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Subjective health literacy among school-aged children

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Subjective health literacy among school-aged children

Abstract

Purpose The aim of this study was to explore Finnish adolescents' subjective health literacy (HL) in association to school achievement, learning difficulties, educational aspirations, and family affluence.

Design/methodology/approach Nationally representative data were collected in Finland as part of the international Health Behaviour in School-aged Children (HBSC) study. The respondents consisted in total of 3,833 adolescents (7th and 9th graders) from 359 schools. The Health Literacy for School-aged Children (HLSAC) instrument was applied to measure adolescents' subjective HL, while the Family Affluence Scale (FAS) was used to measure adolescents' socioeconomic status. Information was gathered on school achievement, learning difficulties, and educational aspirations.

Findings Approximately one third of the adolescents manifested a high level of HL, around 60% had a moderate level of HL, and about one tenth had low HL. The HL level was lower for boys than for girls, and lower for 7th graders than for 9th graders. In the total sample the strongest explanatory variables for HL were school achievement in the first language, and educational aspirations.

Originality/value This study provides the first Finnish nationally representative examination of adolescents' subjective HL levels, and how these vary across age and gender groups. In drawing conclusions and presenting suggestions for HL interventions, it is important to verify the nature of the HL examined in any given study, and how it was researched.

Keywords health literacy, children, adolescent(s), school, school achievement, learning difficulties, educational aspirations, family, income

Article Classification Research paper

Introduction

In the fields of public health and health promotion there has been increasing interest in the health literacy (HL) of various age groups. HL as "the degree to which individuals have the capacity to obtain, process and understand basic health information and the services needed to make appropriate health decisions" (Ratzan and Parker, 2000, vi) has been reported to be a clear risk factor for poor health (Vollandes and Paasche-Orlow, 2007). The development of HL among the population can be seen as an important means to decrease health disparities (Kickbusch *et al.*, 2006). The advancement of HL among the broader population requires a focus on HL, with age-appropriate measurements, across various age groups and settings (Kickbusch *et al.*, 2013). Children within schools comprise one such target.

School comprises a valuable setting for supporting HL, since the school reaches most of the population within a certain age demographic. The foundation for HL, health behaviour, and health and well-being in general is laid during childhood and the school years. Adolescence is generally understood to be a significant period of life in many respects, including that of independent decision-making (Ghanbari *et al.*, 2016). Health inequalities among the adult population can be partly explained via health behaviours adopted in adolescence, and with reference to early life circumstances (Inchley *et al.*, 2016, 5).

One of the main purposes of the school is to reduce inequalities, including those that are already present in adolescence (UNESCO, 2014a). Education contributes to the health and well-being of pupils in a general sense (UNESCO, 2014b); however, when health-related competences (i.e. HL) are given specific attention when formulating and putting into practise school health education learning objectives and standards, health disparities are likely further decrease (see Parker *et al.*, 2003). As Perry (2014, p217) has aptly noted, “the task of improving HL amongst millions of adolescents is daunting; but, ultimately, improving HL in adolescents is imperative for achieving better health outcomes”. There is a clear and increasing gap between the demands to take care of one’s health and the actual skills that people possess (Kickbusch *et al.*, 2013; Gazmararian *et al.*, 2005; Parker *et al.*, 2003). From this perspective, the development of HL among schoolchildren is not merely desirable, but could be regarded as a moral act.

The level of school-aged children’s HL - what have we learned so far?

Over the years, most studies on HL have been conducted on patients in a health care context, with a research focus on the basic skills of reading, writing, and numeracy. These are often referred to collectively as functional HL, as defined by Parker *et al.* (1995). Research on these domains continues, and the importance of functional HL skills on a person’s health remains widely recognized. Nevertheless, there has been an increasing willingness to move beyond these skills and to monitor a broader construct of HL, one that would encompass the HL competences (e.g. critical thinking, problem solving and advocacy skills) that are nowadays needed if individuals are to take care of and sustain their own and community health in modern society (Nutbeam, 1998; Sørensen *et al.*, 2012).

There has only been limited monitoring and reporting of HL of any kind among school-aged children overall (Ghanbahari *et al.*, 2016; Ormshaw *et al.*, 2013), with studies focusing primarily on the functional HL of adolescents. Moreover, there have not been many cross-national comparative studies on adolescents’ HL levels, although some information has been obtained from countries or regions in various parts of the world, including Asia (Taiwan, China) and the United States. Studies focusing on functional HL have shown that up to 90% of children in Taiwan and China have a moderate or high level of HL, while 10% have low HL (Chang, 2010; Lam and Yang, 2014). In the United States the proportion of young people with “below basic” HL has been the same as in Taiwan and China (Kutner *et al.*, 2006; see also Ghaddar *et al.*, 2012). The findings reflect a good general literacy level among young people in those areas (UNESCO, 2014c). Interestingly, when another study in the same area of Asia assessed HL – via an instrument which addressed the broader construct of HL – the proportion of children with low HL was higher, at over 25% (Shih *et al.*, 2016). This is consistent with the view that functional HL tools such as Test of Functional Health Literacy in Adults (TOFHLA; Parket *et al.*, 1995) and Rapid Estimate of Adult Literacy in Medicine (REALM; Davis *et al.*, 1991) focus on phenomena (e.g. reading ability; DeWalt and Pignone, 2005) that are narrower in scope than the HL domains addressed in the fields of public health and health promotion.

In Europe, HL has been measured mainly in adult populations via the European Health Literacy Survey (EU-HLS). This has been conducted within eight European countries, and it has included also adolescents and young adults (15 years and older) (Sørensen *et al.*, 2015).

However, since age-specific findings have not been reported, there is no information on HL among the young people represented in that sample.

In Finland, HL among school-aged children has been studied as part of the national assessment of learning applied to health education as a distinct school subject. Using an objective measure (a pen and paper exam) based on a broad construction of HL, a nationally-representative sample of 9th graders gave responses in various tasks (Summanen, 2014). The pupils showed only a satisfactory level of competence. However, it should be noted that the assessment was first and foremost an evaluation of how well pupils had met the learning criteria identified in the national curriculum. Hence, the main starting point for the development of the exam was the curriculum, not the concept of HL, even if the findings do indeed reflect HL.

According to a review by Perry (2014, p 215), the majority of studies on the current HL status of adolescents have used “health literacy instruments that have not been validated for use in adolescents”, hence caution is seen as necessary in interpreting the findings. Moreover, most of the studies have focused on functional literacy, with a concomitant lack of studies addressing the broader construct of HL, plus related factors. It is only recently that efforts have been made to develop adolescent-specific instruments that go beyond the evaluation of basic literacy skills (Ghanbahari *et al.*, 2016; Paakkari *et al.*, 2016; Shih *et al.*, 2016). One of such instruments is the Health Literacy for School-aged Children (HLSAC) instrument (Paakkari *et al.*, 2016). It was developed based on a broader construct of HL and for the purpose of measuring HL of the adolescents.

The aim of this study was to investigate the level of subjective HL among adolescents (boys and girls, 7th and 9th grade, ages 13 and 15) in Finland, on the basis of the HLSAC instrument. In addition, the study sought to determine the associations between HL, school achievement, learning difficulties, educational aspirations, and family affluence.

Methods

Participants and data collection

The empirical data for the study were collected in Finland in 2014, as part of the cross-national collaborative study entitled *Health Behaviour in School-aged Children* (HBSC). The general objective of the HBSC research is to gain a better understanding of lifestyles, health behaviours, and the surrounding context, insofar as they affect children and adolescents (Currie *et al.*, 2009). The research thus covers various aspects of adolescence, including demographic factors, health behaviours, perceived health, HL, learning, lifestyles, and life circumstances. All the measures are based on self-reports.

The data for the present study were nationally representative, being obtained from a total of 3,833 adolescents (boys 7th grade N=880, boys 9th grade N=882, girls 7th grade N=894, girls 9th grade N=963) in 359 schools. The schools were chosen from the Finnish school register using a cluster sampling method. Sampling was adjusted to take into account the province within Finland, the type of municipality (urban, semi-urban, rural), and the size of the school. Within each school the participating class was randomly selected.

The data collection followed the general guidelines of responsible conduct of research (Finnish Advisory Board on Research Integrity, 2012), and the research protocol of the international HBSC study (Currie et. al. 2014): thirteen- and fifteen-year-old participants responded voluntarily and anonymously to a standardized paper-and-pen questionnaire, administered in the course of one lesson. The pupils were informed of the confidentiality of the data, and of the fact that only group-level results would be reported.

The response rate of the pupils was 85%, while the response rate for the schools was 68%.

Measures

HL instrument

A brief *Health Literacy for School-aged Children* (HLSAC) instrument (Paakkari et al., 2016) was used to measure the adolescents' subjective (self-reported, perceived) HL. The validated 10-item instrument (Table 1) contains two items from each of the five core components (theoretical knowledge, practical knowledge, critical thinking, self-awareness, citizenship). The HLSAC instrument has been found to have high internal consistency (overall Cronbach's alpha .93, Table 2).

All the items took the form *I am confident that...*, and the Likert-type response scale included four options: *not at all true*, *barely true*, *somewhat true*, and *absolutely true*. For the analysis of the HL levels the response options *not at all true* and *barely true* were combined to describe 'low' HL.

The levels of HL were classified in such a way as to fall into three groups. The thresholds were set by an expert group (consisting of researchers and teachers in the field of health promotion, education, and psychology) who determined the HL scores required to reach a given level. Following consideration of the contents of the items, and inspection of the response distribution, the resulting HL levels consisted of "low" (score 10-25), "moderate" (score 26-35), and "high" (score 36-40).

School achievement

Participants were asked to indicate their school achievement in their first language and in mathematics via the following question: *In my latest school report the mark was...* The response scale (marks) ranged from 4 (fail) to 10 (excellent). The marks thus obtained were regrouped to form three categories (marks 4 to 6, marks 7 to 8, marks 9 to 10).

Learning difficulties

Respondents were asked to indicate whether they had learning difficulties in two areas, namely (i) reading or spelling, and (ii) mathematics. The response options for both questions were *no*, *some*, and *yes*.

Educational aspirations

To assess educational aspirations, the adolescents were asked what they would do when they finished comprehensive school (at age 15). The response options were: *upper secondary school* (age 16-19), *vocational school or other vocational training*, an

apprenticeship, double examination (upper secondary school and vocational school), *get a job, be unemployed, or don't know*. Only the options *upper secondary school* and *vocational school or other* were included in the statistical analysis (dummy variable), because of very low frequencies for the other responses. The upper secondary school in Finland mainly represents an academic orientation, while the vocational school or vocational training can be seen as having a practical orientation.

Family affluence

The *Family Affluence Scale* (FAS, Torsheim *et al.*, 2015) included six items that are associated with parental income and hence function as measures of adolescents' socioeconomic status. The questions encompassed the material conditions of the household, covering: occupancy of bedrooms; number of bathrooms; number of computers and dishwasher ownership; ownership of a car; and holidays abroad. The response options for the questions on the dishwasher and on having own bedroom were *no* and *yes*. For the other questions the response scale was *none, one, two, and more than two*. The respondents were divided into three affluence groups according to the HBSC protocol (Currie *et al.*, 2016), hence: low affluence (lowest 20%), medium affluence (middle 60%), and high affluence (highest 20%).

Statistical analysis

All the statistical analyses were conducted for the total sample, separately for boys and girls, and for 7th and 9th graders. The descriptive statistics for HL included means, standard errors, standard deviations, distributions of skewness and kurtosis, and percentage distributions of the HL levels. The differences between the group means (for gender and grade), gender and grade interaction effect on the HL were tested via a two-way analysis of variance (ANOVA).

The analyses were conducted using SPSS (version 22). The relationships between subjective HL and school achievement, learning difficulties, educational aspirations, and family affluence were tested via a mixed-effects multilevel regression analysis, because the data had a hierarchical structure (pupils nested in classrooms). The analyses in this case were conducted using Stata (version 14).

Results

Level of subjective health literacy

The HLSAC instrument used contains 10 items (Table 1).

Respondents indicated that their theoretical and practical knowledge was, generally speaking, at the 'good' level. Around 90% reported having a good knowledge of health; they felt that they could easily find understandable health information and could follow the instructions of doctors or nurses (response options: *somewhat true* or *absolutely true*).

More difficulties were indicated regarding critical thinking and citizenship. About 15% reported difficulties in the ability to compare the information from different sources, or in the ability to decide if information is right or wrong. Approximately one in five indicated

problems in terms of being able to give ideas on how to improve health in their environment.

Gender comparison showed that the boys reported more difficulties (response options *not at all true* or *barely true*) than the girls on almost every HL item. Similarly more girls than boys reported having good competence in the cases that were asked, that is, they chose the response option *absolutely true* more often than the boys in most of the HL items.

Table 1. Percentage distributions of the items in the HLSAC instrument, divided by gender

Table 2 reports the descriptive HL statistics for girls and boys in the 7th and 9th grades, separately. The HL distributions were approximately normal. In every group the minimum score was 10 and the maximum 40. The overall mean HL score was 32.55. The lowest subjective HL was found among 7th grade boys (mean score 31.90), and the 9th grade girls reported highest subjective HL (mean score 33.32). The girls HL mean score was higher than boys, and according a two-way analysis of variance (ANOVA) the difference was statistically significant ($F(df1)=8.214, p=.004$). The mean score of the HL was higher among the 9th graders than among 7th graders, and this difference was also statistically significant ($F(df1)=10.555, p=.001$).

Table 2. Descriptive statistics and the Cronbach's alphas for health literacy (HLSAC)

Thereafter we categorized HL into three levels (low = score 10-25, moderate = score 26-35, high = score 36-40). We observed that around one tenth of the participants had low HL, 57% had moderate HL, and approximately one third achieved a high level of HL (Figure 1). In both age groups there were more boys than girls with low HL. In both genders the proportion of pupils who had a high level of HL increased towards the 9th grade.

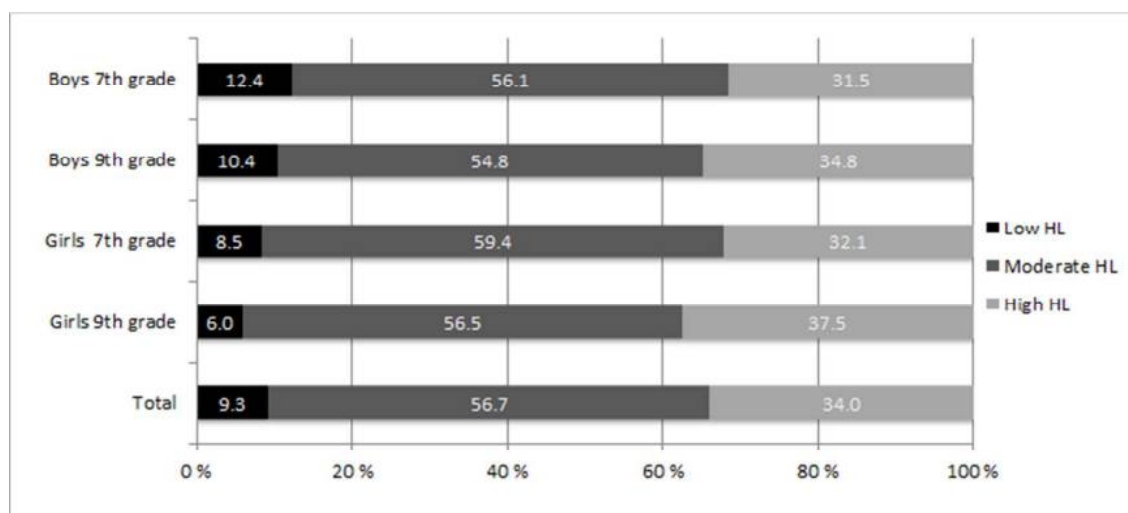


Figure 1. Levels of subjective HL by gender and grade, and for the total sample; percentage distribution

HL associations with school achievement, learning difficulties, educational aspirations, and family affluence

The descriptive statistics for the predictors (Table 3) showed that poorer results were more common among boys, and in general more frequent for mathematics than for the first language. Adolescents reported more difficulties in mathematics than in reading or spelling. About four out of five respondents reported that they had no difficulties in reading or in spelling. In mathematics, on average half of the participants reported difficulties, with girls reporting more difficulties than the boys. The majority of the participants intended to apply to upper secondary school, or to vocational school, or other vocational training. Among boys the intention to go vocational school or vocational training was higher than for the girls, most of whom reported that they intended to go to upper secondary school.

Table 3.

Percentage distributions for school achievement, learning difficulties, educational aspirations, and family affluence (predictors), categorized by gender

In the total sample the strongest correlations between HL and the other variables were for school achievement in the first language, and for educational aspirations ($r = .22$) (Table 4). The correlations for the other variables (difficulties in reading, spelling or mathematics, family affluence) varied between .12 and .14. Better performance in the first language or mathematics, family affluence, and higher educational aspirations predicted higher HL, whereas lower HL was associated with difficulties in reading, spelling, or mathematics. Overall, the correlations were somewhat higher among the 9th grade pupils than among the 7th grade pupils.

Table 4. The mixed-effects multilevel regression model for HL (dependent variable)

In the total sample the predictive variables for HL were school achievement in the first language, educational aspirations, difficulties in reading or spelling, difficulties in mathematics, and family affluence. Among the respondents who were planning to go to upper secondary school after finishing the comprehensive school, the HL score was 1.3 points higher than among those who were planning to enter vocational school or other vocational training.

The HL predictors varied between class and gender groups. For the girls (7th and 9th graders) the strongest predictive variable for HL was school achievement in the first language, and for the boys difficulties in mathematics. The multilevel effect of the school was significant only for the total sample and for 9th grade girls.

Discussion

To recap, the first aim of the study was to ascertain the level of school-aged children's subjective HL, and the associations of HL with school achievement, learning difficulties, educational aspirations, and family affluence.

Subjective HL

The adolescents' subjective HL level proved to be fairly high according to the HLSAC-scale: about 60% had moderate HL, around one third reported a high level of HL, and no more than about one tenth had low HL. The girls' HL level was higher than that of the boys, and HL was higher among the 9th graders than the 7th graders. According to the regression analysis, the strongest predictive variables for HL in the total sample were school achievement in the first language and educational aspirations. For the boys, the most important predictor of HL was difficulties in mathematics, and for the girls, school achievement in the first language. A regression model across gender and grade level explained 8% of the HL variance. The model predicted more of the HL variance for the 9th grade than for the 7th grade.

The fact that, in general, most of the pupils reported a fairly high level of HL may be because in the Finnish school system health issues are taught within health education as a school subject, which is a statutory independent subject both at primary school (grades 1-6, ages 7-13) and at secondary school (grades 7-9, ages 13-15). Schools have to follow the national curriculum and the objectives for the subject. Moreover, every school has to offer the same amount of HE teaching to every pupil. Nevertheless, pupils gain health knowledge in other contexts as well, such as within media, guardians, and peers or other school subjects. It suggests that general health promotion work in the school community (involving e.g. health-promoting schools/ whole-school approach) can advance HL among adolescents. Since the 9th graders have received more teaching than the 7th graders, this may partly explain the finding that the older pupils had better HL than the younger ones. On the other hand, we do not as yet have cross-national research results on the levels of HL in countries where there is no systematic teaching of HE. Hence, we do not know how having HE as a school subject affects the level of HL.

Overall, girls showed a higher level of HL than boys. The result was consistent with the national HE examination, which showed a large gender difference (Summanen, 2014). Similar gender differences have been found among adults (Sørensen *et al.*, 2015), but the comparison of the results is problematic because of different age groups and instruments. There is ongoing debate on the size of the gender gap and the explanations for it (Hyde, 2014; Voyer and Voyer, 2014). From a wider perspective, potential reasons for gender differences could relate to aspects of society, the culture, the school environment, and pedagogy that may favour girls (Stoet and Geary, 2013). The results of the PISA study indicate consistent differences between boys and girls in reading, doing homework, and investing effort at school (OECD, 2015), and in attitudes to learning and school (OECD, 2015; Summanen, 2014). In Finland girls tend to be more interested than boys in the health issues discussed in HE lessons (Aira *et al.*, 2014).

Pupils with a higher level of self-regulation (i.e. the ability to control, direct, and plan their thinking, emotions, and behaviours, Schunk and Zimmerman, 1997), generally perform

better than students with lower levels of self-regulation (OECD, 2015). Girls tend to be more self-regulated and disciplined than boys, and have better ability to set goals, plan ahead, and deal with setbacks and frustrations (Duckworth and Seligman, 2006; Kenney-Benson *et al.*, 2006). All these reasons could partly explain the higher HL levels among the girls in our study. However, it is important to remember that boys and girls are not homogenous groups: both boys and girls include pupils who do not cope with school, and others who manage education well.

Associations between HL and other variables

The second aim of this study was to explore the association of HL with school achievement, learning difficulties, educational aspirations, and family affluence.

There were statistically significant associations between HL and the variables in question.

School achievement in the first language was the strongest predictive variable both in the total sample and for girls; however, for boys the best predictor was difficulties in mathematics. This finding was consistent with the study of the Finnish National Board of Education, in which school achievement in mathematics explained 21% of the success in the HE national exam, while the first language explained as much as 31% (Summanen, 2014). School achievement in general is linked to perceived competence in health issues; thus the finding is unsurprising, given the nature of HLSAC, which is based on beliefs in one's own competences (i.e. self-efficacy).

In this study, difficulties in reading, spelling, or mathematics, and also low educational aspirations, predicted a lower level of HL. Learning difficulties have been found to be associated with adolescents' academic achievement, and this also predicts their educational aspirations (Rimkute *et al.*, 2013). Adolescents with higher educational aspirations are more willing than others to seek an academic professional career in the future (Jodl *et al.*, 2001). The study by Summanen (2014) indicated that pupils who were planning to continue to upper secondary school succeeded better in assessments of learning within HE (i.e. the school subject) than those who were planning otherwise. In particular, pupils who were thinking of taking a break for a year, or going directly to a job, succeeded poorly in the examination (Summanen, 2014).

Studies have shown that, compared to students who move on to upper secondary school after comprehensive school, unhealthy behaviours are more common among adolescents who go on to vocational school or training (Grotvedt *et al.*, 2008; Luopa *et al.*, 2014; Vereecken *et al.*, 2004). In Finland, among those adolescents who study at upper secondary school, 8% smoke daily, while for young people studying in vocational school the proportion is 36%. A similar picture emerges with regard to other unhealthy behaviours such as alcohol consumption, having less sleep, physical inactivity, and experimentation with drugs (Luopa *et al.*, 2014). The aspiration to study in a vocational school indicated a lower level of HL overall. Thus, a non-academic educational path, in conjunction with low HL (which is a risk factor *per se*), can reinforce health inequalities among children and adolescents.

In this study, family affluence predicted a higher level of HL. It has been suggested that low socio-economic status is a risk factor for academic performance (Frederickson and Petrides, 2008). According the PISA study (OECD, 2015), there are differences in academic achievement (reading, mathematics, science, problem-solving) which are associated with parents' education, occupation, and family wealth or household possession. Boys in particular are in a disadvantaged position when their parents' socio-economic status is low (OECD, 2015). Parents' education was also linked to HE learning outcomes in a study conducted for the Finnish National Board of Education (Summanen, 2014). There are multiple reasons for the correlation between family affluence and adolescent HL. Highly affluent families may possess forms of capital that are conducive to HL. These include general knowledge of health issues, and a high value given to health in general, in addition to the higher school achievement and the higher income of the families (Reardon, 2011).

The amount of explained variance remained low in the regression model with school success, educational aspirations, family affluence, and learning difficulties explaining HL. This has been noticed also in previous studies. The comparative study on HL in EU (HLS-EU Consortium, 2012) showed that age, gender, education, financial deprivation and social status explained about 10 % of variance in HL in countries like Austria, Germany or Netherlands. However, in other countries, e.g. Poland, Greece and Bulgaria, the coefficient of determination was higher, over 20 %. It seems that the socio-economic indicators influence to HL more in certain countries than in others (HLS-EU Consortium, 2012).

Limitations of the study

This study had certain limitations. In the best case, the same instrument will contain both subjective and objective measurements of HL. It then becomes possible to compare results for the same respondents. Because the respondents may give so-called 'socially expected answers', the self-reported questionnaires could give higher scores than objective measurements. The measurement of educational difficulties was here based on the adolescents' report of their experience, and the report could be different from what would be revealed by actual tests in reading, mathematics, or problem-solving. Moreover, the marks in the first language and in mathematics were reported by the pupils themselves, and there could have been some problems with retention of the information.

The research design was cross-sectional, meaning that the results do not address change across time, instead describing differences between two (separate) samples of 7th and 9th graders. A longitudinal study could provide more detailed information on the development of each participant's HL during the last years of secondary school.

Comparison of the findings between different studies using different instruments (e.g. Chang, 2010; Ghaddar *et al.*, 2012; Lam and Yang, 2014; Shih *et al.*, 2016; Sørensen *et al.*, 2015) is difficult, since the studies in question may be measuring various constructs of HL. Previous research has shown that the tool used to measure HL has an influence on the level of HL identified (Barber *et al.*, 2009).

Conclusions

This paper provides the first results on the level of adolescents' subjective HL in Finland, measured by the instrument specifically developed for the target group. It is based on nationally representative data, and it offers important insights into how HL levels vary between different class and gender groups. The study of subjective HL is clearly important, since one's perceived competence – i.e. self-efficacy – has been found to be a clear and independent factor explaining various health-related behaviours (Bandura, 2004; Conner and Norman, 2005). The overall findings of this study are somewhat different from those of Finnish National Board of Education (Summanen, 2014); when measured objectively adolescents' HL was at the satisfactory level (Summanen, 2014), whereas this study using a subjective measure showed a good level of HL among the target group. This indicates that both objective and subjective measures are needed in order to construct strong policy recommendations.

It is likely that reducing school achievement gaps could contribute to a reduction in HL disparities among school-aged children. If this is so, it confirms the important role of education and of schools in tackling health disparities. The establishment of school-based learning standards for HL could assist in tackling health disparities overall (Parker *et al.*, 2003).

In drawing conclusions and making suggestions for HL interventions, there is a clear need for researchers and politicians to be clear about the different kinds of HL covered in various studies, and the methods and measures applied. Caution is needed, insofar as general discussion of HL – divorced from careful consideration of what is actually focused on – could lead to impractical conclusions, false generalizations, and unhelpful concrete practices. Future avenues could include monitoring children's HL across various settings, using the same instrument to check the influence of the context. It may be possible to utilize the findings of this study within cross-national research, for example as part of the international HBSC study.

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Subjective health literacy among school-aged children

Tables

Table 1. Percentage distributions of the items in the HLSAC instrument, divided by gender

	Boys (N=1820)				Girls (N=1912)			
	Not at all true	Barely true	Somewhat true	Absolutely true	Not at all true	Barely true	Somewhat true	Absolutely true
Theoretical knowledge								
Having good information regarding health	2.6	9.3	44.6	43.5	0.5	7.5	45.4	46.6
Ability to give examples of things that promote health	2.3	13.6	49.9	34.1	0.9	12.2	49.9	37.0
Practical knowledge								
Ability to find health-related information that is easy to understand	2.1	9.3	44.3	44.3	0.6	6.3	42.5	50.7
Ability to follow the instructions given by doctors and nurses	2.3	9.6	43.9	44.3	0.7	5.7	35.3	58.2
Critical thinking								
Ability to decide if health-related information is right or wrong	2.3	12.7	49.7	35.4	1.5	12.9	51.9	33.7
Ability to compare health-related information from different sources	2.8	13.8	48.5	34.9	1.9	13.8	51.7	32.6
Self-awareness								
Ability to justify one's own choices regarding health	2.5	12.2	48.7	36.6	0.9	9.3	49.7	40.2
Ability to judge how one's own behaviour affects one's health	3.2	12.0	45.3	39.5	1.1	9.0	48.8	41.1
Citizenship								
Ability to judge how one's own actions affect the surrounding natural environment	2.5	10.6	49.4	37.5	0.9	8.8	48.2	42.1
Ability to give ideas on how to improve health in one's immediate surroundings	3.5	16.5	51.8	28.2	2.4	16.3	52.4	28.9

Table 2. Descriptive statistics and the Cronbach's alphas for health literacy (HLSAC)

	N	Min.	Max.	Mean	Std. Error	Std. Deviation	Skewness	Std. Error	Kurtosis	Std. Error	α
Boys 7 th grade	880	10	40	31.90	0.20	5.91	-0.65	0.08	0.52	0.17	.94
Boys 9 th grade	882	10	40	32.39	0.20	6.06	-0.96	0.08	1.42	0.16	.95
Girls 7 th grade	894	10	40	32.51	0.17	5.13	-0.54	0.08	0.25	0.16	.91
Girls 9 th grade	963	10	40	33.32	0.16	4.88	-0.61	0.08	0.38	0.16	.91
Total	3619	10	40	32.55	0.09	5.53	-0.76	0.04	0.93	0.08	.93

Table 3. Percentage distributions for school achievement, learning difficulties, educational aspirations, and family affluence (predictors), categorized by gender

Predictor	Boys (N=1870)			Girls (N=1928)		
	Marks 4 to 6	Marks 7 to 8	Marks 9 to 10	Marks 4 to 6	Marks 7 to 8	Marks 9 to 10
School achievement in the first language	17.7	61.7	20.6	4.0	46.9	49.1
School achievement in the math	19.7	48.1	32.2	12.4	47.6	40.0
Difficulties in reading or spelling	No 78.2	Some 18.7	Yes 3.1	No 78.2	Some 17.7	Yes 4.1
Difficulties in mathematics	56.6	35.7	7.6	45.6	40.5	14.0
Educational aspirations	Upper secondary school 51.3	Vocational school 39.4	Other 9.3	Upper secondary school 70.3	Vocational school 23.3	Other 6.4
Family affluence	Low 20.0	Medium 60.0	High 20.0	Low 20.0	Medium 60.0	High 20.0

Table 4. The mixed-effects multilevel regression model for HL (dependent variable) divided into grade and gender groups, and total sample.

	Coefficient	t	Sig.	95% confidence interval		Pearson correlation
Total sample						
School achievement in the first language	0.56	5.54	.000	0.36	0.76	0.22
Educational aspirations (upper secondary school)	1.25	5.24	.000	0.78	1.71	0.22
Difficulties in reading or spelling	-0.76	-3.83	.000	-1.15	-0.37	-0.14
Family affluence	0.22	4.26	.000	0.12	0.32	0.12
Difficulties in mathematics	-0.45	-3.02	.003	-0.74	-0.16	-0.14
Boys 7th graders						
Educational aspirations (upper secondary school)	0.95	2.08	.038	0.05	1.85	0.13
Difficulties in mathematics	-0.98	-2.55	.011	-1.73	-0.22	-0.13
Family affluence	0.30	2.50	.013	0.06	0.54	0.12
Boys 9th graders						
Educational aspirations (upper secondary school)	1.41	2.93	.003	0.47	2.36	0.25
Difficulties in mathematics	-1.05	-3.23	0.001	-1.69	-0.41	-0.23
Difficulties in reading or spelling	-1.12	-2.62	.009	-1.95	-0.28	-0.19
Family affluence	0.33	2.98	.003	0.11	0.54	0.15
School achievement in the first language	0.53	2.53	.012	0.12	0.95	0.24
Girls 7th graders						
Educational aspirations (upper secondary school)	1.22	2.57	.010	0.29	2.15	0.17
School achievement in the first language	0.62	2.79	.005	0.19	1.06	0.17
Family affluence	0.27	2.70	.007	0.07	0.47	0.13
Girls 9th graders						
School achievement in the first language	0.89	4.97	.000	0.54	1.24	0.30
Educational aspirations (upper secondary school)	1.80	4.43	.000	1.00	2.60	0.29
Difficulties in reading or spelling	-0.76	-2.65	.008	-1.33	-0.20	-0.17

Figure 1. Levels of subjective health literacy (HL) by gender and grade, and for the total sample; percentage distribution

