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RESEARCH ARTICLE

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Do older adults drink alcohol whilst taking alcohol-interactive medication? Prevalence and ten-year mortality risk: findings from the UK Whitehall II cohort study

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ABSTRACT

Background: Older people commonly take prescribed medications, some of which are contra-indicated with alcohol. Few population-based studies have assessed the relationship between taking these medicines, different levels of alcohol use, and potential harm.

Aims: To investigate the prevalence of taking alcohol-interactive (AI) medication and alcohol consumption among older adults and to compare the ten-year mortality risk among different categories of drinkers.

Methods: Data were obtained from 6220 participants (mean age 70, 71% male) within the UK Whitehall II cohort study of civil servants from phase 11 (2012–2013) who were followed up for mortality over ten years. Alcohol use was based on volume of consumption in self-reported drinks per week, and hazardous pattern of consumption was assessed with the Alcohol Use Disorders Identification Test – Consumption (AUDIT-C). AI medications were coded from self-reported medication use. Deaths were obtained from the NHS central registry (2012–2022).

Results: 55% of participants took AI medication and of these, 73% also consumed alcohol, and 43% drank hazardously. These participants were more likely to be male, older, and belong to lower socioeconomic groups. Among those taking AI medication, there was a significantly higher mortality hazard for ex-drinkers (HR =1.43 CI 1.14, 1.80) and nondrinkers (HR= 2.09 CI 1.33, 3.27) compared to moderate drinkers but no significant difference for higher risk/hazardous drinkers after adjusting for confounding factors.

Conclusion: In these older adults, there was a high prevalence of taking alcohol-interactive medication and drinking alcohol. Whilst there was no increased mortality risk other non-fatal outcomes should be considered.

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Introduction

Alcohol use is a major risk factor for disease worldwide and a significant cause of death among all adults (Griswold et al. 2018), and there is evidence that alcohol consumption may be a particular problem for older adults. Data indicate that between 2009 and 2010, 44% of alcohol-related hospitalizations in UK were among individuals aged 65 and older (Wadd and Papadopoulos 2014). Even at lower levels of alcohol consumption, older adults are more susceptible to harm than other age groups (Kelly et al. 2018). Older adults who consume alcohol face an increased risk of alcohol-related health issues, such as experiencing imbalance and subsequent falls after alcohol intake (Vogel-Sprott and Barrett 1984).

Older people often use multiple medications simultaneously (Hovstadius et al. 2010). An Irish study reported that the proportion of people over 65 years of age using multiple medications increased from 18% in 1997 to 60% in 2012 (Moriarty et al. 2015). Some of these medications have explicit warnings not to be taken whilst consuming alcohol as the effects are likely to interact. The interplay between medications and the acute and chronic effects of alcohol is both extensive and complex (Adams 1995). Alcohol may enhance the effect of certain medications resulting in exaggerated therapeutic responses, such as barbiturates (increased sedation) and anticoagulants (excessive bleeding). Alcohol may increase toxicity, for example through adverse hepatic reactions (Price et al., n.d.). Alcohol may make certain medication less effective (NIAAA. 2014). Equally, certain medications may enhance the actions of alcohol; for example, cerebral depression occurs more readily when alcohol is used with sedatives (Immonen et al. 2013).

While there are a number of studies demonstrating which medications interact with alcohol (Schuckit 1987;

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Weathermon and Crabb 1999; Nagaraj et al. 2017), there is much less evidence on specific adverse outcomes and their severity in older adults, including whether severity may increase in an alcohol dose-dependent manner. A cross-sectional study of 2100 people aged over 65 years in Finland found that when classified as 'at-risk' alcohol users, 'moderate' alcohol users, and 'minimal/non-alcohol users', the prevalence of using AI medications was 42.4%, 34.9%, and 52.7%, respectively ($p < 0.001$) (Immonen et al. 2013). A systematic review by Holton et al. (2017) summarized 20 studies on co-using alcohol and AI medications in older adults between 1990 and 2016. The proportion of older adults taking medications while drinking alcohol ranged from 18% to 39%. Additionally, falls were more common among those taking AI medications who were also high-risk drinkers.

These studies are all cross-sectional studies, and longitudinal studies are lacking to investigate the association between alcohol-medication interactions and potential harm. Thus, the aim of this study is to investigate the prevalence of taking alcohol-interactive medication and drinking alcohol among older adults within the Whitehall II cohort study and to compare the ten-year risk of mortality associated with taking alcohol-interactive medication among different categories of drinkers.

Methods

Sample

The Whitehall II cohort population originally consisted of 10,308 civil servants (67% male, 33% female) who were recruited from 20 Whitehall departments between 1985 and 1988 when they were aged 35–55 (Marmot et al. 2013). Following the initial visit and baseline data collection, study participants were posted questionnaires at timed intervals and invited to a research clinic at 5-year intervals. Data from 6220 participants remaining in the study at Phase 11 (2012–2013 data collection) were used for this study with follow-up for mortality from NHS central registry over the subsequent ten years.

Exposure measure (collected at Phase 11)

In a self-completed questionnaire, participants were asked if they have had an alcoholic drink in the last 12 months or were life-long nondrinkers or ex-drinkers.

Average volume consumed: Volume of drinking was determined from self-reported number of alcoholic drinks per week and converted to units of alcohol based on UK drinking standards (Britton et al. 2016). One UK unit converts to 10 ml/8g ethanol. 'Moderate drinkers' were classified as those consuming between 1 and 21 units of alcohol in the past week for men and between 1 and 14 units for women. 'Increasing-risk drinkers' were those consuming 22–50 units for men and 15–35 units for women. 'Higher-risk drinkers' were men drinking more than 50 units and women more than 35 units (based on UK drinking guidelines at the time of interview, NICE. 2010) (Thompson and Pirmohamed 2021).

Pattern of drinking: Hazardous drinking was determined from completion of the Alcohol Use Disorders Identification Test - Consumption (AUDIT-C), a validated and widely used screening tool (Bush et al. 1998). Participants were assigned scores in response to the three self-completed questions (How often did you have a drink containing alcohol in the past year? How many drinks containing alcohol did you have on a typical day when you were drinking in the past year? How often did you have six or more drinks on one occasion in the past year?) Hazardous drinkers were defined as having a score equal to or above four for men and score equal to or higher than three for women (Supplementary table S1) (Bradley et al. 2007).

Alcohol interactive (AI) medications

Participants self-reported prescribed medications that they were using in the last 14 days and these were coded by trained coders into broader drug groups.

The 'Potentially Serious Alcohol Medication Interactions in Older adults' (POSAMINO) study identified a set of 38 medications that can be used to identify older people at risk of potentially serious effects from taking AI medications and alcohol (Holton et al. 2017). The POSAMINO criteria were applied to the Whitehall II drug groups to identify those that are potentially alcohol-interactive (Table 1).

Outcome measure

Participants were individually linked to death records over a 10-year period in the NHS central registry (2012–2022).

Covariates

Age, general health (measured by General Health Questionnaire (Chandola et al. 2003)), sex, smoking status, socio-economic status (SES) (by civil service employment grade), and ethnicity (white vs. any ethnic minority background) were considered to be potential confounding factors in the association between taking AI medication while drinking alcohol and mortality.

Table 1. Alcohol interactive (AI) medications included in this study.

Body system	Drug group
Cardiovascular system	Beta Blockers
Cardiovascular system	Other anti-hypertensives
Cardiovascular system	ACE inhibitors
Cardiovascular system	Nitrates
Cardiovascular system	Diuretics
Respiratory system	Antihistamines
Central nervous system	Hypnotics
Central nervous system	Anxiolytics
Central nervous system	Antipsychotics
Central nervous system	Antidepressants
Musculoskeletal & joint diseases	Analgesics
Central nervous system	Parkinsonism
Endocrine	Insulin
Endocrine	Oral antidiabetic

Participants with incomplete data on alcohol consumption or medication were excluded from the analysis.

Statistical analyses

Patterns in alcohol use and taking AI medication

The number and proportion in each drinking category (volume and hazardous pattern) corresponding to AI medication use were determined and demographic characteristics compared.

Mortality risk associated with different drinking groups taking AI medication

Cox regression was used to compare mortality rates among participants taking AI medication. For average volume of alcohol per week, participants were classified as nondrinkers, ex-drinkers, moderate drinkers (reference group), increasing risk drinkers and higher risk drinkers. The last two groups were combined due to small numbers of higher risk drinkers. For hazardous drinking, participants were classified as nondrinkers, ex-drinkers, low risk (reference group) and AUDIT-C positive screen (score of >4/3 men/women).

Unadjusted results and adjusted results (adjusting for age, general health, sex, smoking status, SES, and ethnicity) were calculated, respectively.

Results

The mean age of the participants was 70 years (Table 2). Women accounted for less than 30% of the participants. More than 90% of the participants were white. The number of participants in high SES and medium SES was similar, whilst the proportion of participants with low SES was 12%.

Table 2. Characteristics of Whitehall II participants at phase 11 (2012–2013).

Demographic	Analytical sample	
	N/Mean	%/SD
Age	69.8	5.87
Age (categories)		
59–65	2058	33.1%
66–70	1724	27.7%
71–75	1207	19.4%
76–80	1080	17.4%
>80	151	2.4%
Sex		
Male	4396	70.7%
Female	1824	29.3%
Ethnicity		
White	5756	92.5%
Other	454	7.3%
Last known Civil Service grade		
High	2813	45.2%
Medium	2671	42.9%
Low	736	11.8%
Smoking status		
Never-smoker	2640	42.4%
Ex-smoker	2959	47.6%
Current smoker	216	3.5%
GHQ score	2.5	5.0
GHQ score (binary)		
Low	5034	80.9%
High	1037	16.7%
Total	6220	100%

Ex-smokers comprised nearly half of the participants, while current smokers comprised less than 5% of the participants.

During the 10-year follow-up (average follow up 8.04 years), 761 (12.2%) of 6220 participants were recorded to have died.

Just over half the sample were taking AI medication (55%) and of these, 73% also reported consuming alcohol (59.8% moderately and 13.2% increasing and higher risk) (Table 3).

The mortality risk for volume of drinking among participants taking AI medications is shown in Table 4. After adjusting for age, general health, sex, smoking status, SES, and ethnicity, ex-drinkers, and nondrinkers were at increased risk of death, compared to moderate drinkers, with hazard ratios of 1.43 (95% CI 1.14, 1.80) and 2.09 (95% CI 1.33, 3.27), respectively. Increasing risk drinkers and higher risk drinkers did not have statistically significantly higher hazard ratios of death compared to moderate drinkers.

Mortality risk for hazardous drinking among participants taking AI medications is shown in Table 5. In the adjusted model (adjusted for age, general health, sex, smoking status, SES, and ethnicity), there was no significant associations between drinking hazardously and mortality (hazard ratio: 0.83, 95% CI 0.66, 1.04). Lifelong nondrinkers had 1.85 (CI 1.16, 2.95) times the hazard rate of death compared to non-hazardous drinkers.

Discussion

This study found that among these community dwelling older adults, 40% of the sample were drinking whilst taking AI medication. Of those taking AI medication, 13.2% were consuming volumes considered to be at increasing risk and higher risk (22 or more units per week for men and 15 or more units per week for women). Nearly half were considered to be drinking hazardously according to the AUDIT-C screening tool.

Among participants taking AI medication, this study found that after accounting for confounding factors, the hazard rate of death was significantly higher for ex-drinkers and nondrinkers compared to moderate drinkers. This supports the 'sick-quitter' hypothesis (Sarich et al. 2019) and the theory that those who are life-long nondrinkers in the UK may also have more health problems (Ng Fat et al. 2014). However, in this study, higher risk and hazardous drinkers did not have significantly higher mortality risk than moderate drinkers.

In a previous systematic review, the proportion of older adults taking medications while drinking alcohol ranged from 18% to 39% (Weathermon and Crabb 1999). These estimates are slightly lower than the finding in our study where 40% of the sample were drinking whilst taking AI medication. No other study compared different drinking categories (by volume and hazardous drinking status) and AI medications, so we are unable to compare our findings. A few previous studies examined the association between alcohol-medication interactions and risk of falls, which provides

Table 3. Characteristics of drinking categories and alcohol-interactive medication.

Volume per week

		Ex-drinker	Lifelong nondrinker	Moderate drinker	Increasing risk drinker	Higher risk drinker	Total*
		$N = 1244$	$N = 188$	$N = 3961$	$N = 760$	$N = 67$	$N = 6220$
Taking AI meds		810 (23.8%)	109 (3.2%)	2035 (59.8%)	413 (12.1%)	38 (1.1%)	3405
Not taking AI meds		434 (15.4%)	79 (2.8%)	1926 (68.4%)	347 (12.3%)	29 (1.0%)	2815
AMONG THOSE TAKING AI MEDS							
Variable		$N = 810$	$N = 109$	$N = 2035$	$N = 413$	$N = 38$	$N = 3405$
Age	59–65	203 (20.80%)	32 (3.28%)	562 (57.58%)	166 (17.01%)	13 (1.33%)	976
	66–70	200 (22.62%)	20 (2.26%)	542 (61.31%)	104 (11.76%)	18 (2.04%)	884
	71–75	166 (22.93%)	32 (4.42%)	442 (61.05%)	81 (11.19%)	3 (0.41%)	724
	76–80	210 (29.49%)	21 (2.95%)	423 (59.41%)	54 (7.58%)	4 (0.56%)	712
	>80	31 (28.44%)	4 (3.67%)	66 (60.55%)	8(7.34%)	0 (0.00%)	109
Sex	Male	431 (18.34%)	41 (1.74%)	1512 (64.34%)	334 (14.21%)	32 (1.36%)	2350
	Female	379 (35.92%)	68 (6.45%)	523 (49.57%)	79 (7.49%)	6 (0.57%)	1055
Ethnicity	White	673 (21.84%)	62 (2.01%)	1903 (61.77%)	406 (13.18%)	37 (1.20%)	3081
	Non White	135 (42.59%)	47 (14.83%)	128 (40.38%)	6 (1.89%)	1 (0.32%)	317
Socioeconomic status	High	187 (13.06%)	12 (0.84%)	983 (68.65%)	234 (16.34%)	16 (1.12%)	1432
	Medium	401 (26.43%)	62 (4.09%)	866 (57.09%)	167 (11.01%)	21 (1.38%)	1517
	Low	222 (48.68%)	35 (7.68%)	186 (40.79%)	12 (2.63%)	1 (0.22%)	456
Smoking status	Never-smoker	320 (23.48%)	78 (5.72%)	858 (62.95%)	103 (7.56%)	4 (0.29%)	1363
	Ex-smoker	345 (20.46%)	23 (1.36%)	1017 (60.32%)	272 (16.13%)	29 (1.72%)	1686
	Current-smoker	27 (23.28%)	5 (4.31%)	59 (50.86%)	23 (19.83%)	2 (1.72%)	116
GHQ score	Low	529 (20.28%)	78 (2.99%)	1642 (62.94%)	334 (12.80%)	26 (1.00%)	2609
	High	198 (28.78%)	26 (3.78%)	375 (54.51%)	78 (11.34%)	11 (1.60%)	688

Hazardous drinking (Defined by AUDIT)

		Ex-drinker	Lifelong nondrinker	Non-hazardous drinker	Hazardous drinker	Total
		$N = 1244$	$N = 188$	$N = 1685$	$N = 3103$	$N = 6220$
Taking AI meds		810 (23.8%)	109 (3.2%)	883 (25.9%)	1603 (47.1%)	3405
Not taking AI meds		434 (15.4%)	79 (2.8%)	802 (28.5%)	1500 (53.3%)	2815
AMONG THOSE TAKING AI MEDS						
Variable		$N = 810$	$N = 109$	$N = 883$	$N = 1603$	$N = 3405$
Age	59–65	203 (20.80%)	32 (3.28%)	236 (24.18%)	505 (51.74%)	976
	66–70	200 (22.62%)	20 (2.26%)	217 (24.55%)	447 (50.57%)	884
	71–75	166 (22.93%)	32 (4.42%)	204 (28.18%)	322 (44.48%)	724
	76–80	210 (29.49%)	21 (2.95%)	192 (26.97%)	289 (40.59%)	712
	>80	31 (28.44%)	4 (3.67%)	34 (31.19%)	40 (36.70%)	109
Sex	Male	431 (18.34%)	41 (1.74%)	689 (29.32%)	1189 (50.60%)	2350
	Female	379 (35.92%)	68 (6.45%)	194 (18.39%)	414 (39.24%)	1055
Ethnicity	White	673 (21.84%)	62 (2.01%)	798 (25.90%)	1548 (50.24%)	3081
	Non white	135 (42.59%)	47 (14.83%)	83 (26.18%)	52 (16.40%)	317
Socioeconomic status	High	187 (13.06%)	12 (0.84%)	367 (25.63%)	866 (60.47%)	1432
	Medium	401 (26.43%)	62 (4.09%)	404 (26.63%)	650 (42.85%)	1517
	Low	222 (48.68%)	35 (7.68%)	112 (24.56%)	87 (19.08%)	456
Smoking status	Never-smoker	320 (23.48%)	78 (5.72%)	404 (29.64%)	561 (41.16%)	1363
	Ex-smoker	345 (20.46%)	23 (1.36%)	414 (24.56%)	904 (53.62%)	1686
	Current-smoker	27 (23.28%)	5 (4.31%)	25 (21.55%)	59 (50.86%)	116
GHQ score	Low	529 (20.28%)	78 (2.99%)	719 (27.56%)	1283 (49.18%)	2609
	High	198 (28.78%)	26 (3.78%)	155 (22.53%)	309 (44.91%)	688

*The denominator for each percentage corresponds to the value in the 'Total' column for each row.

Table 4. Mortality risk for volume of drinking among participants taking AI medication.

Variable		HR	95% CI	*P*
Unadjusted				
Units of alcohol past week	Moderate drinker	1.00	–	–
	Ex-drinker	1.53	1.26, 1.86	<0.01
	Nondrinker	1.55	1.01, 2.37	0.04
	Increasing/Higher risk drinker	0.97	0.73, 1.28	0.83
Adjusted for age, general health, sex, smoking status, SES, and ethnicity				
Units of alcohol past week	Moderate drinker	1.00	–	–
	Ex-drinker	1.43	1.14, 1.80	<0.01
	Nondrinker	2.09	1.33, 3.27	<0.01
	Increasing/Higher risk drinker	1.15	0.86, 1.53	0.35

Table 5. Mortality risk for hazardous drinking among participants taking AI medication.

Variable		HR	95% CI	*P*
Unadjusted				
AUDIT-C case	Ex-drinker	1.33	1.06, 1.67	0.01
	Lifelong nondrinker	1.34	0.86, 2.09	0.19
	No hazardous drinker	1.00	–	–
	Hazardous drinker	0.79	0.64, 0.98	0.03
Adjusted for age, general health, sex, smoking status, SES, and ethnicity				
AUDIT-C case	Ex-drinker	1.26	0.98, 1.63	0.08
	Lifelong nondrinker	1.85	1.16, 2.95	0.01
	No hazardous drinker	1.00	–	–
	Hazardous drinker	0.83	0.66, 1.04	0.11

a point of comparison (Sheahan et al. 1995; Wong et al. 2016). An Irish study found that taking certain central nervous system medication whilst drinking increased the risk of falls over a four-year period, but other alcohol-interactive medication was not associated with falls (Holton et al. 2019). In the present study, no significant increases in mortality risk were found among those drinking alcohol (including at higher risk/hazardous levels) and taking AI medication.

The present study had several strengths. First, exposure to alcohol was defined according to both volume consumed and whether it was deemed to be consumed in a hazardous pattern. This has the potential to identify those most at risk and to tailor public health and medical advice with more granularity. Furthermore, nondrinkers were more accurately defined as ex-drinkers or life-long nondrinkers. Both these latter groups have been shown to have different risk factors and health outcomes than moderate drinkers (Fillmore et al. 2007). Careful consideration was given to potential confounding factors in an attempt to isolate the risks associated with dual intake of alcohol and medication. This was often not the case with previous studies in this research field. The outcome measure, death, was not restricted to a specific health condition, recognizing that there are multiple potential harms from mixing alcohol with medication. Additionally, all-participants were flagged for mortality through NHS records, therefore minimizing the bias due to participant loss-to-follow up in cohort studies.

Limitations include the use of self-reported alcohol consumption which may be at risk of under-reporting bias (Del Boca and Noll 2000). Alcohol use was only captured once and it is possible that drinking behavior may vary over the life-course (Britton et al. 2015) and medication use only related to the last two weeks. The study participants were all civil servants at recruitment, and therefore the prevalence of drinking and taking AI medications may not be generalizable to adults of a similar age in the UK. For example, the socioeconomic profile may be skewed, and this is likely to be related to alcohol and medication use (Hwang et al. 2023) Further threats to generalizability are that 93% of the sample were white ethnicity and 71% were male.

Conclusions

This study found a high number of participants were taking alcohol-interactive medication whilst also consuming alcohol. This suggests that people are either not being informed of the necessity to avoid alcohol or are choosing to ignore the advice. Future qualitative research could explore this by understanding the perspectives and behaviors of healthcare professionals and patients. Whilst this study did not find an increased risk of mortality among higher risk/hazardous drinkers compared to moderate drinkers who are taking AI medication, this does not mean that they were not at increased risk of accidents and other non-fatal events. Future research should explore the potential mechanisms of alcohol- medication interactions and the patterns of disease incidence, hospital admissions, incidents such as falls, and other potential harm besides mortality.

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Author contributions

Yuxuan Wu and Eloise Evans: Conceptualization; methodology; formal analysis. Annie Britton and Sadie Boniface: Conceptualization; methodology; project administration; supervision.

Disclosure statement

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