

Research Article

Alcohol Consumption among the Oldest Old and How It Changes during Two Years

Robin Fornazar,¹ Fredrik Spak,¹ Synneve Dahlin-Ivanoff,^{2,3} and Katarina Wilhelmson^{1,3}

¹ Department of Social Medicine, Sahlgrenska Academy, University of Gothenburg, P.O. Box 453, 405 30 Gothenburg, Sweden

² Department of Clinical Neuroscience and Rehabilitation, Sahlgrenska Academy, University of Gothenburg, P.O. Box 455, 405 30 Gothenburg, Sweden

³ The Swedish Institute for Health Sciences (Vårdal institutet), Universities of Gothenburg and Lund, P.O. Box 187, 221 00 Lund, Sweden

Correspondence should be addressed to Robin Fornazar; robin.fornazar@socmed.gu.se

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This longitudinal study aimed to examine the pattern of alcohol consumption (using the AUDIT-C) among the oldest old (80+) and how it changed two years later. Five hundred seventy-six persons from the Gothenburg metropolitan area were interviewed between 2008 and 2011. Men represented a higher proportion of at-risk consumers (21.8%) than women (14.5%), but there was no sex difference in binge drinking (13.8% versus 12%). Men decreased their weekly consumption and also the proportion of binge drinking, and women decreased only in binge drinking. Further studies of the causality between alcohol consumption and health are suggested.

1. Introduction

For several reasons older adults represent an important age-group to study in relation to alcohol consumption. This group is becoming larger with increasing life expectancy in the world [1] which makes it important to better understand their alcohol consumption pattern. However, little research into alcohol consumption among older adults has been done at community level, in particular among the oldest old specifically [2] until the early 21st century. There are official national guidelines for alcohol consumption [3], although to our knowledge only one official national guideline is for older adults exclusively [4]. The guidelines are also unclear as to the scientific data that support them. Most screening instruments are designed for general populations which may not be suitable for older adults [5]. Older adults are more often on medications compared to younger persons, which can cause problematic interactions with alcohol consumption [4, 6–8] and drinking has also been associated with forgetting to take the medicine [9]. The mixture of alcohol and medication may be rather prevalent. For instance, one study found 43%

to 48% of the older adults 75+ to be on medication while consuming alcohol [2]. There are also other biological differences between older adults and the younger population. For instance, older adults metabolise alcohol slower [4, 6] and have lower body water content for the alcohol to be diluted in which generates a higher blood concentration of alcohol [4]. On the other hand, from a cohort study it has been suggested there are health benefits attributed to alcohol consumption in older adults [10].

Alcohol consumption and the relation with self-rated health among older adults are unclear. It has been found to be positive [11–13], but no association has also been found [9]. An association between alcohol consumption and depression was not found in one study [14] but negative associations were found in other studies [15, 16]. Frailty, is a measure of potential risk of morbidity and functional disability [17] and has lately become an established concept in the research field of the elderly [17–20]. Abstaining older adults has been found to be frailer than moderate consumers [21, 22]. However, the results could have been confounded since no adjustments for abstaining due to poor health were made. The relation

between alcohol consumption and falls or injuries due to falls is not well established since conflicting results have been found [9, 23, 24].

In Sweden all age-groups decreased their average consumption between 2003 and 2007 except for men and women 65 years or older whose consumption increased [25]. In a Finnish study 5% ($n = 2$) of men 80–84 years old were drinking more than 7 units of alcohol per week (approximately 80 g). Among those 85 years or older no one had this high consumption, which also was seen for women in both age-groups. Among men the proportions of abstainers in the two age-groups were 41% and 38% and among women 69% and 73% [2]. In Germany a primary health care sample of older adults showed 52.1% of 80–84 year olds and 56.9% of 85+ to be abstainers. The corresponding figures for at-risk drinking (>30 g men, >20 g women) were 5.5% and 4.6% [26]. In Australia 5.3% of 75–84 years olds and 4.8% of those 85 or older were considered as at-risk consumers (drinking at least 140 g/week). The proportion of abstainers in the two age-groups were 28.2% and 38.3% [27]. For older adults of mixed sexes 75+ in Britain 23% were abstainers, 76% moderate drinkers (<210 g/week for men and <140 g/week for women) and 3.4% at-risk consumers (above moderate drinking cutoffs) [14]. In a population-based sample from USA 8.3% of mixed genders 65+ were heavy drinkers, defined as drinking more than 198 g/week for men and 98 g/week for women [28]. From 2003 to 2007 the proportions of older adults (65+) in Sweden reporting binge drinking during previous week was relatively stable for both sexes. Men had a prevalence of 2.5% and women 0.5% [25]. A similar prevalence has been found in USA [15] where a higher proportion (9%) for mixed genders 65+ also has been found in a population-based telephone survey [28].

To summarise, older adult consumers are not only likely to experience more harm from consuming an equivalent amount of alcohol as younger people but might also make some health benefits. Since there are mixed results of the association between health indicators and alcohol consumption and variation between proportions in alcohol consumption categories in different studies (probably because of variation in gender, age, and context between studies) it makes alcohol consumption among the oldest old an important topic to study. In a recent systematic review of older adults and alcohol consumption it was concluded that more data and reporting of alcohol consumption among older adults are needed [29].

The aims of this study were to examine the pattern of alcohol consumption among the oldest old. We wanted to study: (1) the distribution on consumption pattern including at-risk consumption, (2) how the consumption changed during two years, and (3) possible differences within subgroups concerning demographic and health related factors.

2. Methods

2.1. Data. The participants in this study were older adults aged 80+ from the Gothenburg metropolitan area, Sweden ($n = 581$). They were recruited from two studies: *elderly persons in the risk zone* (Äldre i riskzon in Swedish) and *a continuum of care for frail elderly people* (Vårdkedja för

sårbara äldre) in order to obtain a heterogeneous population concerning frailty. The data collection from these studies has been described in more detail elsewhere [30, 31] but is briefly described here.

In the first study the participants were randomly chosen from the official registers (Kommuninvånarregistret in Swedish) and were followed for two years. The criteria for inclusion were living in community, being independent of home help service or care from the municipality, being independent in the activities of daily living and having a score of at least 25 at the Mini-Mental Test [32] which indicate them to be cognitively intact ($n = 459$). In the second study older adults who sought care at the Emergency Department at the Mölndal Hospital outside Gothenburg were followed up for one year. They were included if they were being discharged to their own homes, had no acute severe illness with immediate need of treatment by a physician, and did not have dementia nor received palliative care ($n = 122$).

The data collection was made at several time-points between 2008 and 2011 but the study only includes data from baseline, after one and after two years. The participants were interviewed in their homes. The questionnaires used in the interviews included information of demographics, alcohol and tobacco consumption, physical and mental health, activities of daily living, quality of life, leisure activities, medications, assistive devices, social network, and aid/support.

2.2. Attrition. From the respondents that were included at baseline, 7 did not respond to the frequency and amount questions and 5 did not respond to the binge drinking question which resulted in 574 respondents available for analysis of alcohol consumption and 576 of binge drinking at baseline. Ninety-six respondents did not complete the one-year followup, 3 did not answer the frequency and amount questions, and 6 did not answer the binge drinking question. This resulted in 482 respondents with complete data on weekly consumption and 479 on binge drinking at one-year followup. At two-year followup, some participants who participated during baseline but did not participate during one-year followup were included. However, 122 older adults from a continuum of care for frail elderly people were not followed up, 112 respondents from elderly persons in the risk zone did not complete the interview, and only 1 respondent did not answer the alcohol questions which resulted in 346 respondents. Reasons behind the nonresponses at both followups were illness, unwillingness of further participation, death, not being reached, not living in community-dwelling or unknown circumstances (Figure 1).

Among the nonresponders during one-year followup there were significantly higher proportions of persons 85+ (P value: 0.005) and with poor self-rated health (0.018), compared to participating respondents. Among nonrespondents there was also a lower proportion of binge drinkers (0.045). No further significant differences regarding baseline characteristics were seen. In elderly persons in the risk zone (which had a two-year followup) a significant difference in age was seen at two-year followup where nonrespondents consisted of a higher proportion of 85+. No further significant differences at the two-year followup were

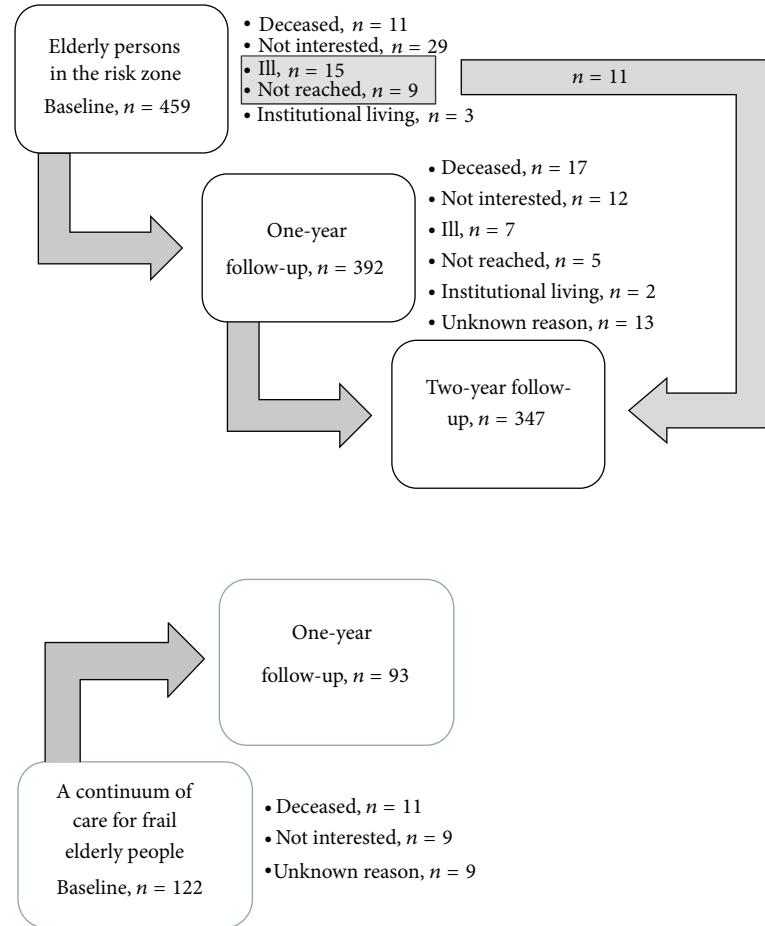


FIGURE 1: Flow chart over the attrition from baseline to follow-up.

seen regarding the other background factors or alcohol measures.

2.3. Outcome Measurement. AUDIT-C [33], a short version of the AUDIT which was developed to identify risk drinkers [34], was used to obtain information of alcohol consumption. The interviewers asked the respondents how they usually consume alcohol by using three questions. The questions with corresponding answer categories were (1) how often alcohol is consumed (never, once a month, 2–4 times a month, 2–3 times a week, 4 times a week, or more); (2) how many glasses of alcohol are typically consumed during a drinking day (1–2, 3–4, 5–6, 7–9 or at least 10 glasses); and (3) how often a woman drinks at least 4 and a man at least 5 glasses per occasion (never, at most once a month, monthly, weekly, daily, or almost daily). If the answer to the first question was never drinking alcohol, the remaining questions should have been left blank. One glass of alcohol was considered to be approximately 12 g of ethanol.

An estimation of the *weekly alcohol consumption* was made by combining the frequency and amount questions (the first two questions) at AUDIT-C according to the method used by Seppa et al. [35]. At each answer of the questions a precise value had to be estimated. The values of the frequency

question “how often alcohol is consumed” were estimated to be 0, 0.25, 1, 3, and 5 times a week. The corresponding estimations for the amount question “how many glasses of alcohol are typically consumed during a drinking day” were 20, 40, 70, 100, and 120 g of alcohol per drinking occasion. The combination of frequency and amount yielded 19 unique categories: 0, 5, 10, 17.5, 20, 25, 30, 40, 60, 70, 100, 120, 200, 210, 300, 350, 360, 500, and 600 g. Four groups were constructed depending on their total alcohol consumption per week: abstainers (0 g/week), low consumers (men $0 < 100$ g, women $0 < 70$ g) and at-risk consumers (men ≥ 100 g, women ≥ 70 g). The cut-offs for at-risk drinking were chosen on two grounds. First, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) suggest that aging lowers the alcohol tolerance. Therefore, a cutoff for at-risk consumption should be lower for persons of 65 years or more, and they suggest a consumption of more than 7 standard drinks (each containing 14 g of ethanol) to be at-risk consumption [7]. Second, some guidelines for general populations suggest sex-specific cutoffs [3, 36] and to our knowledge there is no evidence that the difference between sexes in factors that affect the tolerance to alcohol (e.g., the amount of body fat) [37] disappears with age. Hence, we used the guidelines from NIAAA [7] for categorisation of at-risk drinking for men but lowered it for women to account

for differences between the sexes, which generally is done to account for the sex body weight difference, as well as for the sex difference in body water/fat content [37]. *Binge drinking* was dichotomised into never binge drinking or binge drinking at least occasionally and was referred to as how the respondents normally consume alcohol.

2.4. Baseline Characteristics. A number of characteristics were included to be able to study the alcohol consumption within subcategories of each characteristic. The *age* during the interview was divided into two groups: 80–84 and 85 or older. *Educational level* was defined as the highest achieved education and was divided into three categories: elementary, upper secondary, and university. The respondents answered a question whether they lived alone or with husband/wife, children, or others and the question was dichotomised into *cohabiting* or not. *Self-rated health* on a five-degree scale was dichotomised where poor or fairly good health was considered as poor health, while good, very good, or excellent health was considered as good health. *Depression* was defined with Geriatric Depression Scale 20 [38, 39], a questionnaire including 20 statements of indicators of depression. Each question yielded one point if the respondents had the indicator during the last week and if they had 6 or more indicators in total they were considered as being at risk of depression. *Frailty* was measured with indicators of weakness, fatigue, weight loss, low physical activity, poor balance, slow gait speed, and deteriorated cognition in this study [18]. Respondents with no indicators of frailty were considered as nonfrail, 1–2 indicators as prefrail, and at least 3 indicators as frail. A more detailed description of the concept is given in the research protocol for elderly persons in the risk zone [30]. *Falls* were dichotomised into no falls on one hand and falls without injury, falls with injury, and falls with need of treatment on the other hand, during the last three months. Smokers or/and users of moist snuff were considered as *nicotine users* and the others as nonusers.

2.5. Analyses. All analyses were performed using SPSS v.19. Chi-square test was used to obtain *P* values for proportional differences within subgroups of baseline characteristics. Sign-test was used to obtain *P* values of changes in weekly alcohol consumption (ordinal data) between the different measurements, that is, at baseline, after one year, and after two years. If a respondent went from one consumption category into another, a change in consumption was considered to have occurred. Note that the number of steps when changing between consumption categories was not taken into account. However, respondents changing their consumption by more than one step were very few. McNemar's test was used for changes between binge drinking categories (binary data) between the different measurements.

3. Results

3.1. Consumption Pattern and Characteristics at Baseline. Most of the respondents were found in the low consumption category but there were several significant differences within sub-groups during baseline. Differences in proportions within drinking categories were found depending on

education level where higher proportions of at-risk consumers (*P* value < 0.001) and binge drinkers (0.008) were observed amongst those with a higher level of education. Among those not cohabiting there was a higher proportion of abstainers and a lower proportion of at-risk consumers compared to those cohabiting (0.005). They consisted of an almost significantly lower proportion of binge drinkers (0.053). Poor compared to good self-rated health was associated with a higher proportion of abstainers (0.047), and binge drinkers consisted of a higher proportion of at-risk consumers compared to nonbinge drinkers (<0.001).

Men had a significantly higher educational level (*P* value < 0.001), were cohabiting to a higher extent (<0.001), and were less depressed (0.04) than women. Men were also abstaining from alcohol and constituted a higher proportion of at-risk consumers (0.026) than women. There were no further differences between the sexes concerning baseline characteristics.

A significantly lower proportion of abstainers was seen among men cohabiting compared to those not cohabiting, and among women the proportion of at-risk consumers was higher for those cohabiting than those not cohabiting (Table 1). As expected, binge drinkers were at-risk consumers to a significantly larger extent than non-binge drinkers in both sexes. In women, the proportion of at-risk consumers was higher for each level of education and the difference was significant.

The younger sub-group category of men constituted a significantly higher proportion of binge drinkers than the older men (Table 1). The proportion of binge drinkers was higher among prefrail and frail males compared to their nonfrail counterparts. Within the sub-groups there were no further significant differences in weekly consumption or binge drinking.

3.2. Changes in Weekly Consumption and Binge Drinking from Baseline to One-Year Followup. From baseline to one-year followup there was a significant decrease in weekly consumption among men but not among women (Table 2). Among sub-group categories of men there were significant changes in respondents 85+, university educated, cohabiting, with good self-rated health, nondepressed, prefrail, those having no falls, nonusers of nicotine, and nonbinge drinkers. There was no significant association within any sub-group of women.

At one-year followup compared to baseline, there were significantly lower proportions of binge drinkers among men (Table 2). This was also seen among several sub-group categories: 80–84 years old, upper secondary educated, those cohabiting, those with good self-rated health, non-depressed, pre-frail, those having no falls, nonnicotine users, and both low and at-risk consumers. The numbers of men that went from being binge drinkers to becoming nonbinge drinkers varied between 0 and 23 between the sub-group categories. Those becoming binge drinkers varied from 0 to 6 persons. Among women there were lower proportions during followup and this was also seen in sub-group categories (Table 2). Both age-groups, elementary and upper secondary educated, those not cohabiting and also those cohabiting,

TABLE I: Baseline characteristics with weekly alcohol consumption and binge drinking in older adult men and women, $n = 576$.

	Men ($n = 217$)						Women ($n = 359$)					
	Abstainers %	Low consumers %	At-risk consumers %	Binge drinkers %	Abstainers %	Low consumers %	At-risk consumers %	Binge drinkers %	Abstainers %	Low consumers %	At-risk consumers %	Binge drinkers %
All	14.4	31	63.9	138	21.8	47	13.8	30	11.2	40	74.3	266
Age												14.5
80-84	14.0	18	66.7	86	19.4	25	17.7*	23	12.1	24	73.9	147
85+	14.9	13	59.8	52	25.3	22	8.0	7	10.1	16	74.8	119
Educational level												15.1
Elementary	14.1	12	71.8	61	14.1	12	8.1	7	13.1***	26	78.4	156
Upper secondary	15.4	10	60.0	39	24.6	16	15.4	10	8.3	9	75.2	82
University	13.6	9	57.6	38	28.8	19	19.7	13	10.0	5	56.0	28
Cohabiting												34.0
Yes	9.4**	15	68.6	109	22.0	35	15.6	25	9.6*	9	67.0	63
No	28.1	16	50.9	29	21.1	12	8.8	5	11.7	31	76.9	203
Self-rated health												11.4
Poor	21.1	12	56.1	32	22.8	13	15.1	24	16.2	16	71.7	71
Good	12.0	19	66.5	105	21.5	34	10.5	6	9.3	24	75.3	195
Depression												15.4
Yes	6.7	1	60.0	9	33.3	5	13.3	2	4.4	2	75.6	34
No	12.8	20	62.2	97	25.0	39	17.3	27	10	25	74.3	185
Frailty												15.7
Nonfrail	19.2	5	61.5	16	19.2	5	0*	0	0	0	83.9	26
Prefrail	9.5	11	65.5	76	25.0	29	19.8	23	8.5	17	74.0	148
Frail	12.5	3	45.8	11	41.7	10	25.0	6	14.8	9	72.1	44
Falls												13.1
Yes	14.6	7	66.7	32	18.8	9	12.5	6	16.5	14	70.6	60
No	14.4	24	63.5	106	22.2	37	14.3	24	9.6	26	75.5	206
Nicotine use												15.0
Yes	12.5	2	50.0	8	37.5	6	12.5	2	5.0	1	75.0	15
No	14.6	29	64.6	128	20.7	41	14.1	28	11.6	39	74.1	249
Binge drinking												14.3
Yes	0***	0	43.3	13	56.7	17	—	—	0***	0	62.8	27
No	16.7	31	67.2	125	16.1	30	—	—	12.7	40	75.9	239
Weekly consumption categories												11.4
Low consumers	—	—	—	—	—	—	9.4***	13	—	—	—	—
At-risk consumers	—	—	—	—	—	—	36.2	17	—	—	—	—

* $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$. Significant differences between categories in sub-groups (χ^2 -test) are in bold type. The varying numbers of participants are owing to internal dropouts.

TABLE 2: Percentage of respondents increasing or decreasing their weekly consumption and binge drinking from baseline to one-year followup in men, women, and sub-group categories of baseline characteristics, $n = 478$.

	Men ($n = 174$)				Women ($n = 304$)			
	Weekly alcohol consumption		Binge drinking		Weekly alcohol consumption		Binge drinking	
	Increased %	Decreased %	Baseline %	One-year followup %	Increased %	Decreased %	Baseline %	One-year followup %
All	5.8**	17.9	15.5**	5.7	5.6	7.3	12.9***	3.0
Age								
80–84	7.6	13.3	19.2**	5.8	5.0	7.8	13.4***	2.2
85+	2.9**	25	10.0	5.6	6.5	6.5	12.1*	4.0
Educational level								
Elementary	7.8	12.5	9.1	6.1	4.1	4.7	10.1***	0.6
Upper secondary	9.3	25.9	18.5*	3.7	9.9	8.8	15.2**	4.3
University	0**	16.3	20.4	7.4	2.3	14.0	18.6	9.3
Cohabiting								
Yes	5.3**	19.1	16.7**	6.1	6.0	6.0	16.7*	4.7
No	7.1	14.3	11.9	4.7	5.5	7.7	11.4***	2.3
Self-rated health								
Poor	10.5	23.7	13.2	5.3	3.6	7.2	9.5*	1.2
Good	4.4**	16.3	16.2**	5.9	6.4	7.3	14.2***	3.7
Depression								
Yes	0	30	20.0	0	2.6	10.3	17.9*	0
No	4.6**	19.2	18.5**	5.3	6.5	7.4	14.4***	3.7
Frailty								
Nonfrail	19.0	19.0	0	4.8	0	0	10.0	0
Prefrail	1.0***	19.6	21.6**	5.2	7.1	8.9	17.3***	4.8
Frail	5.6	27.8	27.8	5.6	5.6	7.4	11.1*	0
Falls								
Yes	10.8	13.5	13.5	8.1	7.4	4.4	13.2***	0
No	3.9**	16.1	16.2**	5.1	5.1	7.7	12.4***	3.8
Nicotine use								
Yes	14.3	35.7	15.4	23.1	12.5	0	18.8	6.3
No	5.0**	16.5	15.6***	4.4	5.3	7.7	12.3***	2.4
Binge drinking								
Yes	3.7	22.3	—	—	5.1	10.3	—	—
No	6.1*	17.1	—	—	5.7	6.8	—	—
Weekly alcohol consumption								
Yes	—	—	10.8*	2.7	—	—	11.4***	1.4
No	—	—	35.9*	15.4	—	—	29.2*	10.4

* $P < 0.05$, ** $P < 0.01$, and *** $P < 0.001$. Significant P values of changes in weekly alcohol consumption (sign test) and binge drinking (McNemar's test) for each sub-group category are in bold type. Only respondents eligible for followup are included.

those having good and also poor self-rated health, depressed and non-depressed, prefrail and frail, those having falls and not having falls, non-nicotine users, and low and high consumers consisted of lower proportions of binge drinkers during one-year followup compared to baseline. The numbers of women becoming non-binge drinkers varied between 1 and

32, while the numbers of women becoming binge drinkers varied between 0 and 2.

3.3. Changes in Weekly Consumption and Binge Drinking from Baseline to One-Year and Two-Year Followups for Elderly Persons in the Risk Zone. To be able to study changes in

weekly consumption and binge drinking at two-year followup it was necessary to study the population from elderly persons in the risk zone separately since it was the only one of the two populations that contained a two-year measurement (data not shown for the separate analyses of elderly persons in the risk zone).

For men, decreasing weekly consumption from baseline to one-year followup was significant in the same sub-group categories as for the whole population but with the addition of upper secondary education (P value: 0.035), poor self-rated health (0.039), and binge drinkers (0.031). From baseline to two-year followup there were no additional significant changes to one-year followups in the sub-groups, and between one-year and two-year followups there were no significant changes at all. Among women there were no significant changes from baseline to one-year follow-up (as was seen for the total population) but from baseline to two-year and one-year to two-year followups there was a barely significant decrease in consumption in the sub-group category of 85+ (P value: 0.049). From baseline to two-year followup there was also a decrease among those not using nicotine (0.025).

The changes in binge drinking from baseline to one-year followup among men were the same as for the total population. However, from baseline to two-year followup there were only significant decreases in sub-group categories of 80–84 years old and those having no falls (P value: 0.004). From one-year to two-year followup there was an increase of pre-frail men binge drinking (0.039). Among women changes from baseline to one-year follow-up in the same sub-group categories as for the whole population were significant except for those with poor self-rated health, depressed, and at-risk consumers. From baseline to two-year followup there were significant decreases in binge drinking among all women (P value < 0.001) and in sub-group categories of 80–84 years old (0.019) and 85+ (0.039), elementary educated (0.012), those not cohabiting (0.012) and also cohabiting (0.004), those with good self-rated health (0.002), non-depressed (0.002), prefrail (<0.001), those with (0.031) and without (0.003) reporting falls, non-nicotine users (0.001) and finally low-consumers (0.003) as well as at-risk consumers (0.039). Between one-year and two-year followups there were no significant changes.

4. Discussion

This study found that a very large proportion of the oldest old was consuming alcohol and most of them were low consumers. In men there was a slightly higher proportion of abstainers compared to women (14.4% and 11.2%), but the proportional difference of at-risk consumers was higher with almost 22% of men and 15% of women being at-risk consumers. A population-based study in Finland found 11.3% of the 81–90-years old men and 1.4% of the women to be at-risk drinking (consuming >88 g/week or binge drinking or consuming ≥3 drinks several days/week) [9]. In a US study with the same definition of at-risk drinking as in the Finnish study it was found that both sexes together in this age-group had a prevalence of 4.9% with at-risk consumption [40].

In another US study a primary care population of mixed sexes was divided into 75–85 and 85+ years old and at-risk prevalence was 3.5% and 2.2% for the groups, respectively, while the corresponding proportions of abstainers were 72% and 80% [15]. Other studies have also found higher proportions of abstainers and lower proportions of at-risk consumers [2, 27] than we did in our population. However, the majority of our population was not sampled in a health care setting which probably makes our population healthier and being able to consume more. There may also be cultural differences explaining the discrepancy.

The difference in binge drinking between men and women was small, with a prevalence of 13.8% and 12%, respectively. An American study found the prevalence of having 4 or more episodes of binge drinking (drinking ≥56 g per occasion) during the last three months to be 1.9% for 75–85 years old and 0.6% for 85+ consisting of mixed sexes [15]. This is much lower than the data in our study but is probably explained by our low cutoff for binge drinking and also to reflect a generally higher alcohol consumption in the age groups in Sweden. If having a measure of more frequent binge drinking, for example, monthly or weekly, it could have been a better estimate of risky drinking because it is probably riskier to binge drink more often than just once a year. However, the low number of older adults that were binge drinking at least once monthly would have yielded too few respondents for analyses, which forced us to dichotomise the binge drinking variable as we did. A lower number of glasses of alcohol per occasion may be more appropriate for older adults because they are likely to be affected at lower doses than younger people [4, 6]. However, there are no recommendations of lower cutoffs for older adults as old as our population in other studies to the authors' knowledge.

At one-year followup men had significantly decreased their weekly consumption and this was seen in several sub-groups. Previous studies have found the consumption to be generally lower with higher age [2, 9, 14] and this supports our finding but among the women in our study there was no significant decrease at all. In men, an additional year of follow-up did not contribute to further significant changes in consumption. In women, on the other hand, an additional year of followup made decreases in two sub-group categories significant, but they were not strongly significant and might be explained by multiple testing because of the high P values. The decrease among men may be due to deteriorated health. Former drinkers have been found to have worse health than other abstainers [16, 41] which supports the hypothesis of deteriorating health as a reason for decreasing consumption. However, a post hoc analysis showed that there were no significant changes in self-rated health from baseline to one-year follow-up among men in our dataset (data not shown). The lower number of participants at the two-year followup and the lower consumption among men after one year compared to baseline might explain why no further changes in consumption occurred between one-year and two-year followups. Except women 85+ and female non-nicotine users, women in general did not decrease their weekly consumption. A post hoc analysis showed that women had significantly deteriorated self-rated health at

followup which does not support the hypothesis of decreasing consumption as health declines. More sophisticated analyses adjusting for confounders are needed to see what really made them decrease their consumption.

Among both men and women there were rather large decreases of the proportions of binge drinkers during one-year followup where men had decreased from 15.5% to 5.7% and women from 12.9% to 3.0%. Measured from baseline to two-year follow-up, some of the changes in binge drinking among sub-group categories of men that were seen from baseline to one-year followup disappeared. This indicates an increase in binge drinking between one-year and two-year followup. However, the increase was only significant within the group of prefrails and can perhaps be explained by multiple testing due to a high P value only marginally significant. In women there were also decreases in the majority of sub-group categories which is in contrast to the weekly consumption where no significant decrease was found. The first step when it comes to changing alcohol consumption due to health deterioration or getting more sensitive to alcohol consumption might be to quit binge drinking, with the second step being to quit or decrease weekly consumption. Thus, the women in this study might have a health status good enough to continue consuming the same amounts during the week but poor health status enough to quit binge drinking at followup. In women the second year of followup made significant decreases in two sub-group categories disappear (indicating an increase) and also make the decrease in one sub-group category to become significant, which makes it difficult to interpret the effect of an additional year of followup.

High education has been associated with higher consumption among older adults [42], while improved self-rated health [13] and better subjective well-being [16] have been associated with consuming alcohol as opposed to abstaining. Since a large proportion of the respondents in this study comes from a municipality having a higher level of education and better health than the average in Gothenburg, our proportion of at-risk consumers might have been overestimated if we wish to generalise the results to the oldest old in Gothenburg, Sweden, or any similar population. On the contrary, the cutoffs used in this study, may have underestimated the number of older adults at-risk drinking since NIAAA based its recommendation on persons older than 65, and our population is much older and have a higher cutoff. The method used to estimate the weekly consumption can be argued to have caused an overestimation of the weekly consumption. For instance, the alternatives at the AUDIT-C question of frequency contained an interval (e.g., 2–4 times a month) and the precise frequency was often estimated to be near the higher level (i.e., 4 times a month in this example). The same goes for the number of glasses consumed per drinking occasion. The true value might lie close to the higher level in a general population but since we have an older population it seems reasonable to believe that their true values lie below this. Those subjects that did not participate during followup were older and had worse health and fewer were binge drinkers. These were factors associated with less consumption than their counterparts

and it seems reasonable to believe this made our results overestimated.

There are some additional limitations with this study. Only one of the two study populations used in this study was followed up for two years and this weakened the possibility of finding significant associations at two-year followup. This, rather than the possibility that there were no further changes, may explain not finding further significant changes in weekly alcohol consumption or binge drinking. Another limitation is that this study does not explain why some older adults decreased, or increased, their consumption and other did not. Personal interviews with each of the older adults and a relatively high number of old adults of very high age and still having relatively good health are rare as far as the authors' know and this is the main strength with this study.

5. Conclusions

This study adds to increased knowledge of alcohol consumption among the oldest old. Our study sample comes from a community-dwelling population and consists of a relatively large number of older adults 80+, which seems to be rare.

A large proportion of both men and women was alcohol consumers and a substantial part was at-risk consumers or binge drinkers. It was more common with at-risk consumers among men than women but binge drinking was not. Men decreased their weekly consumption and the proportion of binge drinking, while women decreased the latter. Further studies are needed to explain the mechanisms behind this. In this study, we have not analyzed predictors of decrease/increase in alcohol consumption. For that purpose, further and deeper analyses are needed. Our intention is to examine the causality between alcohol consumption and self-rated health and depression and frailty and falls in a forthcoming paper.

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