Changes in alcohol consumption and drinking patterns during 11 years of follow-up among ageing men: the FinDrink study

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Background: Alcohol consumption is often reported to decrease with ageing. We investigated alcohol consumption and drinking patterns in an ageing population-based male sample during an 11-year follow-up period. Methods: This study with baseline and two follow-up examinations (at 4 and 11 years) included 1516 randomly selected participants, aged 42, 48, 54 and 60 years from Eastern Finland. Alcohol consumption and drinking patterns during the year preceding the examination were assessed. Data were analysed using Generalized Estimating Equations and Mixed Models. Results: Over the 11-year study period, the amount of alcohol consumed weekly increased among the 42-year-olds (P < 0.001) and remained constant among the older cohorts. The risk of frequent drinking (alcohol consumption at least twice weekly) increased among all cohorts (OR = 2.04, 95% CI = 1.50–2.79 for 42-year-olds; OR = 1.71, 95% CI = 1.13–2.58 for 48-year-olds; OR = 1.67, 95% CI = 1.16–2.39 for 54-year-olds and OR = 1.67, 95% CI = 1.21–2.29 for 60-year-olds). There was also an increasing probability of heavy consumption (more than 14 weekly drinks) among the 42-year-olds (OR = 1.47, 95% CI = 1.09–2.00). The risk of binging (six-plus drinks at one occasion) decreased among the older participants (OR = 0.65, 95% CI = 0.47–0.89 for 54-year-olds, and OR = 0.56, 95% CI = 0.39–0.81 for 60-year-olds). Conclusion: Finnish men born in 1926–1946 do not seem to decrease drinking while ageing. In contrast those born in 1944–1946 increase drinking until their 60s. This should be taken into consideration in planning health services for aged men in the near future.

Keywords: ageing, alcohol consumption, drinking behaviour, FinDrink study, longitudinal study, population study.

Introduction

Alcohol consumption increases the risk of various adverse health outcomes.1 Alcoholic psychoses, fatty liver, acute hepatitis and liver cirrhosis are directly related to heavy alcohol consumption,2 and it is a major risk factor for pancreatitis, depression, epilepsy, injuries, gastrointestinal cancers, etc.1,2 The effect of alcohol consumption on cardiovascular disease (CVD) risk is controversial, with high levels of consumption linked to higher rates of CVD and moderate levels often found to be associated with decreased risk for CVD.3,4 According to the European Comparative Alcohol Study,5 there is a direct association between per capita alcohol consumption and mortality in European countries. Alcohol-related diseases are the leading causes of death among working-age Finns.6 In 2007, 18.7% of deaths among men aged 15–64 years was attributed to alcohol-related diseases. Alcohol consumption in Finland has increased since the 1960s.7 Between 2003 and 2007 the recorded yearly consumption increased from 7.7 to 8.71 per capita. According to cross-sectional drinking habit surveys conducted among 15–69-year-old Finns between 1968 and 1996, the proportion of abstainers declined especially among men aged 50–69 years (from 19% to 11%) and all women (from 43% to 14%).8 In 1996, 93% of men and 86% of women consumed alcohol.

Cross-sectional studies have shown that the level of alcohol consumption depends on age. Several European and American studies indicate that younger adults drink more alcohol than older ones.9,12 There are also fewer weekly drinkers, binge drinkers13 and heavy drinkers14,15 in the older age groups than in the younger ones. The differences are also seen within the aged population. Recently, Kirchner et al.16 found that those aged 65–74 years are more likely to drink alcohol than those aged 75 years and older. The proportions of heavy drinkers and binge drinkers were smaller in the older group than in the younger one. Similar observations have been made among the Finnish adult8 and aged populations.17 Also, many longitudinal studies on the effect of ageing on alcohol consumption have reported decline in consumption over time. Using data from three longitudinal surveys in the United States in 1970s and 1980s, Kerr et al.18 found that adults aged 17–74 years tended to decrease alcohol consumption during a follow-up of 12–16 years. Another study found an increase in the proportion of abstainers and light drinkers and a decline in heavy drinkers in British cohorts born in 1912–1961.19 Also, a study of 55–65-year-old Americans showed an increase in abstention as well as a decline in drinking days and quantity of alcohol consumed during a 10-year follow-up.20 However, a Finnish study found that men born in 1900–1919 did not significantly change the amount of alcohol consumed monthly between 1974 and 1984.21 After this, no population-based cohort studies have been conducted in Finland describing the change in alcohol consumption and drinking patterns over time. Thus, we analysed changes

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in alcohol consumption in an ageing population-based male sample over an 11-year period.

**Methods**

**Study subjects**

The data for this study came from the Kuopio Ischaemic Heart Disease Risk Factor Study (KIHD). As described in detail earlier, KIHD is an ongoing population-based study that investigates risk factors for chronic diseases. The KIHD study is approved by the ethics review board of the University of Kuopio and all participants gave informed consent. At baseline, an age-stratified random sample of men aged 42, 48, 54 and 60 years from Kuopio, Finland, was recruited in two waves (N = 2682). The first cohort (cohort 1) was examined only once and the second (cohort 2), consisting of 1935 men, was followed up. For this study, only participants in cohort 2 were included. A total of 1516 men (78%) of cohort 2 completed the baseline examination during August 1986 to December 1989. For the re-examination conducted at 4 years, 1229 men were eligible of which 1038 (84%) participated. At 11 years, 1007 were eligible and 854 (85%) participated. The subjects were aged 46–65 years at 4 years (March 1991 to December 1993) and 53–73 years at 11 years (March 1998 to February 2001). The reasons for loss to follow-up were death (134), severe illness (76), migration (45), refusal (318), unable to contact (178), no address information (6) and other reasons (6).

**Measurement of alcohol consumption**

Alcohol consumption was evaluated using self-administered questionnaires. The questionnaires were the same in each examination with an exception of including newly introduced alcoholic cider in follow-up examinations. The questions were modified from the Nordic Alcohol Consumption Inventory, which includes questions on the quantity and frequency of drinking during the preceding year. One alcohol unit contains on average 12 grams of 100% alcohol.

Overall drinking refers to any amount of alcohol consumed during the year prior to the examination. Those drinkers consuming any amount of alcohol on average at least twice a week were defined as frequent drinkers. Binge drinking was defined as consuming on average at least six units of one type of alcoholic beverage on one drinking occasion (one bottle of wine or equivalent). Beverage with the highest level of alcoholic beverage on one drinking occasion (one bottle of wine or equivalent).24 Beverage with the highest level of consumption in an ageing population-based male sample over an 11-year period.

**Statistical analyses**

For comparing alcohol consumption between participants and drop-outs, we used Student’s t-test and Pearson’s χ²-test.

For change in average weekly alcohol consumption over the 11-year follow-up, we employed a Mixed Model with a fixed effects analysis. It allowed us to include all participants with data for at least one examination. We log transformed—lg (units/week)—the continuous measure of the average alcohol consumption in order to meet assumptions of normality and homogeneity of distributions. Independent variables included in the model were age-cohort (42-, 48-, 54- and 60-year-olds), examination period and their interaction.

We used Generalized Estimating Equations for fitting the logistic regression model to compare drinking patterns (overall, frequent, binge and heavy drinking measured as binary variables) over time. The models were fitted separately for each age cohort and period was used as an independent variable. Baseline was the reference category in all models. Because the goal was to describe the changes in alcohol consumption in a population, we did not control for any covariates. The results are expressed as odds ratios (OR) with 95% confidence intervals (CI).

Except in overall drinking, abstainers were excluded from the analyses. The number of participants excluded due to abstaining was 187/1516 at baseline, 144/1038 at 4 years and 104/854 at 11 years.

**Results**

**Overall alcohol consumption**

In the youngest cohort of men >90% consumed alcohol during the preceding year at all periods examined (table 1). In the older cohorts the percentage of alcohol consumers was between 82 and 88. The probability of drinking alcohol did not change significantly during the 11-year follow-up period with the exception of 54-year-olds who were less likely to drink alcohol at 4-year examination than at baseline (OR = 0.76, 95% CI 0.61–0.96). However, this reduction in consumption probability levelled off during the following seven years. Similar tendency, although not significant, could be seen among the 60-year-olds (4 years vs. baseline, OR = 0.79, 95% CI 0.61–1.01). The predicted probabilities of overall drinking in each cohort are shown in figure 1.

**Drinking behaviour**

The probability for frequent drinking (alcohol at least twice weekly) increased significantly in each cohort (table 1 and figure 1). The increase was greatest among the youngest cohort (from 19.3 to 30.9%). The probability increased by 54% from baseline to the 4-year examination (95% CI 1.12–2.11) and doubled by the 11-year examination (95% CI 1.50–2.79). A similar increase was also seen among the 48-year-olds (OR = 1.45, 95% CI 1.04–2.02 and OR = 1.71, 95% CI 1.13–2.58, respectively). In the two oldest cohorts, the increase in the probability of drinking at least twice a week increased significantly from baseline to the 11-year examination (OR = 1.67, 95% CI 1.16–2.39 and OR = 1.67, 1.21–2.29, respectively), but not during the first 4 years.

In the youngest cohort, approximately every third was a binge drinker (consuming on average six-plus drinks in one occasion) at each examination and there were less bingers in every older cohort (table 1). Over the 11-year period the probability of binge drinking decreased significantly in the oldest cohorts (table 1 and figure 1). Among the 54-year-olds the probability of binging was lower at 4– and 11-year examinations compared with the baseline (OR = 0.74, 95% CI 0.57–0.97 and OR = 0.65, 95% CI 0.47–0.89, respectively). Similarly, among the oldest participants, the probability of binging decreased from baseline to the 11-year examination (OR = 0.56, 95% CI 0.39–0.81).

Heavy alcohol consumption (>14 weekly alcohol units) was most common in the youngest cohort. Every fifth was a heavy drinker at baseline and one in four 11 years later. The increase in the probability of heavy drinking was statistically significant (OR = 1.47, 95% CI 1.09–2.00) (table 1 and figure 1). In older cohorts the probability of heavy drinking remained constant.

**Average weekly consumption**

In addition to analysing drinking behaviour we measured average alcohol consumption as units per week. At baseline,
### Table 1 Percentages of overall drinking and drinking patterns in examination periods, and odds ratios from cohort-stratified Generalized Estimating Equations Models over the 11-year period

<table>
<thead>
<tr>
<th>Age at Baseline (years)</th>
<th>Examination period</th>
<th>Overall drinking (all participants)</th>
<th>Frequent drinking (drinkers only)</th>
<th>Binge drinking (drinkers only)</th>
<th>Heavy drinking (drinkers only)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% (% (N))</td>
<td>OR (95% CI)</td>
<td>% (% (N))</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>42</td>
<td>1</td>
<td>19.1 (191)</td>
<td>1</td>
<td>18.3 (183)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>22.3 (226)</td>
<td>0.96 (0.68–1.41)</td>
<td>2.1 (211)</td>
<td>1.45 (1.04–2.02)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>86.1 (861)</td>
<td>0.70 (0.51–1.00)</td>
<td>1.7 (171)</td>
<td>0.75 (0.59–1.06)</td>
</tr>
<tr>
<td>48</td>
<td>1</td>
<td>86.6 (866)</td>
<td>1</td>
<td>16.3 (163)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>84.0 (840)</td>
<td>0.76 (0.61–0.96)</td>
<td>0.94 (0.94–1.01)</td>
<td>14.8 (148)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>88.6 (886)</td>
<td>1.06 (0.79–1.43)</td>
<td>1.67 (167)</td>
<td>0.75 (0.59–1.06)</td>
</tr>
<tr>
<td>54</td>
<td>1</td>
<td>84.9 (849)</td>
<td>1</td>
<td>15.1 (151)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>82.5 (825)</td>
<td>0.79 (0.61–1.01)</td>
<td>1.13 (113)</td>
<td>0.80 (0.61–1.01)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>82.2 (822)</td>
<td>0.79 (0.57–1.10)</td>
<td>2.17 (217)</td>
<td>1.21 (1.21–2.29)</td>
</tr>
</tbody>
</table>

Examination periods: 1 = Baseline, 2 = 4-year and 3 = 11-year; overall drinking = any alcohol during the preceding year; frequent drinking = alcohol at least twice a week; binge drinking = at least six alcoholic drinks at one occasion; heavy drinking = alcohol more than 14 units weekly

### Discussion

In our study, the overall probability of drinking among men aged 42–49 years at baseline did not change during the 11-year follow-up period. However, there were changes during the amount of alcohol consumed and in the patterns of drinking. Most importantly, the overall consumption among the younger age group declined during the 11-year follow-up period, which is in agreement with previous studies. During the 1960s, the consumption of alcohol was higher among men and women compared to the previous generation. This decline was more pronounced in the younger age group, which is consistent with previous findings. However, the consumption among men aged 42–49 years at baseline did not change during the 11-year follow-up period. This finding is in agreement with previous studies, which have reported a decline in overall alcohol consumption among younger adults in Finland.

### Main findings

#### Attention at follow-up examinations

We compared the baseline alcohol consumption of these participants with those who dropped out at each of the follow-ups after the baseline. We found that the baseline alcohol consumption was significantly lower among drop-outs than among participants who continued to follow-up throughout the 11-year period. The difference was 7.3% units, SD 9.2 and 9.6 units, SD 16.9. The proportion of frequent drinkers was also lower among drop-outs than among participants who continued to follow-up throughout the 11-year period. The difference was 7.3% units, SD 9.2 and 9.6 units, SD 16.9. The proportion of heavy drinkers was also lower among drop-outs than among participants who continued to follow-up throughout the 11-year period. The difference was 7.3% units, SD 9.2 and 9.6 units, SD 16.9.

### Attrition at follow-up examinations

We compared the baseline alcohol consumption of those who dropped out at each of the follow-ups after the baseline. We found that the baseline alcohol consumption was significantly lower among drop-outs than among participants who continued to follow-up throughout the 11-year period. The difference was 7.3% units, SD 9.2 and 9.6 units, SD 16.9. The proportion of frequent drinkers was also lower among drop-outs than among participants who continued to follow-up throughout the 11-year period. The difference was 7.3% units, SD 9.2 and 9.6 units, SD 16.9. The proportion of heavy drinkers was also lower among drop-outs than among participants who continued to follow-up throughout the 11-year period. The difference was 7.3% units, SD 9.2 and 9.6 units, SD 16.9.
This is in contrast with our findings where the proportion of heavy drinkers remained the same or increased. Studies on the change in total alcohol consumption in the Finnish population are sparse. A study of 40-year-old Finnish men showed a 37-gram decrease in weekly alcohol consumption (from 142 to 105 grams) over a five-year period (1989–1994). Another study of men aged 55–74 years found that beer consumption decreased from 1974 to 1984, one-third of the abstainers started to drink, and half of those drinking more than 273 grams/week, decreased drinking. Also, Kaprio et al. found an increase in monthly alcohol consumption by 32 grams (from 436 to 468 grams) among 25–43-year-old men during a six-year period (1975–1981). In contrast, studies outside Finland mostly suggest a decreasing trend in the amount of alcohol consumed with age. However, in a Dutch birth-cohort study some evidence was found for increasing alcohol consumption from 1958 to 1989 in cohorts born in 1900–1950. The increase was greatest among those born in 1920–1930’s. These results are more in accord with our results. However, the study period is different. During the study period (1986–2001) some changes in pertinent policies and the socioeconomic context have occurred, influencing alcohol consumption among the Finns. In 1987, removal of some restrictions of buying alcohol and liberalization of licensing increased alcohol consumption. During the economic depression in 1991–1994 alcohol consumption declined but the situation changed again in 1995 when Finland became a member of the EU and availability of alcohol increased.
The reduction in the proportion of binge drinkers and the increase of frequent drinkers in our study could be partly explained by change in drinking culture, from a culture of binge drinking towards a more social drinking context where smaller quantities are consumed at sitting but more frequently, through the week. An increase in the number of drinking occasions among Finnish men in 1984–1992 has been previously reported by Simpura et al.33 Leifman34 shows that the frequency of drinking occasions in European countries with different drinking histories are converging. Frequency of occasions has increased in Finland and Sweden while decreasing in Germany, France and Italy. Despite a slight change in drinking patterns away from binge drinking, Finland still has, along with Sweden and UK, the highest binging levels in the EU.24 Drinking during lunch or dinner is not as common in Finland as is drinking in restaurants and bars or at home not related with meals.

Methodological considerations
One explanation for the observed decline of alcohol consumption in longitudinal studies is the higher mortality of heavy drinkers compared with lighter drinkers.35,36 We compared alcohol consumption between participants and drop-outs to evaluate the effect of attrition on our results. The difference in the average weekly alcohol consumption between the groups (1.1 units at baseline and 2.3 units at 4 years, drop-outs drinking more) should be taken into account. Also, 5%–units higher prevalence of heavy drinkers in drop-outs at baseline and 11%–units higher prevalence of binge drinkers in drop-outs at 4 years compared with participants might have affected our results. There could be the ‘healthy drinker’ effect whereby those remaining are healthier, drink less or perhaps are less affected by heavy drinking.

From a methodological point of view, one explanation for the decreasing probability of binge drinking is the manner in which drinking was measured for every occasion. Each beverage type was asked about separately and the average number of drinks at one occasion was calculated for each beverage. We did not combine all possible beverage types consumed at a sitting, but the beverage which was found to have the highest number of drinks reported at one sitting was included in the final analysis. Underestimation of binging arises from the possibility that participants may consume several beverage types at the same sitting or they might have changed their drinking preferences over time from drinking one beverage to combination.

Public health implication
Observed consumption behaviour has ramifications for increases in medical problems and the provision of health services. In the near future, as this cohort ages, problems related to alcohol consumption will most probably be higher for them, than for any other cohort with less consumption at every age level. Furthermore, this age cohort in Finland is big (also called as a baby-boom generation) which increases the magnitude of the possible alcohol-related problems in the Finnish ageing population.

In general, one reason for reducing alcohol consumption in older age is the increasing number of health problems and medications.20,37 Furthermore, older people are more vulnerable to the effects of alcohol than younger adults due to physiological changes and increased central nervous system sensitivity.38 This being said, attention should be paid especially to the cohort of 42-year-old men. These men were found to increase alcohol consumption as they aged with the proportion of heavy drinkers also increasing.

Generalizability of the results
The drinking culture in an isolated Finnish population is different from that in many other countries, limiting the generalizability of our results to other populations. However, there are regions with similar populations and drinking culture, such as other Nordic countries, the UK and Ireland.39 Also, some populations in North America are quite similar in terms of drinking behaviour.40 However, changes in drinking behaviour need to be further studied across a range of populations.

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Conflicts of interest: None declared.

Key points
- In previous studies alcohol consumption is usually reported to decrease with ageing.
- According to our findings, men aged 42–60 years living in Eastern Finland do not decrease alcohol consumption over 11 years of follow-up. On the contrary, this generation maintains drinking levels or even increases the amount of alcohol consumed over time.
- Special concern is for those born after the World War II, ‘the wet generation’, among which the probability of heavy drinking increased.
- Such consumption behaviour will have ramifications for increases in medical problems and the provision of health services in the near future.

References