conversion units. By and large, our results are robust to these methodological changes.

It is important, once a model has been fitted, to estimate whether any predictions stemming from it can be validly extended to other samples or to the same subjects in the future. This is known as the validation stage. Validation can be external or internal –that is, it can resort to data not used in the fitting of the model (external) or to the data included in the estimation stage (internal). We opted for an internal validation of our models, for which we applied the bootstrap method,[68-70].

Table 6 presents the tests of internal validation of the logistic regression models for men and women. The *c*-statistic measures the discriminative ability of the model: the concordance between predicted and observed responses. The slope statistic (also known as the shrinkage factor) is a measure of the amount of over-fitting likely to be present.

< Insert Table 6 here>

The *c*-statistic ranges between 0.5 (no predictive discrimination) and 1 (perfect separation power between respondents with different harmful drinking risk levels). We note the models discriminate slightly better among women than men, but in both cases we obtain acceptable concordance. With regards to the shrinkage factor, it should be of concern if the slope coefficient fell below 0.85,[69]. In our case, the results indicate a mild over-fitting: about 11 per cent (for women) and 13 per cent (for men) of the model fit is statistical noise –i.e. within acceptable levels.

Transitions

Table 7 presents the results for the Markov chain models, which estimate the associations between being or not being classified as a higher risk drinker in Wave 4 and the risk classification in Wave 5 conditional on a number of personal characteristics measured in Wave 4. For completeness, it includes the results from the alternative conversion measures already described (i.e. the drinkaware and the GLS measures).

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<Insert Table 7 here>

For women who were not classified as higher-risk drinkers in Wave 4, our findings suggest that being lonely, being younger and having a higher income in Wave 4 are all associated with a higher probability of becoming a higher-risk alcohol drinker in Wave 5. In turn, observing a healthy diet is associated with a lower probability of becoming a higher-risk alcohol drinker. No variables were significantly associated with ceasing to be in the higher-risk category by Wave 5 for those women who were classified as such in Wave 4.

For men who were not classified as at higher-risk in Wave 4, a higher probability of becoming a higher-risk alcohol drinker in Wave 5 is associated with not eating healthily, being younger and having a higher income. Furthermore, we also found that the presence of children living in the household, being lonely, being older, and having a lower income increases the likelihood of ceasing to be at higher risk by Wave 5. The last two findings are worth a further explanation: we found that, for men, the older they are the less likely it is they may become higher-risk drinkers and for those at a higher-risk category, the more likely it is that they may cease to be so. Similarly for income levels: the higher the income, the more likely that men may become higher-risk drinkers if they were not so, and the less likely that they cease to be higher-risk drinkers if they happened to be classified as such.

Apart from the associations with covariates at baseline (i.e. Wave 4), we also investigated whether the transitions into and out of the higher-risk category between both waves were associated with having widowed, retired during this period, taken on caring responsibilities, or the 'empty nest' syndrome (i.e. if there were any children living in the household in Wave 4 and they had all left by Wave 5). We failed to find any significant associations (results can be requested from the author).

Comparing the results in Tables 5 and 7 using alternative measures, we find that the changes in conversion units for wine and beer are more crucial to explain the factors associated with becoming a higher risk drinker over time (i.e. transitions) than with those associated with drinking at harmful levels in one point in time. For example, when using the GLS conversion units, only three variables result significant for the transition between not being at a higher-risk to becoming a higher-risk drinker among women, and with the same signs as before -age, loneliness and income- whilst for men loneliness, age and income cease to be significantly associated with ceasing to be in a high risk category. In turn, the drinkaware measures render solely age and healthy diet as significant variables regarding the transition into harmful levels for women.

A final methodological point has to do with under-reporting. A recent study, [71], using data from the Health Survey of England (HSE), failed to find any association between under-reporting and age among people aged 50 or over. ELSA uses the same respondents as the HSE, therefore we are confident that our results are not contaminated by under-reporting. However, that study found that under-reporting is probably more to do with drinking pattern than demographic or social factors, which means that respondents classified as at higher-risk might be under-reporting their consumption more than those drinking at safer levels[8].

6. Conclusions

[8] We are grateful to Dr Sadie Boniface, Research Associate at UCL Epidemiology & Public Health, University College London, for this clarification in a personal communication.

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Several socio-economic factors are associated with high risk alcohol consumption behaviour among older people, which must be factored in when designing and evaluating preventative interventions. Without repeating the findings discussed above, we can sketch –at the risk of much simplification- the problem of harmful alcohol drinking among people aged 50 or over in England as a middle-class phenomenon: people in better health, higher income, with higher educational attainment, and socially more active are more likely to drink at harmful levels. This characterisation mirrors the main results from some studies among people of working age, [72-73].

Among the many policy frameworks around ageing –e.g. "active ageing",[74], "productive ageing",[75], etc.- "successful ageing",[43] is one of the most widely used and embraces components such as non-smoking, greater physical activity, more social contacts, better self-rated health, absence of depression, among others, [76].

Alcohol consumption is growing among older people in England, [77-78]. The results reported in this paper allow us to conclude that, generally speaking, people aged 50 or over ageing 'successfully' in England are more at risk of drinking at harmful levels or of developing harmful drinking consumption patterns than those who fit less well into the paradigm of ageing 'successfully'. There is some evidence that to some extent this is a generational trait: current age cohorts of older people exhibited higher alcohol consumption levels in the past and would be carrying on their relatively higher levels into older age compared to older people in the past [40]. Nevertheless, our findings suggest harmful drinking in later life is more prevalent among people who exhibit a lifestyle associated with affluence [93] and with a 'successful' ageing process. Harmful drinking may be, then, a hidden [94] health and social problem in otherwise successful older people. Consequently, and based upon our results, we recommend the explicit incorporation of alcohol drinking levels and patterns into the successful ageing paradigm.

A number of limitations to this study need to be pointed out. First, we restricted the longitudinal study to two waves. A longer window would make the detection and analysis of trends possible. Second, the dataset used in this paper, ELSA, albeit representative of people aged 50 or over in England, is carried out every two years. Consequently, the transitions analysed in the paper comprised changes between two points in time two years apart, which is an important gap to study lifestyle changes and consumption patterns of frequently purchased goods such as alcoholic drinks. Third, an also related to ELSA, we mentioned in the text that it is not possible to obtain scores for other scales and instruments, and unfortunately the survey only records weekly consumption rather than daily. Fourth, we restricted the main results to the definitions of risk by NICE although, as mentioned earlier, there is some merit in defining levels of risk specifically for older people based on available physiological evidence.

7. References

[1] Bridgewater R, Leigh S, James O and Potter J. (1987). Alcohol consumption and dependence in elderly patients in an urban community. BMJ, 295(6603): 884-885.

[2] Liberto J, Oslin D and Ruskin P. (1992). Alcoholism in Older Persons: A Review of the Literature. Psychiatric Services, 43(10).

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[3] Sorocco K and Ferrell S. (2006). Alcohol Use Among Older Adults. The Journal of General Psychology, 133:4, 453-467.

[4] St John P, Snow W and Tyas S. (2010). Alcohol use among older adults. Reviews in Clinical Gerontology, 20(1):56-68.

[5] Kalapatapu R, Paris P and Neugroschl J. (2010). Alcohol Use Disorders in Geriatrics. The International Journal of Psychiatry in Medicine, 40(3):321-337.

[6] Pontes Ferreira M and Suzy Weems M. (2008). Alcohol Consumption by Aging Adults in the United States: Health Benefits and Detriments. Journal of the American Dietetic Association, 108(10):1668-1676.

[7] Breslow R and Smothers B. (2004). Drinking Patterns of Older Americans: National Health Interview Surveys, 1997-2001. Journal of Studies on Alcohol and Drugs, 65(2).

[8] Moore A, Beck J, Babor T, Hays R and Reuben DB. (2002). Beyond alcoholism: identifying older, at-risk drinkers in primary care. J Stud Alcohol. 63(3):316-24.

[9] San Jose B, Bongers I, Garretsen H. (1999). Drinking Patterns and Attitudes toward Drinking in the Late-Middle-Aged. Subst Use Misuse, 34(8):1085-100.

[10] Kim K, Choi E, Lee S, Park J, Lee J, Huh Y, Youn J, Jhoo J, Choo I, Kim M, Lee D and Woo J. (2009). Prevalence and neuropsychiatric comorbidities of alcohol use disorders in an elderly Korean population. Int J Geriatr Psychiatry, 24(12):1420-8.

[11] Fink A, Hays R, Moore A and Beck J. (1996). Alcohol-Related Problems in Older Persons. Determinants, Consequences, and Screening. Arch Intern Med., 156(11):1150-1156.

[12] Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. The Lancet, 373:2223–2233.

[13] Tait R, French D, Burns R, Byles J, and Anstey K. (2013). Alcohol, hospital admissions, and falls in older adults: a longitudinal evaluation. International Psychogeriatrics, 25(6):901-912.

[14] Thun M, Peto R, Lopez A, Monaco J, Henley S, Heath Jr. C and Doll R. (1997). Alcohol Consumption and Mortality among Middle-Aged and Elderly U.S. Adults. N Engl J Med; 337:1705-1714.

[15] Di Castelnuovo A, Costanzo S, Bagnardi V, Donati MB, Iacoviello L, de Gaetano G. (2000). Alcohol dosing and total mortality in men and women: An updated meta-analysis of 34 prospective studies. Arch Intern Med;166:2437-2445.

[16] Holahan C, Schutte K, Brennan P, Holahan C, Moos B and Moos R. (2010). Late-Life Alcohol Consumption and 20-Year Mortality. Alcoholism: Clinical and Experimental Research, 34(11).

[17] Shen C, Schooling M, Chan W, Xu L, Lee S and Lam T. (2013). Alcohol intake and death from cancer in a prospective Chinese elderly cohort study in Hong Kong. J Epidemiol Community Health, 67(10):813-820.

[18] Nadkarni A, Murthy P, Crome I and Rao, R. (2013). Alcohol use and alcohol-use disorders among older adults in India: a literature review. Aging & Mental Health, 17(8): 979-991.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[19] WHO (1993). The ICD-10 Classification of Mental and Behavioural Disorders. Clinical descriptions and diagnostic guidelines. World Health Organization. Geneva: Switzerland.

[20] NICE (2011). Alcohol-Use Disorders Diagnosis, Assessment and Management of Harmful Drinking and Alcohol Dependence. National Clinical Practice Guideline 115. National Collaborating Centre for Mental Health. The British Psychological Society and The Royal College of Psychiatrists. London: UK.

[21] Flynn, N (2011). Harmful drinking and alcohol dependence: advice from recent NICE guidelines. The British Journal of General Practice, 61(593): 754–756.

[22] Goodwin JS, Sanchez C, Thomas P, Hunt C, Garry P and Goodwin, JM. (1987). Alcohol intake in a healthy elderly population. American journal of public health, 77(2), 173-177.

[23] Iliffe S, Haines A, Booroff A, Goldenberg E, Morgan P and Gallivan S. (1991). Alcohol consumption by elderly people: a general practice survey. Age and Ageing, 20: 120-3.

[24] Peltzer K and Phaswana-Mafuya N. (2013). Problem drinking and associated factors in older adults in South Africa. African Journal of Psychiatry, 16(2).

[25] Fornazar R, Spak, F, Dahlin-Ivanoff S and Wilhelmson K. (2013). Alcohol Consumption among the Oldest Old and How It Changes during Two Years. ISRN Geriatrics, ID 671218. doi:10.1155/2013/671218.

[26] Hoeck, S and Van Hal, G. (2013). Unhealthy drinking in the Belgian elderly population: prevalence and associated characteristics. European Journal of Public Health, 23(6):1069-1075.

[27] Adams W, Garry P, Rhyne R, Hunt C, and Goodwin J. (1990). Alcohol intake in the healthy elderly. Changes with age in a cross-sectional and longitudinal study. J Am Geriatr Soc. 38(3):211-6.

[28] Platt A, Sloan F and Costanzo P. (2010). Alcohol-Consumption trajectories and associated characteristics among adults older than age 50. Journal of Studies on Alcohol and Drugs, 71(2):169-179.

[29] Molander R, Yonker J and Krahn D. (2010). Age-Related Changes in Drinking Patterns From Mid- to Older Age: Results From the Wisconsin Longitudinal Study. Alcoholism: Clinical and Experimental Research, 34(7):1182–1192.

[30] Brennan P, Schutte K and Moos R. (2010). Patterns and predictors of late-life drinking trajectories: A 10-year longitudinal study. Psychology of Addictive Behaviors, Vol 24(2): 254-264.

[31] Bobo J, Greek A, Klepinger D and Herting J. (2013). Predicting 10-Year Alcohol Use Trajectories Among Men Age 50 Years and Older. The American Journal of Geriatric Psychiatry, 21(2):204-213.

[32] Gee G, Liang J, Bennett J, Krause N, Kobayashi E, Fukaya T and Sugihara Y. (2007). Trajectories of Alcohol Consumption among Older Japanese Followed from 1987-1999. Research on Aging, 29(4), 323-347.

[33] WHO (2012). Alcohol in the European Union. Consumption, harm and policy approaches. P. Anderson, L. Møller; and G. Galea (eds.) WHO Regional Office for Europe. World Health Organisation. Copenhagen: Denmark.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[34] Cheshire H, Hussey D, Phelps A and Wood N (2012). Methodology, in: The Dynamics of Ageing. Evidence from the English Longitudinal Study of Ageing 2002–10 (Wave 5), J Banks, J Nazroo and A Steptoe (eds.). The Institute for Fiscal Studies, London: UK.

[35] Royal College of Psychiatrists (1979). Alcohol and Alcoholism. The Report of a Special Committee of the Royal College of Psychiatrists. Tavistock. London: UK

[36] Department of Health (1995). Sensible Drinking: Report of an inter-departmental working group. London: UK.

[37] Keller, M. (1977). A lexicon of disablements related to alcohol consumption, in: Alcohol-Related Disabilities, G Edwards, MM Gross, M Keller, J Moser and R Room (eds). WHO Offset Publications N. 32. World Health Organisation. Geneva: Switzerland.

[38] Royal College of Physicians (2011). Royal College of Physicians' written evidence to the Science and Technology Select Committee Inquiry on alcohol guidelines. Royal College of Physicians, London: United Kingdom.

[39] National Institute on Alcohol Abuse and Alcoholism (2003). *Assessing Alcohol Problems: A Guide for Clinicians and Researchers*, 2d ed. NIH Pub. No. 03–3745. U.S. Department of Health and Human Services, Public Health Service. Washington, DC: United States of America.

[40] Smith, L. and Foxcroft, D. Drinking in the UK. An exploration of trends. Joseph Rowntree Foundation. York: United Kingdom.

[41] Gell, L.; Meier, P.S.; and Goyder, E. (2015). Alcohol Consumption Among the Over 50s: International Comparisons. Alcohol and Alcoholism; 50(1):1-10.

[42] Crome I, Li, T-K, Rao, R, and Wu, L-T (2012). Alcohol limits in older people, Addiction, 107(9): 1541-1543.

[43] Rowe, J. W.; Kahn, R. L. (1997). Successful Aging. The Gerontologist 37 (4): 433-40

[44] Lang I, Wallace R, Huppert F and Melzer D. (2007). Moderate alcohol consumption in older adults is associated with better cognition and well-being than abstinence, Age and Ageing, 36(3):256–261.

[45] Poli A, Marangoni F, Avogaro A, Barba G, Bellentani S, Bucci M, Cambieri R, Catapano AL, Costanzo S, Cricelli C, de Gaetano G, Di Castelnuovo A, Faggiano P, Fattirolli F, Fontana L, Forlani G, Frattini S, Giacco R, La Vecchia C, Lazzaretto L, Loffredo L, Lucchin L, Marelli G, Marrocco W, Minisola S, Musicco M, Novo S, Nozzoli C, Pelucchi C, Perri L, Pieralli F, Rizzoni D, Sterzi R, Vettor R, Violi F and Visioli F. (2013). Moderate alcohol use and health: A consensus document. Nutrition, Metabolism and Cardiovascular Diseases, 23(6):487-504.

[46] Rogers R, Krueger P, Miech R, Lawrence E, and Kemp R. Nondrinker (2013). Mortality Risk in the United States. Population Research and Policy Review, 32(3): 325-352.

[47] Schonfeld L and Dupree L. (1991). Antecedents of Drinking for Early- and Late-Onset Elderly Alcohol Abusers. Journal of Studies on Alcohol and Drugs, 52(6),

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

For peer review only

[48] Liberto J and Oslin D. (1995) Early versus late onset of alcoholism in the elderly. Int. J. Addiction 30(13, 14):1799-1818.

[49] Dar K. (2006). Alcohol use disorders in elderly people: fact or fiction? Advances in Psychiatric Treatment, 12:173-181.

[50] Moos R, Schutte K, Brennan P and Moos B. (2010). Late-life and life history predictors of older adults' high-risk alcohol consumption and drinking problems. Drug Alcohol Depend. 108(1-2):13-20.

[51] Tamers S, Okechukwu C, Bohl A, Guéguen A, Goldberg M, and Zins M. (2014). The Impact of Stressful Life Events on Excessive Alcohol Consumption in the French Population: Findings from the GAZEL Cohort Study. PLoS One. 9(1): e87653. Published online Jan 27, 2014. doi: 10.1371/journal.pone.0087653.

[52] Iparraguirre J. (2014). Physical Functioning in work and retirement: commentary on age-related trajectories of physical functioning in work and retirement –the role of sociodemographic factors, lifestyle and disease by Stenholm et al. J Epidemiol Community Health. doi:10.1136/jech-2014-203945.

[53] Muriel A and Oldfield Z. (2010). Financial circumstances and consumption. In: Financial circumstances, health and well-being of the older population in England: ELSA 2008 (Wave 4). J Banks, C Lessof, J Nazroo, N Rogers, M Stafford and A Steptoe (eds) (Chapter 3). Institute for Fiscal Studies.

[54] Demakakos P, Nunn S and Nazroo J. (2006). Loneliness, relative deprivation and life satisfaction, in: Retirement, health and relationships of the older population in England: The 2004 English Longitudinal Study of Ageing (Wave 2). J Banks, E Breeze, C Lessof and Nazroo, J (eds.) The Institute for Fiscal Studies: London, UK.

[55] Jivraj S, Nazroo J and Barnes M. Change in social detachment in older age in England, in: The Dynamics of Ageing: Evidence from the English Longitudinal Study of Ageing 2002-10 (Wave 5). J Banks, J Nazroo and A Steptoe (eds.) The Institute for Fiscal Studies: London, UK.

[56] Hayfield T, and Racine, JS (2008). Nonparametric Econometrics: The np Package. Journal of Statistical Software, 27(5). URL http://www.jstatsoft.org/v27/i05/.

[57] Thygesen, L, Johansen, C, Keiding, N, Giovannucci E, and Grønbæk, M. (2008). Effects of sample attrition in a longitudinal study of the association between alcohol intake and all-cause mortality. Addiction, 103, 1149-1159.

[58] Chatfield M, Brayne C, and Matthews F. (2005). A systematic literature review of attrition between waves in longitudinal studies in the elderly shows a consistent pattern of dropout between differing studies. Journal of Clinical Epidemiology, 58:13-19.

[59] Keil U, Chambless L, Döring A, Filipiak B and Stieber J. (1997). The relation of alcohol intake to coronary heart disease and all-cause mortality in a beer-drinking population. Epidemiology, 8(2):150-6.

[60] Bagnardi V, Blangiardo M, La Vecchia C, and Corrao G. (2001). Alcohol consumption and the risk of cancer: A meta-analysis. Alcohol Res Health;25:263-270.

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

For peer review only

[61] Wellmann J, Heidrich J, Berger K, Döring A, Heuschmann P and Keil U. (2004). Changes in alcohol intake and risk of coronary heart disease and all-cause mortality in the MONICA/KORA-Augsburg cohort 1987-97. European Journal of Cardiovascular Prevention & Rehabilitation, 11(1):48-55.

[62] Sadakane A, Gotoh T, Ishikawa S, Nakamura Y, Kayaba K and Jichi Medical School (JMS). Cohort Study Group. (2009). Amount and frequency of alcohol consumption and all-cause mortality in a Japanese population: the JMS Cohort Study. Journal of Epidemiology, 19(3):107-115.

[63] Ruf E, Baumert J, Meisinger C, Döring A and Ladwig, K. (2014). Are psychosocial stressors associated with the relationship of alcohol consumption and all-cause mortality? BMC public health, 14(1):312.

[64] Williams R. (2009). Using Heterogeneous Choice Models to Compare Logit and Probit Coefficients Across Groups. Sociological Methods & Research, 37(4), 531–559.

[65] Jackson, C. (2011). Multi-State Models for Panel Data: The msm Package for R. Journal of Statistical Software, 38(8):1-29.

[66] Bartolucci F, Farcomeni A and Pennoni F. (2012). Latent Markov models: a review of a general framework for the analysis of longitudinal data with covariates. MPRA Paper 39023, Munich Personal RePEc Archive. University Library of Munich, Germany.

[67] Pardoux, E. (2008). Markov processes and applications : algorithms, networks, genome, and finance. John Wiley & Sons Ltd.

[68] Harrell Jr F. (2001). Regression Modeling Strategies: with applications to linear models logistic regression and survival analysis. Springer Series in Statistics. Springer. New York: USA.

[69] Harrell Jr F, Lee K and Mark D. (1996). Multivariable prognostic models: issues in developing models, evaluation assumptions and adequacy, and measuring and reducing errors. Statistics in Medicine, 15:361-387.

[70] Steyerberg, E, Harrell Jr, F, Borsboom, G, Eijkemans, M, Vergouwe, Y and Habbema, J. (2001). Internal validation of predictive models: efficiency of some procedures for logistic regression analysis. Journal of clinical epidemiology, 54(8), 774-781.

[71] Boniface, S.; Kneale, J.; and Shelton, N. (2014). Drinking pattern is more strongly associated with under-reporting of alcohol consumption than socio-demographic factors: evidence from a mixed-methods study. BMC Public Health, 14:1297. http://www.biomedcentral.com/1471-2458/14/1297

[72] Ling, J.; Smith, K.; Wilson, G.; Brierley-Jones, L.; Crosland, A.; Kaner, E.; and Haighton, C. (2012). The 'other' in patterns of drinking: A qualitative study of attitudes towards alcohol use among professional, managerial and clerical workers. BMC Public Health, 12: 892. doi:10.1186/1471-2458-12-892

[73] Brierley-Jones, L.; Ling, J.; McCabe, K.; Wilson, G.; Crosland, A.; Kaner, E.; and Haighton, C. (2014). Habitus of home and traditional drinking: a qualitative analysis of reported middle-class alcohol use. Sociology of Health & Illness, 36(7): 1054-1076.

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

For peer review only

[74] Constança, P; Ribeiro, O. and Teixeira, L. (2012). Active Ageing: An Empirical Approach to the WHO Model. Current Gerontology and Geriatrics Research; article ID 382972, 10 pages, http://dx.doi.org/10.1155/2012/382972

[75] Morrow-Howell, N.; Hinterlong, J. and Sherraden, M. (2001). Productive aging: concepts and challenges. John Hopkins University Press, Baltimore: United States of America.

[76] Depp, C. A., and Jeste, D. V. (2006). Definitions and predictors of successful ageing: a comprehensive review of larger quantitative studies. American Journal of Geriatric Psychiatry, 14, 6-20.

[77] Knott, C.; Coombs, N.; Stamakis, E.; and Biddulph, J. (2015). All cause mortality and the case for age specific alcohol consumption guidelines: pooled analyses of up to 10 population based cohorts. British Medical Journal. BMJ 2015;350:h384

[78] Crome I, Dar K, Janikiewicz S, Rao T, Tarbuck A. (2011). Our invisible addicts. First report of the Older Persons' Substance Misuse Working Group of the Royal College of Psychiatrists. College Report CR165. Royal College of Psychiatrists. London: United Kingdom.

[76] Bristow M and Clare A. (1992). Prevalence and characteristics of at risk drinkers among elderly acute medical inpatients. Br J Addiction, 87: 291-4.

[77] Mirand A and Welte J. (1996). Alcohol consumption among the elderly in a general population, Erie county, New York. Am. J. Public Health 86(7): 978-894.

[78] Ruchlin H. (1997). Prevalence and Correlates of Alcohol Use among Older Adults. Preventive Medicine, 26(5):651-657.

[79] Dent O, Grayson D, Waite L, Cullen J, Creasey H, and Broe G. (2000). Alcohol consumption in a community sample of older people. Australian and New Zealand Journal of Public Health, 24(3): 323–326.

[80] Ganry O, Joly J, Queval M and Dubreuil A. (2000). Prevalence of alcohol problems among elderly patients in a university hospital. Addiction, 95: 107-113.

[81] Ganry O, Baudoin C, Fardellone P, Dubreuil A and the EPIDOS Group. (2001). Alcohol consumption by non-institutionalised elderly women: The EPIDOS Study, Public Health, 115(3):186-191.

[82] Leeson G. (2007). The alcohol behaviour of independent older people in Denmark. International Journal of Health Promotion and Education, 45(2): 49-52.

[83] Merrick E, Horgan C, Hodgkin D, Garnick D, Houghton S, Panas L, Saitz R, and Blow F. (2008). Unhealthy drinking patterns in older adults: prevalence and associated characteristics. Journal of the American Geriatrics Society, 56(2):214-223.

[84] Kirchner J, Zubritsky C, Cody M, Coakley E, Chen H, Ware J, Oslin D, Sanchez H, Durai U, Miles K, Llorente M, Costantino G and Levkoff S. (2007). Alcohol consumption among older adults in primary care. Journal of General Internal Medicine, 22(1):92-97.

[86] Castro-Costa E, Ferri C, Lima-Costa M, Zaleski M, Pinsky I, Caetano R, and Laranjeira R. (2008). Alcohol consumption in late-life — The first Brazilian National Alcohol Survey. Addictive Behaviors, 33(12):1598-1601.

For peer review only

BMJ Open: first published as 10.1136/bmjopen-2015-007684 on 23 July 2015. Downloaded from http://bmjopen.bmj.com/ on April 16, 2024 by guest. Protected by copyright.

[86] Hirata S, Nakano Y, Arrais Pinto Jr J, Litvoc J and Bottino C. (2009). Prevalence and correlates of alcoholism in community-dwelling elderly living in São Paulo, Brazil. International Journal of Geriatric Psychiatry, 24(10):1045–1053.

[87] Sacco P, Bucholz K and Spitznagel E. (2009). Alcohol Use Among Older Adults in the National Epidemiologic Survey on Alcohol and Related Conditions: A Latent Class Analysis. Journal of Studies on Alcohol and Drugs, 70(6):829-38.

[88] Immonen S, Valvanne J, and Pitkala K. (2011). Prevalence of at-risk drinking among older adults and associated socio-demographic and health-related factors. The Journal of Nutrition, Health & Aging, 15(9):789-794.

[89] Sacco P, Bucholz K and Harrington D. (2014). Gender differences in stressful life events, social support, perceived stress, and alcohol use among older adults: results from a National Survey. Subst Use Misuse. 49(4):456-65.

[90] Busby W, Campbell A, Borrie M and Spears G. (1988). Alcohol use in a community-based sample of subjects aged 70 years and older. J Am Geriatr Soc., 36(4):301-5.

[91] Liew H-P. (2011). Trajectories of alcohol consumption among the elderly widowed population: A semi-parametric, group-based modeling approach. Advances in Life Course Research, 16(3):124–131.

[92] Borok J, Galier P, Dinolfo M, Welgreen S, Hoffing M, Davis J, Ramirez K, Liao D, Tang L, Karno M, Sacco P, Lin J, and Moore, A. (2013). Why Do Older Unhealthy Drinkers Decide to Make Changes or Not in Their Alcohol Consumption? Data from the Healthy Living as You Age Study. Journal of the American Geriatrics Society, 61(8): 1296-1302.

[93] Ezzati M, Vander Hoorn S, Lawes CM, Leach R, James WPT, López AD, Rodgers A, and Murray CJL. (2005). Rethinking the “Diseases of Affluence” Paradigm: Global Patterns of Nutritional Risks in Relation to Economic Development. Plos Medicine, 2(5), e133

[94] Donatelli NS, and Soames J. (2014). Alcohol and Aging: The Invisible Epidemic. Journal of Emergency Nursing, 40(2): 177-180.

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Table 1 – Main Findings in Relevant Literature

Determinants of Alcohol use and abuse in Old Age																	
Paper	**Gender**	**Age**	**Education**	**Income**	**Health status**	**Smoking**	**Marital status**	**Economic activity**	**Ethnicity**	**Religion**	**Depression**	**Social connectedness**	**History of problem drinking**	**Anxiety (and related factors)**	**Weight**	**Beliefs about health effects of excessive drinking**	**Other covariates**
[22]	x	x	x														
[76]	x					x	x	x									Mobility
[77]	x			x	x	x		x		x							Living in a suburb
[78]	x	x	x		x				x						x	x	City size, Diabetes
[79]	x						x										
[80]	x		x	x			x						x				
[81]			x	x		x	x										
[82]	x	x					x										
[83]	x	x	x	x	x	x	x		x		x						
[84]					x						x	x		x			
[85]	x	x		x													
[86]	x	x	x		x	x			x								
[87]	x	x	x		x	x			x		x						Being the adult child of an alcoholic
[10]	x	x				x											
[88]	x	x	x	x	x	x	x										
[89]	x	x	x	x	x		x										
[26]	x	x		x	x							x					
[24]	x					x			x						x		

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Determinants of Transitions between Alcohol Abuse Risk in Old Age																	
Paper	**Gender**	**Age**	**Education**	**Income**	**Health status**	**Smoking**	**Marital status**	**Economic activity**	**Ethnicity**	**Religion**	**Depression**	**Social connectedness**	**History of problem drinking**	**Anxiety (and related factors)**	**Weight**	**Beliefs about health effects of excessive drinking**	**Other covariates**
[90]	x			x	x							x					Time
[32]	x	x			x			x									
[30]	x					x			x			x		x			
[28]	x		x	x	x		x		x	x			x				
[50]	x	x		x		x				x		x	x	x			Friends' approval of drinking
[16]	x	x		x		x	x						x				Avoidance coping, physical activity
[29]	x	x	x	x	x			x		x							Indebtedness
[91]	x				x						x		x				Health of deceased spouse
[92]																x	Environment
[25]	x		x		x	x					x						Frailty, cohabitation
[31]		x	x		x	x					x		x				Pain

Note: (x) *significant association*

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Table 2
Alcohol consumption by risk – ELSA Waves 4 and 5
Alternative conversion measures

NHS calculator		Wave 5					
		Abstainer	Lower	Increasing	Higher	Total	
Wave 4	Abstainer	2,768	732	158	37	3,695	*42.3%*
	Lower	842	2,063	330	20	3,255	*37.3%*
	Increasing	117	403	806	114	1,440	*16.5%*
	Higher	28	33	106	170	337	*3.9%*
	Total	3,755	3,231	1,400	341	8,727	
		43.0%	*37.0%*	*16.0%*	*3.9%*		

drinkaware		Wave 5					
		Abstainer	Lower	Increasing	Higher	Total	
Wave 4	Abstainer	2,768	658	210	59	3,695	*42.34%*
	Lower	787	1,546	339	30	2,702	*30.96%*
	Increasing	156	459	925	166	1,706	*19.55%*
	Higher	44	40	194	346	624	*7.15%*
	Total	3,755	2,703	1,668	601	8,727	
		43.03%	*30.97%*	*19.11%*	*6.89%*		

GLS		Wave 5					
		Abstainer	Lower	Increasing	Higher	Total	
Wave 4	Abstainer	2,768	721	173	33	3,695	*42.34%*
	Lower	842	2,019	324	21	3,206	*36.74%*
	Increasing	120	419	825	109	1,473	*16.88%*
	Higher	25	32	129	167	353	*4.04%*
	Total	3,755	3,191	1,451	330	8,727	
		43.03%	*36.56%*	*16.63%*	*3.78%*		

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Table 3 Descriptive statistics – Wave 5				
Variable	**Mean**	**St. Dev.**	**Min**	**Max**
Higher Risk (=1)	0.041	0.198	0	1
Alcohol Units	12.726	21.474	0	686
Age	66.639	9.031	50	89
Gender (Male=1)	0.445	0.497	0	1
Income (in logs)(*)	5.657	0.6978	-4.605	8.80
Smoking	2.687	10.079	0	210
Physical activity	2.808	0.834	1	4
Depression	0.143	0.35	0	1
Loneliness	0.476	0.499	0	1
Self-reported health status	3.196	1.114	1	5
Ethnicity (Non-white=1)	0.031	0.174	0	1
Social detachment	0.135	0.342	0	1
Religion	1.352	1.245	0	3
Children in household	0.327	0.679	0	3
Caring responsibilities	0.105	0.307	0	1
Healthy Diet	0.517	0.5	0	1
(*) Equivalent to £286.3, £2, £0.01 and £6,634 per week, respectively				

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Table 4
Distribution of Sample by Risk and Gender
Wave 5

	Female		Male	Total
Abstainer	2400	*63.91%*	1355	3755
Lower	1633	*50.54%*	1598	3231
Increasing	653	*46.64%*	747	1400
Higher	109	*31.96%*	232	341
Total	4795	*54.94%*	3932	8727

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Table 5
Wave 5 - Logistic Regression Results (Firth bias-corrected)
Probability of being in the Higher-Risk Drinking Category (People aged 50 or over)

Dependent variable: whether respondent is in the higher-risk category	Women		Women (Linear on Age)		Men	
	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)	Estimate	Pr(>|z|)
Intercept	-2.080	0.791	-4.541	0.003	-16.990	0.001
Age	-0.106	0.658	-0.056	0.001	0.437	0.004
Age Squared	0.000	0.859			-0.004	0.002
Income (logs)	0.435	0.011	0.466	0.002	0.035	0.714
Smoking	0.022	0.001	0.023	0.000	0.018	0.001
Physically Active	-0.094	0.507	0.064	0.622	-0.009	0.917
Self-reported health	0.302	0.006	0.266	0.007	0.131	0.074
Children in household	-0.540	0.004	-0.348	0.033	-0.142	0.158
Depression (Yes=1)	0.185	0.574	0.149	0.608	0.012	0.959
Loneliness (Yes=1)	0.308	0.212	0.163	0.465	0.083	0.632
Ethnicity (Non-White=1)	-1.912	0.059	14.767	0.976	-1.977	0.001
Social Detachment (Yes=1)	0.069	0.834	0.229	0.439	0.122	0.571
Religion Important (Yes=1)	-0.011	0.895	-0.048	0.518	-0.075	0.167
Caring Responsibilities (Yes=1)	0.007	0.981	0.122	0.625	-0.412	0.134
Healthy Diet (Yes=1)	-0.102	0.646	-0.159	0.413	-0.088	0.536
Education attainment						
No Qualifications	1.000		1.000		1.000	
NVQ1/ CSE other grade	0.321	0.685	0.142	0.854	0.312	0.390
NVQ2/GCE O Level / NVQ3/ GCE A Level / Foreign	0.700	0.023	0.688	0.025	0.206	0.367
Higher below degree / NVQ4/ NVQ5/ Degree	0.817	0.017	0.866	0.008	0.717	0.001
Marital status						
Married / Co-habiting	1.000		1.000		1.000	
Single, Separated or Divorced	-0.079	0.769	-0.108	0.657	0.297	0.096
Widowed	-0.528	0.189	-0.608	0.103	0.384	0.211
Economic activity						
Employed			1.000		1.000	
Inactive	-0.103	0.786	-0.041	0.904	-0.109	0.719
Retired	0.446	0.139	0.497	0.050	-0.166	0.380
Likelihood ratio test	*83.64* *df=21 p=0 n=4,423*		*84.19* *df=21 p=0 n=4,423*		*96.83* *df=21 p=0 n=3,927*	

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Table 6 Resampling Validation of Logistic models (Bootstrap n=200)			
Females			
	Original sample	**Optimism**	**Corrected index**
Concordance c-statistic	0.735	0.020	0.715
Slope	1.000	0.113	0.887
Males			
Concordance c-statistic	0.689	0.022	0.667
Slope	1.000	0.129	0.871

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Table 7
Transitions between Risks - Wave 4 and Wave 5 - Markov Chain Models

NHS calculator	Females				Males			
	No-No	No-Hi	Hi-No	Hi-Hi	No-No	No-Hi	Hi-No	Hi-Hi
Baseline	-0.1284 (-0.146, -0.1129)	0.1284 (0.1129, 0.146)	0.4099 (0.3631, 0.4628)	-0.4099 (-0.4628, -0.3631)	-0.07325 (-0.08495, -0.06316)	0.07325 (0.06316, 0.08495)	0.45714 (0.39835, 0.52462)	-0.45714 (-0.52462, -0.39835)
Single, Separated or Divorced		0.8872 (0.6308, 1.248)	0.8434 (0.5988, 1.188)			1.071 (0.7703, 1.489)	1.164 (0.8086, 1.675)	
Widowed		1.64 (1.0244, 2.625)	1.128 (0.7176, 1.772)			0.9054 (0.5809, 1.411)	1.0137 (0.6597, 1.558)	
Inactive		0.6145 (0.3337, 1.132)	1.244 (0.6817, 2.27)			0.8579 (0.562, 1.309)	1.1513 (0.7475, 1.773)	
Retired		1.131 (0.7928, 1.614)	1.28 (0.9365, 1.75)			1.298 (0.8913, 1.89)	1.017 (0.7068, 1.465)	
Social detachment		1.422 (0.9136, 2.212)	1.015 (0.6432, 1.601)			1.4434 (0.8713, 2.391)	0.7146 (0.4624, 1.105)	
Healthy Diet		0.701 (0.5451, 0.9014)	0.9571 (0.756, 1.2116)			0.8587 (0.6603, 0.997)	0.8458 (0.655, 1.092)	
Children in Household		0.9449 (0.7957, 1.122)	1.1568 (0.9798, 1.366)			0.9236 (0.7666, 1.113)	1.019 (1.006, 1.192)	
Care responsibilities		0.9425 (0.6036, 1.472)	0.6723 (0.3791, 1.193)			1.024 (0.695, 1.509)	1.119 (0.7619, 1.644)	
Depression		1.27 (0.8707, 1.853)	1.241 (0.8175, 1.883)			1.043 (0.7161, 1.518)	1.036 (0.6994, 1.534)	
Loneliness		1.339 (1.0513, 1.706)	0.956 (0.7434, 1.229)			0.703 (0.5397, 1.0158)	1.199 (1.009, 1.5631)	
Age		0.9553 (0.9346, 0.9765)	1.0063 (0.9861, 1.0269)			0.9372 (0.9149, 0.9601)	1.0089 (1.004, 1.02)	
Income		1.132 (1.0595, 1.336)	1.038 (0.8977, 1.201)			1.182 (1.0725, 1.436)	0.925 (0.8906, 0.994)	

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Drinkaware	Females				Males			
	No-No	No-Hi	Hi-No	Hi-Hi	No-No	No-Hi	Hi-No	Hi-Hi
Baseline	-0.05259 (-0.0634, -0.04362)	0.05259 (0.04362, 0.0634)	0.5712 (0.47439, 0.68777)	-0.5712 (-0.68777, -0.47439)	-0.03057 (-0.03853, -0.02425)	0.03057 (0.02425, 0.03853)	0.68763 (0.55616, 0.85019)	-0.68763 (-0.85019,-0.55616)
Single, Separated or Divorced		0.9057 (0.5652, 1.451)	0.6875 (0.413, 1.144)			0.7229 (0.4171, 1.253)	0.9928 (0.6098, 1.617)	
Widowed		1.4345 (0.7141, 2.882)	0.9938 (0.4726, 2.09)			1.0514 (0.5504, 2.008)	0.8398 (0.408, 1.728)	
Inactive		0.8234 (0.381, 1.78)	0.6979 (0.225, 2.165)			0.7967 (0.4215, 1.506)	0.9268 (0.5042, 1.704)	
Retired		0.9799 (0.595, 1.614)	1.024 (0.6472, 1.62)			1.0329 (0.587, 1.817)	0.9927 (0.5872, 1.678)	
Social detachment		1.2899 (0.6687, 2.488)	0.7697 (0.3952, 1.499)			1.9598 (0.8407, 4.568)	0.9514 (0.4915, 1.842)	
Healthy Diet		0.6579 (0.4613, 0.9384)	1.0043 (0.7052, 1.4303)			0.9161 (0.6166, 1.361)	1.1118 (0.7642, 1.618)	
Children in Household		0.9264 (0.7216, 1.189)	1.2061 (0.9336, 1.558)			0.7426 (0.5467, 1.009)	1.0267 (0.7604, 1.386)	
Care responsibilities		1.0629 (0.5575, 2.026)	0.9598 (0.4473, 2.06)			0.9351 (0.5207, 1.679)	0.894 (0.5063, 1.578)	
Depression		1.348 (0.7908, 2.298)	1.077 (0.5404, 2.147)			1.063 (0.5895, 1.916)	1.379 (0.8133, 2.337)	
Loneliness		0.875 (0.6125, 1.25)	1.216 (0.8404, 1.759)			1.188 (0.7972, 1.771)	1.248 (0.8561, 1.819)	
Age		0.9679 (0.9378, 0.999)	1.0238 (0.9902, 1.058)			0.9348 (0.9008, 0.97)	1.0158 (0.9824, 1.05)	
Income		1.2226 (0.9522, 1.57)	0.9997 (0.7827, 1.277)			1.1396 (0.8527, 1.523)	0.9005 (0.7337, 1.105)	

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GLS	Females				Males			
	No-No	No-Hi	Hi-No	Hi-Hi	No-No	No-Hi	Hi-No	Hi-Hi
Baseline	-0.03457 (-0.04375, -0.02731)	0.03457 (0.02731, 0.04375)	0.69281 (0.54746, 0.87675)	-0.69281 (-0.87675, -0.54746)	-0.02025 (-0.02771, -0.0148)	0.02025 (0.0148, 0.02771)	0.91466 (0.68949, 1.21338)	-0.91466 (-1.21338, -0.68949)
Single, Separated or Divorced		1.273 (0.736, 2.203)	1.068 (0.6276, 1.816)			1.096 (0.5616, 2.139)	1.562 (0.8658, 2.818)	
Widowed		1.526 (0.643, 3.624)	1.103 (0.4569, 2.662)			0.5722 (0.2113, 1.549)	0.9541 (0.3912, 2.327)	
Inactive		1.006 (0.3744, 2.705)	1.415 (0.417, 4.803)			0.6471 (0.2721, 1.539)	0.8418 (0.3536, 2.004)	
Retired		1.244 (0.6795, 2.279)	1.099 (0.6418, 1.883)			0.7033 (0.3443, 1.437)	0.7587 (0.3923, 1.467)	
Social detachment		0.9481 (0.438, 2.052)	0.6427 (0.2881, 1.434)			2.094 (0.7146, 6.137)	1.529 (0.5673, 4.123)	
Healthy Diet		0.7523 (0.4854, 1.166)	0.8406 (0.5396, 1.31)			0.8258 (0.4966, 1.373)	0.7078 (0.4352, 1.151)	
Children in Household		0.8265 (0.6051, 1.129)	0.9603 (0.6897, 1.337)			0.6799 (0.4455, 1.038)	1.149 (1.023, 1.57)	
Care responsibilities		0.6944 (0.2448, 1.97)	1.6489 (0.7734, 3.515)			1.0217 (0.5086, 2.053)	0.6739 (0.3038, 1.495)	
Depression		1.5815 (0.8629, 2.899)	0.6557 (0.2568, 1.675)			0.8389 (0.3616, 1.946)	1.3212 (0.6781, 2.574)	
Loneliness		1.11 (1.0729, 1.383)	1.325 (0.8505, 2.064)			1.051 (0.6321, 1.748)	1.07 (0.6529, 1.753)	
Age		0.9401 (0.9036, 0.978)	0.9878 (0.9486, 1.029)			0.9753 (0.9301, 1.023)	1.0318 (0.9844, 1.081)	
Income		1.199 (1.0947, 1.606)	1.111 (0.795, 1.554)			1.5299 (1.0274, 2.278)	0.8842 (0.6755, 1.157)	

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Socio-Economic Determinants of Risk of Harmful Alcohol Drinking among People aged 50 or over in England

Annex 1 – Sensitivity analysis of NICE's cut-off points for higher-risk drinking

Figures A1 and A2 below present a graphical representation of the logistic regression results (Firth bias-corrected)m for men and women, respectively, using NICE's definition of higher-risk drinking (i.e. > 50 alcohol units per week for men / > 35 units per week for women) –that is, the results in Table 5 above, in dashed lines- and two alternative definitions: > 48 alcohol units per week for men / > 33 units per week for women, and > 52 alcohol units per week for men / > 37 units per week for women. We find that the delimitation of higher-risk drinking has only minor implications for the statistical results.

<Insert Figure A1a here>

<Insert Figure A1b here>

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Annex 2 - Sensitivity analysis of changing conversion units for wine and beer

The results reported in Table 5 above are based on the conversion tables in the 'alcohol unit calculator' by the NHS –see text.

Figures A2a and A2b below compare the estimates with those obtained from using the conversion measures in the drinkaware website (www.drinkaware.co.uk) and in the 2007 General Lifestyle Survey (GLS).

<Insert Figure A2a here>

<Insert Figure A2b here>

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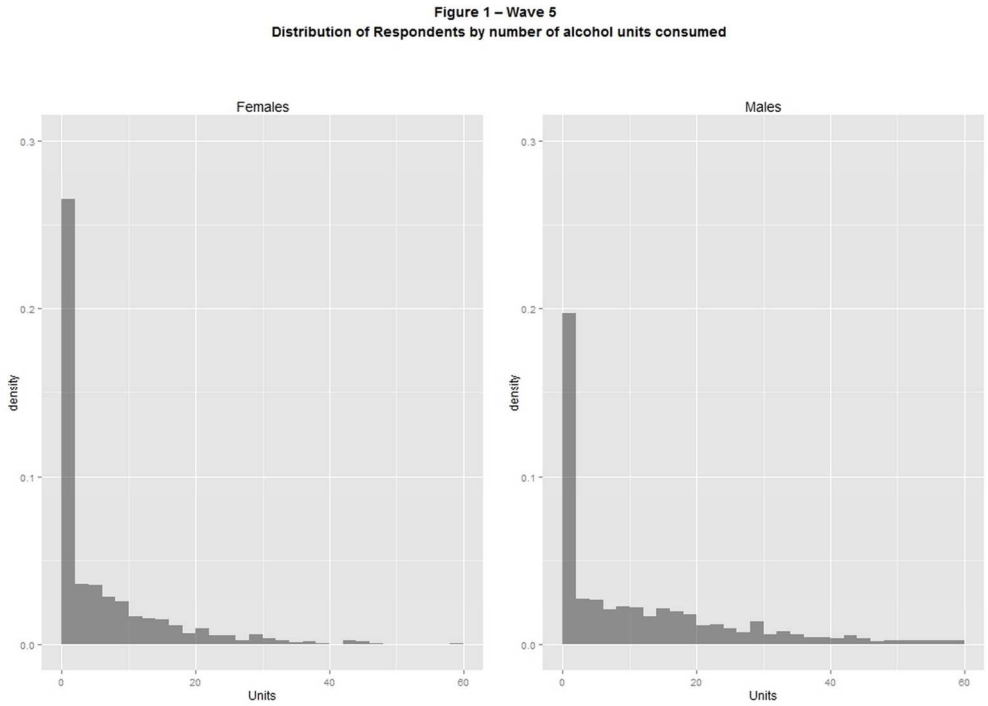

Distribution of Respondents by number of alcohol units consumed
119x90mm (300 x 300 DPI)

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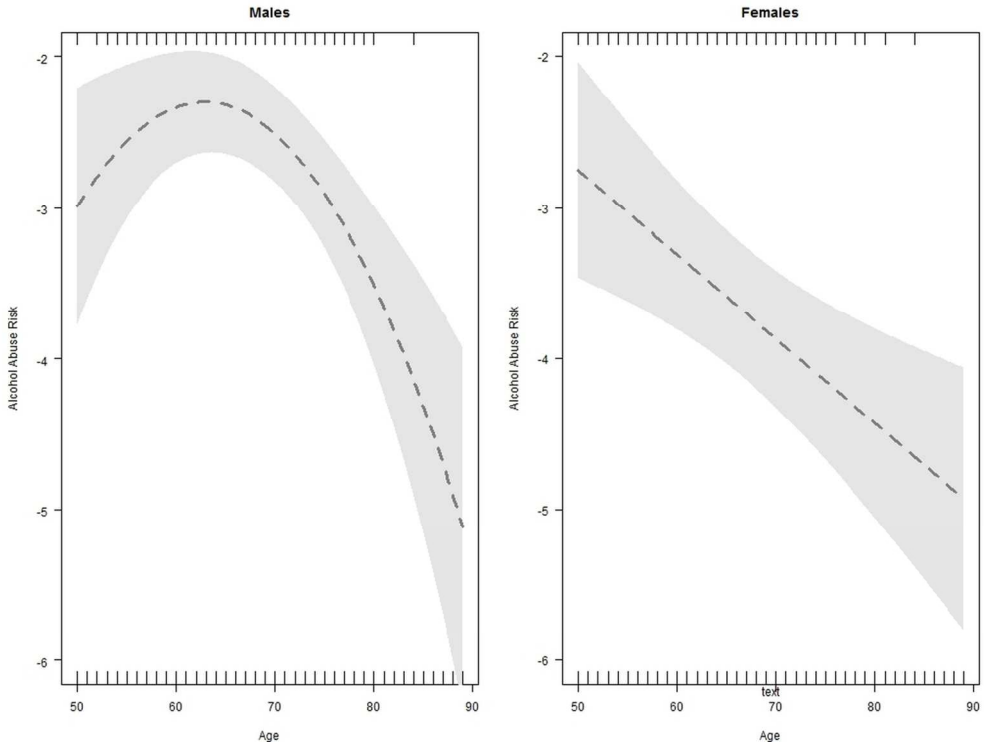

Conditional probability plot of being at higher-risk drinking category by age and gender
119x90mm (300 x 300 DPI)

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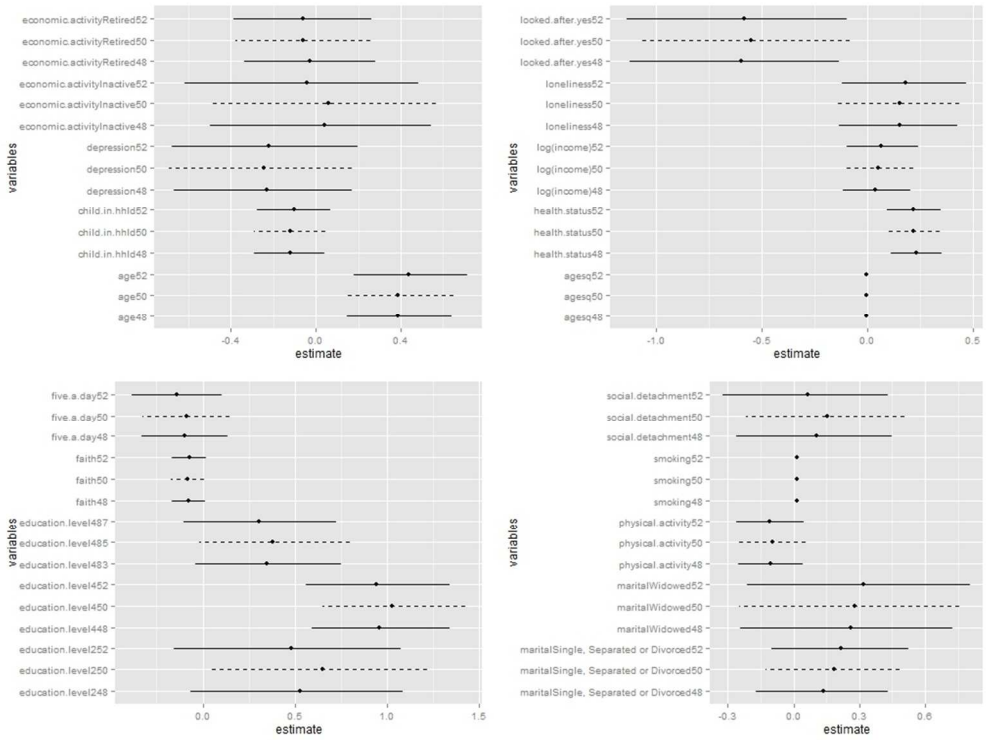

Sensitivity analysis of changes in cut-off points for higher-risk drinking
Males
361x270mm (72 x 72 DPI)

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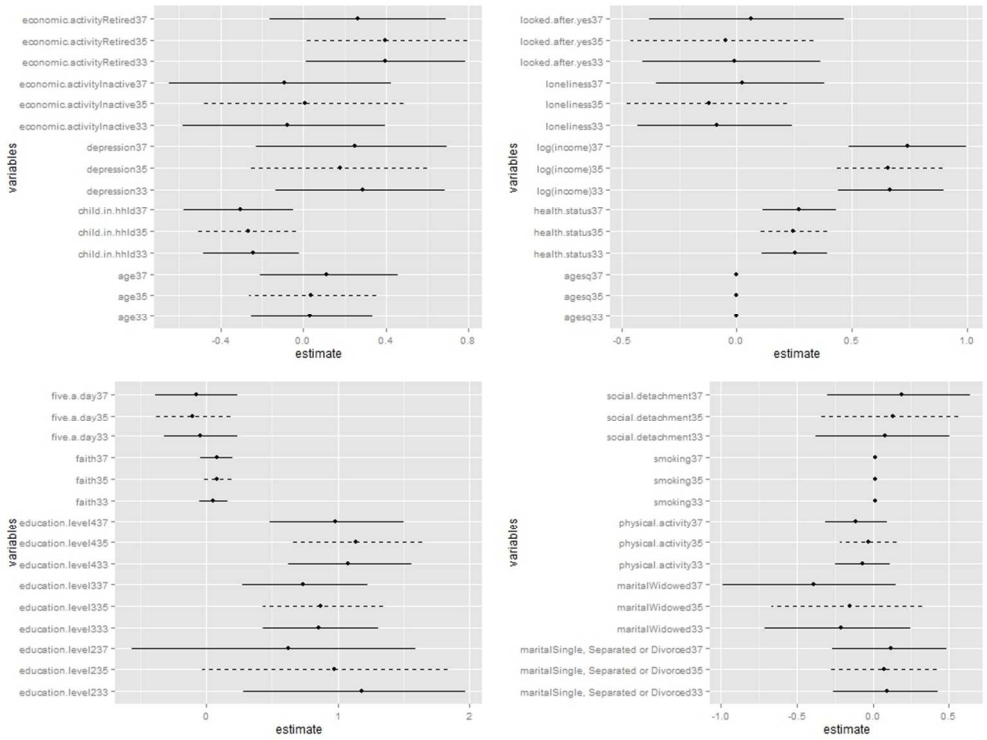

Sensitivity analysis of changes in cut-off points for higher-risk drinking
Females
361x270mm (72 x 72 DPI)

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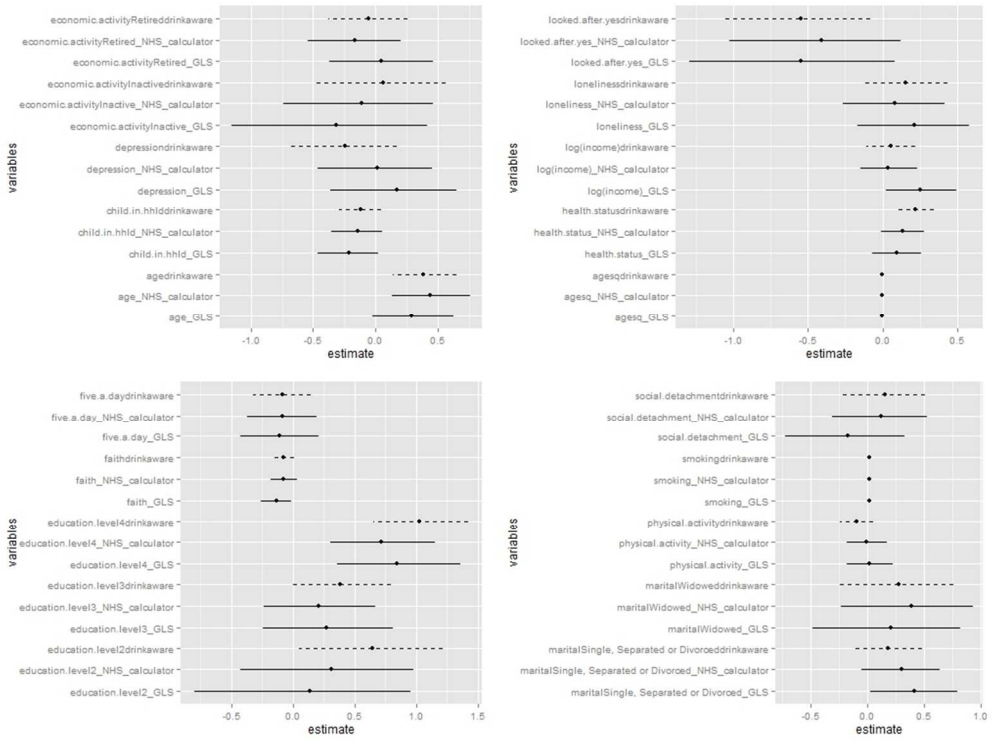

Sensitivity analysis of changes in conversion units for wine and beer
Males
361x270mm (72 x 72 DPI)

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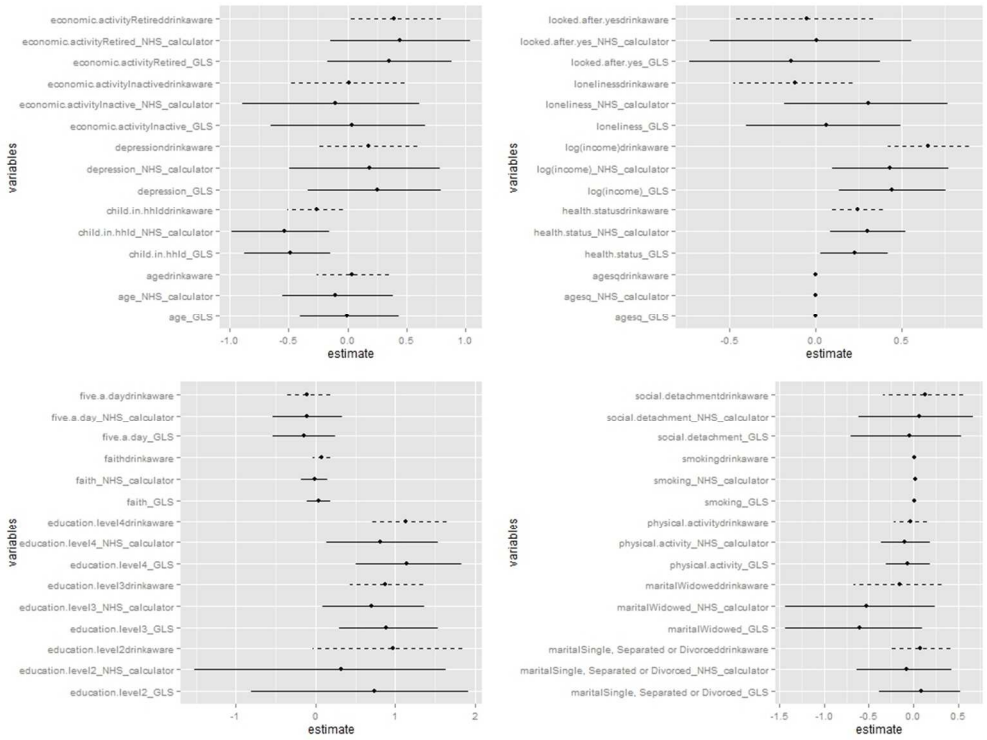

Sensitivity analysis of changes in conversion units for wine and beer
Females
361x270mm (72 x 72 DPI)

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