Test-retest repeatability of questionnaire for pain symptoms for school children aged 10 to 15 years


## ABSTRACT

**BACKGROUND AND AIMS:** There is a growing body of evidence, that pain is common at school age. Less is known about the repeatability of pain questionnaires for children. This study aimed to assess the test-retest repeatability of the Finnish version of the electronic pain questionnaire for school-aged children.

**METHODS:** Primary (n=79) and lower secondary (n=127) schoolchildren aged 10 to 15 years from two schools from the Jyväskylä region of Finland, filled in an electronic questionnaire twice in an interval of two weeks. It captured the frequency of pain symptoms with a 5-point Likert-scale questionnaire covering nine areas of the body for the last three months. The intraclass correlation coefficient (ICC) values 0.40–0.59 reflected fair and 0.60–0.74 good repeatability.

**RESULTS:** The highest prevalences of pain were in the head (29%) and neck and shoulder (NS) (23%) areas. ICC values showed good repeatability for questions about pain frequency in the head, NS and lower extremities. In primary school, these values were good in the lower extremities and fair in NS, lower back and the head. In lower secondary school, the ICC values were good in NS and the head, fair in the stomach and lower extremities.

**CONCLUSIONS:** This electronic questionnaire was an acceptably repeatable indicator to measure the frequency of pain in the most prevalent pain areas: the head and NS.

**IMPLICATIONS:** It is important to be aware of the impact of health-related outcomes on children's ability to be successful in their lives. With the help of a simple electronic questionnaire, it is possible to cost-effectively capture, for example, the prevalence and frequency of pain during the school hours. The identification of children's pain symptoms accurately provides more possibilities to prevent and to minimize the chronic pain among schoolchildren.



**Keywords**: Pain, children, repeatability, questionnaire

## BACKGROUND AND AIMS

About 15% to 25% of all children and adolescents report recurrent or chronic pain conditions (1). The limbs (34%), head (26%), abdomen (16%) and back (15%) have reported to be the most common pain areas among 12–18-year old adolescents (2). Already 6–8-year old children has been reported to have frequent pain most commonly in the lower limbs (40%) and head (31%) whereas back and neck-shoulder area pain prevalences were 7% (3). Studies have shown that children with long-term pain report similar or more disabilities in daily life than children with chronic somatic disorders (2). Disabilities manifest in social functioning, school participation, sports activities, and/or sleeping problems (4). Pain in children and adolescents is also a burden on their families and to society (2). Pain in adulthood is known to have severe economic consequences (5), but even in adolescence, long-term pain may have extensive financial consequences (6).

Reliable and valid pain assessment tools are needed for research and clinical purposes to accurately measure the frequency of pain in children. However, information about the repeatability of these questionnaires is limited. To study the prevalence and frequency of pain symptoms, self-report questionnaires are common instruments. Hakala et al. 2002 studied the changes in musculoskeletal pain in 189 894 school children in the Adolescent Health and Lifestyle survey in 1985–2001. They captured the prevalence of pain during the past half a year and the questions were categorized on four levels (seldom, once a month, one a week and daily). The test-retest reliability coefficient for back and neck pain were 0.48–0.67 and lower back pain ~0.60 (7), when the questionnaire was re-taken after four to six weeks. Jannini et al. 2011 studied the frequency of musculoskeletal pain during the previous three months in the neck, upper limbs, chest, trapezoid muscles, lower back and lower limbs in children using a questionnaire earlier developed for adolescents (8). The test-retest reliability of the questionnaire with a 10 day`s interval was substantial with a Kappa [κ] value of 0.72. The whole questionnaire contained 70 questions, and conclusions about the repeatability of pain questions only are not available.

El-Metwally et al. 2007 captured the information on musculoskeletal pain frequency (neck, upper limbs, chest, upper back, lower back, buttocks) in Finnish schoolchildren with a structured 5-point Likert-scale questionnaire (9). The test-retest reliability of the questionnaire in detecting children with pain at least once per week was good with a Kappa [κ] value of 0.90. Although this

questionnaire has been widely used in research (9, 10, 11), its repeatability has not been studied in Finnish children. The purpose of this study was to assess the test-retest repeatability of the pain-related questions using the Finnish electronic version of this questionnaire, which categorizes pain frequency into 5-levels among school-aged children.

## METHODS

### Participants

Two schools from the Jyväskylä region of Finland, were included in this study. The total study population included 206 children from grades 4 to 9 (aged 10–15 years, mean age 13.8, SD 1.8 years (56% girls)). Of these, 79 were 10-13-year-old children from a primary school (mean age 11.9, SD 0.9) years and 127 were 13–15-year-old children from a lower secondary school (mean age 15.1, SD 0.9 years). Written informed consent was obtained from all the children and their guardians before participation in the study, according to the Declaration of Helsinki. Pain symptom questionnaires were filled out twice – in spring 2015 in the lower secondary school and in autumn 2015 in the primary school – as part of the research related to the Finnish Schools on the Move program. Its study protocol was approved by the Ethics Committee of the University of Jyväskylä.

### Instrument and procedure

The pain questionnaire used in this study has previously been structured for study purposes in Finland (10, 11). The 5-level frequency classification was originally adopted from a nationwide survey on health and health-related behavior in schoolchildren by the WHO (12). The questionnaire captures the frequency of pain symptoms in various areas of the body (head, NS, upper limb, chest, stomach, upper back, lower back and buttocks, lower limb regions) during the last three months. The questionnaire contains a figure of the human body with zones and written names of the corresponding body areas to ensure that the regions of the body were understood correctly. It was possible for all participants to seek help on the questionnaire from an adult in the classroom. The original pain questionnaire in Finnish as well as in English translation can be seen in Appendix 1 and 2.

The electronic questionnaire was filled in during school hours with an interval of two weeks. The pupils answered to the question: “How often have you had symptoms in the last three months?” and listed body areas accordingly, such as “neck or shoulder pain or ache.” There were five answer options given to classify the pain symptoms: 1) almost daily, 2) more than once a week, 3) about

once a week, 4) once a month, and 5) seldom or never. The pupils were also asked to report if the pain originated due to a trauma: “Have you injured any of the above-mentioned and pictured pain areas during the previous three months (for example, fallen, stumbled, breached during sport, etc.)?” Options were “yes” or “no.” If the answer was “yes,” they were asked to choose and mark the injured body area on the menu with the help of the body map. Pains due to traumatic causes were excluded from the analysis. In further analysis, the 5-level answers were grouped into a dichotomous scale of symptoms occurring at least once a week and less than once a week.

**Data Analysis**

Descriptive statistics are expressed as means with standard deviations (SD) or 95% confidence intervals (CI) and counts with percentages. Test-retest reliability was tested with the intraclass correlation (3,1), Two-Way Mixed Single Measures, for the 5-point scale and with Cohen`s Kappa [κ] coefficient and global percent agreement for a 2-point scale. ICC values < 0.40 reflect poor, 0.40–0.59 fair, 0.60–0.74 good and 0.75–1.00 excellent repeatability (13). Kappa [κ] values of 0.00 to 0.20 represents poor, 0.21 to 0.40 fair, 0.41 to 0.60 moderate, 0.61 to 0.80 good, and 0.8 to 1.00 very good repeatability (14). Agreement among respondents between the first and second tests is presented as a percent, showing the percentage of answers which stayed in the exactly same category during both measurements.

**RESULTS**

Of the 206 children from grades 4 to 9 who were invited into the study, 83% (N= 181) filled in questionnaires twice and were included in the analysis. Seventy-seven children (41 boys and 36 girls) were from primary school (grades 4 to 6) and 104 children (40 boys and 64 girls) from lower secondary school (grades 7 to 9). The highest prevalence of pain symptoms observed were in the head (29%) and NS area (23%) (Table 1). In both the head and NS, the prevalence of pain was more than twice as high in lower secondary school students (37% and 30%) than in primary school students (16% and 13%).

The repeatability of the pain questionnaire is presented in Table 2. In the analysis with a 5-point scale, questions about pain in NS, the head and lower extremities had good repeatability in all schoolchildren (ICC 0.67, 0.66 and 0.62, respectively). In primary schoolchildren, the ICC for the lower extremities (ICC 0.70) was good, and for NS (0.59), lower back (0.58) and the head (0.56) the ICC was fair. Other questions had poor repeatability (ICC < 0.40). In the analysis of lower

secondary schoolchildren, the ICC for pain in NS and the head were good (0.70, 0.69), and the stomach (0.59) and lower extremities (0.57) were fair, while the other areas remained poor.

In secondary analysis using a 2-point scale and Kappa [κ] coefficient, the questions about pain in the head (0.70) and NS (0.68) had good repeatability in all schoolchildren. The agreement percentage varied between 88–94%. In primary schoolchildren, four pain area questions reached good repeatability with the following Kappa values: lower extremities (0.79), NS (0.67), lower back (0.67) and head (0.66). The other pain areas had moderate repeatability, except the upper extremities had fair repeatability (0.30). In lower secondary schoolchildren, questions about the head (0.69) and NS (0.67) were good, while the lower extremities (0.52), stomach (0.47) and upper extremities (0.45) were moderately repeatable. The agreement percentage in primary and secondary school varied between 92–98% and 83–92% respectively.

## DISCUSSION

This study evaluated the test-retest repeatability of pain-related questions in a questionnaire for Finnish school children aged 10 to 15 years. Almost one third of the children reported head pain and a quarter reported pain in the NS area during the last three months. The most repeatable pain area questions were those related to the head, NS and lower extremities in all schoolchildren using an instrument with either a 5-point or 2-point scale.

In general, there was a tendency for higher frequencies of pain in lower secondary schoolchildren than in primary schoolchildren. Particularly, the frequencies of head and NS pain were almost three times higher in lower secondary schoolchildren than in primary schoolchildren. A previous cohort study in Finnish children showed similar results, where the prevalence of at least weekly experienced neck-shoulder pain and lower back pain was much more common in older age groups (14-, 16- and 18-year-old children) than in 12-year-old children (7). Kappa is also dependent on the prevalence of the condition (15). This can partly explain higher Kappa values in most frequent pain localizations. Thus, we should be careful when comparing Kappa values from different studies when the prevalence varies.

When studying frequencies in children and adolescents and the questionnaire as an instrument, the recall time can be an important factor. In a Finnish study, the test-retest reliability was measured

with a four-to-six-week interval with a six-month recall time over three different years (7). The results for back and neck pain repeatability ([κ] 0.48–0.67) were similar compared to our study results. In a Brazilian study, to reduce the effects of memory bias, respondents, 10- to 19-year-old children were asked to report on musculoskeletal symptoms suffered during the previous three months (8). The test-retest reliability of the questionnaire with a 10-day interval was substantial with a Kappa [κ] value of 0.72. In an American study of seventh- and eighth-graders, for evaluation of the internal consistency of a pilot survey with questions about back and neck pain, the test-retest with a one-week interval, for evaluation of the internal consistency of a pilot survey questions for back and neck pain showed [κ] 0.54 as a mean (16). In this study, the recall time was "present school year." However, the age of the population and differences in the test-retest settings of these studies affect comparability to our study.

In addition to recall time, respondent characteristics and question characteristics may affect the reliability of responses in surveys (17). When responding to the present pain questionnaire, children were asked to rate the frequency of their perceived pain on a 5-point Likert-type scale. In different studies, the number of answer choices tends to vary, ranging from two response options up to seven. In this study, the main result remained similar on both ICC and Kappa analyses. In our secondary analysis, slightly better values for younger children in 2-point scale Kappa analysis suggests that it would be easier for younger children to answer with fewer options. Reading comprehension becomes easier with age. Borgers et al. 2000 noticed that older children are better at reading and comprehension and thus produce better data quality (18). Bae et al. 2010 reported, that the older children are, the more repetitive the answers are (19). Our secondary analysis finding should be confirmed in a further study by collecting data with both a 5-level and 2-level classification and comparing these directly.

**Limitations**

The weakness of this study is its relatively small sample. The strength of the study was a high response rate in both age groups, partly because the data was collected during school days in classrooms. The electronic questionnaire ensured that there were no missing values. If the children failed to answer a question, the system did not allow them to proceed. Also, the time interval between two data collections was accurate. In school, children are also able to give more subjective answers, which are free from their parents' opinions.

**Conclusions**

This electronic questionnaire, filled in during school hours with an interval of two weeks, had an acceptable repeatability to screen the frequency of pain both in primary and lower secondary schoolchildren in most prevalent pain areas in both age groups: pain in the head and NS. The 5-point scale answering options were equally repeatable in younger and older children. These results are encouraging regarding the use of this measurement in further studies when measuring lower secondary schoolchildren.

## IMPLICATIONS

It is important to be aware of the impact of health-related outcomes on children's ability to be successful in their lives. With the help of a simple electronic questionnaire, it is possible to cost-effectively capture, for example, the prevalence and frequency of pain during the school hours. The identification of children's pain symptoms accurately provides more possibilities to prevent and to minimize the chronic pain among schoolchildren.

## Authors' statements

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**Conflict of interest**: Authors state no conflict of interest.

**Informed consent:** Informed consent has been obtained from all individuals included in this study.

**Ethical approval:** The study setting for the measurements in 2013–2015 was approved by the Ethics Committee of the University of Jyväskylä. Participants and their parents signed written informed consent forms before they participated in this study. All measurements were carried out in accordance with the Declaration of Helsinki. Participation was voluntary and could be discontinued at any point during the research.

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Table 1. The prevalence of pain experienced once a week or more often at different body areas during first survey, for all children and separately for children in primary and lower secondary school.

| Pain area | All (n=181) | | Primary school (n=77) | | Secondary school (n=104) | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Head | 60 | 29 | 13 | 16 | 47 | 37 |
| Neck and shoulder | 48 | 23 | 10 | 13 | 38 | 30 |
| Upper extremities | 17 | 8 | 4 | 5 | 13 | 10 |
| Chest | 12 | 6 | 3 | 4 | 9 | 7 |
| Upper back | 26 | 13 | 8 | 10 | 18 | 14 |
| Lower back | 27 | 13 | 9 | 11 | 18 | 14 |
| Stomach | 25 | 12 | 7 | 9 | 18 | 14 |
| Buttocks | 17 | 8 | 6 | 8 | 11 | 9 |
| Lower extremities | 26 | 13 | 7 | 9 | 19 | 15 |

Table 2. The test-retest reliability of the pain questions measured two weeks apart in all children, and separately for children in primary and lower secondary school. Trauma includes reported injury at first, second or both surveys.

| Pain Area | | Trauma | ICC (5-point scale) | 2-point scale | 2-point scale Agreement |
|---|---|---|---|---|---|
| | N | N | Kappa (95% CI) | Kappa (95% CI) | (% same) |
| **All** | | | | | |
| Head | 161 | 20 | 0.66 (0.56, 0.74) | 0.70 (0.58, 0.83) | 88 |
| Neck and shoulder | 168 | 13 | 0.67 (0.58, 0.75) | 0.68 (0.55, 0.82) | 89 |
| Upper extremities | 146 | 35 | 0.36 (0.21, 0.50) | 0.41 (0.14, 0.68) | 92 |
| Chest | 177 | 4 | 0.36 (0.23, 0.48) | 0.35 (0.03, 0.66) | 94 |
| Upper back | 170 | 11 | 0.40 (0.26, 0.52) | 0.33 (0.10, 0.56) | 89 |
| Lower back | 167 | 14 | 0.40 (0.26, 0.52) | 0.36 (0.15, 0.58) | 87 |
| Stomach | 174 | 7 | 0.49 (0.37, 0.59) | 0.44 (0.23, 0.66) | 90 |
| Buttocks | 173 | 8 | 0.38 (0.25, 0.50) | 0.21 (-0.03, 0.46) | 90 |
| Lower extremities | 109 | 72 | 0.62 (0.48, 0.72) | 0.60 (0.33, 0.87) | 94 |
| **Primary School** | | | | | |
| Head | 64 | 13 | 0.56 (0.36, 0.71) | 0.66 (0.39, 0.93) | 92 |
| Neck and shoulder | 71 | 6 | 0.59 (0.42, 0.72) | 0.67 (0.40, 0.94) | 93 |
| Upper extremities | 56 | 21 | 0.21 (-0.05, 0.45) | 0.30 (-0.21, 0.80) | 93 |
| Chest | 74 | 3 | 0.28 (0.06, 0.48) | 0.49 (-0.13, 1.10) | 97 |
| Upper back | 71 | 6 | 0.38 (0.16, 0.56) | 0.47 (0.03, 0.91) | 94 |
| Lower back | 73 | 4 | 0.58 (0.40, 0.71) | 0.67 (0.40, 0.94) | 93 |
| Stomach | 73 | 4 | 0.30 (0.08, 0.49) | 0.36 (-0.04, 0.76) | 92 |
| Buttocks | 73 | 4 | 0.44 (0.24, 0.61) | 0.47 (0.03, 0.91) | 95 |
| Lower extremities | 43 | 34 | 0.70 (0.51, 0.83) | 0.79 (0.39, 1.19) | 98 |
| **Secondary School** | | | | | |
| Head | 97 | 7 | 0.69 (0.57, 0.78) | 0.69 (0.54, 0.84) | 86 |
| Neck and shoulder | 97 | 7 | 0.70 (0.58, 0.79) | 0.67 (0.51, 0.83) | 87 |
| Upper extremities | 90 | 14 | 0.39 (0.20, 0.55) | 0.45 (0.13, 0.77) | 91 |
| Chest | 103 | 1 | 0.37 (0.19, 0.52) | 0.29 (-0.07, 0.65) | 92 |
| Upper back | 99 | 5 | 0.39 (0.21, 0.55) | 0.26 (-0.01, 0.53) | 85 |
| Lower back | 94 | 10 | 0.23 (0.03, 0.41) | 0.11 (-0.14, 0.36) | 83 |
| Stomach | 101 | 3 | 0.59 (0.44, 0.70) | 0.47 (0.22, 0.73) | 88 |
| Buttocks | 100 | 4 | 0.36 (0.18, 0.52) | 0.07 (-0.17, 0.31) | 87 |
| Lower extremities | 66 | 38 | 0.57 (0.38, 0.71) | 0.52 (0.18, 0.86) | 91 |