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Self-reported recurrent pain and medicine use behaviours among 15-year olds: Results from the international study

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None declared.

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Abstract

Background: There is considerable variation in adolescent pain prevalence across epidemiological studies, with limited information on pain-related behaviours among adolescents, including medicine use. The aims of this study were (1) to examine the prevalence of recurrent pain among 15-year-old adolescents internationally; (2) to investigate the association between recurrent pain and medicine use behaviours among boys and girls; and (3) to evaluate the consistency of these associations across countries.

Methods: The World Health Organization (WHO) collaborative international Health Behaviour in School-aged Children 2009/2010 study collects data about self-reported aches and medicine use from 36,762 15-year-old adolescents from 22 countries/regions in Europe and the United States. Multi-level multivariate logistic regression, stratified by gender, was used to analyse the association between recurrent pain and medicine use for headache, stomachache, nervousness and difficulties in getting to sleep.

Results: More than 30% of adolescents reported recurrent headache, almost 30% recurrent backache and approximately 20% recurrent stomachache. Although pain prevalence and medicine use for aches were much higher for girls, the association between pain and medicine use was similarly strong for both genders. Adolescents with recurrent pain are more likely to use medicines also for non-corresponding pain, nervousness and difficulties in getting to sleep. The association between recurrent pain and medicine use was consistent across countries despite large-country differences in the prevalence of recurrent pain and medicine use.
Conclusions: Recurrent pain in adolescence is common cross-nationally. Adolescents with recurrent pain are more likely to use medicine in general. Recurrent pain and medicine use should be addressed in adolescent health policies.

1. Introduction

Recurrent pain among adolescents is a common phe- nomenon. Epidemiological studies show that 10–50% of adolescents report recurrent pain (Perquin et al., 2000a; Ghandour et al., 2004; Roth-Isigkeit et al., 2004; Petersen et al., 2006; Sundblad et al., 2007; Stanford et al., 2008; Darlington et al., 2012). In the studies, recurrent pain is defined as pain occurring at least once a week within the time frame of 3 or 6 months. These studies are difficult to compare because of differences in methodology and study populations. Thus, internationally comparable information on recurrent pain in adolescence is lacking.

Many adolescents with recurrent pain have other co-existing health complaints, which may have com- bined negative effects on their physical and emotional functioning (Härmä et al., 2002; Ghandour et al., 2004; Larsson and Sund, 2007; Sundblad et al., 2007; Hjern et al., 2008; Stanford et al., 2008; Hoftun et al., 2012). Effective pain management is therefore an important issue in adolescence. Medicine use for aches is common among adolescents and there is a graded association between medicine use and the frequency of corresponding pains (Hansen et al., 2003; Gobina et al., 2011). Most pain relief medicines used by ado- lescents are readily available non-prescription analge- sics (Stoelben et al., 2000; Westerlund et al., 2008). Medicine use for aches among adolescents is therefore a public health concern as adolescents have insuffi- cient knowledge and low awareness of appropriate use of medicines and the potential risks associated with intake (Stoelben et al., 2000; Nabors et al., 2004; Hämeen-Anttila and Bush, 2008). Furthermore, medi- cine use behaviour adopted in adolescence continues into adulthood (Andersen et al., 2009).

Some previous studies show that adolescents with recurrent pain more frequently use pain medications than those without (Perquin etal., 2000b; Roth- Isigkeit et al., 2005; Gobina et al., 2011). However, there is still insufficient knowledge on medicine use among adolescents with recurrent pains cross-nationally.

This study uses data from a large international comparative study collected and analysed using con- sistent robust methodological procedures across 22 countries in Europe and North America. The aims of this paper are (1) to examine the prevalence of recur- rent pain among 15-year-old adolescents; (2) to investigate the association between recurrent pain and medicine use behaviours among boys and girls; and (3) to evaluate whether these associations are consistent across countries.

2. Methods

2.1 Study design and sample

Data from the World Health Organization (WHO) collabora- tive international Health Behaviour in School-aged Children (HBSC) 2009/2010 study were used. The HBSC study is a school-based survey carried out every four years in each of the participating countries. All 43 countries and regions par- ticipating in the HBSC 2009/2010 survey followed the inter- national study protocol (Currie et al., 2010), thus providing a strong basis for international comparisons. Cluster sam- pling is used to achieve a representative sample of 11-, 13- and 15-year-old adolescents from schools in each of the countries in accordance with the structure of the national educational systems. Data are collected through standardized self-administrated anonymous questionnaires in the class- room. The questionnaire consists of mandatory and optional questions in accordance with the study protocol and 22 countries included the optional items about medicine use in their questionnaire in 2010. Only data collected from 15-year-olds were included in this study as at this age ado- lescents are more independent in their use of medicine (Holstein et al., 2008a; Hansen et al., 2009). The individual response rate was at least

80% in the majority of countries. Descriptive information about the study population (*n* = 36,762) is presented in Table 1.

Each country followed their respective national ethical and legal requirements for this survey. For more detailed information regarding the HBSC study and methodology, see Currie et al. (2009) and Roberts et al. (2009).

2.2 Measurements

The experience of pain (headache, stomachache and back ache) during the previous 6 months was analysed using the HBSC symptom checklist. The HBSC symptom checklist has previously shown good reliability and validity (Haugland and Wold, 2001a; Haugland et al., 2001b, Ravens-Sieberer et al., 2008). The frequency of health complaints in the scale varied from '*about every day*' to '*rarely or never*'. The pain occurring at least weekly was analysed as recurrent in contrast to pain occurring less often. The proportions of missing cases for self-reported pain by country were averaged at 1.2% for headache, 1.3% for stomachache and 1.4% for backache.

Medicine use was measured using the question: '*During the past month, have you taken any medicines for* . . . ?' with separate items for particular health complaints – headache, stomachache, nervousness and difficulties in getting to sleep. There was no separate item on medicine use for backache. Response options '*no*', '*yes*', 'yes*, more than once*' were dichotomized into '*yes*' and '*no*' for the analysis. This measure was shown to have high adolescent–parent agreement (Andersen et al., 2007). The average percentage of missing data by country was 3–4% per medicine use item. Also, reports of weekly nervousness and difficulties in getting to sleep were included in the analysis for exploring co-occurrence with recurrent pain.

2.3 Statistical analysis

The prevalence of medicine use and recurrent pain was compared separately for boys and girls testing for statistical significance by the chi-square test. A significance level of 0.05 and confidence level of 95% was adopted for all statis- tical analyses. The association between recurrent pain and medicine use was examined using multi-level logistic regres- sion. To measure the effect of country of residence, country was included in the model as a second-level factor. A median odds ratio (MOR) was calculated as a measure of heteroge- neity in logistic multi-level regression models to evaluate the random country effect (Rabe-Hesketh and Skrondal, 2008). Multi-level modelling was carried out using STATA 3.1. soft- ware (Stata Corp LP, College Station, TX, USA).

3. Results

3.1 Prevalence of recurrent pain

On average, across all countries, more than 30% of adolescents reported recurrent headache, almost 30% reported recurrent backache and approximately 20% of adolescents had recurrent stomachache.

The most prevalent pain in both genders was recur- rent headache (Table 2). The prevalence of recurrent headache among boys varied from 16% in Flemish- speaking Belgium and TFYR Macedonia to more than 30% in Czech Republic, Hungary, Italy and Turkey. Among girls, the prevalence of recurrent headache ranged from 32.7% in Denmark to 59.2% in Italy. In all countries, the prevalence of recurrent headache was significantly 1.5–2 times higher among girls than boys.

In the study population, the second most common recurrent pain was backache. The lowest prevalence for boys was found in TFYR Macedonia (12.8%), but for girls, the lowest prevalence was in Greenland (15.7%). The highest prevalence of recurrent backache was in Czech Republic; reported by 33.2% of boys and 40.6% of girls. In most of the countries, the prevalence of recurrent backache was higher among girls than boys; however, gender differences were generally greatest for recurrent headache and stomachache (Table 2).

Among boys, the prevalence of recurrent stomach- ache ranged from 8.9% in Denmark to 23.0% in Hungary, and among girls, from 12.1% in Denmark to 40.0% in Luxembourg. Recurrent stomachache was significantly more prevalent among girls than boys in all countries except Denmark and Greenland.

Different types of recurrent pain were found to co-exist in individuals (Supporting Information Table S1). The association between all three types of pains was tested also in a log-linear analysis. The three-way effect was not statistically significant. The two-way effect was found to be significant ($p < 0.001$), suggesting an association between any two of the pain types, although not a third.

3.2 Prevalence of medicine use

Self-reported medicine use among 15-year-old adoles- cents was common. On average, almost half of 15-year- old adolescents used medicine for headache. There were significant gender differences in all countries, with girls 1.5 times more likely to use medicines for headache than boys. The lowest prevalence of medi- cine use for headache (approximately 30%) among boys was in Ukraine, Czech Republic and Greenland. In the United States and Ireland, almost half of boys used medicine for headache, whereas in Finland, 54.9% of boys used medicine for headaches. Among girls, the lowest prevalence of medicine use for headache was in Austria (41.8%) and the highest was in Finland (70.2%) (Supporting Information Table S2).

On average, one-third of adolescents used medicines for stomachache. In all countries, except Greenland, there was a significant gender difference in medicine use for stomachache. The greatest gender differences were found in Denmark, Finland and Sweden where the prevalence of medicine use for stomachache for girls was up to five times higher than for boys.

The prevalence of medicine use for sleeping difficul- ties and nervousness was significantly lower than that for pain. In a majority of the countries, gender differ- ences in medicine use for sleeping difficulties and nervousness were not significant (Supporting Infor- mation Table S2).

3.3 Medicine use among adolescents with recurrent pain

The odds of medicine use for headache and stomach- ache were substantially higher for adolescents with corresponding recurrent pain than for adolescents who reported pain less often (Table 3).

Adolescents with recurrent headache or stomach- ache were more likely also to use medications for other types of pain. For example, adolescents with recurrent headache were twice as likely to additionally use medicine for stomachache in comparison with adolescents reporting headache less often. For both genders, the odds of medicine use for headache and stomachache were 1.5 times greater also among ado- lescents experiencing recurrent backache.

The association between pain and medicine use was similarly strong for both boys and girls, with the exception of one case. While for boys with recurrent stomachache there was four times

increase in the odds of medicine use for stomachache, for girls, the odds increased only by a factor of 2.5 ($p < 0.001$).

For both genders, among those experiencing any of the three types of pain, the odds of medicine use for difficulties in getting to sleep and nervousness were, on average, twice as high (Table 3). An association between recurrent pain and weekly nervousness and difficulties in getting to sleep was apparent (Support- ing Information Table S1). Overall, there was little country variation in the association between medicine use behaviour and recurrent pain as most of the cal- culated MORs were close to 1.0.

4. Discussion

In general, the prevalence of recurrent pain among 15-year-old adolescents was high and pain was more common among girls than boys. The most prevalent recurrent pain was headache. In most of the countries, the prevalence of recurrent backache was significantly higher than that of stomachache. This is in accordance with previous studies which found recurrent stomach- ache to be more prevalent than backache among chil- dren and younger adolescents, but backache to be the more prevalent of the two among older adolescents (Perquin et al., 2000a; Härmä et al., 2002; Roth-Isigkeit et al., 2004; Larsson and Sund, 2007; Sundblad et al., 2007).

In this study, recurrent pain does not describe any clinical diagnosis but rather reflects the pain experi- ence among adolescents in general. Thus, the data on recurrent pain might contain substantial heterogene- ity of pain aetiology and manifestation. However, sub- jective pain experience, regardless of its primary causes per se, is important as it influences adolescent general well-being; recurrent pain has a detrimental effect on adolescents' daily functioning and quality of life (Bandell-Hoekstra et al., 2002; Roth-Isigkeit et al., 2005; Powers et al., 2006; Gauntlett-Gilbert and Eccleston, 2007; Larsson and Sund, 2007).

The current study uniquely allowed for interna- tional comparisons on pain prevalence of adolescents, as all countries within the HBSC study use a common research methodology. The study reveals that there is a relatively high prevalence of recurrent pain in ado- lescence cross-nationally highlighting the need to address adolescent pain within public health policy on an international level.

The applied medicine use items within the study focused upon specific symptoms but not specific medi- cines; thus, the study is not constrained by the differ- ences in national legislation, availability or temporal advances in specific medicines.

In general, use of medicine was a common behav- iour among 15-year-old adolescents; however, the odds of medicine use among adolescents with recur- rent pain were significantly higher. This association was consistent across countries despite large-country differences in the prevalence of recurrent pain and medicine use. This is a notable finding as availability of medicines, cost and legislation of medicine sales are all likely to differ between countries. However, the current study shows little impact of country level factors on the association between medicine use and recurrent pain of individuals.

This study confirms the relevance of gender issues for studying pain phenomena and medicine use behaviours among adolescents. Recurrent pain preva- lence and medicine use for aches was much higher for girls; however, the association between pain and medicine use was similarly strong for both genders. Furthermore, adolescent boys with recurrent stom- achache were more likely to use medicines for stom- achaches than girls with recurrent stomachache. This means that adolescent boys should not be ignored as a potential risk group particularly in terms of medicine use and potential misuse.

The finding that adolescents with recurrent pain were more likely to use medicines also for non- corresponding aches, as well as for nervousness and difficulties in getting to sleep, suggests that adolescents with recurrent pain are more likely to use medicine in general. Alternatively, it might mean that another common factors are associated with both medicine use and health complaint frequency, not accounted for here, such as psycho-emotional factors.

Some, but not all, medicine use for non- corresponding health complaints can be explained by the co-occurrence of these health complaints. Medi- cine use among adolescents is, therefore, not just a reaction to specific health complaints. Adolescents who frequently use medications for pain not only report a higher frequency of pains, but also have a higher level of anxiety, depression and functional dis- ability than those taking less or no medication (Fichtel and Larsson, 2002). Previous studies of medicine use, which controlled for prevalence of corresponding health complaints, found that medicine use behav- iours were more prevalent among young people with poor coping resources (Koushede and Holstein, 2009), poor self-rated health (Holstein et al., 2008b), lower social class (Holstein et al., 2004) and exposure to bullying at school (Due et al., 2007). A qualitative study among teenage girls in Denmark suggests that recurrent headache was attributed to daily stressors, and the use of analgesics for headache was a tool to cope with daily demands rather than just headache (Hansen et al., 2008). For these teenage girls, use of pain killers was a meaningful response to the per- ceived demands to perform well and participate in social activities. Thus, medicine use among adoles- cents with recurrent pain might constitute more complex phenomena, which should be investigated in greater detail.

Self-report in measuring individual experience of pain is a valid method for children above 5 years of age (McGrath et al., 2000). Questionnaires are the most common method of data collection in pain research, usually asking the respondent for retrospective infor- mation on pain occurrence. The internal validity of this method however may be affected by recall bias. In general, little is known about the extent to which adolescents are able to remember the pain character- istics in non-clinical populations. Some existing studies show that agreement between retrospective information sources, such as questionnaires and inter- views and prospective recording in diaries, is quite low (Van den Brink et al., 2001; Laurell et al., 2003). However, self-reporting by a questionnaire is the most feasible method of obtaining data about pain experi- ences in adolescent population.

A further limitation of the study is that only data on pain frequency were available. Existing studies (Perquin et al., 2003; Roth-Isigkeit et al., 2005; Hakala et al., 2012; Tiira et al., 2012) suggest that not only pain frequency but also intensity of experienced pain is an important indicator of pain severity and the pain caused individual burden among adolescents.

This study found that adolescents with recurrent pain are more likely to use medicines and suffer from other health complaints. These outcomes may reflect the individuals' burden of pain. However, pain-related quality of life is a much broader concept, which should be investigated more in future research.

This study has revealed several issues that need further investigation. First, there is a need to examine to what extent the differences in adolescent lifestyle and contextual social or cultural factors might explain the large variation between countries in the preva- lence of recurrent pain. Second, there is a need to assess the significance of other independent factors that might help to explain the association between pains and medicine use at both individual level, e.g., psychological well-being, parenting behaviours, and contextual levels such as the school level.

It is known that recurrent pain during childhood and adolescence increases the risk of chronic pain and other health disorders in adulthood (Fearon and Hotopf, 2001; Jones et al., 2007;

Dengler-Crish et al., 2011; Waldie, 2011). In future studies, it would be important to investigate whether this risk for continu- ation of chronic pain can be mediated by medicine use behaviours for adolescents with recurrent pain.

The study has implications for public health and education practitioners. Adults and health profession- als who deal with adolescents should be aware of the high prevalence of recurrent pain and co-existing health complaints among adolescents and common practice of medicine use among them. We propose that these topics should be addressed in educational programmes for teachers, physicians and nurses. Furthermore, recurrent pain should continue to be moni- tored internationally and addressed in public health policies concerning adolescent health.

What's already known about this topic?

• Recurrent pain and medicine use are common in adolescence.

• The prevalence of both recurrent pain and pain medicine usage is higher among girls than boys.

What does this study add?

• There are large-country differences in the preva- lence of recurrent pain and medicine use; however, the association between both is consis- tent across countries.

• Adolescent boys and girls with recurrent pain are more likely to use medicine not only for corresponding pain but also for other health complaints.

Author contributions

I.G. is responsible for the integrity of the work as a whole, from inception to published article. J.V., A.V., R.V., J.T., V.O.- J., U.R.-S., K. L., F.C., A.B., E.S., A.A. and B.E.H. contributed substantially to the study conception, data interpretation, revising the article and final approval of the version to be published. All authors discussed the results and commented on the manuscript.

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References

Andersen, A., Holstein, B.E., Due, P., Hansen, E.H. (2009). Medicine use for headache in adolescence predicts medicine use for headache in young adulthood. *Pharmacoepidemiol Drug Saf* 18, 619–623.

Andersen, A., Krølner, R., Holstein, B.E., Due, P., Hansen, E.H. (2007). Medicine use among 11- and 13-year olds: Agreement between parents' reports and children's self-reports. *Ann Pharmacother* 41, 581– 586.

Bandell-Hoekstra, I.E., Abu-Saad, H.H., Passchier, J., Frederiks, C.M., Feron, F.J., Knipshild, P. (2002). Coping and quality of life in relation to headache in Dutch schoolchildren. *Eur J Pain* 6, 315–321.

Currie, C., Gaibhainn, S.N., Godeau, E., HBSC Network Coordinating Committee (2009). The health behaviour in school-aged children: WHO collaborative cross-national (HBSC) study: Origins, concept, history and development 1982–2008. *Int J Public Health* 54, S131–S139.

Currie, C., Griebler, R., Incley, J., Theunissen, A., Molchol, M., Samdal, O., Dür, W., eds. (2010). Health Behaviour in School-Aged Children (HBSC) Study Protocol: Background, Methodology and Mandatory Items for the 2009/10 Survey. Edinburgh: CAHRU & Vienna: LBIHPR. Retrieved from: http://www.hbsc.org (accessed on 1 May 2014).

Darlington, A.S.E., Verhulst, F.C., De Winter, A.F., Ormel, J., Passchier, J., Hunfeld, J.A. (2012). The influence of maternal vulnerability and par- enting stress on recurrent pain in adolescents in a general population sample: The TRAILS study. *Eur J Pain* 16, 150–159.

Dengler-Crish, C.M., Horst, S.N., Walker, L.S. (2011). Somatic complaints in childhood functional abdominal pain are associated with functional

gastrointestinal disorders in adolescence and adulthood. *J Pediatr Gas-*

troenterol Nutr 52, 162–165.
Due, P., Hansen, E.H., Merlo, J., Andersen, A., Holstein, B.E. (2007). Is

victimization from bullying associated with medicine use among ado- lescents? A nationally representative cross-sectional survey in Denmark. *Pediatrics* 120, 110–117.

Fearon, P., Hotopf, M. (2001). Relation between headache in childhood and physical and psychiatric symptoms in adulthood: National birth cohort study. *BMJ* 322, 1145.

Fichtel, A., Larsson, B. (2002). Psychosocial impact of headache and comorbidity with other pains among Swedish school adolescents. *Head- ache* 42, 755–766.

Gauntlett-Gilbert, J., Eccleston, C. (2007). Disability in adolescents with recurrent pain: Patterns and predictors across different domains of func- tioning. *Pain* 13, 132–141.

Ghandour, R.M., Overpeck, M.D., Huang, Z.J., Kogan, M.D., Scheidt, P.C. (2004). Headache, stomachache, backache, and morning fatigue among adolescent girls in the United States. *Arch Pediatr Adolesc Med* 158, 797– 803.

Gobina, I., Välimaa, R., Tynjälä, J., Villberg, J., Villerusa, A., Iannotti, R.J., Godeau, E., Gaibhainn, S.N., Andersen, A., Holstein, B.E., HBSC Medi- cine Use Writing Group (2011). The medicine use and corresponding subjective health complaints among adolescents, a cross-national survey. *Pharmacoepidemiol Drug Saf* 20, 424–431.

Hakala, P.T., Saarni, L.A., Punamäki, R.L., Wallenius, M.A., Nygård, C.H., Rimpelä, A.H. (2012). Musculoskeletal symptoms and computer use among Finnish adolescents – pain intensity and inconvenience to everyday life: A cross-sectional study. *BMC Musculoskelet Disord* 13, 41.

Hansen, D.L., Hansen, E.H., Holstein, B.E. (2008). Using analgesics as tools: Young women's treatment for headache. *Qual Health Res* 18, 234–243.

Hansen, D.L., Hansen, E.H., Holstein, B.E. (2009). Young women's use of medicines: Autonomy and positioning in relation to family and peer norms. *Health (London)* 13, 467–485.

Hansen, E.H., Holstein, B.E., Due, P., Currie, C.E. (2003). International survey of self-reported medicine use among adolescents. *Ann Pharma- cother* 37, 361–366.

Haugland, S., Wold, B. (2001a). Subjective health complaints in adoles- cence – reliability and validity of survey methods. *J Adolesc* 24, 611– 624.

Haugland, S., Wold, B., Stevenson, J., Aarø, L.E., Woynarowska, B. (2001b). Subjective health complaints in adolescence. A cross-national comparison of prevalence and dimensionality. *Eur J Public Health* 11, 4–10.

Hämeen-Anttila, K., Bush, P.J. (2008). Healthy children's perceptions of medicines: A review. *Res Social Adm Pharm* 4, 98–114.

Härmä, A., Kaltiala-Heino, R., Rimpelä, M., Rantanen, P. (2002). Are adolescents with frequent pain symptoms more depressed? *Scand J Prim Health Care* 20, 92–96.

Hjern, A., Alfven, G., Östberg, V. (2008). School stressors, psychological complaints and psychosomatic pain. *Acta Paediatr* 97, 112–117.

Hoftun, G.B., Romundstad, P.R., Rygg, M. (2012). Factors associated with adolescent chronic non-specific pain, chronic multisite pain, and chronic pain with high disability: The Young-HUNT Study 2008. *J Pain* 13, 874–883.

Holstein, B.E., Andersen, A., Krølner, R., Due, P., Hansen, E.H. (2008a). Young adolescents' use of medicine for headache: Sources of supply, availability and accessibility at home. *Pharmacoepidemiol Drug Saf* 17, 406–410.

Holstein, B.E., Hansen, E.H., Andersen, A., Due, P. (2008b). Self-rated health as predictor of medicine use among adolescence. *Pharmacoepide- miol Drug Saf* 17, 186–192.

Holstein, B.E., Hansen, E.H., Due, P. (2004). Social class variation in medicine use among adolescents. *Eur J Public Health* 14, 49–52.

Jones, G.T., Silman, A.J., Power, C., Macfarlane, G.J. (2007). Are common symptoms in childhood associated with recurrent widespread body pain in adulthood? Results from the 1958 British Birth Cohort Study. *Arthri- tis Rheum* 56, 1669–1675.

Koushede, V., Holstein, B.E. (2009). Sense of coherence and medicine use for headache among adolescents. *J Adolesc Health* 45, 149–155.

Larsson, B., Sund, A.M. (2007). Emotional/behavioural, social correlates and one-year predictors of frequent pains among early adolescents: Influences of pain characteristics. *Eur J Pain* 11, 57–65.

Laurell, K., Larsson, B., Eeg-Olofsson, O. (2003). Headache in schoolchil- dren: Agreement between different sources of information. *Cephalalgia* 23, 420–428.

McGrath, P.A., Speechley, K.N., Seifert, C.E., Biehn, J.T., Cairney, A.E., Gorodzinsky, F.P., Dickie, G.L., McCusker, P.J., Morrissy, J.R. (2000). A survey of children's acute, recurrent, and chronic pain: Validation of the pain experience interview. *Pain* 87, 59–73.

Nabors, L.A., Lehmkuhl, H.D., Parkins, I.S., Drury, A.M. (2004). Reading about over-the-counter medications. *Issues Compr Pediatr Nurs* 27, 297– 305.

Perquin, C.W., Hazebroek-Kampschreur, A.A., Hunfeld, J.A., Bohnen, A.M., van Suijlekom-Smit, L.W., Passhier, J., van der Wouden, J.C. (2000a). Pain in children and adolescents: A common experience. *Pain* 87, 51–58.

Perquin, C.W., Hazebroek-Kampschreur, A.A., Hunfeld, J.A., van Suijlekom-Smit, L.W., Passchier, J., van der Wouden, J.C. (2000b). Chronic pain among children and adolescents: Physician consultation and medication use. *Clin J Pain* 16, 229–235.

Perquin, C.W., Hunfeld, J.A., Hazebroek-Kampschreur, A.A., Suijlekom-Smit, L.W., Passhier, J., Koes, B.W., van der Wouden, J.C. (2003). The natural course of recurrent benign pain in childhood and adolescence: A two-year population-based follow-up study. *Eur J Pain* 7, 551–559.

Petersen, S., Brulin, C., Bergström, E. (2006). Recurrent pain symptoms in young schoolchildren are often multiple. *Pain* 121, 145–150.

Powers, S.W., Gilman, D.K., Hershey, A.D. (2006). Headache and psycho- logical functioning in children and adolescents. *Headache* 46, 1404– 1415.

Rabe-Hesketh, S., Skrondal, A. (2008). *Multilevel and Longitudinal Model- ling using Stata* (College Station, TX: Stata Press).

Ravens-Sieberer, U., Erhart, M., Torsheim, T., Hetland, J., Freeman, J., Danielson, M., Thomas, C., The HBSC Positive Health Group (2008). An international scoring system for self-reported health complaints in ado- lescents. *Eur J Public Health* 18, 294–299.

Roberts, C., Freeman, J., Samdal, O., Schnohr, C.W., de Looze, M.E., Nic Gabhainn, S., Iannotti, R., Rasmussen, M., International HBSC Study Group (2009). The Health Behaviour in School-aged Children (HBSC) study: Methodological developments and current tensions. *Int J Public Health* 54, S140–S150.

Roth-Isigkeit, A., Thyen, U., Raspe, H.H., Sto˝ven, H., Schmucker, P. (2004). Reports of pain among German children and adolescents: An epidemiological study. *Acta Paediatr* 93, 258–263.

Roth-Isigkeit, A., Thyen, U., Sto˝ ven, H., Schwarzenberger, J., Schmucker, P. (2005). Pain among children and adolescents: Restriction in daily living and triggering factors. *Pediatrics* 115, e152–e162.

Stanford, E.A., Chambers, C.T., Biesanz, J.C., Chen, E. (2008). The fre- quency, trajectories and predictors of adolescent recurrent pain: A population-based approach. *Pain* 138, 11–21.

Stoelben, S., Krappweiss, J., Rössler, G., Kirch, W. (2000). Adolescents' drug use and drug knowledge. *Eur J Pediatr* 159, 608–614.

Sundblad, G.M., Saartok, T., Engstro˝m, L.M. (2007). Prevalence and co-occurrence of self-rated pain and perceived health in school- children: Age and gender differences. *Eur J Pain* 11, 171–180.

Tiira, A.H., Paananen, M.V., Taimela, S.P., Zitting, P.J., Järvelin, M.R., Karppinen, J.I. (2012). Determinants of adolescent health care use for low back pain. *Eur J Pain* 16, 1467–1476.

Van den Brink, M., Bandell-Hoekstra, E.N., Abu-Saad, H.H. (2001). The occurrence of recall bias in pediatric headache: A comparison of ques- tionnaire and diary data. *Headache* 41, 11–20.

Waldie, K.E. (2011). Childhood headache, stress in adolescence, and primary headache in young adulthood: A longitudinal cohort study. *Headache* 41, 1–10.

Westerlund, M., Brånstad, J.O., Westerlund, T. (2008). Medicine-taking behaviour and drug-related problems in adolescents of a Swedish high school. *Pharm World Sci* 30, 243–250.

Table 1 Study population of 15-year-old adolescents by country.

Country or region (Principal investigator)	Boys	Girls	Total
Austria (W. Dür)	885	935	1820
Belgium-Flemish (C. Vereecken)	680	546	1226
Belgium-French (D. Piette)	669	672	1341
Czech Republic (M. Kalman)	747	775	1522
Denmark (P. Due)	577	649	1226
Finland (J. Tynjälä)	1008	1102	2110
France (E. Godeau)	904	1002	1906
Greenland (B. Niclasen)	189	208	397
Greece (A. Kokkevi)	842	806	1648
Hungary (A. Nemeth)	799	934	1733
Ireland (S. Nic Gabhainn)	962	733	1695
Italy[a] (F. Cavallo)	764	782	1546
Latvia (I. Pudule)	666	709	1375
Luxembourg (Y. Wagener)	702	680	1382
Russia[a] (A. Komkov)	919	928	1847
Scotland (C. Currie)	1232	1335	2567
Sweden (L. Augustine)	1059	1031	2090
Switzerland (E. Kuntsche)	1138	1108	2246
TFYR Macedonia (L.K.Unkovska)	814	722	1536
Turkey (O. Ercan)	858	902	1760
Ukraine (O. Balakireva)	881	1016	1897
USA (R. Iannotti)	968	924	1892
Total	18,263	18,499	36,762

[a]Regional sample.

Table 2 Prevalence of recurrent pains among 15-year-old adolescents by gender (%).

	Recurrent headache				Recurrent stomachache				Recurrent backache			
Country	Boys	Girls	*p*	Total	Boys	Girls	*p*	Total	Boys	Girls	*p*	Total
Austria	20.6	35.6	<0.001	28.3	12.1	21.4	<0.001	16.9	20.2	26.7	<0.001	23.5
Belgium-Flemish	15.8	34.8	<0.001	24.2	10.3	23.1	<0.001	16.0	21.5	25.6	NS	23.3
Belgium-French	26.8	51.0	<0.001	39.0	21.2	36.3	<0.001	28.8	28.6	37.9	<0.001	33.3
Czech Republic	33.2	52.6	<0.001	43.0	18.3	30.9	<0.001	24.7	33.2	40.6	<0.01	37.0
Denmark	19.6	32.7	<0.001	26.5	8.9	12.1	NS	10.6	26.5	26.5	NS	26.5
Finland	28.6	48.3	<0.001	38.9	15.3	27.2	<0.001	21.5	24.3	33.0	<0.001	28.9
France	23.8	44.2	<0.001	34.6	19.1	34.3	<0.001	27.1	31.1	39.7	<0.001	35.7
Greenland	23.0	35.0	<0.01	29.4	13.1	16.3	NS	14.8	18.8	15.7	NS	17.2
Greece	24.7	47.6	<0.001	36.0	10.6	18.4	<0.001	14.4	18.3	18.8	NS	18.6
Hungary	31.0	49.7	<0.001	41.1	23.0	34.2	<0.001	29.0	29.5	34.5	<0.05	32.2
Ireland	25.0	41.5	<0.001	32.1	12.7	20.9	<0.001	16.2	23.2	25.7	NS	24.3
Italy	31.9	59.2	<0.001	45.7	18.7	37.0	<0.001	28.0	24.9	36.2	<0.001	30.6
Latvia	21.5	41.7	<0.001	32.1	14.3	24.8	<0.001	19.8	21.8	27.4	<0.05	24.7
Luxembourg	26.6	45.5	<0.001	35.9	21.0	40.0	<0.001	30.4	26.1	33.4	<0.01	29.7
Russia	24.9	42.5	<0.001	33.8	18.7	25.9	<0.001	22.4	19.2	23.5	<0.05	21.4
Scotland	26.3	43.1	<0.001	35.0	14.5	26.7	<0.001	20.9	22.4	25.9	<0.05	24.2
Sweden	26.1	51.4	<0.001	38.6	16.7	35.9	<0.001	26.2	24.4	31.3	<0.001	27.8
Switzerland	21.6	43.4	<0.001	32.5	14.5	30.2	<0.001	22.3	23.2	31.1	<0.001	27.1
TFYR Macedonia	15.5	34.4	<0.001	24.5	10.4	17.4	<0.001	13.7	12.8	17.9	<0.01	15.2
Turkey	33.1	47.9	<0.001	40.7	18.1	21.9	<0.05	20.1	26.9	24.1	NS	25.4
Ukraine	28.3	55.7	<0.001	43.0	18.2	35.1	<0.001	27.3	29.1	35.6	<0.01	32.6
United States	27.8	48.4	<0.001	37.9	18.4	32.6	<0.001	25.4	25.9	36.5	<0.001	31.1
HBSC (average)	25.5	45.6	<0.001	35.6	15.9	28.1	<0.001	22.1	24.3	30.1	<0.001	27.2

NS, not significant.

Table 3 The unadjusted odds of medicine use among adolescents with recurrent pain.

	Medicine for headache		Medicine for stomachache		Medicine for difficulties in getting to sleep		Medicine for nervousness	
Recurrent pains	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Girls								
Headache	4.49***	4.20–4.80	1.59***	1.50–1.69	1.92***	1.70–2.16	1.87***	1.66–2.09
	MOR = 1.08		*MOR = 1.31*		*MOR = 1.24*		*MOR = 1.42*	
Stomachache	1.88***	1.75–2.01	2.46***	2.30–2.64	2.07***	1.84–2.34	1.92***	1.71–2.16
	MOR = 1.04		*MOR = 1.29*		*MOR = 1.22*		*MOR = 1.41*	
Backache	1.63***	1.53–1.75	1.36***	1.27–1.45	1.88***	1.67–2.12	1.84***	1.64–2.07
	MOR = 1.04		*MOR = 1.28*		*MOR = 1.23*		*MOR = 1.43*	
Boys								
Headache	3.77***	3.50–4.05	2.06***	1.89–2.24	2.18***	1.92–2.48	2.00***	1.76–2.27
	MOR = 1.03		*MOR = 1.34*		*MOR = 1.24*		*MOR = 1.46*	
Stomachache	1.93***	1.78–2.10	4.25***	3.87–4.66	2.57***	2.24–2.95	2.41***	2.10–2.76
	MOR = 1.00		*MOR = 1.33*		*MOR = 1.23*		*MOR = 1.45*	
Backache	1.52***	1.42–1.63	1.69***	1.55–1.85	1.94***	1.70–2.21	1.77***	1.55–2.01
	MOR = 1.00		*MOR = 1.33*		*MOR = 1.24*		*MOR = 1.46*	

CI, confidence interval; MOR, median odds ratio; OR, odds ratio.

*$p < 0.05$.

**$p < 0.01$.

***$p < 0.001$.