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**To cite this article:** Riittakerttu Kaltiala-Heino, Sari Fröjd & Mauri Marttunen (2015) Depression, conduct disorder, smoking and alcohol use as predictors of sexual activity in middle adolescence: a longitudinal study, Health Psychology and Behavioral Medicine, 3:1, 25-39, DOI: [10.1080/21642850.2014.996887](https://doi.org/10.1080/21642850.2014.996887)

**To link to this article:** <https://doi.org/10.1080/21642850.2014.996887>



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Published online: 09 Jan 2015.



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## Depression, conduct disorder, smoking and alcohol use as predictors of sexual activity in middle adolescence: a longitudinal study

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(Received 5 October 2014; accepted 7 December 2014)

**Objective:** To study associations between emotional and behavioural symptoms and later engagement in sexual behaviours in middle adolescence. **Materials and methods:** All ninth graders in two Finnish cities were recruited to respond to a questionnaire focusing on mental health and disorders, health behaviours and risk and protective factors (T1), and a follow-up survey two years later (T2). The baseline sample (94.4% of all eligible) comprised 1609 girls and 1669 boys, with mean age of 15.5 years (SD 0.39). A total of 2070 adolescents completed the survey at both T1 and T2. The response rate of the final sample was 63.1% (2070/3278). Of the respondents, 56.6% were girls. Experience of intercourse and number of partners for intercourse were elicited at age 17. Depression was measured with the 13-item Beck Depression Inventory, conduct disorder with the Youth Self-Report, and smoking and alcohol consumption with questions widely used in Finnish adolescent health surveys. The data were analysed using cross-tabulation with chi square statistics for classified variables and *t*-test for continuous variables. Logistic regression was used to study multivariate associations. **Results:** Depression, conduct disorder, smoking and drinking at age 15 were associated with having experienced intercourse by age 17 (odds ratios (ORs) 1.8–10.3) and with multiple partners for intercourse by age 17 (ORs: 2.4–4.7) among girls. In boys, frequent alcohol use and smoking at age 15 (ORs: 2.2 and 4.6) were associated with experience of intercourse by age 17, and these and conduct disorders at age 15 with multiple partners for intercourse by age 17 (ORs: 2.8–3.2). **Conclusion:** Emotional and behavioural disorders in middle adolescence are associated with sexual activity and risk-taking sexual behaviours later in the developmental phase.

**Keywords:** depression; conduct disorder; substance use; sexual behaviour; adolescence

### Introduction

In adolescence, sexual development accelerates, with rapid changes to adolescents' bodies. Young people's experiences of a changing body, sexuality and developing gender identity affect intrapersonal, relational and societal interactions (Romeo & Kelley, 2009). First intercourse is often characterized as sexual debut, and, when occurring during adolescent development, is seen both as normative development and as a form of problem behaviour (Madkour, Farhat, Halpern, Godeau, & Gabhainn, 2010). Intercourse exposes the adolescent to the risk of unwanted

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pregnancy and sexually transmitted diseases, which are more likely with sexual initiation at younger ages (Edgardh, 2000, 2002; Kotchick, Shaffe, & Forehand, 2001; O'Donnell, O'Donnell, & Stueve, 2001). Due to the physical and emotional immaturity of the adolescents, the consequences of these are also likely to be particularly harmful. The vast majority of adolescents across Western countries experience intercourse before the age of 20, but of adolescents aged 15, only one in ten to a third of girls and one in five to a third of boys report having experienced intercourse in European countries and the USA (Eaton et al., 2010; Hubert, Bajos, & Sandfort, 1998; Madkour et al., 2010).

During early and middle adolescence, empirical studies have associated sexual debut and risk-taking sexual behaviours with a variety of problem behaviours, such as substance use, delinquency and school-related problems, and with negative family factors such as low socio-economic, not living with both parents, family disruption and inadequate parental control (Kotchick et al., 2001; Madkour et al., 2010; Wight, Williamson, & Henderson, 2006). Adolescents may engage in sexual behaviours for negative reasons such as peer pressure or pressure from romantic partner, substance abuse or negative family circumstances, or as an attempt to achieve transition to adulthood. Hence, sexual debut may rather become a negative life event than represent a favourable transition step towards adulthood (Dickson, Paul, Herbison, & Silva, 1998; Goodson, Evans, & Edmundson, 1997; Kotchick et al., 2001; Madkour et al., 2010; Rosenthal, Smith, & de Visser, 1999; Wight et al., 2006).

Early coitarche has been associated with childhood and adolescent conduct disorders that also tend to intensify after sexual debut. Depression, suicidality and various risk-taking behaviours are more common among sexually active middle adolescents, not to mention early adolescents. Substance use disorders, antisocial behaviour and schizophrenia but also depression in late adolescence have been associated with risk-taking sexual behaviours and early sexual debut, and adolescents with severe mental disorders have retrospectively reported early coitarche (Hallfors et al., 2004; Heidmets et al., 2010; Ramrakha, Caspi, Dickson, Moffitt, & Paul, 2000; Tubman, Windle, & Windle, 1996). In a large middle adolescent sample, depression (Kaltiala-Heino, Kosunen, & Rimpelä, 2003) and bulimia (Kaltiala-Heino, Rissanen, Rimpelä, & Rantanen, 2001) were the more common the more advanced sexual experiences the adolescents reported. This held true among both girls and boys, and when pubertal timing, age, family structure and socioeconomic status were controlled for. Moreover, depression was more common the greater the number of partners the adolescents reported for intercourse (Kosunen, Kaltiala-Heino, Rimpelä, & Laippala, 2003).

Early maturing adolescents experience intercourse younger and engage in risk-taking sexual behaviour more frequently than their peers whose maturing is average or late (Downing & Bellis, 2009; Edgarh, 2002; Ethier et al., 2006). Early puberty is also associated with both emotional and behavioural disorders among adolescent girls and boys (Kaltiala-Heino, Koivisto, Marttunen, & Fröjd, 2011; Kosunen et al., 2003). Therefore, it is important to control for pubertal timing when associations between mental disorders and sexual behaviour are studied among adolescents.

Hallfors, Walter, Bauer, Ford, and Halpern (2005) reported that sexual activity in adolescence was predictive of later depression, but not vice versa. Otherwise, earlier studies that have associated sexual debut during adolescent development with mental disorders have mainly been cross-sectional or have surveyed young adults retrospectively (Hallfors et al., 2004; Heidmets et al., 2010; Kotchick et al., 2001; Madkour et al., 2010; Ramrakha et al., 2000; Tubman et al., 1996; Wight et al., 2006). In order to better understand the role of mental disorders in adolescent sexual behaviours, longitudinal associations need to be studied in follow-up data. Emotional and behavioural disorders greatly overlap in adolescence, but research on mental disorders and sexual behaviours has mainly not taken this into account but has focused on one type of disorders at a time.

The aim of this study was to analyse longitudinal and concurrent associations between emotional and behavioural disorders and sexual behaviour in middle adolescent population. Given the existing findings that more advanced sexual experiences in early and middle adolescence are cross-sectionally associated rather with poor than positive mental health, we hypothesized that internalizing and externalizing symptoms earlier in adolescent development would predict experience of intercourse and risk-taking sexual experiences later during the developmental phase. In more detail the study questions were

- (1) Are depression, conduct disorder and substance use at age 15 predictive of having experienced intercourse by age 17?
- (2) Are depression, conduct disorder and substance use at age 15 predictive of having experienced intercourse with multiple partners by age 17?

## Materials and methods

### *Study samples and procedures*

This study is part of an ongoing prospective cohort study, the Adolescent Mental Health Cohort (AMHC) study conducted in two Finnish cities, Tampere (200,000 inhabitants) and Vantaa (180,000 inhabitants). Data collection, procedures and measures of the study have been reported in detail elsewhere (Fröjd, Marttunen, Pelkonen, von der Pahlen, & Kaltiala-Heino, 2006; Ritakallio, Koivisto, Pelkonen, Marttunen, & Kaltiala-Heino, 2008). Briefly, a school survey completed by the ninth graders in all Finnish-speaking secondary schools in the two cities was arranged for data collection at T1. During a school lesson and under the supervision of a teacher subjects completed a person-identifiable survey. Another opportunity to participate was offered in the school for those absent from school on the original survey day, followed by a postal survey twice if still not reached. Eligible participants at T2 were students who had participated at T1. We organized school-based surveys at T1 in upper secondary schools and vocational schools followed by postal survey finally by offering the survey by Internet.

The subjects of the present study were students responding to a survey conducted during 2002–2003 (T1) and at two-year follow-up during 2004–2005 (T2). The baseline sample (94.4% of all eligible) comprised 1609 girls and 1669 boys. The mean age was 15.5 years (SD 0.39). Of the respondents, 71% were living in two-parent families. The distribution of the subjects' parents' highest education was (father/mother): 16%/13% basic compulsory education only, 40%/30% basic compulsory education and vocational school, 17%/31% upper secondary school with or without vocational school, and 28%/26% academic degree (Fröjd et al., 2006). A total of 2070 adolescents completed the survey at both T1 and T2. The response rate of the final sample was 63.1% (2070/3278). Of the respondents, 56.6% were girls. The mean age at T2 was 17.6 years (SD 0.4).

### *Measures*

#### *Sexual behaviour*

Sexual experiences were elicited at age 17 by asking “Have you ever had sexual intercourse?” (yes/no), and further by asking “With how many partners have you had sexual intercourse?” (one/two/three/four/five or more). In the analyses, the number of partners was dichotomized to five or more/none to four, with five or more in this age indicating risk-taking sexual behaviour. Earlier Finnish research on adolescent sexual behaviour has similarly used five or more partners to intercourse as indicator of risk-taking sexual activity in middle adolescence (Kosunen et al., 2003).

### *Depression*

A Finnish modification of the 13-item Beck Depression Inventory (BDI) (Raitasalo, 2007) was used to assess depression at ages 15 and 17 (Beck & Beck, 1972; Beck, Rial, & Rickels, 1974). Brief BDI is a widely used self-report scale measuring the severity of depressive symptoms, and its reliability and validity are good (Bennett et al., 1997). The BDI has been shown to be appropriate for measuring depression in adolescents in population studies (Kaltiala-Heino, Rimpelä, Rantanen, & Laippala, 1999; Raitasalo, 2007). Each item is scored 0–3 according to the severity of the symptom. Sum scores of 13 items (range 0–39) were dichotomized to no/mild depression (scores 0–7), and moderate/severe depression (scores 8–39) (Beck & Beck, 1972). In this study, we classify those scoring 8 or more as presenting with depression, or being depressed. The cut-point of 8 predicts a diagnosis of depression by structured interview Schedules for Clinical Assessment in Neuropsychiatry with good sensitivity (0.93) and specificity (0.88) (Fountoulakis et al., 2003).

### *Frequent alcohol use*

Frequency of drinking alcoholic beverages was elicited: “How often do you drink alcoholic beverages?” (once a week or more often/approximately once or twice a month/less often/never). In the analyses we dichotomized alcohol use frequency to once a week or more often vs. less frequently. Those who report drinking once a week or more often are considered frequent alcohol users.

### *Smoking*

At baseline the adolescents were asked “How many cigarettes, pipes or portions of snuff have you consumed so far?” The response alternatives were none/1/2–50/more than 50. A further question was asked “What best describes your current smoking?” with response alternatives daily/weekly/less than weekly/has stopped smoking. Based on these two questions, the adolescents were dichotomized to daily smokers (has smoked more than once, reports now smoking daily) vs. those who smoke less than daily or not at all (all other alternatives). At follow-up smoking was elicited as “What best describes your current smoking?” The response alternatives were smoking daily/weekly/less than weekly/has stopped smoking/has never smoked, and in the analyses they were dichotomized to smoking daily vs. less or not at all. Thus, at both ages 15 and 17 we focus on daily smoking.

### *Conduct disorder*

Conduct disorder was measured by the delinquency and aggression scales of the Youth Self-Report (YSR) (Achenbach, 1991). The 90th percentile was used as a cut-point to distinguish adolescents with significant conduct problems in this population, separately for girls and boys. Although the YSR is a method based on self-reported symptoms, it has been demonstrated that high scores on the YSR externalizing scale are predictive of clinical conduct disorder diagnosis with considerable sensitivity and specificity (Morgan & Cauce, 1999). In the present data, the cut-off score for being classified as displaying conduct disorder was 23 for girls and 24 for boys at age 15, and 21 for girls and 22 for boys at ages 17.

Depression, frequent alcohol use, daily smoking and conduct disorder at ages 15 and 17 were strongly intercorrelated (data not shown). This was taken into account in the multivariate analyses (see below).

### ***Covariates***

Age and pubertal timing were included in the analyses as covariates. Age was calculated from dates of birth and data collection and was used as a continuous variable expressed in years. Pubertal timing was measured by age at menarche/oigarche by asking: How old were you when you first had your periods/experienced ejaculation? The response alternatives were 10 years or less/11/12/13/14/15 or older/I have not yet. In the analyses pubertal timing was classified according to age at menarche/oigarche to early (11 years or earlier), normative (12–13 years) and late (14, 15 or later and not yet).

### ***Attrition***

Altogether 28% of the girls and 46% of the boys responding to the baseline survey dropped out of follow-up. Not responding at follow-up was associated with increased depression, conduct disorder and substance abuse behaviours in the baseline survey (Fröjd, Kaltiala-Heino, & Marttunen, 2011; Kaltiala-Heino et al., 2011). Responding was not associated with pubertal timing in girls, whereas non-normative pubertal timing was associated with lower probability of responding in boys (early 50%, normative 59%, late 49%;  $p = .001$ ). Higher age was associated with lower probability of responding ( $p < .001$ ).

### ***Statistical analyses***

Frequency distributions of all variables studied are given. Bivariate associations between sexual behaviour at age 17 (having experienced intercourse, having had intercourse with five or more partners) and the mental health variables studied as well as with the covariates were studied using cross-tabulation with chi square statistics for classified variables and t-test for continuous variables. We used multivariate logistic regression analyses to investigate the associations. Having had intercourse at age 17 and having had intercourse with five or more partners at age 17 were used in each turn as the dependent variable. Independent variables used were depression, daily smoking, frequent alcohol use and conduct disorder at ages 15 and 17. First, depression at 15 and at 17 (and similarly: daily smoking at 15 and 17, frequent alcohol use at 15 and 17, conduct disorder at 15 and 17) were entered into the analysis controlling for age and age of menarche/oigarche. Because depression, daily smoking, frequent alcohol use and conduct disorder are likely to be intercorrelated, in the next phase all of these at age 15 were entered simultaneously into the logistic regression analysis, controlling for age and age at menarche/oigarche. Finally, the role of current depression, daily smoking, frequent alcohol use and conduct disorder was controlled for by adding these into the analyses at age 17. The results of the logistic regression analyses are reported giving Odds ratios (ORs) with 95% confidence intervals (95% CI). The goodness of fit of the logistic regression models was tested with Hosmer–Lemeshow goodness-of-fit test. All the analyses were carried out separately for girls and boys.

### ***Ethical considerations***

The study was granted approval by the Ethics Committee of Pirkanmaa Hospital District. The subjects gave written informed consent after being informed about the study and the voluntariness of participation. Their parents were informed in advance by letter, but parental consent was not obtained because the Finnish legislation on medical research allows minors from 15 years to consent alone.

## Results

A greater proportion of girls than of boys had experienced intercourse ( $p < .001$ ) and reported five or more partners for intercourse by age 17 ( $p = .009$ ). Depression was more common among girls both at age 15 ( $p < .001$ ) and at age 17 ( $p = .001$ ). Frequent alcohol use did not differ by sex at age 15, but at age 17 boys reported frequent alcohol use more often than girls ( $p = .001$ ). Daily smoking was equally common in both sexes at both time points (Table 1).

Table 1. Distribution of sexual behaviours, depression, frequent alcohol use and daily smoking at ages 15 and 17, and age at menarche/oigarche as well as mean (s.d.) age at baseline among the participants of the AMHC study (%).

	Girls ( $n = 1167$ )	Boys ( $n = 903$ )
Has experienced intercourse at age 17		
Yes	57.6	42.0
No	39.9	51.9
Missing	2.5	6.1
Has experienced intercourse with five or more partners at age 17		
Yes	14.5	11.0
No	83.0	82.9
Missing	2.5	6.1%
Depression at age 15		
Yes	11.8	6.0
No	88.0	93.5
Missing	0.5	0.6
Depression at age 17		
Yes	10.3	6.3
No	89.5	92.8
Missing	0.2	0.9
Frequent alcohol use at age 15		
Yes	9.1	10.9
No	90.6	88.9
Missing	0.3	0.2
Frequent alcohol use at age 17		
Yes	15.9	26.0
No	83.7	73.1
Missing	0.4	0.9
Daily smoking at age 15		
Yes	20.4	19.7
No	78.7	79.1
Missing	0.9	1.2
Daily smoking at age 17		
Yes	25.4	25.6
No	74.1	73.5
Missing	0.4	0.9
Age at menarche/oigarche		
11 or less	19.7	17.5
12–13	63.3	57.6
14 or more/not yet	16.7	20.7
Missing	0.3	4.2
Age at baseline (in years) mean (s.d.)	15.5 (0.36)	15.5 (0.36)

Note: As conduct disorder was defined as the 90th percentile of the sum score of CBCL delinquency + aggression scales, its prevalence is always 10%.

**Bivariate analyses**

Of early maturing boys, 60.0% had experienced intercourse at age 17, compared to 46.2% of normative maturers and 28.2% of late maturers ( $p < .001$ ). Early maturing boys also more often reported having had five or more partners for intercourse at age 17 (19.6% vs. 10.8% vs. 4.8%,  $p < .001$ ). Among girls, experience of intercourse was more common the earlier they had experienced menarche (66.5% vs. 61.3% vs. 43.0%,  $p < .001$ ), and so was having had five or more partners for intercourse (25.7% vs. 13.8% vs. 4.6%,  $p < .001$ ). Among girls, experience of intercourse at age 17 was not associated with age at baseline. Among boys, intercourse by age 17 was associated with slightly older age at baseline (15.53 (0.34) vs. 15.46 (0.36) years,  $p = .003$ ). Having had five or more partners by age 17 was not associated with age at baseline in either sex.

Experience of intercourse and reporting five or more partners for intercourse were more common among those girls and boys who had presented with conduct disorder, reported daily smoking or frequent alcohol use at age 15. In girls, these experiences were also more common among those who had suffered depression at age 15. Current depression, conduct disorder, daily smoking and frequent alcohol use were similarly associated with experience of intercourse as well as with reporting five or more partners for intercourse at age 17 among girls, and all except current depression also among boys (Table 2).

Table 2. Experience of intercourse at age 17, and reporting five or more partners for intercourse by age 17, according to depression, daily smoking, frequent alcohol use and conduct disorder at ages 15 and 17 among Finnish girls and boys (%).

	Girls				Boys			
	Has experienced intercourse at age 17 years (%)	<i>p</i>	Five or more partners for intercourse lifetime (%)	<i>p</i>	Has experienced intercourse at age 17 years (%)	<i>p</i>	Five or more partners for intercourse lifetime (%)	<i>p</i>
Depression at age 15		<.001		.001		.156		.227
Yes	76.9		23.9		51.9		14.8	
No	56.6		13.2		44.0		10.7	
Depression at age 17		.03		.009		.408		.082
Yes	67.2		22.5		42.1		17.5	
No	58.1		13.7		44.7		10.5	
Daily smoking at 15		<.001		<.001		<.001		<.001
Yes	93.9		39.5		78.9		29.2	
No	50.2		8.2		36.4		6.4	
Daily smoking at 17		<.001		<.001		<.001		<.001
Yes	89.9		36.0		74.9		25.5	
No	42.6		7.2		34.5		6.0	
Frequent alcohol use at 15		<.001		<.001		<.001		<.001
Yes	92.1		44.3		76.4		34.7	
No	56.0		11.6		41.0		8.1	
Frequent alcohol use at 17		<.001		<.001		<.001		<.01
Yes	89.0		38.8		70.8		24.3	
No	53.3		10.2		35.5		6.4	
Conduct disorder at 15		<.001		<.001		<.001		<.001
Yes	86.5		12.1		63.4		32.6	
No	56.1		36.1		42.7		8.5	
Conduct disorder at 17		<.001		<.001		<.001		<.001
Yes	72.2		36.1		63.9		24.4	
No	57.0		12.1		42.9		9.3	

### ***Multivariate analyses predicting experience of intercourse***

When entered into the logistic regression analysis without the other symptoms/behaviours but after controlling for age and age at menarche, depression at age 15 was associated with increased OR for experiencing intercourse by age 17 (OR 2.4, 95% CI 1.5–3.8,  $p < .001$ ) among girls. Current depression was not statistically significantly associated with intercourse (Hosmer–Lemeshow goodness of fit 0.830). Conduct disorder at age 15 was associated with experience of intercourse by age 17 (OR 4.0, 95% CI 2.2–7.1,  $p < .001$ ), and current conduct disorder was also statistically significantly associated with experience of intercourse (OR 1.9, 95% CI 1.2–3.1,  $p = .01$ ) (HL 0.355). Both past (OR 5.8, 95% CI 3.2–10.8,  $p < .001$ ) and present (OR 4.7, 95% CI 3.0–7.6) daily smoking increased the OR for having experienced intercourse at age 17 (HL goodness of fit 0.472), as did past (OR 5.8 (2.7–12.3),  $p < .001$ ) and present (OR 6.8 (4.0–11.3),  $p < .001$ ) frequent alcohol use (HL 0.970).

When entered together, and controlling for age and age at menarche, depression, smoking, frequent alcohol use and conduct disorder at age 15 all persisted as associated with having had experience of intercourse at age 17 (Table 3). Adding the current symptoms/behaviours levelled out the predictive association of frequent alcohol consumption at age 15, but also resulted in essentially poorer goodness of fit of the model (Hosmer–Lemeshow goodness of fit 0.02).

Among boys, depression at age 15 and at age 17 did not increase the OR of having experienced intercourse at age 17, when entered into a logistic regression model and controlling for age and age at oigarche. Daily smoking at both age 15 (OR 2.9, 95% CI 1.7–4.8,  $p < .001$ ) and at age 17 (OR 3.1, 95% CI 2.0–4.9,  $p < .001$ ) was associated with having had intercourse by age 17 (HL 0.206), as was frequent alcohol use at age 15 (OR 2.5, 95% CI 1.4–4.5,  $p = .001$ ) and at 17 (OR 3.4, 95% CI 2.4–5.0,  $p < .001$ ) (HL 0.430). Conduct disorder at age 15 proved associated with intercourse by age 17 (OR 2.0, 95% CI 1.2–3.4), but current conduct disorder was not associated with having experienced intercourse at age 17 among boys (HL 0.221).

When independent variables were entered simultaneously, daily smoking at age 15 and frequent alcohol use at age 15 were associated with intercourse by age 17, but depression and conduct disorder at age 15 were not (Table 3). The longitudinal associations between daily smoking and frequent alcohol use at age 15 and intercourse by age 17 persisted when symptoms at age 17 were added to the model (HL for model with all the variables was 0.829).

### ***Multivariate analyses predicting multiple partners for intercourse***

Among girls, previous depression and current depression were not associated with having experienced intercourse with five or more partners at age 17, when entered in a logistic regression model after controlling for age and age at menarche. Past (OR 3.3, 95% CI 2.1–5.2) and present (OR 2.7, 95% CI 1.7–4.4) conduct disorder was associated with reporting five or more partners for intercourse (Hosmer–Lemeshow goodness of fit 0.639), as were past (OR 2.9, 95% CI 1.8–4.5) and present (OR 3.8, 95% CI 2.4–6.0) smoking (HL 0.252) and past (OR 3.6, 95% CI 2.2–5.7) and present (OR 4.2, 95% CI 2.8–6.2) frequent alcohol use (HL 0.686).

When all the symptoms and behaviours studied at age 15 were entered into the model simultaneously, and after controlling for age and age at menarche, intercourse with five or more partners by age 17 was among girls predicted by conduct disorder, daily smoking and frequent alcohol use at age 15 (Table 3). These associations also persisted when current symptoms and behaviours were added into the model (Hosmer–Lemeshow goodness of fit for the model including both past and present symptoms: 0.613).

Among boys, past (OR 4.0, 95% CI 2.3–7.1) and present (OR 2.0, 95% CI 1.1–3.6) conduct disorder (HL 0.393), past (OR 2.7, 95% CI 1.5–4.9) and present (OR 2.8, 95% CI 1.6–5.1)

Table 3. Risk (OR, 95% CI) for having experienced intercourse, and for reporting five or more partners for intercourse by age 17 according to depression, conduct disorder, frequent alcohol use and daily smoking at age 15, among Finnish adolescent girls and boys.

	Experience of intercourse by age 17				Intercourse with five or more partners by age 17			
	Girls		Boys		Girls		Boys	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Age	1.2 (0.8–1.8)	.36	1.9 (1.2–2.9)	.006	0.8 (0.5–1.4)	.5	1.1 (0.6–2.0)	.8
Age at menarche/oigarche		<.001		<.001		<.001		.02
11 or less	2.1 (1.4–3.2)		2.8 (1.7–4.6)		6.6 (2.9–14.7)		2.9 (1.3–6.6)	
12–13	2.0 (1.4–2.8)		1.8 (1.2–8.7)		3.2 (1.5–7.0)		1.6 (0.7–3.4)	
14 or more	ref		ref		ref		ref	
Depression	1.8 (1.1–2.9)	.02	1.0 (0.5–1.9)	.9	1.0 (0.6–1.8)	.9	0.6 (0.2–1.7)	.4
Conduct disorder	2.6 (1.4–2.8)	.002	1.7 (0.7–2.2)	.5	2.4 (1.5–3.9)	.001	2.8 (1.5–5.2)	.001
Frequent alcohol use	3.1 (1.4–6.9)	.005	2.2 (1.2–4.0)	.01	2.4 (1.5–3.9)	.001	2.5 (1.4–4.5)	.003
Daily smoking	10.3 (5.8–18.3)	<.001	4.6 (2.9–7.3)	<.001	4.7 (3.2–7.0)	<.001	3.2 (1.9–5.5)	<.001
Hosmer–Lemeshow goodness of fit	0.837		0.123		0.357		0.027	

Note: The independent variables studied were entered into the model simultaneously after controlling for age and age at menarche/oigarche.

smoking (HL 0.071), and past (OR 3.3, 95% CI 1.9–5.7) and present (OR 3.4, 95% CI 2.1–5.5) frequent alcohol consumption (HL 0.150) were associated with reporting five or more partners for intercourse at age 17 when entered each in turn and after controlling for age and age at oigarche. When entered simultaneously, and after controlling for age and age at oigarche, conduct disorder at age 15, smoking at age 15 and frequent alcohol use at age 15 were predictive of having five or more partners for intercourse by age 17 and depression at age 15 was not, but the fit of the model was not good (Table 3). These predictive associations persisted when present symptoms and behaviours were added into the model, but this model was not better (HL 0.035).

## Discussion

Among girls having experienced intercourse by age 17 was predicted by depression, conduct disorder, daily smoking and frequent alcohol use at age 15. Among boys, daily smoking and frequent alcohol at age 15 predicted intercourse by age 17 in multivariate models. Even if having experienced intercourse by age 17 was not exceptional, with just over half of the girls, and just under half of the boys reporting so, it was nevertheless predicted by a number of negative mental health and behavioural indicators at age 15.

Our longitudinal study supports the findings from cross-sectional and retrospective studies that have associated early sexual debut with mental disorders (Hallfors et al., 2004; Heidmets et al., 2010; Kotchick et al., 2001; Madkour et al., 2010; Ramrakha et al., 2000; Tubman et al., 1996; Wight et al., 2006), and adds to the existing knowledge by demonstrating the associations in longitudinal, prospective data. Mental disorders predispose adolescents to early sexual activity. Our findings also demonstrate an independent role of both emotional (depression) and behavioural (smoking, drinking, conduct disorder) disorders for sexual activity, although only among girls.

Conduct disorder, daily smoking and frequent alcohol use at age 15 were associated with reporting five or more partners for intercourse at age 17. Having had five or more sexual partners by age 17 is likely to rather indicate risk-taking than healthy and positive sexual behaviour.

In bivariate analyses, both past depression and present depression among girls, but not among boys, were associated with having experienced intercourse and also with reporting intercourse with multiple partners by age 17. Regarding girls, this concurs with earlier studies among Finnish adolescents (Kaltiala-Heino, Kosunen et al., 2003; Kosunen et al., 2003). Depressed girls could seek intimacy to relieve feelings of depression, or to gain acceptance that may alleviate low self-esteem, which has been associated with depression and with early sexual debut and risk-taking sexual behaviours among girls. Depressed girls may also not be able to set limits and protect themselves from becoming intimate more easily than perhaps developmentally appropriate (Kosunen et al., 2003).

In boys, no associations were detected between past and present depression and the sexual behaviours studied at age 17. The gender difference could be associated with the persistence of a double standard regarding sexual behaviour; possibly it is an advantage for boys to achieve experiences while for girls there may be pressure to preserve their virginity. Previously it was reported that the associations between depression and sexual behaviours were similar among boys and girls in Finland (Kaltiala-Heino, Kosunen et al., 2003; Kosunen et al., 2003).

The different findings in earlier Finnish studies and the current study may be explained by age differences between the samples. The participants in the present study were somewhat older than those in the earlier study.

Past and present alcohol consumption was associated with experience of intercourse by age 17, and reporting multiple partners for intercourse by age 17. Alcohol consumption contributes to behavioural disinhibition and may understandably lower the threshold for engaging in

sexual behaviours. In adolescence, alcohol use is also likely associated with less parental monitoring, a factor associated with early and risk-taking sexual behaviours (Kotchick et al., 2010; Madkour et al., 2010; Wight et al., 2006). However, the likelihood of sexual debut by age 17 and multiple partners for intercourse by age 17 was associated particularly with daily smoking. These findings coincide with problem behaviour theory suggesting that delinquency, substance abuse and early and risk-taking sexual behaviour and similar problem behaviours cluster together in adolescence (Jessor, van den Bos, Vanderryn, Costa, & Turbin, 1995; Jessor & Jessor, 1977). On the other hand, the association between sexual behaviour and smoking in adolescence could be explained by both smoking and early dating behaviour representing for adolescents signs of adulthood worth pursuing (Difranza & Wellman, 2006).

Among adults, active sex life is rather considered an indicator of mental health, and lack of sexual desire and pleasure is associated with mental disorders such as depression. Among adolescents, the associations between sexual activity and mental health seem more complex. Sexual debut may among middle adolescents represent an attempt to solve psychosocial problems or find relief from psychological symptoms, or to gain quicker entry into adulthood, which may seem particularly attractive if adolescent development is problematic. It is also possible that adolescents with mental disorders are less able to resist pressure by peers, romantic partners and the culture at large, and engage in sexual behaviours earlier than their healthily developing peers. Contemporary Western culture celebrates sexuality and may create inappropriate pressures for adolescents to become sexually active in order to gain social status. (Dickson et al., 1998; Goodson et al., 1997; Kotchick et al., 2001; Madkour et al., 2010; Rosenthal et al., 1999; Wight et al., 2006).

### *Methodological considerations*

The study was based on a large population sample. The coverage of compulsory comprehensive school until age 16 in Finland is more than 99%. The cohort may thus be considered representative of Finnish adolescents except for those with mental handicaps or severe sensory deficits. The material, however, was collected exclusively in urban areas; thus the results may not be generalizable to rural populations. The response in the AMHC baseline survey was good (94.4%). However, among those who already dropped out at baseline, psychosocial and health problems may be more common than among participants. Thus, their absence may result in the reported prevalence rates of depression, conduct disorder and substance use behaviours being underestimates at T1. The response rate in the AMHC follow-up was satisfactory (63.1%). Dropout rate was greater for the boys than for the girls. This means that the results regarding boys may need to be considered with greater caution. Not responding at follow-up was associated with increased depression, conduct disorder and substance use behaviours in the baseline survey (Fröjd et al., 2011; Kaltiala-Heino et al., 2011). It is thus likely that at follow-up, the prevalences of the mental health and behavioural problems studied were somewhat underestimated. Moreover, not responding at follow-up was among boys associated with off-time maturation. Again, pubertal timing was associated with sexual activity. This suggests that some caution is appropriate in drawing firm conclusions on the findings regarding boys, given that dropout in general was also greater among boys. However, even high levels of attrition may not necessarily affect the associations studied in health surveys (van Loon, Tijhuis, Picavet, Surtees, & Ormel, 2003).

The data collection took part during a school lesson in the class, and the situation was supervised by a teacher. Concerns may arise whether a teacher's presence would make the pupils less willing to report on their sexual behaviour, or, similarly, on rule-breaking behaviours such as substance use. The teacher's role was to ensure that the pupils did not interfere with each other's responding so that all could consider their responses in private, and the teacher also stayed

aside to allow privacy her-/himself. The pupils themselves sealed the survey forms in envelopes. This is a routine practice in Finnish schools and we are confident that it did not risk the quality of the responses.

Menarche is an accepted milestone in measuring pubertal maturation (Dick, Rose, Viken & Kaprio, 2000; Rimpelä & Rimpelä, 1993), although self-reported timing of menarche has also been criticized (Dorn et al., 1999). Onset of ejaculations can be considered a corresponding way of measuring puberty in boys in survey studies (Carlier & Steeno, 1985; Kulin, Frontera, Demers, Bartholomew, & Lloyd, 1989), even if there is more room for error. In self-report studies, young boys may be uncertain whether they ejaculate or not, if it occurs spontaneously at night. Studies on the impact of pubertal timing on mental health and psychosocial problems have used Tanner stages (Tanner, 1962) as self-report (Costello, Sung, Worthmann, & Angold, 2007; Hayatbakhsh, Najman, McGee, Bor, & O'Callaghan, 2009), and different self-reports eliciting changes that have or have not occurred (Ge, Conger, & Elder, 2001; Ge et al., 2003), perception of maturation as compared to peers (Graber, Seeley, Brooks-Gunn, & Lewinsohn, 2004) or age at menarche/oigarche (Kaltiala-Heino, Marttunen, Rantanen, & Rimpelä, 2003).

Recall bias might influence the reliability of data in any survey study. This is true for the present data as well. However, regarding the studied symptoms/behaviours in this study, the respondents were mainly asked to consider their experience as per now, not recall from a long time ago. Both at age 15 and at age 17 they were asked to consider current symptoms of depression and conduct disorder, and current drinking and smoking habits. Intercourse is a milestone not likely to be forgotten in middle adolescence. Number of partners for sexual intercourse is likely also well remembered at age 17 when there can normally not yet have been many years with sexual activity. Reliability of self-reported timing of menarche and oigarche is discussed above.

A limitation of the present study is that the data do not indicate whether the participants had already experienced sexual debut at age 15. Therefore, we cannot study the role of mental disorders in the transition from virgin to non-virgin status during middle adolescence. Of Finnish adolescents, a fourth to a third experience sexual debut by age 15–16 (Kaltiala-Heino, Kosunen et al., 2003; Kaltiala-Heino et al., 2001; Kosunen et al., 2003). The role of mental disorders may be different for sexual debut before age 15 and that between ages 15 and 17. More detailed research is needed on this aspect.

In evaluating the validity of information received with logistic regression analyses, it is also important to consider the goodness of fit of the models, not only the significance of the ORs for the different variables. The fit of the models was not always optimal, as can be expected, since even if emotional and behavioural symptoms play a role in adolescent sexual behaviours, they are, of course, not exclusive explanations to the features studied. Our aim was to evaluate if selected predictors were statistically significantly associated with dependent variables, not to create the optimal model beyond the chosen independent variables. In future studies it would be interesting to focus more on ascertaining what combinations of variables in relation to mental disorders produce the best fitting explaining models for sexual activity in adolescence.

## Conclusion

Mental disorders are associated with sexual activity in general, and of risk-taking sexual behaviours in middle adolescence. Attention should be paid to the sexual health needs of adolescents presenting with mental disorders. On the other hand, mental health needs should be screened among adolescents seeking sexual health services. In middle adolescence, coital experiences are in the group level likely to indicate problematic development, although of course, there are early developing individuals in whose life coitarche in middle adolescence is satisfactory and positive.

## Disclosure statement

The authors declare that they have no conflict of interest.

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