A 26-Year Follow-Up Study of Heavy Drinking Trajectories from Adolescence to Mid-Adulthood and Adult Disadvantage

Noora Berg1,*, Olli Kiviruusu1, Sakari Karvonen2,3, Laura Kestilä2, Tomi Lintonen4,5, Ossi Rahkonen3 and Taina Huurre1,6

1Department of Mental Health and Substance Abuse Services, National Institute for Health and Welfare, PO Box 30, FI-00271 Helsinki, Finland. 2Department of Social and Health Policy and Economics, National Institute for Health and Welfare, Helsinki, Finland. 3Department of Public Health, Hjelt Institute, University of Helsinki, Helsinki, Finland. 4The Finnish Foundation for Alcohol Studies, Helsinki, Finland. 5School of Health Sciences, University of Tampere, Tampere, Finland and 6Department of Health and Social Welfare, City of Vantaa, Vantaa, Finland

*Corresponding author. Department of Mental Health and Substance Abuse Services, National Institute for Health and Welfare, PO Box 30, FI-00271 Helsinki, Finland. Tel.: +358-295248519; E-mail: noora.berg@thl.fi

(Received 10 October 2012; first review notified 20 February 2013; in revised form 25 February 2013; accepted 6 March 2013)

Abstract — Aims: The aim of the study was to identify heavy drinking trajectories from age 16 to 42 years and to examine their associations with health, social, employment and economic disadvantage in mid-adulthood. Methods: Finnish cohort study’s participants who were 16 years old in 1983 were followed up at age 22, 32 and 42 (n = 1334). Heavy drinking was assessed at every study phase and based on these measurements trajectories of heavy drinking were identified. The trajectory groups were then examined as predictors of disadvantage at age 42. Results: Five distinct heavy drinking trajectories were identified: moderate (35%), steady low (22%), decreasing (9%), increasing (11%) and steady high (23%). Frequencies of the trajectory groups differed by gender. Using the moderate trajectory as a reference category, women in the steady high trajectory had an increased risk of experiencing almost all disadvantages at age 42. In men, increasing and steady high groups had an increased risk for experiencing health and economic disadvantage. Conclusion: Steady high female drinkers and steady high and increasing male drinkers had the highest risk for disadvantage in mid-adulthood. By identifying heavy drinking trajectories from adolescence to mid-adulthood we can better predict long-term consequences of heavy alcohol use and plan prevention and intervention programmes.

INTRODUCTION

At the population level, people start drinking in adolescence, increase their drinking in young adulthood and decrease, especially heavy drinking, after the age of 30 (Johnstone et al., 1996; Kuntsche et al., 2004; Karlamangla et al., 2006). A drinking pattern in adolescence often carries on into adulthood (Jeffieris et al., 2005; McCambridge et al., 2011) although there is much individual variation in this development (Vaillant, 1995; Maggs and Schulenberg, 2005a).

Many studies have characterized distinct drinking trajectories (Maggs and Schulenberg, 2005a; Sher et al., 2011) and the following drinking trajectories have repeatedly been identified: stable low use (abstainers/light drinkers/rare), stable high use (chronic/persistent heavy drinking), increasing (escalation/late onset) and decreasing use. In addition, a ‘flying’ trajectory (where the course of drinking increases and decreases) and a moderate use trajectory have also been found (Maggs and Schulenberg, 2005b; Sher et al., 2011). Most trajectory studies have focused on adolescence or young adulthood. Studies with long follow-up times into adulthood have often been conducted with relatively small or unrepresentative samples (Jacob et al., 2005; Schuckit and Smith, 2011) or with retrospective data (Kerr and Ye, 2010). There is a lack of studies on drinking trajectories with prospective follow-ups from adolescence to mid-adulthood (Schulenberg and Maggs, 2008).

Disadvantage is a multidimensional concept and can cut across several dimensions of life (e.g. health, social, employment and economic aspects), yet there has been a lack of a multidimensional perspective of disadvantage. Dimensions of disadvantage often intertwine, but examining them separately helps to identify paths to disadvantage. The long-term effects of heavy drinking in adolescence on multiple dimensions of disadvantage are still in part unclear (McCambridge et al., 2011). Studies have shown that heavy drinking in adolescence continues often into adulthood and is associated with alcohol-related problems (McCambridge et al., 2011), poor health (Room et al., 2005), unemployment (Henkel, 2011) and being single or divorced (Power et al., 1999). However, these studies usually have not been able to capture possible heterogeneities in the developmental paths of behaviour (Hill et al., 2000).

Most of the studies on the associations between drinking trajectories and disadvantages have measured outcomes in young adulthood. Few trajectory studies that have examined health outcomes have not found differences in depression or mental health between drinking trajectories (Hill et al., 2000; Hicks et al., 2010). In the study of Tucker et al. (2005), increasers had poorer mental and physical health than abstainers. Studies on social outcomes have found that persistent drinking trajectory is associated with being separated, divorced or never married (Schulenberg et al., 1996; Hicks et al., 2010). Some studies on educational and employment outcomes have not observed any effect of persistent heavy drinking on employment status (Hicks et al., 2010), whereas others have found women in the fling trajectory to have greater educational attainment than those in the increasing or rare drinking trajectories (Schulenberg et al., 1996). Further, studies have found increasers less likely to complete high school than non-bingers (Hill et al., 2000). One longitudinal study of economic outcomes in men did not find any associations between alcohol use disorder trajectories and income (Hicks et al., 2010).

In this study we aimed first to identify developmental trajectories of heavy drinking from adolescence to mid-adulthood and, then, to examine disadvantages at age 42 according to these trajectories in women and men. Multiple...
measures were used to assess each dimension of disadvantage. Our general hypothesis, based on previous studies, was that the poor consequences of heavy drinking from adolescence to mid-adulthood are stronger with persistent and increasing heavy drinking trajectories than with other trajectories.

**METHODS**

**Participants**

The original study population included all Finnish-speaking 9th grade pupils attending comprehensive school in 1983 in an industrial and university city, situated in southern Finland. In the first phase, in 1983, 2194 pupils (96.7%) with a mean age of 15.9 years (SD 0.3 years) completed questionnaires during school hours. The participants were followed up using postal questionnaires in the years 1989, 1999 and 2009, at the respective ages of 22 \( (n = 1656, 75.5\%) \), 32 \( (n = 1471, 67.0\%) \) and 42 \( (n = 1334, 60.8\%) \) years. In the present study, only participants who had participated at least in the questionnaire at age 42 were included in the analyses \( (n = 1334) \), while of those, 86.6% had also participated at age 22 \( (n = 1155) \) and 84.2% at age 32 \( (n = 1123) \) years.

Comparison of those participants in the aged-42 follow-up with non-participants showed that the non-participants were more frequently men \((60.8 \text{ vs. } 45.0\%, P < 0.001)\), were more often heavy drinkers at age 16 \((28.2 \text{ vs. } 23.0\%, P = 0.024)\) and had poorer school performance \((4 – 10, mean 7.3, SD 0.9 \text{ vs. } mean 7.7, SD 0.9, P < 0.001)\) compared with participants. There were no differences between the groups at age 16 in self-perceived health, depressive symptoms, amount of confidants they turn to, relationships with mother/father, parental employment status and parental occupational class.

**Heavy drinking**

Heavy drinking at age 16 was defined as frequent if the participant reported being drunk at least four times during the school term (on average once a month) and infrequent if heavy drinking occurred 1 – 3 times. At age 22, participants were defined as frequent heavy drinkers if they reported heavy drunkenness at least once a month or mild drunkenness at least weekly and infrequent heavy drinkers if they reported heavy drunkenness less often than once a month. Perceived drunkenness at these ages has been shown to correspond with approximately six units of alcohol \((\text{Lintonen and Rimpelä, 2001})\). At ages 32 and 42, heavy drinking was measured with a question ‘How often do you have six or more drinks on one occasion?’ (Alcohol Use Disorders Identification Test \((\text{AUDIT})\) \((\text{Babor et al., 1989})\)). Frequent heavy drinking was defined as having six or more drinks in a session at least once a month and infrequent heavy drinking as drinking the amount less frequently than once a month. At every age the category of ‘no heavy drinking’ was also established (See Table 1).

**Mid-adulthood outcomes**

Dimensions of disadvantage at age 42 were categorized into four groups. The health dimension was measured with self-perceived health and depression. Perceived health was assessed on a 5-point scale and was dichotomized to very/rather good vs. average/rather/very poor \((25\%)\). Depression was measured using a Finnish version of the short 13-item Beck Depression Inventory \((\text{S-BDI})\) \((\text{Beck and Beck, 1972})\), previously validated in Finnish population studies \((\text{Kaltiala-Heino et al., 1999})\). The theoretical range of the scale was 0 – 39. An S-BDI score of five or more was classified as depressed \((16\%)\) \((\text{Beck and Beck, 1972})\).

Social disadvantage was assessed with questions related to marital status \((\text{single/divorced/widowed (24\%) vs. married/cohabiting})\) and loneliness. The loneliness scale was constructed using five statements scored on a 5-point scale \((\text{e.g. ‘There are people close to me, who support me’ and ‘I feel lonely’})\). Higher scores indicate loneliness \((\text{Cronbach’s alpha } = 0.85)\). The sum score was dichotomized into two categories: lonely \((27\%)\) and not lonely.

Unemployment was used to measure employment disadvantage. The subjects were asked about their current employment status and were divided into \((\text{a})\) unemployed, temporarily laid off \((\text{full-time/part-time})\), on a disability pension \((\text{full-time/part-time})\) or on an extended sick leave \((9\%)\) and \((\text{b})\) those who were not included in the previous categories.

Economic disadvantage was measured with questions related to home ownership and ability to cover expenses with income. The subjects reported on a 6-point scale how well they were able to cover expenses with all of their household income. The scale was dichotomized \((\text{very easy/easy/rather easy vs. rather difficult/difficult/very difficult (31\%)})\). The subjects were divided based on their home-ownership status into \((\text{a})\) owners and \((\text{b})\) renters/others \((17\%)\).

**Statistical analyses**

Heavy drinking trajectories were extracted using growth mixture modelling \((\text{Muthen, 2004})\). First the overall shape of
the heavy drinking growth curve from age 16 to 42 was examined with latent growth curve analysis using a logit link to model the categorical manifest heavy drinking variables. Trajectory classes were identified using latent class growth analysis (LCGA) (Nagin, 1999; Muthen and Muthen, 2000a). We used Bayesian information criterion (BIC) and the bootstrapped parametric likelihood ratio test (BLRT) to determine the optimal number of classes, although group sizes and interpretation were also considered. Due to some missing data we used the full information maximum likelihood technique to estimate the parameters. Each case was assigned to a trajectory group based on posterior probabilities of the most likely group membership and these group assignments were used in subsequent analyses.

Logistic regression analyses were carried out to examine how trajectory classes were linked to indicators of disadvantage at age 42. Analyses were made first without any adjustments and then controlling for measures of disadvantage at age 16 (self-perceived health, depressive symptoms, confiding support, relationship with mother and father, mean of school grades, parental unemployment and parental social class). All the control variables were dichotomized to indicate disadvantage and are described elsewhere in more detail (Huurre et al., 2003, 2007, 2010; Berg et al., 2011). Growth mixture modelling was implemented in MPlus version 5.1, while other analyses were performed using PASW 18 for Windows.

RESULTS

Description of heavy drinking trajectories

Table 1 presents the frequencies of heavy drinking by age and gender. At age 16, men and women did not differ by drinking patterns, but after adolescence men increased their heavy drinking more rapidly than women.

The overall shape of the heavy drinking growth curve was examined with latent growth curve analysis. A non-linear model (with two time loadings freely estimated) showed better fit (BIC = 9520.8) to the data than a linear model (BIC = 9752.8) or a model with quadratic growth factor (BIC = 9578.8), so the non-linear model was retained. The non-linear model indicated that in general heavy drinking increased considerably from age 16 to age 22, and continues to increase between ages 22 and 32, it stabilized thereafter, showing a slight decrease towards the age of 42.

The LCGA was used to test group solutions from two to seven classes. Using BIC and BLRT the best two solutions were those with five or six classes. Of these two, the six-class solution showed slightly better statistics, but the percentage sizes and interpretation were also considered. Due to some missing data we used the full information maximum likelihood technique to estimate the parameters. Each case was assigned to a trajectory group based on posterior probabilities of the most likely group membership and these group assignments were used in subsequent analyses. The trajectory groups are presented in Fig. 1.

A moderate trajectory (35%) meant a slight increase in frequency of heavy drinking from age 16 to 22 and a stable infrequent heavy drinking at ages 22–42 (Table 2). The moderate trajectory was the largest group for both women and men. A steady low trajectory (22%) was the second largest group for women and the second smallest for men. A steady high trajectory (23%) was the second largest group for men. In the decreasing trajectory (9%), heavy drinking declined from frequent in adolescence to infrequent or no heavy drinking. This drinking pattern was more common in women than men. In contrast, an increasing trajectory (11%), where frequency of heavy drinking grew from none to frequent from 16 to 32 years and remained frequent at 32–42 years, was more common in men than women. The frequencies of the trajectories differed statistically significantly by gender (P < 0.001).

The associations of trajectories with disadvantages at age 42

Logistic regression analyses were used to examine the relationship between trajectories and disadvantage outcomes at age 42 (Table 3). The moderate trajectory was selected as the reference category because it was the largest group for both genders.

Women in the steady high trajectory were at risk for almost all disadvantages studied at age 42. They perceived their health to be poorer and were more likely to be depressed, single, divorced or widowed, unemployed and renters. The associations remained statistically significant after controlling for age 16 covariates. Women of the steady high trajectory were more likely to have difficulties in covering their expenses with income, and women in the steady low trajectory had a reduced risk for depressive symptoms, but both of these associations were attenuated after adjustments. (Table 3).

Men in the increasing and steady high trajectories were more likely to have poor self-perceived health, but only the
Table 3. Logistic regression analysis predicting age 42 disadvantage from trajectory class membership in women and men

<table>
<thead>
<tr>
<th>Health</th>
<th>Women Model 1</th>
<th>Women Model 2</th>
<th>Men Model 1</th>
<th>Men Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor self-perceived health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Steady low</td>
<td>0.78 (0.50–1.22)</td>
<td>0.77 (0.48–1.23)</td>
<td>1.15 (0.58–2.29)</td>
<td>1.30 (0.62–2.72)</td>
</tr>
<tr>
<td>Decreasing</td>
<td>0.71 (0.36–1.37)</td>
<td>0.60 (0.30–1.21)</td>
<td>0.77 (0.30–1.96)</td>
<td>0.51 (0.19–1.38)</td>
</tr>
<tr>
<td>Increasing</td>
<td>1.04 (0.47–2.31)</td>
<td>0.96 (0.41–2.23)</td>
<td>1.96 (1.17–3.27)</td>
<td>1.77 (1.01–3.11)</td>
</tr>
<tr>
<td>Steady high</td>
<td>2.13 (1.32–3.44)</td>
<td>1.88 (1.12–3.17)</td>
<td>1.91 (1.22–3.00)</td>
<td>1.54 (0.93–2.56)</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Steady low</td>
<td>0.60 (0.35–0.99)</td>
<td>0.66 (0.39–1.12)</td>
<td>1.47 (0.61–3.52)</td>
<td>2.12 (0.84–5.34)</td>
</tr>
<tr>
<td>Decreasing</td>
<td>0.88 (0.45–1.73)</td>
<td>0.77 (0.38–1.54)</td>
<td>1.21 (0.39–3.77)</td>
<td>0.20 (0.03–0.67)</td>
</tr>
<tr>
<td>Increasing</td>
<td>1.12 (0.49–2.58)</td>
<td>0.89 (0.36–2.17)</td>
<td>1.95 (0.99–3.84)</td>
<td>2.46 (1.18–5.13)</td>
</tr>
<tr>
<td>Steady high</td>
<td>2.16 (1.31–3.57)</td>
<td>1.87 (1.09–3.22)</td>
<td>1.44 (0.77–2.69)</td>
<td>1.49 (0.73–3.06)</td>
</tr>
<tr>
<td>Loneliness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Steady low</td>
<td>0.98 (0.65–1.47)</td>
<td>1.05 (0.69–1.60)</td>
<td>0.72 (0.37–1.40)</td>
<td>0.77 (0.37–1.60)</td>
</tr>
<tr>
<td>Decreasing</td>
<td>0.83 (0.46–1.50)</td>
<td>0.64 (0.34–1.19)</td>
<td>1.06 (0.49–2.29)</td>
<td>1.03 (0.46–2.31)</td>
</tr>
<tr>
<td>Increasing</td>
<td>0.70 (0.31–1.60)</td>
<td>0.63 (0.27–1.47)</td>
<td>1.17 (0.71–1.92)</td>
<td>1.19 (0.69–2.03)</td>
</tr>
<tr>
<td>Steady high</td>
<td>1.10 (0.68–1.81)</td>
<td>0.87 (0.51–1.49)</td>
<td>0.98 (0.64–1.51)</td>
<td>0.96 (0.59–1.56)</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Steady low</td>
<td>1.32 (0.65–2.71)</td>
<td>1.13 (0.52–2.44)</td>
<td>1.51 (0.59–3.82)</td>
<td>2.81 (0.98–8.03)</td>
</tr>
<tr>
<td>Decreasing</td>
<td>1.33 (0.50–3.56)</td>
<td>0.95 (0.34–2.67)</td>
<td>2.79 (1.06–7.34)</td>
<td>1.80 (0.59–5.45)</td>
</tr>
<tr>
<td>Increasing</td>
<td>0.86 (0.19–3.88)</td>
<td>0.95 (0.20–4.38)</td>
<td>1.24 (0.56–2.75)</td>
<td>1.04 (0.39–2.74)</td>
</tr>
<tr>
<td>Steady high</td>
<td>3.47 (1.71–7.06)</td>
<td>2.37 (1.08–5.20)</td>
<td>1.55 (0.80–3.00)</td>
<td>1.43 (0.63–3.25)</td>
</tr>
<tr>
<td>Economic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inability to cover expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Steady low</td>
<td>1.18 (0.81–1.73)</td>
<td>1.12 (0.75–1.68)</td>
<td>1.11 (0.56–2.21)</td>
<td>1.15 (0.55–2.42)</td>
</tr>
<tr>
<td>Decreasing</td>
<td>0.91 (0.52–1.59)</td>
<td>0.71 (0.39–1.29)</td>
<td>0.58 (0.21–1.59)</td>
<td>0.50 (0.18–1.41)</td>
</tr>
<tr>
<td>Increasing</td>
<td>1.56 (0.79–3.09)</td>
<td>1.65 (0.81–3.35)</td>
<td>1.85 (1.11–3.08)</td>
<td>1.99 (1.15–3.45)</td>
</tr>
<tr>
<td>Steady high</td>
<td>1.79 (1.13–2.81)</td>
<td>1.48 (0.91–2.43)</td>
<td>1.94 (1.24–3.02)</td>
<td>1.76 (1.08–2.89)</td>
</tr>
<tr>
<td>Renter or other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Steady low</td>
<td>0.96 (0.57–1.60)</td>
<td>0.87 (0.50–1.51)</td>
<td>1.37 (0.58–3.29)</td>
<td>1.69 (0.64–4.44)</td>
</tr>
<tr>
<td>Decreasing</td>
<td>0.97 (0.47–2.00)</td>
<td>0.74 (0.35–1.59)</td>
<td>2.19 (0.85–5.63)</td>
<td>1.75 (0.61–4.51)</td>
</tr>
<tr>
<td>Increasing</td>
<td>1.49 (0.64–3.48)</td>
<td>1.37 (0.55–3.44)</td>
<td>2.07 (1.07–3.98)</td>
<td>2.17 (1.05–4.49)</td>
</tr>
<tr>
<td>Steady high</td>
<td>3.24 (1.93–5.46)</td>
<td>2.72 (1.55–4.79)</td>
<td>2.28 (1.29–4.04)</td>
<td>2.18 (1.12–4.21)</td>
</tr>
</tbody>
</table>

DISCUSSION

In this study we found five distinct heavy drinking trajectories and the proportions of trajectories as well as associations with disadvantage differed by gender. Women in the steady high heavy drinking trajectory had an increased risk of experiencing many disadvantages at age 42. In men, increasing and steady high trajectories had an increased risk of experiencing health and economic disadvantage. Most of the associations remained when adjusting for disadvantage at age 16. We found trajectories similar to those found in previous studies based on shorter follow-up times (Hill et al., 2000; Maggs and Schulenberg, 2005b; Jackson et al., 2008). At the
population level adolescent experimenters have been seen to ‘naturally recover’ from the earlier heavy drinking (Muthen and Muthen, 2000b). The moderate trajectory, the most prevalent trajectory in our study, in part reflects this phenomenon. This study, however, shows that many, especially men, do not mature out of heavy drinking. Several issues such as changes in marital status, economic situation or negative life events can affect the individual drinking trajectory (Curran et al., 1998; Dawson et al., 2006; Rolfe et al., 2009). Gender differences may be due to family formation and women’s stronger social pressures to adapt to parental roles (Holmila and Raitasalo, 2005).

The steady high trajectory in women and increasing trajectory in men were associated with poor health and depression at age 42. Few other earlier trajectory studies that have examined health outcomes have had inconsistent results (Hill et al., 2000; Tucker et al., 2005; Hicks et al., 2010). Differences in results might be due to different alcohol measures or reference groups. It is also possible that the association between heavy drinking and health might be blurred in young adulthood when many still experiment with drinking, and become more visible in mid-adulthood, when heavy drinking has persisted longer.

Previous studies (Schulenberg et al., 1996; Hicks et al., 2010) have found persistent heavy drinking to be associated with being separated, divorced or having never married. We found this association only in women. The decreasing trajectory reduced the risk for being single, divorced or widowed in men. This could indicate a group of men who drink heavily in adolescence, but then adapt to adult roles (husband, father). Men in the steady low trajectory were at risk of being single, divorced or widowed. This might express the notable role that alcohol use often has in social relations and meeting new people (Kuntsche et al., 2005). There is some evidence that the discrepancies in drinking patterns between spouses are more important than a history of problem drinking as such in increasing the probability of divorce (Ostermann et al., 2005).

Women in the steady high trajectory had an increased risk of unemployment. Heavy drinking can cause low productivity and absenteeism, which in turn can affect employment status. We did not find this association in men, which is consistent with a study by Hicks et al. (2010). Instead we found out that men in the decreasing trajectory had an increased risk of being unemployed, although the association was attenuated when disadvantage in adolescence was adjusted for. Gaining sufficient education is usually a precondition for beginning the employment path. It might be that heavy drinking in adolescence has disrupted one’s educational path with long-term consequences.

In our study men in the increasing and steady high trajectories had a risk of having difficulties covering their expenses. Hicks et al. (Hicks et al., 2010) did not find associations between alcohol abuse/dependence trajectories and income in men. Differences in results might exist because heavily drinking adolescents enter the workforce early and at first earn more money than low drinkers (Newcomb, 1996; Kouvonnen and Lintonen, 2002), but as the follow-up reaches mid-adulthood, the associations of income with heavy drinking might first disappear and then become reversed.

The possible mechanisms behind above-mentioned associations vary. The relationship between drinking and disadvantage can be bidirectional; drinking may indicate disadvantage in other dimensions of life while on the other hand heavy drinking may cause disadvantage. This study examined the associations between heavy drinking trajectories and disadvantage only at age 42. However, it is possible that trajectories are associated with disadvantage already earlier in life. It is likely that different factors indicating disadvantage act as a chain of exposures, where one element of disadvantage follows another. These exposures or risk factors appear through the life course and may accumulate (Rutter and Madge, 1976), thus interfering with developmental paths.

For women the steady high trajectory indicated disadvantage most often. For men the results were not as consistent. Heavy drinking might be more commonly accepted in men (Holmila and Raitasalo, 2005) and it does not lead to disadvantage as easily as for women. Another explanation is methodological; we used the same measures for women and men, even though risks and consequences might be different (Holmila and Raitasalo, 2005).

Some trajectory studies have raised the question of how to distinguish the long-term effects of an early onset from those of a persistent pattern of heavy drinking. Usually those with persistent drinking trajectories are also subject to other risk factors (e.g. Kestilä et al., 2008). In our study moderate and decreasing trajectories did not differ substantially. Thus, indicating that consequences of adolescence heavy drinking do not seem to continue into adulthood, if heavy drinking is reduced.

Methodological considerations

The analysis of attrition showed that heavy drinking was more common within the non-participant group. Therefore, it is possible that frequencies of trajectories and associations with disadvantage would be different from those found in this study.

The reference categories in studies on alcohol trajectories predicting later outcomes have consistently been non-heavy drinkers or steady low trajectories. This is perhaps justified when study participants are adolescents and it is illegal to use alcohol, but might be problematic when extending to adult behaviour. A moderate amount of alcohol use within adults can be seen as general behaviour and commonly accepted. Because of the methodological design of previous trajectory studies, it might be possible that some associations relating to non-heavy drinkers have been missed.

This present study highlights that steady high drinkers among women and steady high and increasing drinkers among men were the groups that indicated the highest risk for disadvantage in mid-adulthood, which is in accordance with our hypothesis. It seems that the persistence of heavy drinking is associated with later disadvantage and not heavy drinking that takes place only in adolescence. Therefore, identification of groups in the greatest risk for disadvantage is crucial. Also multiple approaches, such as age-specific interventions, to prevention are needed.

Acknowledgements — The authors thank Maiju Pankakoski for providing statistical advice.

Funding — This work was supported by The Finnish Foundation for Cultural Studies (to N.B.), the Juho Vainion Foundation (to N.B.), the Doctoral Programs in Public Health (to N.B.), and the Juho Vainion Foundation (to N.B.).
Hicks BM, Iacono WG, McGue M. (2004) Characteristics of binge drink-
Lintonen T, Rimpelä M. (2001) The validity of the concept of ‘self-
driven drunkenness’ in adolescent health surveys. J Subst
Use 6:145–50.
Maggis JL, Schulenberg JE. (2005a) Initiation and course of alcohol
consumption among adolescents and young adults. Recent Dev
Alcohol 17:29–47.
Maggis JL, Schulenberg JE. (2005b) Trajectories of alcohol use
of late adolescent alcohol consumption: a systematic review of
ing and related techniques for longitudinal data. In Kaplan D
(ed), The Sage Handbook of Quantitative Methodology for the
Social Sciences. Thousand Oaks, California: Sage Publications,
Inc., 345–68.
Muthen B, Muthen LK. (2000a) Integrating person-centered and
variable-centered analyses: growth mixture modeling with latent
Muthen BO, Muthen LK. (2000b) The development of heavy drink-
ing and alcohol-related problems from ages 18 to 37 in a U.S.
Nagin DS. (1999) Analyzing developmental trajectories: a semi-
parametric, group-based approach. Psychol Methods 4:139–57.
Newcomb MD. (1996) Pseudomaturity among adolescents: con-
struct validation, sex differences, and associations in adulthood.
Ostmann J, Sloan FA, Taylor DH. (2005) Heavy alcohol use and
Power C, Rodgers B, Hope S. (1999) Heavy alcohol consumption and
marital status: disentangling the relationship in a national
Drinkers Project. Final Report, Birmingham: Department of
Health.
Heinemann.
Schuckit MA, Smith TL. (2011) Onset and course of alcoholism
over 25 years in middle class men. Drug Alcohol Depend
113:21–8.
Schulenberg JE, Maggs JL. (2008) Destiny matters: distal develop-
mental influences on adult alcohol use and abuse. Addiction
103:1–6.
Schulenberg J, O’Malley PM, Bachman JG et al. (1996) Getting
drunk and growing up: trajectories of frequent binge drinking
during the transition to young adulthood. J Stud Alcohol
57:289–304.
Sher KJ, Jackson KM, Steinley D. (2011) Alcohol use trajectories and
the ubiquitous cat’s cradle: cause for concern? J Abnorm
Psychol 120:322–35.
Tucker JS, Ellickson PL, Orlando M et al. (2005) Substance use
trajectories from early adolescence to emerging adulthood: a
comparison of smoking, binge drinking, and marijuana use. J
Cambridge: Massachusetts: Harvard University Press.

Conflict of interest statement. None declared.