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Early puberty is associated with mental health problems in middle adolescence

Riittakerttu Kaltiala-Heino^{a,b,*}, Mauri Marttunen^c,
Päivi Rantanen^d, Matti Rimpelä^e

^aTampere School of Public Health, 33014 University of Tampere, Box 607, Tampere 33101, Finland

^bTampere University Hospital, Department of Psychiatry, Tampere, Finland

^cDepartment of Mental Health and Alcohol Research, National Public Health Institute, Mannerheimintie 166, 00300, Finland

^dTampere University Hospital, Department of Adolescent Psychiatry, Box 2000, Tampere 33521, Finland

^eNational Research and Development Centre for Welfare and Health, Box 220, Helsinki 00531, Finland

Abstract

This study set out to assess the relationship between pubertal timing and emotional and behavioural problems in middle adolescence. The study involved a school based survey of health, health behaviour and behaviour in school as well as questions about emotional and behavioural problems (the School Health Promotion Study). Secondary schools in four regions and 13 towns in Finland participated in the study in 1998. The respondents were 36,549 adolescents aged 14–16. The study included questions on depression, bulimia nervosa, psychosomatic symptoms, anxiety, drinking, substance use, smoking, bullying and truancy. Among girls, both internalising and externalising symptoms were more common the earlier puberty occurred. Among boys, externalising symptoms only were associated with early puberty. It is concluded that early pubertal timing is associated with increased mental health problems. Professionals working with adolescents should consider the mental health needs of early maturing adolescents.

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Introduction

Many mental disorders such as major depression (Angold, Costello, & Worthman, 1998), certain anxiety disorders (Feehan, McGee, Raja, & Williams, 1994; Hayward et al., 1992), eating disorders (Steinhausen, 1994) and substance use disorders (Perkonig, Lieb, & Wittchen, 1998) increase in prevalence during adolescence. A total of 15–25% of adolescents meet the diagnostic criteria of some specific mental disorder (Newman et al., 1996). Stage of pubertal development rather than chronological age has been reported as a risk

factor for eating disorders (Koff & Rierdan, 1993), depression (Angold et al., 1998) and anxiety (Hayward et al., 1992).

Puberty includes major hormonal changes that are likely to contribute for example to both to depressive affect and aggression (Brooks-Gunn & Warren, 1989). Biological changes of puberty also have a social value. Therefore, the challenge of adapting to one's own changing body and to role expectations might contribute to negative affect and mental disorders during adolescent development. Thus, from both social and psychological perspectives, maturing off time, either earlier or later than peers, may cause excessive stress and be a risk factor for symptoms and disorders.

For girls, early pubertal timing has been associated with psychosomatic symptoms, eating disorders, depression, anxiety and disturbed self-image (Aro & Taipale,

*Corresponding author. Tampere School of Public Health, 33014 University of Tampere, Box 607, Tampere 33101, Finland. Tel.: +358-3-215-6791; fax: +358-3-215-6057.

E-mail address: merihe@uta.fi (R. Kaltiala-Heino).

1987; Graber, Lewinsohn, Seeley, & Brooks-Gunn, 1997; Hayward et al., 1997; Wichstrom, 1995), suicide attempts (Wichstrom, 2000), substance use and delinquent behaviour (Graber et al., 1997; Laitinen-Krispijn, van der Erde, Hazebroek-Kampschreur, & Verhulst, 1999; Lintonen, Rimpelä, Vikat, & Rimpelä, 2000).

Among boys, early maturation has been reported to promote psychosocial adjustment (Stattin & Magnusson, 1990) and late maturation considered a risk for poor adjustment and negative self-perception (Graber et al., 1997; Laitinen-Krispijn et al., 1999; Nottelman et al., 1987). Thus, mental disorders might also be associated with late maturation among boys. However, substance use and delinquency (Graber et al., 1997; Lintonen et al., 2000; Williams & Dunlop, 1999) correlate with early maturation among boys as do suicide attempts (Wichstrom, 2000). We have also found that both bulimia and depression are associated with early maturation among boys (Kaltiala-Heino, Rissanen, Rimpelä, & Rantanen, 2001b; Kaltiala-Heino, Kosunen, & Rimpelä, 2001a).

Most of the previous research on pubertal timing and mental health has focused on girls or on single outcomes. More information is needed on boys and on the specificity of type of disorders (internalising, externalising) associated with pubertal timing among boys and girls.

This study aimed to answer the following questions using a large, non-selected middle adolescent population:

How does pubertal timing correlate with different internalising and externalising problems?

What are the correlates for boys and girls separately?

Material and methods

The School Health Promotion Study is an anonymous classroom survey among 8th and 9th grade secondary school students about health, health behaviour and school experiences. Approved by the Ethical Committee of Tampere University Hospital, the study has been carried out annually since 1995. The data for the present study comprises responses to the 1998 Study. Secondary schools in four regions and 13 towns of Finland participated. The study was carried out in April, at the end of the spring term. Less than 1% of the returned forms were rejected due to poor data quality, resulting in 38,517 utilisable responses. Pupils absent on the survey day were not contacted. In previous years we have found that on any day, 10–15% of pupils are absent.

Of the respondents, 19,321 were boys and 19,196 girls. Their mean age (s.d.) was 15.3 (0.59) (range 14–16) years. In total, 73.1% were living with both parents, 75.2% had lived in the same municipality for more than 9 years, and 62.8% reported stable employment of their

parents (none unemployed during past 12 months). The parents (one or both) of one-fourth (23.2%) of the respondents had completed university education.

Pubertal timing

Pubertal timing was assessed by the age at onset of menstruation/ejaculations by asking “How old were you when you had your first menstruation (ejaculation)?: (10 years or younger/11 years/12 years/13 years/14 years/15 years or older/I have not yet experienced menstruation (ejaculation)).” A majority of the respondents had experienced menarche/oigarche at age 12 or 13 (Table 1). In this study we use the phrase early onset of menstruation and ejaculations for menarche/oigarche that has occurred earlier than among the majority of peers. For these data, then, early onset refers to menarche/oigarche either at 11 and 10 years or less. Very early menarche/oigarche refers to onset at 10 years or earlier. In the analyses, we use as our reference category “15 years or older” combined with “I have not yet experienced menstruation/ejaculation”.

Internalising problems

Depression

Depressive symptoms were measured by the Finnish version of the 13-item short form of the Beck Depression Inventory (BDI) (Beck & Beck, 1972; Kaltiala-Heino, Rimpelä, Rantanen, Laippala, 1999a). Initially the 13-item BDI was adopted as such, but in 1998, the Ministry of Education decided not to allow us to use the item enquiring about suicidal ideation, for fear that asking about suicidality might provoke it in adolescents. Based on data from a previous sample (Kaltiala-Heino et al., 1999a) we concluded that even with one less item the original threshold between no/mild (0–7 points) and moderate/severe (8 or more) depression, would change

Table 1
Percent frequency distribution of 14–16 year old Finnish adolescents by year of menarche/oigarche

	Girls N = 19,196	Boys N = 19,321
Age at menarche/oigarche		
10 years or less	3.1	5.5
11 years	15.7	11.4
12 years	32.6	21.5
13 years	28.9	26.1
14 years	12.0	17.8
15 years	2.1	4.0
Did not occur yet	3.1	6.0
Missing	2.5	7.7

the status of only 0.7% of the respondents from cases to non-symptomatic subjects. So in the analyses, depression scores were dichotomised as moderate to severe (8 or more points) vs. no or mild (0–7 points).

Anxiety

A single question concerned cognitive aspects of anxiety. The respondents were asked to rate the alternative that best described them today: *I don't easily lose my nerve or get anxious (=0)*/*I don't feel anxious or nervous (=0)*; *I get anxious and nervous rather easily (=1)*; *I get very easily distressed, anxious or nervous (=2)*; *I am constantly anxious and distressed, my nerves are always on edge (=3)*. In the analyses, scores of anxiety were dichotomised as 2–3 (significant anxiety) vs. 0–1 (no or non-significant anxiety).

Excessive psychosomatic symptoms

Psychosomatic symptoms were measured by asking, *During the past six months, did you experience any of the following symptoms? How frequently?* The list of symptoms comprised neck and shoulder pain, low back pain, stomach ache, feeling tense or nervous, irritation or tantrums, difficulties falling asleep or waking up at night, headache and fatigue (Aro, 1987). The response alternatives for each symptom were *rarely or not at all* *about once a month*/*about once a week*/*daily or almost daily*. A symptom occurring *daily or almost daily* was considered frequent. In the analyses, the summed score of psychosomatic symptoms was dichotomised as 3+ *daily symptoms* (excessive psychosomatic symptoms) vs. <3 *symptoms daily* (no excessive psychosomatic symptoms).

Bulimia and bulimic symptoms

To assess bulimia and bulimic symptoms we used a questionnaire formulated according to the DSM-IV criteria of bulimia nervosa (Kaltiala-Heino et al., 2001b). Bulimia nervosa was recorded if a respondent reported all the diagnostic criteria elicited: bingeing a lot of food in a short time (for example, in 2 h) at least twice a week for more than 3 months, being afraid of losing control of eating while bingeing, trying to avoid weight gain by strict dieting or fasting, heavy exercise, vomiting or using laxatives/diuretics, and feeling good for nothing or a failure if not slim with an ideal figure. Our questionnaire assessed lifetime bulimic behaviour. In the analyses we compared subjects reporting all the criteria with subjects reporting none or some of the criteria of bulimia nervosa.

Externalising problems

Drunkenness

Drinking to intoxication was assessed with two questions: “Did you ever drink so much alcohol that

you were really drunk?” (Never/once/2–3 times/4–10 times/more than 10 times), and “How frequently do you drink so much that you are really drunk?” (once a week or more frequently/about 1–2 times a month/less frequently/never). For the analyses, the answers were dichotomised as *drunkenness 10 or more times/less than 10 times or not at all* and *weekly drinking up to being really drunk/less than weekly or not at all drinking up to being really drunk*.

Other substance use

Experimenting with cannabis, pills, alcohol with pills, inhalants and hard drugs was assessed by asking about each separately using the question “Did you ever try or use cannabis (alternatively: pills in order to get intoxicated/alcohol mixed with pills/inhalants/hard drugs)?” (Never/once/2–4 times/5 times or more). For the analyses, the summed score of experimentation of any substance was dichotomised into having used the substances *five or more times* vs. *not at all or occasionally*.

Regular smoking

Smoking was assessed with two questions: “How many cigarettes, pipes or cigars have you smoked altogether so far?” (none/only one/about 2–50/more than 50), and “Which of the following best describes your current smoking?” (I smoke once a day or more frequently/I smoke once a week or more frequently, however not daily/I smoke less frequently than weekly/I have quit smoking). Respondents who reported *both smoking daily and having smoked more than 50 cigarettes, pipes or cigars* were classified as *regular smokers* to be compared with non- or non-regular smokers.

Bullying

Bullying of others was assessed with a question derived from a WHO youth health study (King, Wold, Tudor-Smith, & Harel, 1996). An introduction clarified the behaviour as follows: *We say a pupil is being bullied when another pupil, or a group of pupils, says or does nasty and unpleasant things to him or her. It is also bullying when a pupil is teased repeatedly in a way he or she doesn't like. But it is not bullying when two pupils of about the same strength quarrel or fight*. Thereafter the respondents were asked how frequently they had bullied others during the ongoing school term: *many times a week, about once a week, less frequently* and *not at all*. The responses were dichotomised as *bullying others at least weekly* vs. *bullying others less frequently than weekly or not at all*.

Truancy

Truancy was assessed with a question “How many days have you been absent from school due to truancy during the past 30 days?” (none/one day/2–3 days/more

Table 2
Internalising and externalising problems among 14–16 year old girls and boys

	Girls <i>N</i> = 19,196			Boys <i>N</i> = 19,321		
	% (<i>n</i>)			% (<i>n</i>)		
	Yes	No	Missing	Yes	No	Missing
<i>Internalising symptoms</i>						
Depression: BDI 8+	13.4 (2567)	86.1 (16,529)	0.5 (100)	6.8 (1313)	92.6 (17,881)	0.7 (126)
Anxiety	6.4 (1231)	91.8 (17,630)	1.7 (335)	3.1 (598)	94.9 (18,335)	2.0 (388)
Excessive psychosomatic symptoms: 3 or more daily	9.2 (1767)	90.1 (17,289)	0.7 (140)	3.6 (698)	95.2 (18,399)	1.2 (224)
Symptoms of bulimia: all DSM-IV criteria	2.2 (419)	93.1 (17,876)	4.7 (140)	0.8 (153)	93.8 (18,139)	5.4 (1038)
<i>Externalising problems</i>						
Drunkenness more than 10 times	14.1 (2767)	84.1 (16,148)	1.5 (281)	18.2 (3522)	80.2 (15,495)	1.6 (304)
Drunkenness weekly	2.9 (556)	95.6 (18,351)	1.5 (289)	5.7 (1092)	92.3 (17,840)	2.0 (389)
Substance use: 5 or more times	5.4 (1045)	93.3 (17,913)	1.2 (238)	4.9 (938)	93.3 (18,018)	1.9 (365)
Regular smoking	19.7 (3788)	77.3 (14,846)	2.9 (562)	19.5 (3775)	77.6 (15,000)	2.8 (546)
Frequent truancy	5.4 (1038)	80.4 (15,440)	14.2 (2718)	6.4 (1241)	80.1 (15,476)	13.5 (2604)
Bullies others at least weekly	2.5 (471)	93.4 (17,925)	4.2 (800)	9.8 (1885)	86.2 (16,665)	4.0 (781)

than 3 days). In the analyses subjects truant for more than 3 days during the past month (*frequent truancy*) were compared with subjects truant for 3 or less days.

Statistical analysis

The association of pubertal timing with the studied symptoms and problem behaviours was studied using logistic regression. Logistic regression analysis is a method to evaluate the association between a dichotomous dependent variable and either categorical or continuous independent variables. Usually, results are expressed as Odds Ratios (OR) and their confidence intervals, other statistics such as *p*-values and model fit indicators can also be used (Hosmer & Lemeshow, 1989).

A series of analyses were carried out separately for girls and boys. Internalising and externalising problems were the dependent variables, dichotomised as described above. Independent variables were age at menarche for girls and age at oigarche for boys, classified as 10 years or under/11 years/12 years/13 years/14 years/15 years or later and has not occurred yet, the last being the reference category. Current age, which was used as continuous, was controlled for. OR and their 95% confidence intervals are presented for each year of age at menarche/oigarche, illustrating the risk associated with earlier pubertal timing as compared with late (15 years or later) timing. Probability levels are given for the whole term (age at menarche/oigarche), evaluating the overall importance of age at menarche/oigarche for each problem, not single comparisons separately.

To exclude confounding by co-occurring internalising and externalising symptoms the associations of pubertal

timing with internalising symptoms was finally analysed among those who did not report any of the studied externalising problems, and vice versa.

With regard to missing data, 1488 boys (7.7%) and 480 (2.5%) girls who did not answer the question about pubertal timing were excluded from the analyses. Further dropout was caused by incomplete reporting of the internalising and externalising symptoms. The number of respondents with missing data on each of the symptoms is presented for boys and girls in Table 2.

To assess whether those who skipped the questions concerning particular internalising or externalising symptoms were likely to have those symptoms, we compared the sociodemographic background of subjects who skipped the questions with those who reported having the problem and those who reported not having it (Kaltiala-Heino, Rissanen, Rimpelä, & Rantanen, 1999b). Those who skipped the question were similar to those who reported not having the problem in socio-demographic background and relationship to school, friends, family and perceived somatic health. Sometimes their answers fell in between those reporting a particular symptom and those not having it, but they were never more similar to the former. Thus, we concluded that those skipping questions concerning the studied internalising and externalising problems were not likely to be cases. A sensitivity analysis was carried out assigning the missing data on each outcome first to yes and then to no.

Results

Of girls, 59.6% (*n* = 11,440) reported neither internalising nor externalising problems. In total, 10.7% (2058) reported internalising symptoms only, 19.9%

(3828) externalising symptoms only, and 9.7% (1870) reported both. Respectively, 60.8% (11741) of boys showed none of the problems. In total, 3.6% (697) reported internalising symptoms only, 29.4% (5677) externalising symptoms only, and 6.2% (1205) both.

Age at menarche/oigarche was highly significantly associated with all the studied problems. Among girls, all the studied internalising and externalising symptoms and behaviours were more common the earlier the menarche (Table 3). Among boys, internalising symptoms were associated with very early oigarche, and normative timing of oigarche appeared protective of depression and anxiety. All the studied externalising symptoms and problem behaviours were associated with early oigarche. Frequent smoking and having been drunk 10 or more times were linearly related to early onset of ejaculations (see Table 3).

When those with externalising symptoms were excluded from the analyses, the association of internalising symptoms with early pubertal timing (10–12 years) persisted among girls, even if the overall significance of age at menarche was lower. When those with internalising symptoms were excluded, the risk for externalising behaviours except for bullying increased the earlier the menarche (Tables 4 and 5). Among boys, depression and anxiety were associated with very early oigarche (10 years or less) even when those with externalising problems were excluded. The risk for externalising symptoms and problem behaviours (except for bullying) increased the earlier the oigarche also when those with internalising symptoms were excluded (Tables 4 and 5).

To confirm that the associations between age at menarche/oigarche with the internalising and externalising symptoms were similar in all the studied age groups (14, 15 and 16 years), stratified analyses were carried out. The OR patterns were similar in all age groups and corresponded to findings in the total sample (except that irregularities were found regarding bullying among girls), but with decreasing sample sizes, the 95% confidence intervals of the OR often widened beyond statistical significance.

Sensitivity analysis

The sensitivity analysis, assigning all the missing values first to a yes category and then to a no category, resulted in slight changes in the exact values of the OR and their 95% confidence intervals. However, the detected associations between pubertal timing and internalising and externalising symptoms were unchanged except for truancy among girls.

Discussion

Both internalising and externalising problems were higher among those experiencing early puberty in

comparison to those with late puberty (15 years or later). Based on previous literature this was anticipated for girls, but previous studies have seldom focused on more than one outcome. Early menarche was also associated with internalising problems when externalising ones were excluded, and vice versa. The unfavourable effect of early menarche on psychological health of female adolescents was thus not explained by only one type of symptoms. To our knowledge the only study assessing the effect of pubertal timing on multiple outcomes in both internalising and externalising domains is that by Graber et al. (1997). Our results are consistent with theirs in a different culture, with the exception that they also reported an association between late puberty and depression among girls, in addition to the anticipated association of early puberty.

Regarding boys, our results differ from the previous reports that early maturation would be beneficial and late maturation risky for psychosocial adjustment and mental health (Graber et al., 1997; Laitinen-Krispijn et al., 1999; Nottelman et al., 1987; Stattin & Magnusson, 1990). Very early maturation first seemed a risk factor for both internalising and externalising, and normative pubertal timing seemed protective of internalising problems for boys. However, when those with externalising problems were excluded, the protective effect of normative pubertal timing was levelled out, and early puberty increased the risk for depression and anxiety but not for psychosomatic symptoms and bulimia. Thus, externalising symptoms to some extent explain the association between early puberty and internalising disorders among boys. In accordance with previous findings regarding substance use and delinquency (Graber et al., 1997; Lintonen et al., 2000; Williams & Dunlop, 1999), externalising problems were higher in a linear manner at earlier ages of onset of puberty among boys.

The differences between the present finding that early maturation correlates with problems among boys and the previous findings that early maturation is beneficial for them may be due to their concentration on less specific outcomes such as self-esteem whereas we assessed symptoms and problems. However, the Graber et al. (1997) study of highly specific mental health outcomes also supported the hypothesis that early maturation is favourable for boys. The difference might be related to cultural differences between the United States and Finland. Perhaps sex role expectations are sharper and more separate in the United States than in Finland where men and women pursue similar competencies and achievements in work life. This might be reflected in a higher number of similar pressures experienced by girls and boys when maturing earlier than peers.

Pubertal development involves biological, psychological and social changes that all may contribute to

Table 3
Prevalence, and risk, adjusted for current age, (OR, 95% CI) for internalising and externalising problems among 14–16 year old girls and boys according to age at menarche/oigarche

	Age at menarche/oigarche											
	10 or less		11		12		13		14		15 Ref (%)	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Depression: BDI 8+	20.6%/2.7 (2.0–3.6)	19.7%/3.4 (2.7–4.3)	15.6%/3.4 (1.5–2.4)	9.6%/1.5 (1.2–1.9)	13.9%/1.7 (1.3–2.0)	6.0%/0.9 (0.7–1.1)	12.7%/1.5 (1.2–1.9)	5.4%/0.8 (0.6–1.0)	11.0%/1.3 (1.0–1.6)	4.9%/0.7 (0.6–0.9)	8.9	6.7
Anxiety	12.2%/3.4 (2.2–5.0)	11.9%/4.2 (3.0–5.8)	8.6%/2.3 (1.6–3.2)	4.3%/1.4 (1.0–1.9)	6.0%/1.6 (1.1–2.2)	2.5%/0.8 (0.6–1.0)	6.2%/1.6 (1.2–2.3)	2.2%/0.7 (0.5–1.0)	5.4%/1.4 (0.9–2.0)	2.3%/0.7 (0.5–1.0)	3.9	3.1
Psychosomatic symptoms: 3 or more daily	18.3%/4.0 (2.8–5.7)	12.7%/4.6 (3.6–6.4)	12.1%/2.5 (1.8–3.3)	5.4%/1.8 (1.3–2.5)	9.8%/1.9 (1.5–2.6)	3.0%/1.0 (0.7–1.4)	8.0%/1.6 (1.2–2.1)	2.7%/0.9 (0.7–1.2)	6.6%/1.3 (0.9–1.8)	2.4%/0.8 (0.7–1.1)	5.2	3.0
Bulimia: all DSM-IV criteria	5.5%/4.9 (2.4–9.8)	4.7%/5.2 (3.0–9.1)	3.3%/2.9 (1.5–5.4)	0.6%/0.6 (0.3–1.3)	2.3%/2.1 (1.2–4.0)	0.6%/0.6 (0.3–1.2)	1.8%/1.6 (0.8–3.0)	0.5%/0.5 (0.3–1.0)	1.7%/1.5 (0.8–3.0)	0.6%/0.6 (0.3–1.2)	1.1	0.9
Ten or more times drunk	23.0%/5.1 (3.7–7.2)	42.7%/7.8 (6.3–9.6)	20.2%/4.3 (3.3–5.9)	27.7%/4.0 (3.3–4.7)	16.5%/3.5 (2.6–4.7)	21.6%/2.9 (2.4–3.4)	12.3%/2.5 (1.8–3.3)	15.6%/1.9 (1.6–2.3)	9.3%/1.7 (1.3–2.3)	11.3%/1.3 (1.1–1.6)	5.2	8.7
Weekly drunkenness	6.7%/6.9 (3.4–13.9)	20.2%/6.5 (4.9–8.6)	3.8%/3.8 (2.0–7.3)	7.7%/2.1 (1.6–2.8)	3.4%/3.3 (1.8–6.4)	5.6%/1.5 (1.2–2.0)	2.1%/2.1 (1.1–4.0)	3.8%/1.0 (0.8–1.3)	2.3%/2.2 (1.1–4.4)	4.1%/1.1 (0.8–1.5)	1.0	3.7
5 or more trials with substances	14.8%/11.7 (6.6–20.7)	19.6%/7.1 (5.3–9.5)	8.5%/6.2 (3.1–10.7)	6.7%/2.1 (1.5–2.8)	6.1%/4.4 (2.6–7.6)	4.9%/1.5 (2.1–2.0)	4.1%/2.9 (1.7–5.0)	3.1%/1.0 (0.7–1.3)	3.2%/2.2 (1.2–3.9)	3.0%/0.9 (0.7–1.2)	1.4	3.3
Smokes regularly	29.6%/5.2 (3.9–7.1)	38.9%/5.1 (4.2–6.2)	26.6%/4.6 (3.5–5.9)	26.4%/2.9 (2.4–3.4)	21.9%/3.4 (2.8–4.0)	22.0%/2.4 (2.1–2.8)	17.6%/2.5 (2.0–3.0)	18.6%/1.9 (1.6–2.1)	13.4%/1.8 (1.5–2.2)	13.2%/1.3 (1.1–1.5)	7.2	10.9
Bullies others at least weekly (this term)	5.8%/3.6 (2.0–6.6)	22.6%/2.8 (2.3–3.5)	2.9%/1.7 (1.0–2.9)	11.6%/1.3 (1.0–1.6)	2.8%/1.7 (1.0–2.8)	10.0%/1.1 (0.9–1.3)	2.1%/1.2 (0.7–2.1)	8.7%/0.9 (0.8–1.1)	1.9%/1.2 (0.7–2.1)	8.3%/0.9 (0.7–1.1)	1.7	9.4
Truancy 3 or more times past month	11.5%/4.7 (2.8–7.7)	20.9%/4.9 (3.7–6.4)	7.9%/3.1 (2.0–4.9)	9.1%/1.8 (1.4–2.4)	7.0%/2.7 (1.8–4.2)	7.6%/1.5 (1.2–2.0)	5.5%/2.1 (1.4–3.3)	5.7%/1.1 (0.9–1.5)	4.6%/1.7 (1.1–2.8)	5.0%/1.0 (0.7–1.3)	2.6	5.1

Note: All *p*-values <0.0001.

Table 4
Prevalence, and risk (OR, 95% CI), adjusted for current age, for externalising symptoms/problem behaviours among 14–16 year old girls and boys who do not report symptoms of any internalising disorders, according to age at menarche/oigarche

	Age at menarche											
	10 or less		11		12		13		14		15 Ref (%)	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Ten or more times drunk	16.7%/4.5 (2.9–7.0)	35.3%/7.1 (5.6–9.0)	16.9%/4.6 (3.2–6.6)	25.7%/4.4 (3.6–5.5)	14.1%/3.8 (2.7–5.5)	20.5%/3.3 (2.7–4.0)	10.4%/2.7 (1.9–3.9)	14.7%/2.2 (1.8–2.7)	7.3%/1.8 (1.2–2.6)	9.8%/1.4 (1.1–1.7)	4.0	7.2
Weekly drunkenness	3.8%/10.1 (3.6–36.8)	12.7%/5.9 (4.0–8.6)	2.7%/7.6 (2.4–23.8)	6.4%/2.8 (1.9–4.0)	2.2%/6.1 (1.9–18.9)	5.0%/2.1 (1.5–3.0)	1.5%/4.1 (1.3–12.8)	3.2%/1.4 (1.0–1.9)	1.9%/5.3 (1.6–17.0)	3.2%/1.4 (0.9–2.0)	0.4	2.3
Five or more trials with substances	7.6%/9.5 (4.1–21.8)	9.5%/5.5 (3.6–8.4)	5.3%/6.5 (3.0–13.9)	4.8%/2.6 (1.7–4.0)	3.8%/4.6 (2.2–9.9)	3.7%/2.0 (1.4–3.0)	2.5%/3.0 (1.4–6.5)	2.7%/1.5 (1.0–2.2)	2.2%/2.6 (1.2–5.8)	2.2%/1.2 (0.8–1.8)	0.8	1.8
Smokes regularly	23.1%/5.1 (3.5–7.5)	33.8%/5.0 (4.0–6.2)	23.2%/5.2 (3.8–7.1)	23.7%/3.1 (2.5–3.7)	18.7%/4.0 (3.0–5.4)	20.8%/2.6 (2.2–3.1)	15.5%/3.2 (2.4–4.4)	17.3%/2.1 (1.7–2.5)	10.8%/2.1 (1.5–2.9)	12.0%/1.3 (1.1–1.6)	5.3	9.1
Bullies others at least weekly (this term)	1.6%/1.6 (0.5–4.4)	14.6%/2.0 (1.5–2.6)	2.0%/2.0 (0.6–4.4)	9.0%/0.1 (0.9–1.4)	2.1%/2.0 (0.9–1.4)	9.1%/1.2 (0.9–1.4)	1.6%/1.5 (0.7–3.0)	7.5%/0.9 (0.8–1.2)	1.3%/1.3 (0.6–2.7)	7.1%/0.9 (0.7–1.1)	1.1	7.9
Truancy 3 or more times past month	5.3%/2.5 (1.3–5.0)	14.0%/4.2 (3.0–6.0)	4.5%/2.1 (1.2–2.7)	7.1%/2.0 (1.4–2.8)	4.5%/2.2 (1.3–3.7)	6.7%/1.9 (1.4–2.5)	4.2%/2.0 (1.2–3.5)	5.0%/1.4 (1.0–1.9)	3.2%/1.5 (0.8–2.7)	3.8%/1.0 (0.7–1.4)	2.1	3.6

Note: All *p*-values <0.0001 except Bullies, girls *p*<0.1, and Truancy, girls *p*<0.02.

Table 5

Prevalence, and risk (OR, 95% CI), adjusted for current age, for internalising symptoms among 14–16 year old girls and boys who do not report any externalising symptoms/problem behaviours according to age at menarche/oigarche

	Age at menarche/oigarche												p	
	10 or less		11		12		13		14		15 Ref (%)			
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys		
Depression: BDI 8+	10.5%/1.7 (1.1–2.6)	6.5%/1.7 (1.0–2.7)	11.3%/1.7 (1.3–2.4)	4.5%/1.2 (0.9–1.7)	9.8%/1.2 (1.2–2.1)	4.3%/1.1 (0.8–1.5)	9.5%/1.1 (1.1–2.0)	3.5%/0.9 (0.7–1.2)	7.2%/1.1 (0.8–1.5)	3.1%/0.8 (0.6–1.1)	6.7	3.9	0.0001	0.01
Anxiety	6.7%/2.2 (1.2–4.0)	4.4%/2.3 (1.2–4.3)	5.7%/1.9 (1.2–2.9)	2.2%/1.1 (0.7–1.9)	4.4%/1.4 (0.9–2.2)	1.5%/0.8 (0.5–1.3)	4.6%/1.5 (1.0–2.3)	1.4%/1.5 (0.5–1.2)	4.0%/1.3 (0.8–2.0)	1.5%/0.8 (0.5–1.3)	3.1	1.9	0.03	0.002
Psychosomatic symptoms: 3 or more daily	9.7%/2.4 (1.4–4.0)	3.3%/1.9 (0.9–3.8)	7.9%/1.9 (1.3–2.8)	1.8%/1.1 (0.6–1.9)	6.4%/1.6 (1.1–2.2)	1.9%/1.1 (0.7–1.8)	5.6%/1.3 (0.9–1.9)	1.5%/0.9 (0.5–1.4)	4.4%/1.0 (0.7–1.6)	1.2%/0.7 (0.4–1.2)	4.2	1.7	0.06	0.07
Bulimia: all DSM-IV criteria	3.5%/4.1 (1.6–10.7)	0.6%/1.3 (0.3–6.7)	2.6%/3.1 (1.4–6.8)	0.3%/0.8 (0.2–2.9)	1.5%/1.8 (0.8–3.9)	0.4%/1.0 (0.4–2.7)	1.4%/1.6 (0.7–3.6)	0.3%/0.6 (0.2–1.8)	1.3%/1.5 (0.6–3.5)	0.2%/0.6 (0.2–1.8)	0.8	0.4	0.08	0.8

mental health problems. The influence of biological processes is expected to be different in girls and boys, and is likely to account for greater prevalence of depression among adolescent girls. The timing of puberty also has psychological and social consequences that might affect mental health. We found that compared to those maturing late, both those maturing normatively and especially those maturing early had more problems. One might expect that deviation from normative timing in either direction might be stressful, but this was not the case. One interpretation is that late maturing adolescents have more time to develop psychologically and academically before encountering the social and sexual challenges of adolescence. They may also learn to anticipate and adapt to the pubertal changes while observing their earlier maturing peers. However, the possibility that mental health problems contribute to earlier puberty cannot be ruled out based on this cross-sectional study. Some previous research has also suggested that psychosocial factors like problems in the family may trigger earlier onset of puberty (Graber, Brooks-Gunn, & Warren, 1995; Wrerson, Long, & Forehand, 1993). There might be common underlying reasons for both mental health problems and early maturation, or the associations between psychosocial distress, early maturation and mental health problems might be reciprocal.

A limitation of this study is the use of self-report data and lack of diagnostic interviews. Some of the mental health problems were assessed with single-item measures only. Our finding that early puberty puts not only girls but also boys at greater risk of mental health problems may also be to some extent related to the way of measuring the mental health problems in School Health Promotion Study. However, the measures used were mainly well-known and relevant. Self-reported symptoms of mental disorders and disorders diagnosed with clinical interviews occur on the same continuum (Aro, 1987; Drewnowski, Yee, Kurht, & Krahn, 1994; Fairburn & Beglin, 1990; Linton & Rimpelä, 2001; Zoccolillo, Vitaro, & Tremblay, 1999). Anonymous answering in this study may reduce the influence of social desirability.

Menarche is an accepted milestone in measuring puberty maturation (Rimpelä & Rimpelä, 1993). No similarly accepted measure of puberty development in males is available. However, onset of ejaculations (oigarche) can be considered a corresponding way of assessing puberty development among boys in survey studies (Carlier & Steeno, 1985). Oigarche has been shown to be an indicator of pubertal development (Kulin, Frontera, Demers, Bartholomew, & Lloyd, 1989; Nielsen et al., 1986; Schaefer, Marr, Seidel, Tilgen, & Scharer, 1990), though there is more room for error. In self-report studies, young boys may be uncertain whether they ejaculate even if it occurred spontaneously

at night. Another method of assessing oigarche is to measure morning spermaturia. In this method, a problem arises from the fact that even after reaching spermarche, sperm cannot be observed in all the urine samples of males. Because of measurement problems the current findings among boys might be re-examined using, for example, both Tanner stages and oigarche.

The present results are based on a large population sample. The coverage of comprehensive school obligatory until age of 16 in Finland is more than 99%. The sample is well representative of Finnish adolescents. Pupils absent from school at survey day are likely to suffer excessively from psychosocial and health problems. Thus, their absence might result in the presented prevalence rates being underestimates.

Conclusion

Early pubertal timing associates with mental health problems in middle adolescence. The association between early pubertal timing and externalising problems is similar among girls and boys. Among girls, internalising problems also associate with early puberty, among boys, externalising problems partially explain the association between early puberty and internalising problems. Professionals working with adolescents in health and social services and schools should pay attention to mental health needs of adolescents who mature earlier than the majority of their peers. Maturing earlier than peers seems to create additional stress in the process of adapting to the changes in one's own body and social role brought about by pubertal maturation. Early maturing adolescents might benefit from tailored health education and counselling.

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