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Observational studies

The Nord-Trøndelag Health Study shows increased prevalence of primary recurrent headaches among adolescents over a four-year period

Brit A. Jacobsen[a,b,*], Grete Dyb[b,d], Knut Hagen[e,g], Lars J. Stovner[e,g], Turid L. Holmen[f], John-Anker Zwart[b,c,e,h]

[a] Department of Neurology, Vestfold Hospital, Tønsberg, Norway
[b] Faculty of Medicine, University of Oslo, Oslo, Norway
[c] Department of Neurology, Oslo University Hospital, Ullevål, Oslo, Norway
[d] Norwegian Centre for Violence and Traumatic Stress Studies, Oslo, Norway
[e] Department of Neuroscience, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, Norway
[f] HUNT Research Centre, Department of Public Health, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim, Norway
[g] Norwegian National Headache Centre, Section of Neurology, St. Olavs Hospital, Trondheim, Norway
[h] National Centre for Spinal Disorders, St. Olavs Hospital, Trondheim, Norway

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ABSTRACT

Objective: Earlier epidemiological studies have shown that headaches are frequent among adolescents, especially girls. In particular, recurrent primary headache disorders such as migraine and tension-type headaches are common complaints in this age group. Headaches are increasingly being recognized as a significant health problem in adolescents and can lead to significant disabilities by affecting their lives, their school performance and their social lives. The aim of this study was to compare the prevalence of primary headaches among adolescents aged 16–20 years in Norway in two periods. Very few replicate studies have re-evaluated the prevalence of primary headaches in this age range and it is uncertain whether the prevalence is increasing.
Methods: Two cross-sectional, population-based studies were conducted in Norway from 1995 to 1997 (Young-HUNT 1) and from 1999 to 2001 (Young-HUNT 2). In Young-HUNT 1, 2594 adolescents in 2nd and 3rd grade in upper secondary school (aged 16–20 years) completed a comprehensive questionnaire including one question regarding headache during the last 12 months. In addition, 1730 of the students were interviewed about their headache complaints. In Young-HUNT 2, 2373 adolescents aged 16–20 years completed the same questionnaire and 1655 were interviewed in the same way as the earlier survey. The interviews were performed by trained nurses, and respondents were asked if they had experienced recurrent headache during the last year. If so, the headache was classified as migraine (MI), tension-type headache (TTH) or non-classifiable headache (NCH). Headache frequency during the past year was recorded according to the following categories: Less than 1 day per month (less than monthly), 1–3 days per month (monthly), 1–5 days per week (weekly), or more than 5 days per week (daily).
Results: The participation rate was 88% in Young-HUNT 1 and 81% in Young-HUNT 2. The overall prevalence of having had headaches during the last 12 months did not change significantly (79.4% versus 77.5%; OR: 0.89, 95%CI: 0.79–1.02, $p = 0.09$), whereas the prevalence of recurrent headaches increased from 30.3% in Young-HUNT 1 to 35.4% in Young-HUNT 2 (OR: 1.26, 95%CI: 1.09–1.46, $p = 0.002$). The prevalence of tension-type headache changed significantly from 19.0% to 21.9% (OR: 1.20, 95%CI: 1.02–1.42, $p = 0.03$). Also the prevalence of migraine tended to increase (7.5% versus 8.7%, OR: 1.18, 95%CI: 0.92–1.52, $p = 0.18$). The overall frequency of recurrent headache changed towards more monthly and less weekly headache.
Conclusions: This is the first large-scale population-based study among adolescents in Norway assessing changes in the prevalence of primary headaches over a four-year period of time. The overall prevalence of recurrent headaches increased significantly from Young-HUNT 1 to Young-HUNT 2. An increase was seen in all types of recurrent headaches and was significant for tension-type headache.
Implications: Earlier follow-up studies have examined changes in prevalence of recurrent headaches in young age, but the results are diverging. Our findings support the impression that the prevalence of recurrent headache among adolescents is increasing, and underlines the need for prospective designed studies with emphasis on prognosis and etiological factors.

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* Corresponding author at: Department of Neurology, Vestfold Hospital, 3103 Tønsberg, Norway. Tel.: +47 33342000; fax: +47 33343958.
E-mail address: brit.jacobsen@siv.no (B.A. Jacobsen).

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1. Introduction

Earlier epidemiological studies have shown that headache in general and recurrent primary headache disorders such as migraine (MI) and tension-type headaches (TTH) in particular are common complaints among adolescents, especially girls [1–4]. Headaches are increasingly being recognized as a significant health problem in this age group and can lead to significant disabilities in adolescents by affecting their lives, their school performance and their social lives [5,6].

The estimated prevalence rates of MI and TTH among children and adolescents vary between different studies [7–9]. Differences in classification, study methodology and population samples have been accepted as explanations of this variability [8]. Most studies use the diagnostic criteria of the International Headache Society (IHS) [10,11], although the application of the IHS criteria in the pediatric population has been debated [12]. Clinical interviews are regarded as the gold standard in the assessment of the headache diagnoses [13], but this method is difficult to apply in large population samples. Performing short interviews based on recognition of typical headache descriptions has proven to be an efficient and reliable way to identify MI and TTH sufferers among adolescents [14].

Reliable information about changes in prevalence of primary headaches over a period of time is important, both from a clinical and a public health perspective [15]. Secular trends in the prevalence of migraine among adolescents have not been investigated to any large extend, and it is uncertain whether the prevalence is increasing [16]. Conducting repeated studies of headache symptoms in the same population is a reliable method of assessing potential changes in prevalence rates over time. To our knowledge, only few replicate studies of headache prevalence surveys have been published [9,15] and even fewer relating to adolescents [16].

The aim of this study was to assess any change in prevalence of primary headaches among adolescents over a four-year period.

2. Materials and methods

2.1. Young-HUNT 1

During a two-year period from August 1995 to June 1997, all students in lower secondary school (aged 12–16 years) and upper secondary school (aged 16–20 years) in Nord-Trøndelag county in Norway were invited to participate in the youth part of the Nord-Trøndelag Health Study, Young-HUNT.

A detailed description of the study has been published previously [2]. In short, a total of 8984 adolescents 12–20 years of age (88% of the adolescent population of the region) completed a comprehensive self-administered questionnaire during one school hour, with several health-related questions. One of the questions was whether they had experienced any headache during the last 12 months. In addition 6174 (69%) of them underwent a headache interview in connection with a clinical examination performed at the schools during school hours. The interviews were performed by trained nurses, and the students were asked to report recurring headaches not related to cold, fever or any other disease in the past 12 months. Two typical headache symptom history descriptions, one for MI and one for TTH were then presented, and the students were asked to classify their headache according to the descriptions. A third alternative ("non-classifiable headache", NCH) was given in case neither of the two descriptions resembled their symptoms. Headache frequency during the past year was recorded according to the following categories: less than 1 day per month (less than monthly), 1–3 days per month (monthly), 1–5 days per week (weekly), or more than 5 days per week (daily).

The "recognition-based" headache diagnoses obtained by the nurses was validated against extensive semi structured interviews by neurologists in a prior study [14], and the agreement between the two methods was acceptable (chance-corrected agreement (κ) 0.76).

Zwart et al. found that in Young-HUNT 1, the overall one-year prevalence of migraine was 7%, of tension-type headache 18%, and of non-classifiable headache 4.8%. Higher prevalence rates were found for girls in all age groups and for all headache categories. The overall frequency of recurrent headaches did not vary significantly with age, but girls had significantly more frequent headaches than boys [2].

2.2. Young-HUNT 2

In the school years 1999–2000 and 2000–2001 a follow-up study of Young-HUNT 1 was performed. Students in 2nd and 3rd grade in upper secondary school (aged 16–20 years) in North-Trøndelag county and apprentices of the same age who participated in Young-HUNT 1 were invited ($n = 2969$). The study was performed in the exact same way as the earlier study, with the same questionnaire, clinic examination and headache interview. Of the total population, 2399 (81%) completed the questionnaire and 1665 (69.4%) were interviewed about their headache complaints.

2.3. Ethics

Written consent from the parents was required for students less than 16 years of age. The Regional Medicine Ethical Committee and the Norwegian Data Inspectorate Board approved the study.

2.4. Statistical analyses

The difference between prevalence of headache in Young-HUNT 1 and Young-HUNT 2 and the difference of headache frequencies between the two studies were analyzed with χ^2 test. Odds ratios (ORs) and 95% confidence limits were calculated. All data analyses were performed with the Statistical Package for the Social Sciences (SPSS), version 16.0 (Chicago, IL).

3. Results

To obtain comparable groups we analyzed data for the 2652 adolescents who were in 2nd and 3rd grade in upper secondary school (aged 16–20 years) in Young-HUNT 1. Questionnaires in which the headache question had not been answered ($n = 58$) were excluded, leaving a total study population in this study of 2594. Out of these, 1730 individuals underwent a headache interview whereof 96.8% (96.9% girls and 96.5% boys) with recurrent headache answered the question about headache frequency. In Young-HUNT 2, 26 students had not answered the headache question in the questionnaire and were excluded, leaving a total study population of 2373. Of these, 1655 underwent a headache interview and headache frequency was reported of 92.2% (95.6% girls and 84.2% boys) with recurrent headache. The study population of the present study is presented in Table 1.

3.1. All headaches combined

In Young-HUNT 1 ($n = 2594$), 79.4% reported in the questionnaire having had any type of headache during the last 12 months (88.4% girls and 70.5% boys). The corresponding findings in Young-HUNT 2 ($n = 2373$) were 77.5% (87.5% girls and 65.8% boys). In the subgroup of individuals who were also interviewed the figures were 80.1% (88.7% girls and 69.6% boys) in Young-HUNT 1 and 77.3% (87.7% girls and 65.1% boys) in Young-HUNT 2.

Table 1
Study population.

	Young-HUNT 1			Young-HUNT 2		
	n	Mean age (SD)	% girls	*n*	Mean age (SD)	% girls
Participants included with valid questionnaires	2594	18.1 (0.8)	49.8	2373	18.4 (0.8)	53.7
Participants included with valid questionnaires and interviews	1730	18.1 (0.7)	54.7	1655	18.2 (0.7)	54.1

SD = standard deviation.

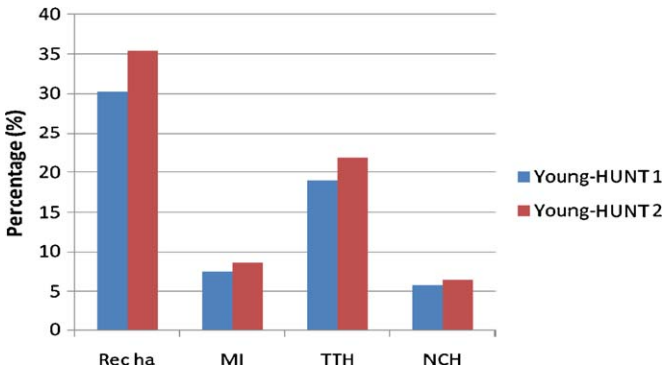

Fig. 1. Prevalence of recurrent headaches for boys and girls combined.

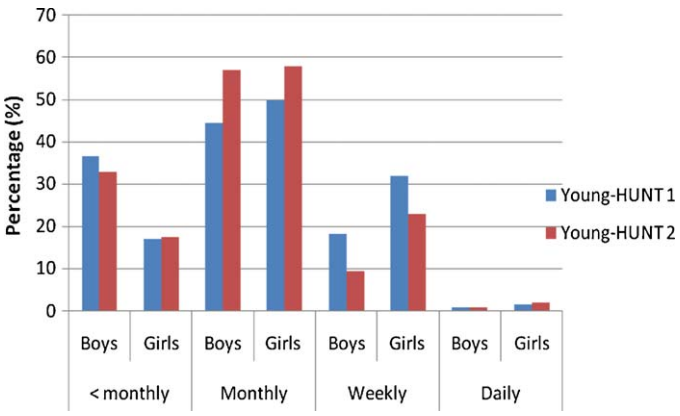

Fig. 2. Relative headache frequencies in boys and girls.

The one year prevalence of any type of headache, boys and girls combined, did not change significantly (OR: 0.89, 95%CI: 0.79–1.02, $p = 0.09$). For boys however, there was a significant decrease from 70.5% to 65.8% (OR: 0.81, 95%CI: 0.68–0.96, $p = 0.01$). There was a significantly higher one year prevalence of headache for girls in both studies, and the male:female ratios were 1:1.3 in both studies.

3.2. Recurrent headaches

The prevalence of recurrent headaches found in the interviews, increased significantly from 30.3% in Young-HUNT 1 to 35.4% in Young-HUNT 2 (OR: 1.26, 95%CI: 1.09–1.46, $p = 0.002$) (Fig. 1). Among girls the prevalence increased significantly from 40.4% to 45.6% (OR: 1.24, 95%CI: 1.03–1.49, $p = 0.02$), and among boys there was a significant change from 18.1% to 23.3% (OR: 1.38, 95%CI: 1.07–1.76, $p = 0.01$) (Table 2). In both studies weekly and daily headache was more common in girls while less than monthly headache was more common in boys than girls (Table 3 and Fig. 2).

The overall frequency of recurrent headache changed towards more monthly and less weekly headache in Young-HUNT 2. This change was greater for boys than for girls. For less than monthly and daily headache the frequencies were stable (Fig. 2). Both the increase in monthly headache (48.3% versus 57.6%) and the decrease in weekly headache for boys and girls combined (28.2% versus 19.1%) were statistical significant (monthly: OR: 1.45, 95%CI: 1.14–1.85, $p = 0.003$, weekly: OR: 0.60, 95%CI: 0.45–0.80, $p < 0.000$). These changes were also significant for girls (monthly: OR: 1.39, 95%CI: 1.04–1.84, $p = 0.03$, weekly: OR 0.63, 95%CI: 0.46–0.87, $p = 0.005$) and boys (monthly: OR: 1.66, 95%CI: 1.04–2.64, $p = 0.03$, weekly: OR: 0.47, 95%CI: 0.23–0.94, $p = 0.03$) when analyzed separately.

Table 2
Prevalence of migraine (MI), tension-type headache (TTH) and non-classifiable headache (NCH) among boys and girls.

	Young-HUNT 1		Young-HUNT 2	
	n	%	*n*	%
Recurrent headache				
Boys	142	18.1	177	23.3
Girls	382	40.4	409	45.6
MI				
Boys	32	4.1	48	6.3
Girls	97	10.3	96	10.7
TTH				
Boys	86	11.0	105	13.7
Girls	242	25.6	258	28.7
NCH				
Boys	36	4.6	31	4.1
Girls	64	6.8	77	8.6

33 individuals (12 boys and 21 girls) in Young-HUNT 1 and 29 individuals (7 boys and 22 girls) in Young-HUNT 2 had a combination of MI and TTH, and these were included in prevalence count in both diagnostic groups.

3.3. Different types of recurrent headaches

In Young-HUNT 1 the prevalence of MI was 7.5%, of TTH 19.0% and of NCH 5.8% whereas the corresponding findings in Young-HUNT 2 were 8.7%, 21.9% and 6.5% (Fig. 1). There were 33 individuals in Young-HUNT 1 and 29 individuals in Young-HUNT 2 who had a combination of MI and TTH and these were included in both diagnostic groups. When each type of recurrent headache was analyzed separately in both genders combined, only the increase in prevalence for TTH was statistically significant (OR: 1.20, 95%CI: 1.02–1.42, $p = 0.03$).

As shown in Table 2, the prevalence of MI increased significantly among boys from 4.1% to 6.3% (OR: 1.59, 95%CI: 1.00–2.51, $p = 0.047$). For girls there were no significant changes of prevalence in the different types of recurrent headaches, the greatest change was seen for TTH (25.6% versus 28.7%, $p = 0.12$). The only decrease in prevalence was for NCH among boys (4.6% versus 4.1%, $p = 0.63$). The male:female ratios were stable for TTH (1:2.3 in Young-HUNT 1 and 1:2.1 Young-HUNT 2), for MI the ratio decreased from 1:2.5 in Young-HUNT 1 to 1:1.7 in Young-HUNT 2 and for NCH it increased from 1:1.5 to 1:2.1.

4. Discussion

This is the first large-scale population-based study among adolescents in Norway assessing changes in the prevalence of primary

Table 3
Headache frequencies among boys and girls with recurrent headaches.

	Frequency reported		<Monthly		Monthly		Weekly		Daily	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Young-HUNT 1										
Totally	507	96.8	113	22.3	245	48.3	143	28.2	6	1.2
Boys	137	96.5	50	36.5	61	44.5	25	18.2	1	0.7
Girls	370	96.9	63	17.0	184	49.7	118	31.9	5	1.4
Young-HUNT 2										
Totally	540	92.2	117	21.7	311	57.6	103	19.1	9	1.7
Boys	149	84.2	49	32.9	85	57.0	14	9.4	1	0.7
Girls	391	95.6	68	17.4	226	57.8	89	22.8	8	2.0

headaches over a four-year period of time. Although the prevalence of having had headache during the last 12 months was relatively stable and tended to decrease, the prevalence of recurrent headaches increased significantly over a four-year period.

Earlier follow-up studies have examined changes in prevalence of recurrent headaches in young age, but the results are diverging [17]. An increase of headache prevalence from 14% to 52% has been found among 7-year-old children, comparing findings from similar studies in 1974 and 1992 [18]. Among Dutch schoolchildren aged 10–17, prevalence of frequent headache increased from 44% in 1983 to 51% in 1995 [19]. Wang et al. found an increase in one-year migraine prevalence from 5.2% to 7.4% among adolescents aged 13–15 years during 1999–2001 [16]. In contrast, no increasing tendency in migraine prevalence was found in a large American population-based study of individuals older than 12 years of age, compared with a similar study conducted 10 years earlier [9]. Virtanen et al. found that the prevalence of regular headache (i.e., at least once a month) among adolescent Finnish twins increased from 59% at age 11 to 65% at age 14 and decreased to 63% at age 17 [17]. The reasons for the discrepancy among different studies are not known, but are probably due to differences in study methodology, diagnostic criteria, age groups and populations as well as geographical, sociocultural and ethnic factors. In addition, only a limited number of replicate studies of headache prevalence surveys among children and adolescents have been published. Our findings support the impression that the prevalence of recurrent headache among adolescents is increasing, but we found a significant change towards less weekly and more monthly headache. Changes in life conditions and habits including increased stress and reduced physical activity have been suggested as causal factors of the probable increasing prevalence of recurrent headaches among children and adolescents, though evidence is still lacking [20].

Several follow-up studies among adults have shown stable one-year prevalence of migraine at about 11–17% overall, and 16–23% for women and 5–10% for men [9,15,21]. In our study we found no significant overall change in migraine prevalence between Young-HUNT 1 (7.5%) and Young-HUNT 2 (8.7%). The prevalence for boys, however, increased significantly (4.1–6.3%) in contrast to what have been seen among adults. The prevalence of migraine was lower among the adolescents in our surveys than seen in the adult population. This is consistent with findings from other studies, showing that the prevalence of migraine increases throughout childhood and early adult life, until approximately age 40, after which it declines [7,22].

TTH is the most common but least studied form of recurrent headache. Prevalence data of TTH are sparse, and the variation on TTH prevalence is wide. Prevalence varies between 16% and 78% in different population studies, with a global prevalence of current TTH of 42% among adults [7]. The wide variation in prevalence of TTH might be due to different inclusion criteria as TTH varies considerably in frequency, duration and intensity. A significant increase in the prevalence of TTH from 79% in 1989 to 87% in 2001 was found among adults aged 25–36 years from the general Danish population [15]. In this study the majority had episodic infrequent TTH according to the 2nd edition of the HIS classification [10], while the prevalence of frequent episodic TTH increased from 29% to 37%. We found a significant increase in the prevalence of TTH in our adolescent population from 19.0% to 21.9% with an overweight of monthly/frequent episodic TTH. As for MI we found lower prevalence for TTH than seen in most studies in the adult population which can be explained by the fact that the prevalence of TTH peaks between ages 30–39 and subsequently decreases with age [23].

The participation rates in Young-HUNT 1 and in Young-HUNT 2 were comparable and acceptable high, which indicates that the study cohorts represent the population fairly well. It is expected that any non-response bias would apply equally to both of the cross-sectional cohorts and thus not interfere with the comparison over time. More girls answered the questionnaire in Young-HUNT 2, and this could lead to an overestimation of the one-year prevalence of headache compared to Young-HUNT 1. However, the one-year prevalence of any headache was relatively stable in the two studies and tended to decrease. There was no systematic selection of the interviewed participants, and they had similar age and gender distributions in both surveys. Important strengths of the HUNT methodology is that all headache diagnoses in both surveys are based on validated interviews by trained nurses, and the exact replication of design and methodology. These features ensure high stability and validity and enables comparison of prevalence estimates over time. The majority of participants in Young-HUNT 2 had answered identical headache questions in Young-HUNT 1. We cannot rule out that there has been some kind of education of the participants in this respect during the HUNT surveys, which may have had an impact of the way they have responded to the questions.

In conclusion, this population-based study shows an increase in the prevalence of recurrent headaches among adolescents over a four-year period and underlines the need for prospective designed studies with emphasis on prognosis and etiological factors.

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