

ORIGINAL REPORT

The medicine use and corresponding subjective health complaints among adolescents, a cross-national survey[†]

Inese Gobina^{1*}, Raili Välimaa², Jorma Tynjälä², Jari Villberg², Anita Villerusa¹, Ronald J. Iannotti³, Emmanuelle Godeau⁴, Saoirse Nic Gabhainn⁵, Anette Andersen⁶ and Bjørn E. Holstein⁶ the HBSC Medicine Use Writing Group[‡]

¹Department of Public Health and Epidemiology, Riga Stradins University, Latvia

²Department of Health Sciences, University of Jyväskylä, Finland

³Prevention Research Branch, Eunice Kennedy Shriver National Institute of Child Health and Human Development, Bethesda, Maryland, USA

⁴Service Médical du Rectorat de Toulouse, UMR Inserm U558/University Paul Sabatier, Toulouse, France

⁵Health Promotion Research Centre, School of Health Sciences, National University of Ireland, Ireland

⁶National Institute of Public Health, University of Southern Denmark, Denmark

ABSTRACT

Background Medicine use among children and young people is under-researched. Studies that investigated cross-national patterns in adolescents' medicine use practice are rare. This study aims to investigate adolescents' medicine use for corresponding health complaints in Europe and USA.

Methods Nationally representative samples of adolescents from 19 countries and regions in Europe and USA completed an anonymous, standardised questionnaire as part of the Health Behaviour in School-aged Children 2005/2006 survey. The prevalence of health complaints and medicine use were determined. The influence of the frequency of medicine use, age, gender and country of residence, on the likelihood of medicine use was assessed using multilevel multivariate logistic regression, with separate analyses for boys and girls.

Results Both health complaints and medicine use were common among adolescents. Medicine use was strongly associated with the frequency of health complaints. The prevalence of both medicine use and health complaints was higher among girls than boys. Boys and girls with weekly health complaints were both similarly likely to report elevated rates of medicine use.

Conclusions The findings indicated that adolescents who report more frequent recurrent health complaints are also more likely to report more frequent medicine use for their health complaints. Adolescent boys with weekly health complaints have the same risk of medicine use as girls with weekly health complaints. The importance of educating school-aged children to interpret their bodily feelings and complaints and to use medicines appropriately is of high priority. Copyright © 2011 John Wiley & Sons, Ltd.

KEY WORDS — medicine use; adolescence; health complaints

Received 3 June 2010; Revised 13 December 2010; Accepted 14 December 2010

INTRODUCTION

Medicine use is prevalent among 11- to 15-year-old adolescents internationally, with consistent gender

patterning, girls reporting more medicine use than boys.^{1,2} A review of the research literature from 17 countries indicated relatively high levels of autonomy in using medicines among adolescents.³ Overdoses and the uncontrolled use of medicine have been related to harmful health effects and further to suicide attempts among adolescents.^{4,5} The use of medicine has also been associated with other health risk behaviours and poor self-rated health.^{6,7} One US study found expected medicine use to have a strong relationship with the perceived vulnerability and severity of health problems.⁸

Aside from gender differences, there is a general dearth of information about variations in medicine use

* Correspondence to: I. Gobina, Department of Public Health and Epidemiology, Riga Stradins University, Latvia. E-mail: inese.gobina@rsu.lv

[†]Ethical background: the study conformed to the ethical standards of each of the countries involved.

[‡]Members of the HBSC Medicine Use Writing Group: Robert Griebler (AUT), Anette Andersen (DNK), Bjørn Holstein (DNK), Ina Borup (DNK), Raili Välimaa (FIN), Emmanuelle Godeu (FRA), Anna Kokkevi (GRC), Anastasios Fotiou (GRC), Saoirse Nic Gabhainn (IRL), Alberto Boraccino (ITA), Lorenza Dallago (ITA), Inese Gobina (LVA), Yolande Wagener (LUX), Kate Levin (GBR-SCT), Emmanuel Kuntsche (CHE), Ronald Iannotti (USA).

among adolescents cross-nationally derived from population-based studies, and internationally comparable studies on medicine use among adolescents are rare. The Health Behaviour in School-aged Children Study (HBSC) is the only source of information on medicine use based on unified methodology among adolescents across a wide range of countries in Europe and North America. One advantage of HBSC is that it simultaneously assesses both the prevalence of medicine use for specific symptoms (headache, stomach-ache, difficulties in getting to sleep and nervousness) and corresponding self-reported health complaints.

In previous analyses of HBSC studies, substantial cross-country variations in medicine use have been documented. However, it has not been possible to fully explain such variation in terms of the cross-national patterns in health complaints.^{1,9} For example, HBSC studies in Denmark during the period from 1988 to 2006 revealed an increase in self-reported medicine use which was not explained by corresponding increases in symptom prevalence.^{10,11}

Several recent papers document that medicine use among adolescents is strongly associated with social and psychosocial factors. These studies report that medicine use is associated with low social class,¹² immigration status,¹³ parental medicine use,¹⁴ being exposed to bullying at school,¹⁵ having poor self-rated health^{7,16} and low sense of coherence.¹⁷ One qualitative study among teenage girls even suggests that the use of pain killers is not really related to prevalence of pain but rather to daily stressors and the fear of developing a headache.¹⁸ It still remains undocumented to what extent medicine use for specific symptoms is related to the prevalence of corresponding health complaints.

Previous research has shown that there is a high prevalence of recurrent subjective health complaints among adolescents, and significant gender and age differences have been identified. Older adolescents and girls generally report more health complaints.^{19–22} More adverse health and psychosocial outcomes (e.g. depression, anxiety, school absence, bullying) have been found among adolescents with weekly health complaints.^{19,23–26} Moreover, the use of medicine may indicate the severity and individual burden of weekly health complaints for adolescents. Danish studies suggest a strong association between the prevalence of health complaints and medicine use among adolescents.^{7,15} This paper aims first to investigate whether age and gender patterns in adolescent self-reported medicine use are consistent across multiple countries, and second to document the cross-national consistency in the relationship between medicine use and subjective health complaints.

METHODS

Design and sample

Health Behaviour in School-aged Children (HBSC) is a periodic cross-national study conducted by an international network of research teams in collaboration with the World Health Organisation (WHO) Regional Office since the 1980's.²⁷

The 2005/2006 HBSC study was implemented in 41 countries and regions and data from a subsample of 19 countries or regions which included optional questions about medicine use were analysed for this study: Austria, Belgium (French (Fr) and Flemish (Fl)), Denmark, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, The former Yugoslav Republic of Macedonia (TFYR Macedonia), Netherlands, Romania, Scotland, Sweden, Switzerland and USA. The individual response rate per country was above 80%, and total sample size was 86 860. Table 1 provides descriptive information about the study population.

All countries carried out the data collection in accordance with the international study protocol, providing a strong basis for international comparison.²⁸ The HBSC study is a school-based survey with data collected through standardised procedures and standardised self-administered anonymous questionnaires in the classroom. The sample units were school classes (or schools where sampling frames of classes was not available). The target population of the HBSC study was children attending regular schools aged 11, 13 and 15 years old with a sample of approximately 1500 from each age group. In Finland and Italy medicine use questions were included only for 13- and 15-year olds and in Romania for 15-year olds. Participation was voluntary, and anonymity and confidentiality were ensured. Each country respected ethical and legal requirements in their countries for this type of survey. For more detailed information regarding the methodology see Roberts *et al.*^{28,29} and the HBSC study home page: www.hbsc.org.

Measurements

Medicine use was assessed with the question 'During the past month, have you taken any medicine for the following: headache; stomach-ache; difficulties in getting to sleep; nervousness'. Response options were: 'no', 'yes, once' and 'yes, more than once', which were dichotomised into 'yes' and 'no' for these analyses.

The occurrence of subjective health complaints were measured using the reliable and validated HBSC symptom checklist,^{30,31} where respondents were asked

Table 1. Study population of the HBSC 2005/2006 Survey, $n = 86\,860$

Country (Principal investigator)	Boys			Girls			Total (n)
	11-year olds (n)	13-year olds (n)	15-year olds (n)	11-year olds (n)	13-year olds (n)	15-year olds (n)	
Austria (W. Dür)	853	794	693	841	793	801	4775
Belgium-Fr (D. Piette)	670	697	831	621	707	785	4311
Belgium-Fl (C. Vereecken)	732	850	731	727	753	683	4476
Germany (U. Ravens-Sieberer)	1127	1234	1271	1104	1207	1281	7224
Denmark (P. Due)	985	980	762	1108	1057	790	5682
Finland (J. Tynjälä)	—*	834	790	—*	891	895	3410
France (E. Godeau)	1265	1147	1139	1228	1279	1083	7141
Greece (A. Kokkevi)	543	553	650	544	634	766	3690
Ireland (S. Nic Gabhainn)	719	870	817	651	915	868	4840
Italy (F. Cavallo)	—*	661	678	—*	682	657	2678
Luxemburg (Y. Wagener)	617	769	776	645	762	731	4300
Latvia (I. Pudule)	715	691	628	710	775	702	4221
TFYR Macedonia (L. Kostarova)	826	847	952	840	862	944	5271
Netherlands (W. Vollenbergh)	663	779	672	687	736	691	4228
Romania (A. Baban)	—*	—*	606	—*	—*	999	1605
Scotland (C. Currie)	804	1120	1108	887	1136	1090	6145
Sweden (U. Marklund)	772	655	752	741	698	774	4392
Switzerland (H. Schmid)	728	772	733	778	801	767	4579
USA (R. Iannotti)	500	708	649	594	806	635	3892
Total	12 519	14 961	15 238	12 706	15 494	15 942	86 860

*Data on medicine use was not collected for these subsamples.

to consider the frequency with which they had experienced the following health complaints over the previous six months: headache, stomach-ache, nervousness and difficulties in getting to sleep. Response options were: 'about every day', 'more than once a week', 'about every week', 'about every month', 'rarely or never'. These were grouped into three categories: 'weekly' (about every day, more than once a week, and about every week) 'monthly' (about every month) and 'rarely or never'.

Statistical analyses

Statistical analyses included frequencies, cross-tabulations and chi-square tests; logistic regression analyses with odds ratios was used to investigate the association between medicine use and corresponding weekly and monthly subjective health complaints. A significance level of 0.05 was adopted for all statistical analyses. Factors contributing to young people's medicine use during the previous month were analysed using a multilevel logistic regression analysis model, separately for boys and girls. Age and the prevalence of subjective health complaints were included as variables, using one category as a reference group. To examine the effect of adolescents' country of residence, country was included in the model as a second-level factor. Larsen *et al.*³² suggest that one way to compare the size of the effect of the random variable would be to see what would happen if the

study only contained two randomly selected countries, and if the difference between these countries was treated as a fixed rather than a random effect. A median odds ratio (MOR) was thus calculated to evaluate the random country effect. MOR is based on the consideration that a random country effect model regards the countries as randomly selected and therefore treats the effect of specific countries as outcomes as a random variable rather than the fixed parameters in regression models. Multilevel modelling was carried out using MLwiN software.³³

RESULTS

Prevalence of medicine use

Reported medicine use for selected subjective health complaints was common. On average, the most prevalent was the medicine use for headache (40.9%) followed by stomach-ache (23.8%). The same percent of adolescents, 6.5%, used medicine for nervousness and for difficulties in getting to sleep (Table 2).

The prevalence of medicine use for headache, stomach-ache, and difficulties in getting to sleep or nervousness during the past month varied substantially across countries and between reported subjective health complaints. The highest variation among countries was in the medicine use for headache and stomach-ache. Among countries where the medicine use items were asked of all three age groups, the

Table 2. Prevalence of medicine use during the past month per country by gender (%)

Country	Medicine use for headache				Medicine use for stomach-ache				Medicine use for difficulties in getting to sleep				Medicine use for nervousness			
	Boys	Girls	<i>p</i>	Total	Boys	Girls	<i>p</i>	Total	Boys	Girls	<i>p</i>	Total	Boys	Girls	<i>p</i>	Total
Austria	27.4	34.2	<0.001	30.8	13.7	22.2	<0.001	18.0	7.3	7.1	NS	7.2	8.7	8.0	NS	8.3
Belgium-Fr	25.7	34.8	<0.001	30.2	15.8	32.4	<0.001	24.0	3.2	3.8	NS	3.5	3.7	3.2	NS	3.4
Belgium-Fl	33.5	46.0	<0.001	39.5	18.6	23.3	<0.001	20.9	7.2	9.5	<0.01	8.3	7.3	7.8	NS	7.6
Germany	29.4	37.5	<0.001	33.4	11.6	22.6	<0.001	17.1	4.7	4.2	NS	4.5	4.9	3.8	<0.05	4.3
Denmark	36.2	49.0	<0.001	42.9	8.8	22.2	<0.001	15.8	5.6	5.0	NS	5.3	3.9	3.9	NS	3.9
Finland*	52.3	64.0	<0.001	58.4	9.7	35.1	<0.001	23.1	3.0	2.8	NS	2.9	2.7	1.3	<0.01	2.0
France	42.5	54.1	<0.001	48.3	30.8	51.3	<0.001	41.1	10.2	10.1	NS	10.2	9.0	9.6	NS	9.3
Greece	31.8	47.4	<0.001	40.0	8.0	16.8	<0.001	12.6	3.4	2.6	NS	3.0	4.4	4.9	NS	4.7
Ireland	39.7	47.2	<0.001	43.4	17.1	28.4	<0.001	22.7	6.1	4.9	NS	5.5	4.9	4.1	NS	4.5
Italy*	30.1	41.2	<0.001	35.7	16.4	28.9	<0.001	22.7	3.2	3.4	NS	3.3	4.1	5.3	NS	4.7
Luxemburg	29.5	41.3	<0.001	35.3	18.4	35.6	<0.001	27.0	7.3	5.9	NS	6.6	7.7	7.3	NS	7.5
Latvia	35.6	50.7	<0.001	43.4	30.6	44.0	<0.001	37.5	7.1	6.4	NS	6.8	9.5	10.8	NS	10.1
TFYR Macedonia	30.6	41.2	<0.001	35.9	22.4	30.2	<0.001	26.3	12.6	10.0	<0.01	11.3	21.2	18.2	<0.01	19.7
Netherlands	35.5	52.2	<0.001	43.9	12.1	32.8	<0.001	22.5	4.5	5.9	NS	5.2	2.3	3.9	<0.01	3.1
Romania†	41.9	63.6	<0.001	55.5	18.0	32.9	<0.001	27.3	5.8	5.9	NS	5.8	7.1	9.9	NS	8.9
Scotland	39.2	51.7	<0.001	45.6	14.9	35.2	<0.001	25.3	5.8	6.2	NS	6.0	3.5	3.9	NS	3.7
Sweden	36.6	49.4	<0.001	43.0	8.9	23.8	<0.001	16.5	5.1	5.4	NS	5.2	3.9	4.2	NS	4.1
Switzerland	26.5	34.0	<0.001	30.3	11.5	24.1	<0.001	18.0	6.5	7.4	NS	6.9	5.3	5.7	NS	5.5
USA	43.1	59.8	<0.001	51.8	18.9	30.7	<0.001	25.1	8.6	11.2	<0.01	10.0	4.5	5.1	NS	4.8
HBSC (average)	34.9	46.8	<0.001	40.9	16.6	30.7	<0.001	23.8	6.5	6.4	NS	6.5	6.5	6.5	NS	6.5

*Data from 13- and 15-year olds.

†Data from 15-year olds.

prevalence of medicine use for headache ranged from 30% in Belgium-Fr, Germany, and Switzerland to 52% in USA. The proportion using medicine for stomach-ache varied from 13% in Greece to 41% in France. There was less variation among countries in medicine use for difficulties in getting to sleep and nervousness. Overall, the prevalence of medicine use for all or most of the selected health complaints was above average in France, Latvia, TFYR Macedonia and USA (Table 2).

Medicine use for aches was significantly more common among girls than among boys ($p < 0.001$) and

this gender pattern was observed in all countries. There was no consistent gender pattern in medicine use for difficulties in getting to sleep or for nervousness, and these gender differences were not significant in most of the countries (Table 2).

Subjective health complaints

Table 3 shows the prevalence of weekly and monthly health complaints by age and gender. The prevalence of health complaints is substantial among adolescents.

Table 3. Prevalence of corresponding health complaints by age and gender (%)

Health Complaints	Boys				Girls			
	11 years	13 years	15 years	Total	11 years	13 years	15 years	Total
Headache								
Monthly*	20.6	23.4	26.2	23.5	20.4	24.3	25.5	23.5
Weekly†	18.8	22.4	21.8	21.1	26.0	33.7	42.5	34.3
Stomach-ache								
Monthly	22.0	24.1	24.8	23.7	23.6	34.9	42.6	34.0
Weekly	14.2	14.1	12.8	13.7	22.9	25.2	25.9	24.7
Difficulties in getting to sleep								
Monthly	14.2	16.1	17.5	16.0	15.3	16.2	17.1	16.2
Weekly	27.8	26.8	28.4	27.7	31.0	33.7	38.0	34.3
Nervousness								
Monthly	22.3	25.8	26.6	25.0	22.4	24.1	24.3	23.7
Weekly	25.8	31.1	34.6	30.6	29.2	39.1	46.5	38.5

*About every month.

†About every day, more than once a week, about every week.

Overall, girls reported subjective health complaints more often than boys ($p < 0.001$). However, gender differences were much greater in reporting weekly health complaints than monthly health complaints. For girls, all of the selected health complaints were more prevalent with increasing age ($p < 0.001$). Among girls, the increase by age in the proportion of weekly health complaints was steeper than that for monthly health complaints; the only exception was the prevalence of monthly stomach-aches which was more prevalent than weekly stomach-aches. For boys, the prevalence of difficulties in getting to sleep and stomach-ache did not vary substantially by age but the total prevalence of headache and nervousness increased by age.

The association between medicine use and corresponding health complaints

Association between medicine use and corresponding health complaints were investigated separately for monthly and weekly health complaints. Among the countries with the highest levels of medicine use, the prevalence of reported health complaints among adolescents was substantial, but was not significantly different than in other countries, and in some countries with lower medicine use the prevalence of health complaints was even higher (data not shown). Thus no consistent, unidirectional pattern emerged.

Multilevel models for pooled samples revealed that both individual factors and country of residence contributed significantly to the variation in medicine use during the past month. Among individual factors, the frequency of corresponding health complaints was the most important (Tables 4 and 5).

Among both girls and boys, the use of medicine for selected health complaints increased considerably with a frequency in reported subjective health complaints. For example, the odds of medicine use for headache was about eight times higher among those who reported headache weekly compared to those who reported headache less than once a month or never during the preceding six months (Tables 4 and 5). Although the prevalence of weekly health complaints and medicine use are both higher among girls, the odds of medicine use by weekly health complaints are similar for both genders.

Among girls medicine use for headache and stomach-ache increased with age and was most prevalent in 15-year olds. Medicine use for sleeping difficulties or nervousness was less common among 13- and 15-year olds compared to 11-year olds, but no statistically significant difference was found between 13- and 15-year-old girls (Table 4). In boys medicine use for

Table 4. Medicine use among *girls* for headache, stomach-ache, sleeping difficulties and nervousness by age group and subjective health complaints

	OR	95%CI	
Medicine use for headache			
Age			
11 years	1.00		
13 years	1.30	1.24	1.35
15 years	1.54	1.48	1.59
Headache			
Rarely/never	1.00		
Monthly	3.85	3.79	3.90
Weekly	7.90	7.85	7.95
MOR		1.43	
Medicine use for stomach-ache			
Age			
11 years	1.00		
13 years	1.18	1.12	1.24
15 years	1.65	1.59	1.71
Stomach-ache			
Rarely/never	1.00		
Monthly	4.17	4.12	4.23
Weekly	6.18	6.12	6.25
MOR		1.44	
Medicine use for sleeping difficulties			
Age			
11 years	1.00		
13 years	0.70	0.65	0.75
15 years	0.72	0.67	0.78
Sleeping difficulties			
Rarely/never	1.00		
Monthly	2.55	2.42	2.69
Weekly	4.62	4.51	4.72
MOR		1.48	
Medicine use for nervousness			
Age			
11 years	1.00		
13 years	0.71	0.68	0.75
15 years	0.74	0.68	0.79
Nervousness			
Rarely/never	1.00		
Monthly	1.85	1.75	1.96
Weekly	4.15	4.05	4.25
MOR		1.43	

Odd ratios, their 95% confidence intervals (CI) and median odds ratio (MOR). Multilevel logistic regression analysis.

headache was most common among 13- and 15-year olds compared to 11-year olds, but no significant difference was found between 13- and 15-year olds. Medicine use for stomach-ache, sleeping difficulties and nervousness decreased with age and was most prevalent in the youngest age-group (Table 5).

In addition to variance between adolescents, the median value of the odds-ratio (MOR) between the country with the highest risk and the country with the lowest risk, when randomly selecting two countries, demonstrated a clear effect of country on medicine use. The MOR for boys varied from 1.25 to 1.55 and for girls from 1.43 to 1.48 (Tables 4 and 5).

Table 5. Medicine use among boys for headache, stomach-ache, sleeping difficulties and nervousness by age group and subjective health complaints

	OR	95%CI	
Medicine use for headache			
Age			
11 years	1.00		
13 years	1.10	1.04	1.15
15 years	1.15	1.09	1.21
Headache			
Rarely/never	1.00		
Monthly	4.41	4.36	4.47
Weekly	7.62	7.56	7.68
MOR		1.31	
Medicine use for stomach-ache			
Age			
15 years	1.00		
13 years	1.26	1.19	1.33
11 years	1.56	1.49	1.63
Stomach-ache			
Rarely/never	1.00		
Monthly	3.40	3.33	3.47
Weekly	6.19	6.12	6.26
MOR		1.55	
Medicine use for sleeping difficulties			
Age			
15 years	1.00		
13 years	1.35	1.25	1.46
11 years	1.92	1.82	2.03
Sleeping difficulties			
Rarely/never	1.00		
Monthly	2.55	2.43	2.68
Weekly	4.62	4.52	4.72
MOR		1.25	
Medicine use for nervousness			
Age			
15 years	1.00		
13 years	1.29	1.19	1.40
11 years	1.86	1.75	1.96
Nervousness			
Rarely/never	1.00		
Monthly	1.87	1.75	1.99
Weekly	3.73	3.62	3.83
MOR		1.43	

Odd ratios, their 95% confidence intervals (CI) and median odds ratio (MOR). Multilevel logistic regression analysis.

DISCUSSION

Medicine use among adolescents was prevalent among all participating countries, with medicine use for aches being most common. Multilevel models revealed that in both girls and boys medicine use for headache is more prevalent in older age groups; furthermore, medication for stomach-ache by girls increased with age. Medicine use for other selected health complaints decreased with age in both girls and boys.

Adolescent girls report more health complaints and more frequently use medicine than boys.^{1,19–21} Although the prevalence of both medicine use and health complaints for boys was significantly lower than

for girls, the odds of medicine use for boys with frequent health complaints was just as great as for girls. These results correspond with the Danish study⁷ and suggest that boys with weekly subjective health complaints are at the same added risk of excessive medicine use as girls with weekly health complaints. This finding indicates that adolescent boys should not be neglected when addressing subjective health and medicine use issues.

School-aged children's access to medicine and the availability of medicine to them differs by country. The most important source of supply of medicines for adolescents is parents, and for most adolescents, medicines are accessible in the home. The role of physicians, peers, teachers or others as possible sources of medicine supply for adolescents is less significant.^{34–36} Cultural differences in coping with sickness and using medicines to deal with health complaints should be considered as possible explanatory factors. However, for evidence-based interventions, more research is required in this area. From our data, there was no evident explanation for the country differences concerning medicine use among adolescents.

This study aimed to examine adolescents' medicine use for corresponding health complaints, and the results show a strong, consistent and graded association between frequency of the relevant complaint and medicine use for this complaint. The odds of medicine use by adolescents with weekly health complaints increased considerably compared to those with monthly health complaints. Medicine use for adolescents with weekly health complaints may be related to severity of these health complaints; however, it is likely to indicate the individual burden of weekly health complaints. Medicine use to deal with frequent subjective health complaints is prevalent among adolescents but it should not necessarily be regarded as an acceptable behaviour or promoted as the main possible coping strategy. The initial and primary method of helping adolescents cope with stressful situations should be through family and primary health care support.

The study underscores the importance of promoting adolescents' knowledge and skills in interpreting their physical and psychological feelings, as well as their symptoms, in order to react as appropriately as possible—to balance their daily rhythms, eat appropriately and regularly, seek help for their troubles and problems, learn to cope with stressful situations, and learn to use medicine correctly. As the youngest respondents in this study were only 11 years old, the greatest responsibility for taking care of young people's well-being and health, including medicine use, lies with their parents and other significant adults.

As the level of autonomy in medicine use among young people is surprisingly high and their knowledge of medicine use is poor,³ schools and the health sector have an important responsibility to develop educational initiatives in the field. The study also underscores that health education about medicines is an important issue.

The major strength of this study is the comparable and representative data on adolescents from 19 countries and regions, and the opportunity to study medicine use for corresponding health complaints, not just medicine use as a separate phenomenon.

However, self-reported medicine use may be influenced by recall bias and by what the adolescents perceive to be medicines. There could be different interpretations of the concept of medicine use. One reason for these different interpretations among adolescents may be the fact that health matters are interpreted in different ways in different countries.³⁷ There is a lack of research on the validity of self-reported medicine use among adolescents. A Danish study² showed high adolescent-parent agreement for medicine use using HBSC medicine use items, which provides confidence in the data on medicine use among adolescents being valid. Also, an unpublished qualitative study of the Danish research group suggests that adolescents 11 years old and older understand the questions and respond adequately regarding common over-the-counter medicines.³⁸

Self-reports of health complaints is the main and valuable source of information regarding subjective experience.³⁹ Most medicine use by adolescents is over-the-counter (OCT) medicines and a prescription-based study would not capture use of OCT medicines. Therefore self-reported medicine use provides the most complete picture of this phenomenon as possible.

Self-reported medicine use for specific health complaints could be conceptualised as a kind of intentional behaviour for coping with perceived health problems. Therefore, medicine use could be used as an indicator of adolescents with significant individual burden of subjective health complaints. In addition, because medicine use among adolescents has also been found to be associated with other risk behaviours such as smoking and drinking,⁶ adolescents' medicine use should be regarded, on the broader scale, as an indicator of subjective health problems and personal burden.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

KEY POINTS

- High proportions of adolescents use medicines for common health complaints and the prevalence of medicine use varies considerably by country.
- Medicine use is strongly associated with the frequency of health complaints.
- Adolescent boys with weekly health complaints have the same risk of medicine use as girls with weekly health complaints.
- Medicine use could be used as an indicator of adolescents with significant individual burden of subjective health complaints.

ACKNOWLEDGEMENTS

The research is based on WHO supported Health Behaviour among School-aged Children Study (HBSC).

We thank the International Coordinator of the 2005/2006 study, Candace Currie, University of Edinburgh, Scotland, and the Data Bank Manager, Oddrun Samdal, University of Bergen, Norway. We thank all our international colleagues mentioned in Table 1 for thorough sampling and data collection and also acknowledge the HBSC Positive Health Focus group for their contribution to the health measurements in the study. The contribution of RJI to this manuscript was supported by the Intramural Research Program of the Eunice Kennedy Shriver National Institute of Child Health and Human Development.

REFERENCES

1. Hansen EH, Holstein BE, Due P, Currie C. International survey of self-reported medicine use among adolescents. *Ann Pharmacother* 2003; **37**: 361–366.
2. Andersen A, Krølner R, Holstein BE, et al. Medicine use among 11 and 13 years olds: agreement between parents' reports and children's self-reports. *Ann Pharmacother* 2007; **41**: 581–586.
3. Hämeen-Anttila K, Bush PJ. Healthy children's view on medicines: a review. *Res Social Adm Pharm* 2008; **4**: 98–114.
4. Hawton K, James L. Suicide and deliberate self harm in young people. *BMJ* 2005; **330**: 891–894.
5. Rogers PD, Copley L. The nonmedical use of prescription drugs by adolescents. *Adolesc Med State Art Rev* 2009; **20**: 1–8.
6. Andersen A, Holstein BE, Hansen EH. Is medicine use in adolescence risk behaviour? Cross-sectional survey of school-aged children from 11 to 15. *J Adolesc Health* 2006; **39**: 362–366.
7. Holstein BE, Hansen EH, Andersen A, Due P. Self-rated health as predictor of medicine use in adolescence. *Pharmacoepidemiol Drug Saf* 2008; **17**: 186–192.
8. Bush PJ, Iannotti RJ. A children's health belief model. *Med Care* 1990; **28**: 69–86.
9. Scheidt P, Overpeck MD, Wyatt W, Aszmann A. Adolescent's general health and well-being. In *Health and Health Behaviour Among Young People. Health Behaviour in School-aged Children: A WHO Cross-National Study (HBSC). International Report*, Currie C, Hurrelmann K, Settertobulte W et al. (Eds). WHO: Copenhagen, 2002; pp. 31–38.
10. Holstein BE, Hansen EH, Due P, Almarsdóttir AB. Self-reported medicine use among 11 to 15 year old girls and boys in Denmark 1988–1998. *Scand J Public Health* 2003; **31**: 334–341.
11. Holstein BE, Andersen A, Due P, Hansen EH. Children's and adolescent's use of medicine for aches and psychological problems: secular trends from 1988 to 2006 [In Danish]. *Ugeskr Laeger* 2009; **171**: 24–28.
12. Holstein BE, Hansen EH, Due P. Social class variation in medicine use among adolescents. *Eur J Public Health* 2004; **14**: 49–52.

13. Holstein BE, Hansen EH. Self-reported medicine use among adolescents from ethnic minority groups. *Eur J Clin Pharmacother* 2005; **61**: 69–70.
14. Hatchette JE, McGrath PJ, Murray M, Finley GA. Maternal influences in adolescents' pain self-management: a qualitative investigation. *Vulnerable Child Youth Stud* 2006; **1**: 159–169.
15. Due P, Hansen EH, Merlo J, *et al.* Is victimization of bullying associated with medicine use among adolescents: cross-sectional survey in Denmark. *Pediatrics* 2007; **120**: 110–117.
16. Skurtveit S, Rosvold EO, Furu K. Use of psychotropic drugs in an urban adolescent population: the impact of health-related variables, lifestyle and socio-demographic factors – the Oslo Health Study 2000–2001. *Pharmacoepidemiol Drug Saf* 2005; **14**: 277–283.
17. Koushede V, Holstein BE. Sense of coherence and medicine use for headache among adolescents. *J Adolesc Health* 2009; **45**: 149–155.
18. Hansen DL, Hansen EH, Holstein BE. Using analgesics as tools: young women's treatment for headache. *Qual Health Res* 2008; **18**: 234–243.
19. Torsheim T, Wold B. School-related stress, support, and subjective health complaints among early adolescents: a multilevel approach. *J Adolesc* 2001; **24**: 701–713.
20. Torsheim T, Ravens-Sieberer U, Hetland J, *et al.* Cross-national variation of gender differences in adolescent subjective health in Europe and North America. *Soc Sci Med* 2006; **62**: 815–827.
21. Cavallo F, Zambon A, Borraccino A, *et al.* Girls growing adolescence have a higher risk or poor health. *Qual Life Res* 2006; **15**: 1577–1585.
22. Ravens-Sieberer U, Torsheim T, Hetland J, *et al.* Subjective health, symptom load and quality of life of children and adolescents in Europe. *Int J Public Health* 2009; **54**: S151–S159.
23. Haugland S. Pain in childhood and adolescence: diagnosis, smokescreen or everyday complaint? *Acta Paediatr* 2004; **93**: 157–163.
24. Due P, Holstein BE, Lynch JW, *et al.* Bullying and symptoms among school-aged children: international comparative cross sectional study in 28 countries. *Eur J Public Health* 2005; **15**: 128–132.
25. Larsson B, Sund AM. Emotional/behavioural, social correlates and one-year predictors of frequent pains among early adolescents: influences of pain characteristics. *Eur J Pain* 2007; **11**: 57–65.
26. Roth-Isigkeit A, Thyen U, Stoven H, *et al.* Pain among children and adolescents: restriction in daily living and triggering factors. *Pediatrics* 2005; **115**: e152–e162.
27. Currie C, Gaibhainn SN, Godeau E. HBSC Network Coordinating Committee. The Health Behaviour in School-aged Children: WHO collaborative cross-national (HBSC) study: origins, concept, history and development 1982–2008. *Int J Public Health* 2009; **54**: S131–S139.
28. Roberts C, Currie C, Samdal O, *et al.* Measuring the health and health behaviours of adolescents through cross-national survey research: recent developments in the Health Behaviour in School-aged Children (HBSC) study. *J Public Health* 2007; **15**: 179–186.
29. Roberts C, Freeman J, Samdal O, *et al.* The Health Behaviour in School-aged Children (HBSC) study: methodological developments and current tensions. *Int J Public Health* 2009; **54**: S140–S150.
30. Haugland S, Wold B. Subjective health complaints in adolescence – reliability and validity of survey methods. *J Adolesc* 2001; **24**: 611–624.
31. Ravens-Sieberer U, Erhart U, Torsheim T, *et al.* An international scoring system for self-reported health complaints in adolescents. *Eur J Public Health* 2008; **18**: 294–299.
32. Larsen K, Petersen JH, Budtz-Jørgensen E, Endahl L. Interpreting parameters in the logistic regression model with random effects. *Biometrics* 2000; **56**: 909–914.
33. Rasbash J, Steele F, Browne W. *A User's Guide to MLwinN. Version 2.0.* University of Bristol, Centre for Multilevel Modelling: UK, 2003.
34. Stoelben S, Krappweis J, Rössler G, Kirch W. Adolescents' drug use and drug knowledge. *Eur J Pediatr* 2000; **159**: 608–614.
35. Sloan ED, Vessey JA. Self-medication with common household medicines by young adolescents. *Issues Compr Pediatr Nurs* 2001; **24**: 57–67.
36. Holstein BE, Andersen A, Krølner R, *et al.* Young adolescents' use of medicine for headache: sources of supply, availability and accessibility at home. *Pharmacoepidemiol Drug Saf* 2008; **17**: 406–410.
37. Jourdan D, Samdal O, Digne F, Carvalho GS. The future of health promotion in schools goes through the strengthening of teacher training at a global level. *Promot Educ* 2008; **15**: 36–38.
38. Tulinus D. *Qualitative interviews with school-children about their medicine use (M.Sc. thesis).* The Danish University of Pharmaceutical Science: Copenhagen, 2004.
39. Steinhausen H, Metzke CW. Continuity of functional-somatic symptoms from late childhood to young adulthood in a community sample. *J Child Psychol Psychiatry* 2007; **48**: 508–513.