

# Age of onset of drinking and the use of alcohol in adulthood: a follow-up study from age 8–42 for females and males

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## ABSTRACT

**Aim** To investigate longitudinally for both genders the relation between the age of onset of drinking and several indicators of alcohol use.

**Design and setting** In the Finnish Jyväskylä Longitudinal Study of Personality and Social Development, data have been collected by interviews, inventories, and questionnaires. Data on alcohol consumption was gathered at ages 14, 20, 27, 36 and 42 years; behavioural data at age 8.

**Participants** A total of 155 women and 176 men; 90.4% of the original sample consisting of 12 complete school classes in 1968.

**Measurements** The age of onset of drinking was determined based on participants' responses that were closest to the actual age of onset of drinking. Four indicators of the adult use of alcohol were used: frequency of drinking, binge drinking, Cut-down, Annoyed, Guilt, Eye-opener (CAGE) and Malmö modified Michigan Alcoholism Screening Test (Mm-MAST). Socio-emotional behaviour at age 8 was assessed using teacher ratings and peer nominations.

**Findings** Early onset of drinking was related to the four indicators of the use of alcohol in adulthood both in men and women. The level of adult alcohol use and alcohol problems was significantly higher in men. The risk for heavy drinking was highest in men and women if drinking was started at less than age 16 years. Socio-emotional behaviour and school success at age 8 did not predict the age of onset of drinking.

**Conclusions** Delaying the initiation of drinking from early adolescence to late adolescence is an important goal for prevention efforts. No clear risk group for early initiators of drinking could be identified on the basis of preceding behaviour among 8-year-olds.

**KEYWORDS** Age of onset of drinking, binge drinking, CAGE, frequency of drinking, gender, longitudinal study, Mm-MAST, socio-emotional behaviour.

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## INTRODUCTION

The use of alcohol has become a part of youth culture in many western countries. According to the European School Survey Project on Alcohol and Other Drugs (Hibell *et al.* 1997), in which youthful drinking was compared in 25 countries, Finnish 16-year girls and boys were among the top three with Danish and British adolescents, in both the frequency of drunkenness and early

age of onset of drinking. An annually administered national health survey conducted in schools (Rimpelä 2004) revealed that in 2004, 37% of Finnish 14-year-old boys and 39% of girls used alcohol every month, and 18% of boys and 19% of girls drank to intoxication at least once a month. In Finland, the legal drinking age is 18 years, but it is frequently ignored by adolescents and by their parents. The trend toward early and even heavy drinking among pre-adolescents has aroused increasing

concern among policy makers in Finland. An important issue is whether the age at onset of drinking is associated with heavy drinking in adulthood, and whether preventive work could be targeted to risk groups for early initiators identified on the basis of their preceding behaviour. The present study investigates these problems based on the data obtained through a longitudinal study.

Young peoples' experimentation with alcohol and tobacco has been seen as modelling adult behaviour, attempting to achieve peer acceptance, and as an effort to overcome age-typical challenges in psychological growth, and it has been assumed that adolescents 'mature' out of abusive drinking patterns as the responsibilities of later adulthood supervene (Grant, Harford & Grigson 1988; Silbereisen & Noack 1988; Jessor, Donovan & Costa 1991; Schulenberg *et al.* 1996; Marlatt *et al.* 1998). However, heavy drinking in adolescence has been found to be related to later problem drinking in several studies (e.g. Wechsler & McFadden 1979; Ghodsian & Power 1987; Harford 1993; Pape & Hammer 1996). Based on their longitudinal study, Labouvie, Bates & Pandina (1997) concluded that alcohol use declines from age 20–30 and that the age of first licit use did not predict alcohol use or use consequences at age 20 or 30. However, significant associations between the early onset of drinking and later heavy use of alcohol have been found in several other studies: low age of onset of drinking is related to (a) frequency of drinking in the high school years (Parker, Levin & Harford 1996; Lo 2000), at ages 19–21 (Samson, Maxwell & Doyle 1989; Flory *et al.* 2004) and at age 26 for males (Casswell, Pledger & Pratap 2002); (b) heavy drinking in the high school years (Windle 1991); at ages 19–21 (Humphrey & Friedman 1986; Samson *et al.* 1989) and at ages 18–37 (Muthen & Muthen 2000); (c) frequency of heavy drinking and alcohol-related problems at ages 17–18 (Werner, Walker & Greene 1994; Hawkins *et al.* 1997); at age 20 (Pedersen & Skrandal 1998) and at ages 18–25 (Barnes, Welte & Dintcheff 1992); (d) problem drinking at age 22 (Pitkänen 1999); (e) Diagnostic and Statistical Manual (DSM)-diagnosed alcohol abuse and dependency in adulthood (Hasin & Glick 1992; Grant & Dawson 1997; Prescott & Kendler 1999; Grant, Stinson & Harford 2001; Warner & White 2003); and (f) alcoholism (Robins & Przybeck 1985; York 1995). Early-onset drinking also increases the risk for unintentional injury involvement after drinking (Hingson *et al.* 2000), and use of drugs (Yamaguchi & Kandel 1984; Windle 1991; Lo 2000; Flory *et al.* 2004).

Gender differences in the age of onset of drinking have not been found in Finnish studies (Lintonen *et al.* 2000; Pitkänen 1999), or in the American studies by Flory *et al.* (2004) and Samson *et al.* (1989). In many other studies the mean of the age of onset of drinking has not been

reported separately for females and males. In two cross-sectional studies, in which the oldest participants were around 60 years old, slight gender differences in the age of onset of drinking was obtained retrospectively regarding earlier age in males (York 1995; Pedersen & Skrandal 1998). However, the drinking habits of the genders differ in adult years: men drink more, their drinking is more often intoxication orientated and it causes more problems than does women's drinking (e.g. Wechsler & McFadden 1979; Barnes *et al.* 1992; Nyström, Peräsalo & Salaspuuro 1993; Casswell *et al.* 2002).

The risks of early onset of drinking for adult alcohol use seem clear based on previous studies, but the bulk of evidence on the relation between early onset and later use of alcohol is based mainly on cross-sectional studies or on studies where the follow-up period is short. Furthermore, the age of onset of drinking has been defined using various criteria and often asked retrospectively. In the present study, longitudinal data from a representative sample were collected from age 8 to age 42, and the age of onset of drinking was determined by posing specific questions at several age stages. In most studies alcohol use in adulthood is assessed based on one measure or item, or alcohol use is indicated by diagnosed alcohol abuse or dependence. In the present study, two quantity–frequency indicators of adult alcohol consumption and two alcoholism screening tests were used in adulthood.

More information is also needed about the antecedents of the onset of drinking. Antisocial behaviour in adolescence has been found to be a risk factor for later problem drinking (e.g. Grant *et al.* 2001; Pulkkinen & Pitkänen 1993; Parker *et al.* 1996; Warner & White 2003) and correlated with the initiation of drinking (Rose *et al.* 2001), but the correlation between adolescent antisocial behaviour and drinking does not provide information about a possible temporal sequence of these behaviours. The present longitudinal data allowed the search of possible antecedents of the early age at onset of drinking from children's socio-emotional behaviour controlling with school success and the socio-economic status of the family before any of the participants had initiated the use of alcohol.

Based on previous studies, it was assumed that the early age at onset of drinking would be a risk for later heavy use of alcohol and problem drinking in both genders, and that the risk would be the higher the earlier the use of alcohol was initiated. It was also expected that low self-control and aggression assessed before the initiation of drinking would be associated with the early age of onset of drinking. These have been shown with the present data to be linked to several later outcomes such as long-term unemployment (Kokko & Pulkkinen 2000); accumulation of risks in social functioning (Rönkä & Pulkkinen 1995); criminal behaviour (Hämäläinen &

Pulkkinen 1996); and the use of alcohol in adulthood (Pulkkinen & Pitkänen 1993, 1994). Aggression is a risk factor leading to a cycle of maladjustment (Kokko & Pulkkinen 2000). The identification of a risk group for early onset of drinking would be an important development in alcohol abuse prevention efforts.

## METHOD

### Participants

The ongoing Finnish Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) provided the participants for the present study. The JYLS has been conducted by Lea Pulkkinen since 1968, when 12 complete school classes of second-grade pupils in the town of Jyväskylä were selected randomly for the study (Pulkkinen 1982). The total number of pupils in these classes was 369 (173 girls and 196 boys). They were mainly (93%) born in 1959, and 71% of them were from blue-collar families. The most recent data were collected in 2001.

The age of onset of drinking was available for 356 participants, representing 96.5% of the entire original sample ( $n = 369$ ). Some data on the use of alcohol at age 36 or age 42 were available for 331 participants (155 women, 176 men); complete (list-wise) data on all measures used was available for 308 participants (142 women, 166 men). The retention rates for these were 90.4% and 84.2%, respectively. Three participants had died; thus the available sample in adulthood was 366 participants.

Attrition analyses showed that the mean age of onset of drinking for the 25 participants (10 women, 15 men) who were not reached in adulthood did not differ from the mean age of the 331 participants who were reached in adulthood and for which some data on adult drinking were available, or from the mean age of onset of drinking of the 308 participants for whom the complete data were available. Neither were there differences between the latter samples in the age of onset of drinking, in the indicators of adult alcohol use, or in the use of alcohol at ages 14, 20 or 27. We also compared the criminal registers of the participants of the original sample ( $n = 369$ ) with those of the participants reached for the follow-up study and did not find differences in them. Maximum available data is used in the analysis, if not otherwise reported.

Data on the use of alcohol in adulthood for the present study were primarily collected at age 42. The same indicators of adult use of alcohol were also used at age 36 and these data were utilized instead of imputing missing information statistically for 25 participants, with some missing information at age 42, and for 47 participants who had taken part in this study at age 36 but who were

not reached for the follow-up at age 42. These participants did not differ in the use of alcohol at age 36 from those who participated in the study both at age 36 and at 42 nor at ages 14, 20, or 27.

The participants represented at age 42 the whole Finnish age cohort born in 1959 regarding, for example, marital status, number of children and employment rate, as shown by the comparisons with the data derived from Statistics Finland (Pulkkinen *et al.* 2003). However, there were more women among the lower white-collar workers and fewer women among the blue-collar workers in the sample than in the age cohort group. No difference existed in the higher white-collar workers.

### Measurements and variables

Data on the use of alcohol were collected using personal interviews by specially trained interviewers at ages 14, 20, 27, 36 and 42, and a Life Situation Questionnaire (LSQ) mailed to the participants before the personal interviews at ages 27, 36, and 42.

*Onset age of drinking.* Onset age of drinking was determined at ages 14, 20, 27, 36 and 42 using questions such as: 'Do you use alcohol?', 'How often do you use alcohol?', 'Have you been drunk?' and 'At what age did you start using alcohol?' The criterion for the onset of the use of alcohol was that the participant had been drunk or admitted using alcohol occasionally; merely tasting alcohol was not considered to indicate onset. Priority was given to the information received closest to the actual onset age. The onset age was used both as a continuous variable and as a categorical variable: 1 = 13 years or younger, 2 = 14–15 years, 3 = 16–17 years, 4 = 18 years (the legal age limit) or older.

*Frequency of drinking.* In the mailed LSQ, the participants were asked to fill in a quantity–frequency (q–f) table developed by Pulkkinen & Pitkänen (1994) with the following instruction: 'How much alcohol do you take at one time? If you have quit, please refer to the situation before you had quit. Circle the most appropriate frequency option on each line.' The horizontal quantity options consisted of different portion estimates per occasion (one drink or less, two to four drinks, five to seven drinks, eight to 12 drinks, 13 drinks or more; at age 42, also options 14–19 drinks and 20 drinks or more). One drink (portion of alcohol) was defined as one bottle (33 cl) of beer (4.5% alc.), one glass of wine (12 cl ~ 12% alc.), one glass of strong wine (8 cl ~ 21% alc.) or one 4 cl shot of spirits. There were seven possible vertical frequency options for each quantity option: 1 = not at all; 2 = at most twice a year; 3 = once every 2 months; 4 = once or twice a month; 5 = once a week; 6 = two to five times a

week; and 7 = six to seven times a week. The annual frequency of drinking was obtained in terms of times approximating days per year (0, not at all; 2, twice a year; 6, once every 2 months; 18, 1.5 times a month; 52, once a week; 182, 3.5 times a week; and 338, 6.5 times a week) by counting the sum of the frequency options across different quantities. The sum of the annual frequency of drinking was limited to every day; that is, 365 times per year.

Thirteen participants reported not using alcohol at the time of the latest data collection (10 participants at age 42 and three at age 36). A 1-year control period was required to assure non-drinking status, because heavy drinkers tend to experience several short attempts to quit. The 1-year criterion was not met by four participants, one woman and three men; three of them reported quitting because of heavy drinking. For them the frequency and quantity for current drinking was coded on the basis of the amount of drinking before quitting. Nine participants had quit drinking 2–29 years before the data collection, median time 4.5 years. They were coded as non-drinkers (= 0) in the quantity–frequency measures in adulthood. Three of them had been heavy drinkers; their former problem drinking was detected correctly by the life-time alcoholism screening tests used in this study.

*Binge drinking.* In the mailed LSQ the participants were asked to remember how often during the past 12 months they had consumed so much alcohol that they had been truly drunk. Binge drinking was operationalized on the basis of the reported times of being drunk, but controlled with the frequency of drinking at least five portions per occasion as reported in the q–f table; the criterion of five drinks for binge drinking has also been used by Hingson *et al.* (2000), Schulenberg *et al.* (1996) and Windle (1991). Binge drinking was coded as 0 = not at all, 1 = once a year, 2 = less often than once a month, 3 = one to three times a month, 4 = once a week, and 5 = several times a week.

Two alcoholism screening tests were used. The Cut-down, Annoyed, Guilt, Eye-opener (CAGE) questionnaire developed by Ewing & Rouse (Ewing 1984) was administered in the mailed LSQ. It included four questions: (a) 'Have you ever felt the need to Cut down on your drinking?'; (b) 'Have you felt Annoyed by criticism of your drinking?'; (c) 'Do you feel Guilty about your drinking?'; and (d) 'Have you ever had a drink in the morning to get rid of a hangover (an Eye opener)?' The responses were coded 0 = no, 1 = sometimes, 2 = often. Cronbach's alpha was 0.81 for women and 0.82 for men.

A modification of the Michigan Alcoholism Screening Test (MAST) developed by Selzer (1971) was completed by each participant during the interview. Our modification, Mm-Mast, was based on the brief MAST (Pokorny

*et al.* 1972) that Kristenson & Trell (1982) adapted for Scandinavia (Malmö modification of the brief MAST; Mm-MAST), which was first used in Finland by Seppä, Sillanaukee & Koivula (1990). It probes personal attitudes and habits rather than symptoms. Mm-MAST used in the present study consisted of nine items, such as 'Have you ever been in the habit of taking a drink before going to a party?' The responses were coded 0 = no, 1 = yes. Cronbach's alpha was 0.64 for women and 0.73 for men.

*Socio-emotional behaviour.* At age 8, teacher ratings and peer nominations of the same 33 items for socio-emotional behaviour (Pitkänen 1969; Pulkkinen 1987) were collected: for instance, 'Quarrels with other children even for a slight reason'. The teacher was asked to assign 3 to those pupils in whom the characteristic in question was very prominent, and 0 to those pupils in whom the teacher had never observed the characteristic in question. The behaviour of the girls/boys was to be compared with that of girls/boys of the same age in general. The pupils were asked to nominate at least three same-sex children who displayed the type of behaviour in question using a pad that included the names of the same-sex classmates. Each variable was formed by the relative number of 'votes' he/she received in the class.

Five variables were formed separately from standardized teacher ratings and peer nominations within the framework of the model of emotional and behavioural regulation (Pulkkinen 1995, 1996). (1) Constructiveness—a sum score of five variables, for example: 'Acts reasonably even in annoying situations'. Cronbach's alpha for the teacher ratings was 0.89 for boys and 0.88 for girls, and for peer ratings 0.90 for boys and 0.89 for girls. (2) Compliance—a sum score of three variables, for example: 'Is peaceable and patient'. Cronbach's alpha for the teacher ratings was 0.89 for boys and 0.85 for girls, and for peer ratings 0.88 for boys and 0.90 for girls. (3) Aggression—a sum score of nine variables, for instance: 'Hurts another child when angry, e.g. by hitting, kicking or throwing something'. Cronbach's alpha for the teacher ratings was 0.91 for boys and 0.90 for girls, and for peer ratings 0.96 for boys and 0.92 for girls. (4) Low self-control—a sum score of four variables, for example: 'Tends to disobey the teacher?' Cronbach's alpha for the teacher ratings was 0.79 for boys and 0.73 for girls, and for peer ratings 0.88 for boys and 0.82 for girls. (5) Anxiety—a sum score of three variables, for example: 'Starts easily crying if others treat him/her nastily'. Cronbach's alpha for the teacher ratings was 0.69 for boys and 0.74 for girls, and for peer ratings 0.83 for boys and 0.73 for girls. The teacher was presented additional questions that were used for the rating of social activity—a sum score of four variables, for example: 'Always busy and plays eagerly with other children'. Cronbach's alpha for the

teacher ratings was 0.79 for boys and 0.82 for girls. The teacher was also asked to assess whether the teacher was concerned about the pupil because of ensuing antisocial symptoms, and whether the teacher felt the pupil would certainly find his/her way later on in life.

*School success.* School success was assessed by asking the class teacher to rank order the pupils. The ranks were coded on a five-point scale taking into account the size of the school-classes.

*Socio-economic status of the family.* Socio-economic status of the family was coded on the basis of the father's occupation (mother's occupation, if she was a sole provider) on a two-point scale: 1 = blue collar and 2 = white collar.

### Statistical analysis

Correlations between the age of onset of drinking and the indicators of adult use of alcohol, and the intercorrelations between the indicators, were calculated as Pearson's correlations for men and women separately. When testing for gender differences in correlations, Fisher's transformation of the correlation coefficient was used.

The main effects of the age of onset of drinking and gender, and their interaction on the four indicators of adult use of alcohol were studied by multivariate analysis of variance (MANOVA) with Wilks's lambda test. Because no interaction was found, the multivariate analysis of variance was conducted for males and females separately. The pairwise comparisons of the means of the indicators between the age groups of onset were based on the parameter estimates of the MANOVA model. The proportion of total variability (effect size) in the four indicators, attributable to the age group of onset of drinking, was described by eta-squared statistic ( $\eta^2$ ), presented as percentages.

The connections of socio-emotional behaviour at early school age, school success, school class and socio-economic status of the family to the age of onset of drinking were studied by analysis of covariance and by regres-

sion analysis with dummy variables. The connections of socio-economic status, school success and school class to the grouping of the age of onset of drinking were tested with the  $\chi^2$  test, and the exact test with Monte Carlo method when needed.

The mediating effects of the socio-emotional behaviour and the socio-economic status of the family on the relationship of the age of onset of drinking, and the indicators of adult alcohol use, were studied by adding these factors as covariates into the MANOVA model.

The analyses were conducted using the SPSS 11.0 statistical program package.

## RESULTS

### Description of the data

All participants had used alcohol at some point of their life. The mean age of onset of drinking was 15.5 years (range 10–30 years; SD = 2.4). The mean age of onset of drinking, nor the distributions, did not differ significantly between genders (Table 1). Two per cent of the participants had started drinking at age 10–11, 9% at age 18, the legal age limit, and 6.5% later.

Adult men used alcohol more often than women (Table 1). The frequency of drinking varied from twice a year or less often (6.5% of women and 5.2% of men) to every day (1.3% of women and 7.5% of men). The median was 52 times per year for women, and 88 times per year for men. Also binge drinking was more common among men than women (Table 1): 3.2% of women, but 10.9% of men reported having been drunk or consumed alcohol at least five portions per session several times a week, 29.0% of women and 12.6% had not been drunk during the last year. Men also scored higher in the alcoholism screening tests than women. The means of the adult alcohol use indicators calculated for all participants, for whom some data on their use of alcohol was available ( $n = 311$ – $331$ ), did not differ from the means calculated for the 308 participants for whom complete data were available.

**Table 1** Mean of the age of onset of drinking and the indicators of adult use of alcohol.

	<i>n</i>	<i>Males</i>			<i>Females</i>			<i>t-Test P</i>
		<i>n</i>	<i>Mean</i>	<i>SD</i>	<i>n</i>	<i>Mean</i>	<i>SD</i>	
Age of onset of drinking (min. 10: max. 30 years)	331	176	15.3	2.3	155	15.6	2.6	0.298
Annual frequency of drinking (0–365 days/year)	329	174	132.0	117.7	155	79.9	84.1	0.000
Binge drinking (0–5)	330	175	2.5	1.5	155	1.5	1.4	0.000
Sumscore of CAGE (0–8 points)	328	175	2.3	2.1	153	1.3	1.7	0.000
Sumscore of Mm-Mast (0–9 points)	311	163	4.8	2.4	148	2.8	1.9	0.000

Correlations between the age of onset of drinking and the four indicators of adult alcohol use were very highly significant ( $P < 0.001$ ): the correlations were  $-0.26$  for females and  $-0.25$  for males for the frequency of drinking;  $-0.29$  and  $-0.32$  for binge drinking;  $-0.26$  and  $-0.32$  for CAGE; and  $-0.43$  and  $-0.36$  for mm-MAST. The differences between females and males were not statistically significant. The intercorrelations between the indicators of adult alcohol use were also significant ( $P < 0.001$ , if not indicated otherwise) and did not differ statistically between genders. The correlations between the frequency of drinking and binge drinking were  $0.44$  for females and  $0.53$  for males, and those between CAGE and Mm-MAST, respectively,  $0.58$  and  $0.70$ . Binge drinking correlated with the alcoholism screening tests more highly ( $0.62$  and  $0.50$  for CAGE, and  $0.53$  and  $0.50$  for mm-MAST, respectively) than with the frequency of drinking ( $0.20$  and  $0.19$  for CAGE, and  $0.35$  and  $0.20$  for Mm-MAST;  $P < 0.05$  for both correlations for CAGE and the latter correlation for mm-MAST).

#### The age of onset of drinking as a predictor of adult alcohol use

The correlations showed that the age of onset of drinking was inversely related to adult alcohol use for both genders. Multivariate analysis of variance was used in order to detect whether there were any periods of the age of onset of drinking that might be more critical than other periods for adult use of alcohol, and to study whether the critical periods were similar for both genders. The partic-

ipants with complete data on the use of alcohol in adulthood (146 females and 162 males) were categorized into four groups for the age of onset of drinking: 13 years or younger (15.1% of females, 19.1% of males); 14–15 years (45.2% of females, 43.8% of males); 16–17 years (24.0% of females, 24.1% of males); and 18 years or older (15.8% of females, 13.0% of males). These proportions of the age groups did not differ from those for whom the age of onset was available ( $n = 356$ ).

The MANOVA revealed that both gender and age of onset had highly significant main effect on the indicators of adult use of alcohol (respectively,  $F_{(4,300.00)} = 19.4$ ,  $P < 0.001$ ;  $F_{(12,794.02)} = 6.17$ ,  $P < 0.001$ ). The interaction of gender and the age of onset of drinking was not significant on any of the indicators for adult use of alcohol ( $F_{12,786.08} = 0.782$ ,  $P = 0.670$ ). This means that gender did not modify the relationship between the age of onset of drinking and adult use of alcohol. The effect of gender was seen only in the level of the use of alcohol. Thus it was reasonable to conduct the analysis separately for genders.

Table 2 presents the means and standard deviations of the groups in four indicators of adult use of alcohol for females and males, and pairwise significances of differences between the groups for both genders. The age of onset of drinking had a significant main effect on adult use of alcohol for both women ( $F_{12,368.05} = 3.28$ ,  $P < 0.001$ ) and men ( $F_{12,410.38} = 3.57$ ,  $P < 0.001$ ). The age group explained 21% of the variability of the Mm-MAST score for females, but 9% for males. The effect size of the age of onset of drinking on binge drinking was 13% for males and 11% for females, on CAGE 10% for males

**Table 2** Mean differences in adult alcohol use (at age 36/42) by age of onset of drinking and gender.

Indicator	Onset age group	Males $n = 162$		Females $n = 146$		Significant difference*			
		Mean	SD	Mean	SD	$\leq 13$	14–15	16–17	$\geq 18$
Frequency of drinking	13 years or less	193.0	137.8	110.0	93.0	–	0.290	<b>0.044</b>	<b>0.011</b>
	14–15 years	133.5	105.1	88.8	87.8	<b>0.017</b>	–	0.168	<b>0.037</b>
	16–17 years	106.3	108.4	65.4	67.5	<b>0.002</b>	0.236	–	0.413
	18 years or more	101.6	119.2	47.6	64.0	<b>0.005</b>	0.264	0.879	–
Binge drinking	13 years or less	3.2	1.5	1.9	1.2	–	0.962	0.059	<b>0.004</b>
	14–15 years	2.8	1.3	1.9	1.5	0.197	–	<b>0.017</b>	<b>0.000</b>
	16–17 years	1.9	1.3	1.2	1.1	<b>0.000</b>	<b>0.001</b>	–	0.182
	18 years or more	1.8	1.5	0.7	1.1	<b>0.000</b>	<b>0.004</b>	0.823	–
CAGE	13 years or less	3.6	2.5	1.8	1.7	–	0.347	<b>0.032</b>	<b>0.011</b>
	14–15 years	2.3	1.9	1.4	1.9	<b>0.004</b>	–	0.090	<b>0.028</b>
	16–17 years	1.6	2.1	0.9	1.2	<b>0.000</b>	0.096	–	0.506
	18 years or more	1.7	2.0	0.6	1.0	<b>0.002</b>	0.252	0.861	–
Mm-MAST	13 years or less	5.8	2.2	3.8	1.3	–	0.360	<b>0.000</b>	<b>0.000</b>
	14–15 years	5.1	2.0	3.4	1.9	0.170	–	<b>0.000</b>	<b>0.000</b>
	16–17 years	4.1	2.7	2.0	1.7	<b>0.010</b>	0.095	–	0.267
	18 years or more	3.4	2.6	1.5	1.7	<b>0.000</b>	<b>0.004</b>	0.142	–

\*Significant ( $P < 0.05$ ) pairwise differences are in bold, females are above the diagonal.

and 6% for females; and on the frequency of drinking 7% for males and 6% for females.

The pairwise comparisons between the groups (Table 2) showed in detail where the significant differences between the groups for the age of onset of drinking occurred. The most consistent findings across genders were that the youngest group (13 years or younger) scored significantly higher in all indicators of adult use of alcohol than the oldest group (18 years or older), and higher than the 16–17-year-olds, except for women's binge drinking ( $P = 0.059$ ). In addition, the 14–15-year-olds differed from the two elder groups in binge drinking for both genders. Gender-specific differences were found as follows: for males, the youngest age group differed from the second youngest group in the frequency of drinking and CAGE, and the second youngest group differed from the oldest group in Mm-MAST. For females, the 14–15-year-olds scored significantly higher than the two elder groups in Mm-MAST, and higher than the oldest group in the frequency of drinking and CAGE.

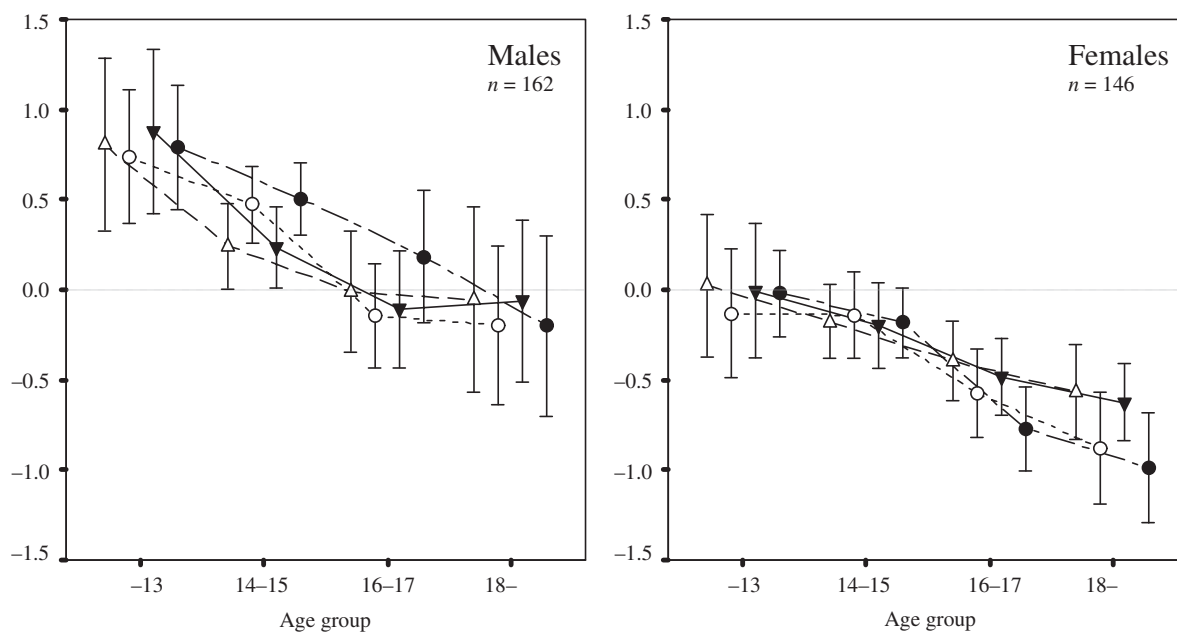
In Fig. 1, the means of the indicators of adult use of alcohol are presented based on scores standardized across the whole sample. The figure demonstrates that the level of male drinking in adulthood was above the grand mean (= 0) in all indicators, and that for women below it. In spite of the differences in the level of drinking, the shapes of the graphs were similar for men and women; that is, the earlier the use of alcohol had been started, the higher were the scores for adult alcohol use. The age of onset of drinking was for both genders simi-

larly related to the frequency of drinking and CAGE, and rather similarly to binge drinking and Mm-MAST.

### Predicting the age of onset of drinking at age 8

At age 8, teacher ratings and peer nominations on the socio-emotional behaviour, school success and parents' socio-economic status were available for all participants. The comparison of the participants who did not take part in the follow-up study in adulthood ( $n = 38$ ) with those who did take part ( $n = 331$ ) revealed two significant differences, but only for females: the non-participating girls were higher in peer nominated anxiety [ $t(df = 171) = 2.7, P = 0.008$ ] and lower in teacher rated aggressiveness [ $t(df = 48.2) = -3.7, P < 0.001$ ] than the participating girls.

The relation of the age of onset of drinking to the participants' socio-emotional behaviour assessed by teachers and peers and school success at age 8 was studied using univariate and multivariate methods controlling school class (12) and socio-economic status of the family. No significant relations were found for boys. For girls, three significant relations to the age of onset were found, these factors were also related to each other. Teacher-rated lower self-control and higher aggressiveness were related to the lower age of onset of drinking ( $r = -0.17; P = 0.014$  for low self-control, and  $-0.21; P = 0.003$  for aggressiveness). In addition, 17% of the girls whose father was in a blue-collar occupation ( $n = 122$ ) started at a very early age (13 years or younger), whereas only



**Figure 1** Means with 95% confidence intervals of the indicators of adult use of alcohol by the age of onset of drinking; standardized across the whole sample.  $\Delta$  = Frequency of drinking,  $\circ$  = Binge drinking,  $\blacktriangledown$  = CAGE,  $\bullet$  = Mm-Mast

2% of the girls whose father was in a white collar occupation ( $n = 43$ ) had started that early [ $\chi^2$  ( $df = 3$ ) = 10.3,  $P = 0.016$ ]. Self-control was lower [ $t(df = 105.1) = 3.0$ ,  $P = 0.003$ ] and aggressiveness higher [ $t(df = 120.5) = 2.4$ ,  $P = 0.017$ ] in girls from blue-collar families than those from white-collar families. The effects of the socio-economic status and socio-emotional characteristics did not, however, mediate the effect of the age of onset of drinking on the use of alcohol in adulthood.

## DISCUSSION

In the present longitudinal study, 90% of the participants have been followed from age 8 to ages 36 or 42. For 84% of the original random sample, complete data on the age of onset of drinking and adult alcohol use were available. The average age of onset of drinking was 15.5 years with no significant gender difference. In spite of this, men and women differed in their use of alcohol at later ages. Men used alcohol more frequently and more often to intoxication, and they scored higher than women in two alcoholism screening tests, CAGE and Mm-MAST. The effect of gender on adult alcohol use was highly significant, as was the effect of the age of onset of drinking, but their interaction was not significant. Thus the effect of the age of onset of drinking on adult alcohol use was similar for men and women. For both genders, a low age of onset of drinking was a significant risk factor for high consumption of alcohol and problem drinking in adulthood. Male and female participants who initiated drinking prior to age 14 scored higher in adult alcohol use indicators than individuals who began drinking at age 18 or later (the legal age limit) and even higher than those who began drinking at age 16–17. For binge drinking, the higher risk also concerned the participants who started the use of alcohol at age 14–15 compared to those who initiated drinking at 16 or later.

The results were in accordance with the bulk of evidence of previous studies in which follow-up data have, for the most part, been collected through adolescence (e.g. Pedersen & Skrandal 1998; Hawkins *et al.* 1997) or to young adulthood (e.g. Pitkänen 1999; Casswell *et al.* 2002), or in which data on the age of onset of drinking has been collected retrospectively (e.g. Barnes *et al.* 1992; Prescott & Kendler 1999). The indicators of adult alcohol use might have been limited to, for instance, diagnosed alcoholism (e.g. Hasin & Glick 1992; Grant *et al.* 2001; Warner & White 2003), or the sample has been selected from women (e.g. Werner *et al.* 1994). The strengths of the present study were (1) the prospective design concerning the age of onset of drinking; (2) a random sample that included both males and females and represented socio-demographically the age cohort group; (3) a long

follow-up time; (4) a high retention rate; and (5) the use of several indicators of adult alcohol use. The quantity and frequency measures indicated the current use of alcohol, and the life-time alcoholism screening tests also considered an individual's past heavy drinking, which was confirmed by the prospective data on the participants drinking history. The age of onset of drinking was related similarly to all four indicators of adult alcohol use.

The early initiation of the use of alcohol was neither explained by the male participants' socio-emotional characteristics and school success assessed prior to the initiation of drinking, nor by their father's occupational status. However, female participants' teacher-rated, but not peer-nominated, aggressiveness and low self-control at early school age predicted the early onset of drinking; these characteristics and very early onset of drinking appeared more often in girls whose father (or the mother if she was a sole provider) was in a blue-collar occupation than in girls whose father was in a white-collar occupation. The only risk-group found for early initiation of drinking consisted of girls from blue-collar families with teacher-rated aggressiveness and/or low self-control; in practise only a class-teacher could identify such a group. The effects of the socio-economic status and socio-emotional characteristics did not mediate the effect of the age of onset of drinking on adult alcohol use in females. The results were in accordance with the results of earlier studies indicating that the predictors of the age of onset of drinking are rather more social (availability of alcohol) and situational (peer influence) than psychological (Marquies, Kessler & Kandel 1977; Pedersen & Skrandal 1998; Hawkins *et al.* 1997). Furthermore, the results of the genetic analyses indicate that shared environmental effects predominate as influences on drinking initiation in early adolescence (Rose *et al.* 2001). Once initiated, patterns of substance use among adolescents are under significant genetic influence (Prescott & Kendler 1999; Rose *et al.* 2001). Environmental effects affecting the initiation of drinking may lie in the family, school or society at large. More information is needed regarding these factors that might affect the early onset of drinking outside the family.

The use of alcohol is not a static phenomenon. In the present study all participants had used alcohol by age 30. At each of the ages 27, 36 and 42, 5–7% of the participants—instead of zero—reported in the LSQ that they had never used alcohol in their lives. For those who had quit drinking, a 1-year control period of non-drinking was required to demonstrate the reliability of their initiative to quit. The value zero was accepted for the quantity and frequency measures for these participants, because they were aimed at measuring the use of alcohol in the 40s. It would be another significant study to investigate with a larger number of participants the connection



between the age of onset of drinking and ability to quit heavy drinking, and reasons for quitting.

Our findings suggest that delaying the initiation of drinking might be an appropriate goal for prevention efforts and that the present level for the legal age limit (18 years) for alcohol use is relevant; in some countries it is even higher. Prescott & Kendler (1999) have, however, claimed that delaying the age of onset of drinking would not prevent severe alcoholism, because so many other factors are included. It may be valid for some individuals, but the results of an epidemiological survey (Grant 1998) and a 7-year follow-up (Hawkins *et al.* 1997) have shown that the onset age of drinking is a powerful predictor of life-time alcohol dependence and misuse, regardless of family history of alcoholism, status, race, gender, proactive parenting, school bonding, peer alcohol initiation and perceived harmfulness of alcohol use. Also, Pedersen & Skrondal (1998) concluded that the age of alcohol debut had an independent effect on both future alcohol consumption and the development of alcohol-related problems.

It is probable that a person has more modes of action and greater ability to control her/his drinking habits in adulthood, if drinking alcohol has not been a part of one's life-style in early adolescence. By delaying the onset age, at least the hazardous effects of heavy drinking in adolescence could possibly be avoided. As proposed by Huttunen (2003), a change in general attitudes is needed to prevent an increase in problems caused by alcohol in the future. Achieving this result will require a joint effort by everyone, including parents, media, professionals, and politicians, and will necessitate a change in adult drinking culture.

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