



Quality of life in 13-year-olds depending on health status, residential neighbourhood deprivation and social capital – results from the Polish HBSC Study 2010–2018

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Abstract

Introduction and Objective. Health-related quality of life (HRQL) should be used more extensively in monitoring the health of school-aged children. The presented study aimed to evaluate trends in KIDSCREEN-10 indices, considering mean scores and the level of social inequalities.

Materials and method. 3,937 children aged 13 participated in three Health Behavior in School-aged Children (HBSC) cross-sectional surveys conducted in Poland between 2010–2018. Subgroups were distinguished according to gender, health status, and three social factors (family affluence, neighbourhood social capital, and local deprivation).

Results. The average KIDSCREEN-10 index value was equal to: 22.36±4.54; 25.41±6.75; and 24.74±6.53 in 2010, 2014, and 2018, respectively. However, in 2018 no deterioration was recorded in boys, in poorer families or in regions with high social capital. The improvement in HRQL in 2014 was accompanied by an increase in disparities in health status and family wealth, as well as a decrease in disparities in local deprivation. An especially high increase in Glass index values was recorded for neighbourhood social capital (increasing from 0.542 in 2010 to 0.938 in 2018). The multivariate general linear model revealed the main effect of the year of the study, gender, chronic disease status, and the three social factors, as well as six significant 2-way interactions.

Conclusions. Changes in the well-being of adolescents should be tracked over time using HRQL indices with proven psychometric properties. The level of social inequalities faced by young people should be included in policies and when designing interventions. The relevant initiatives should be targeted at different populations in order to properly address the needs of different groups of children and adolescents.

Key words

trends, social inequalities in health, neighborhood, health-related quality of life, KIDSCREEN-10, family affluence

INTRODUCTION

Research into health-related quality of life (HRQL) has emerged concurrently with the extension of the life expectancy of persons affected by diseases previously considered incurable. Over time, it has also become an important component of population-based research, which includes gathering information for evidence-informed policies, and screening for mental health disorders [1]. Nowadays, there is a greater awareness of the importance of monitoring HRQL in adolescents to identify groups that are at increased risk of unsuccessful transition to adulthood due to the deterioration of mental health [2]. Improving the HRQL of children and

adolescents can be conducive to achieving the third global Sustainable Development Goal, to ensure healthy lives and promote well-being for all ages [3].

The methodological challenges of such analyses involve measuring HRQL appropriately and determining which groups (or social features) are worth looking at. Access to reliable data sources to track changes over time is also important. After all, interventions intended to improve health and quality of life may affect different social groups to different extents. This is the point where monitoring HRQL changes in social groups overlaps with monitoring social inequalities in health.

Numerous definitions and models of HRQL have been formulated and several questionnaires have been implemented [4, 5, 6]. A common feature of these definitions is considering physical and mental health, the quality of social relationships, and emphasis on subjective assessment. The available tools are

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divided into generic and specific to different subpopulations [7]. KIDSCREEN was the first HRQL instrument designed for teenagers, developed in parallel in several European countries and further applied in numerous population-based studies [8]. Poland was among the 13 countries where a prototype for these tools was developed, thus avoiding the pitfalls of linguistic and cultural adaptation. KIDSCREEN is used in three variants that differ in length and is available as a self-reported or proxy-responder version [9]. In a scoping review published in 2023, Befus et al. summarized 232 applications of KIDSCREEN questionnaires in population-based studies, indicating their growing popularity [10]. Analyses of changes over time were shown in this review in a small number of longitudinal studies. However, attention was given to the factors that contributed to the enhancement of HRQL, including physical activity, overweight and obesity, and the social background of the child's or adolescent's family [11, 12]. Chronic diseases are also an important factor that can impair quality of life. In an earlier review, Silva et al. conducted a meta-analysis of 21 studies using the KIDSCREEN tool, comparing 4,852 children with chronic diseases with 28,578 healthy peers [13].

Concerning the question of reliable data sources supporting the monitoring process, it is important to note that the short KIDSCREEN-10 index was included in the Health Behaviour in School-aged Children (HBSC) survey between 2006–2014, as an optional module. Some countries, including Poland, also kept it out of the international protocol in the subsequent round of the survey in 2018. This provided an opportunity to track changes over time and carry out international comparisons, as well as increased opportunities for analyzing HRQL in the broad context of adolescents' living conditions and in relation to their lifestyles.

According to the classic definition, social inequalities in health indicate avoidable, unfair, and systematic differences in health between different more and less advantaged groups of people or individuals. More precisely, individuals from different backgrounds, social groups, and countries enjoy different levels of health [14]. The association between children's and adolescents' HRQL and family wealth has been extensively discussed in the literature, including using KIDSCREEN questionnaires [15, 16]. Less research has been conducted on the association between HRQL and environmental attributes. The HBSC surveys conducted in Poland between 2010 – 2018 provided an opportunity to carry out such analyses, as they included another optional package which related to residential neighbourhood. The adolescent's perception of their local area can replace external, administrative data sources on the region's socio-economic status [17]. Due to the limited mobility of adolescents, the HBSC conceptual model defines the area of residence as a crucial developmental context.

Given the numerous definitions of social capital, the authors assumed that this term refers to the relationships between people who live in each region and collective actions [18], the level of trust, reciprocity, participation in organizations, informal control, and the possibility of obtaining support when needed [19]. Similarly simplified in the HBSC protocol is the definition of local deprivation, which includes structural characteristics of the neighbourhood, with references to the dimension of living conditions and safety included in the standard multiple indices [20]. Neighbourhoods provide opportunities for support networks, which in turn influence

adolescents' health, behaviour, and well-being. Conversely, they can also be a source of stress and a disturbed sense of security [21]. Moreover, the deprivation level of a region's is associated with access to different types of services and resources [22].

Given the background presented above, the current analyses aim to fill a gap in knowledge and provide a picture of changes in Polish society. The originality of these analyses lies in the multivariate and *dynamic analysis* of social inequalities in health, the combined consideration of three social variables (family wealth, neighbourhood social capital, and local deprivation), and additional adjustment for chronic condition status.

OBJECTIVE AND RESEARCH QUESTIONS

The aim of the study is to analyze the changes in KIDSCREEN-10 indices among Polish teenagers during 2010–2018, while considering the occurrence of chronic diseases as well as the social and structural characteristics of the neighbourhood. At the same time, attention was drawn to the level of health inequality in the subsequent years.

The following research questions (RQ) were formulated:

RQ1: How did the quality of life of Polish adolescents change during the period studied?

RQ2: Did the pattern of change differ among different subpopulations distinguished by gender, health status, family wealth and neighbourhood characteristics?

RQ3: Is the association of HRQL level with the demographic and social factors stable over time?

RQ4: Were changes in the HRQL associated with changes in the magnitude of social inequalities in health?

RQ5: Is there any interaction between the year of the study and the above demographic and social factors as predictors of adolescent HRQL?

MATERIALS AND METHOD

Study origin and design. The data used in this study comes from three consecutive rounds of HBSC surveys conducted in Poland. These are cross-sectional surveys, implemented in schools, and repeated every four years in a growing number of countries (currently 51). This study of students' self-reported health and health behaviour at ages 11, 13, and 15 also covers a broad social context (family, school, peer group, and migrant status). The rules for conducting the survey and the scope of the questionnaire are stated in an international protocol developed for each round by members of the HBSC network. Member countries are required to use the mandatory questions. Optional questions recommended in the protocol, as well as national ones, are included depending on the interests of the researchers in the member countries.

Participants and procedure. The study population consisted of students who participated in HBSC surveys carried out in Poland in 2010, 2014, and 2018, amounting to a total of 3,937 respondents, of whom 47.5% were boys. The number of students living in rural areas in the subsequent survey rounds was as follows: 2010 – 32.7%; 2014 – 34.3%; 2018 – 37.9%. Students from all provinces (voivodships) participated in all three rounds of HBSC surveys discussed,

and completed paper questionnaires in school during school hours. The survey was carried out by trained interviewers who were not affiliated with the schools and, in exceptional cases, by the school guidance counselor. Consent was obtained from school principals and parents or guardians; the local education authority was also informed about the survey. Participation of the teenagers in the survey was anonymous and voluntary, and no incentives were offered.

The HBSC research protocol involves surveying students aged 11, 13, and 15 and recommends that 1,500 students per age group are surveyed in each country [23, 24]. However, the current analysis pertained solely to the middle age group, as it is the only group whose questionnaires included the KIDSCREEN-10 module in all three waves of the study. Age ranging between 12.5 – 14.5 was adopted as an inclusion criterion. The sizes of the groups were as follows: 2010 – 1,646; 2014 – 967; 2018 – 1,506 students. In 2014, 1,536 students in this age group were surveyed, but only 967 completed the questionnaire with questions on neighbourhood characteristics. The use of two versions of the questionnaire was related to conducting surveys in two rounds in the autumn of 2013 and spring of 2014. All three surveys were conducted in the same months (February–May), which increased the comparability of the results. The study design employed stratification by subregion according to EUROSTAT classifications including the nomenclature of territorial units for statistics (NUTS). In the first step, counties (NUTS 4 level) were drawn randomly, with schools and classes at the schools sampled in the second step. The sample was modified in the subsequent rounds of the survey, but about 70% of the students were still attending the same schools located in the same regions.

The mean age of the respondents in the surveyed age group was 13.66 ± 0.42 years. In the consecutive study periods, the average age was: 2010 – 13.72 (0.31), 2014 – 13.73 (0.50), 2018 – 13.55 (0.42). Those surveyed in 2018 were slightly younger than in 2010 and 2014, likely because a higher percentage of them started school at the age of six rather than seven. The survey was carried out in schools in all three periods using the traditional pen-and-paper method of administration. The research procedure was standardized and followed the international protocol, as specified in national and international reports and methodological publications by the HBSC network [23, 24, 25].

Dependent variable. The short KIDSCREEN-10 index was adopted as the primary outcome variable. This scale was an optional recommended package for the HBSC protocol which was used three times between 2006 – 2014. Poland included it in 2010 and continued to use it in the 2018 round for a single age group (13-year-olds), for trend-analysis purposes. A Polish language version was designed and piloted during the development phase of these questionnaires in 2001–2004 as part of an international project called ‘Screening and Promotion for Health-related Quality of Life in Children and Adolescents – A European Public Health Perspective’, funded by the European Commission [26]. The KIDSCREEN-10 index was developed from the longer version, KIDSCREEN-27. The questions pertained to physical and mental health (in terms of positive and negative emotions), independence, relationships with parents and peers, and school performance. The time frame referred to the past week. The answers indicate specific

behaviour or feelings (0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; and 4 = always), or intensity of attitudes (0 = not at all; 1 = slightly; 2 = moderately, 3 = very; and 4 = extremely); however, two questions pertaining to negative emotions (sadness, loneliness) had to be coded in reverse order. The summary score ranged from 0 – 40 points, with high point values indicating good HRQL. Cronbach’s alpha for this scale amounted to 0.729 in the present study. The representativeness of the 2014 data was checked by comparing the KIDSCREEN-10 index of the full sample of 1,536 students aged 13, and of a subsample of 967 students qualified for the analyses below.

Independent variables. Among the independent variables, in addition to gender, there were two residential neighbourhood characteristics, chronic disease status and family wealth, all included in the HBSC international protocols. Structural (deprivation) and social (social capital) aspects of the place of residence were analyzed using two scales recommended in the international protocol as optional [24], and applied in previous national and international papers [17, 27]. In the former case, the scale pertained to the intensity of local problems, later described as local deprivation, consisting of three statements (e.g., ‘In the area where you live, are there run-down houses or buildings?’). Three answer categories were available (lots, some, none), with summary index values ranging from zero to six points. In the latter case, the scale described social relationships in the residential neighbourhood, commonly referred to as social capital. This scale also consisted of three questions (e.g., ‘You can trust people around here’), with the answers coded on a 5-point Likert scale ranging from strongly disagree to strongly agree. The summary index ranged from 0 – 12 points. In both cases, high values indicated better living conditions. Cronbach’s reliability index for the scale amounted to 0.671 and 0.826, respectively, for the study sample. The summary scales describing the neighbourhood in the place of the respondent’s residence were divided into three categories, with the assumption that the middle group was supposed to contain approximately 45–55% of the respondents.

A question concerning chronic diseases was also included in the analysis. This question also came from the HBSC protocol where it is a part of the optional Chronic Conditions module [28, 29]. The question was phrased as follows: ‘Do you have a long-term illness, disability, or medical condition (e.g. diabetes, arthritis, allergy, or cerebral palsy) that has been diagnosed by a doctor?’ with ‘yes’ and ‘no’ provided as the answer categories. This constitutes the so-called uncategorized approach because the respondent is not asked about a detailed diagnosis [30].

The FAS (Family Affluence Scale), a standard tool for investigating material status in HBSC research, was employed as a measure of family wealth [31]. In 2014, this scale was extended from four to six questions. To facilitate the comparison of results, only four common questions were used: the number of cars in the family, whether the student has his/her own room, the number of computers in the household, and family journeys away from home for holidays or vacations. In 2018, the latter question was replaced with a question about traveling abroad. FAS values ranged from zero to nine, with high values indicating that the student came from a more affluent family.

Ethics. Each of the studies in question received approval from the Bioethical Commission operating at the Institute of Mother and Child in Warsaw (2010 survey: No. 16/2009 issued on 16 October 2009; 2014 survey: No. 20/2013 issued on 12 September 2013; 2018 survey: No. 17/2017 issued on 17 March 2017).

Statistical analyses. Samples from the three HBSC rounds were compared in terms of the basic characteristics, as well as the mean KIDSCREEN-10 index using the chi-square test (for frequency) or the Kruskal–Wallis test (for means). *Post hoc* nonparametric analysis was applied to compare the results from 2010 and 2014, as well as 2014 and 2018 surveys. Inequalities in KIDSCREEN-10 indices were tested by delta Glass's coefficient as a measure of effect size, according to gender, health status, and three social factors, separately in each year of data collection. The overall impact of the independent variables was investigated using a multivariate general linear model (GLM), with the main effects of the six variables included, and two-way interactions. Selected significant interactions were presented in a graphical format as marginal KIDSCREEN-10 score means for the GLM.

All reported *p*-values were two-tailed, and values ≤ 0.05 were considered significant. IBM SPSS v.28 statistical software was used (IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp.).

RESULTS

Sample characteristics. Table 1 contains the base characteristic of the study group of 13-year-olds from the three subsequent rounds of the HBSC study. These samples were similar in terms of gender but differed in terms of the remaining attributes. The percentage of students with chronic diseases was 16.5% for the whole study period, and was found to be the lowest in 2018. Family affluence level improved in the last year. As far as neighbourhood attributes are concerned, the middle year stands out as having the most favourable perception of the structural features (low deprivation), with a simultaneous inferior evaluation of their social capital.

Considering quasi-continuous scales, a weak but significant correlation was demonstrated between the two neighbourhood characteristics ($\rho=0.180$; $p<0.001$). No correlation was shown between FAS and local deprivation ($\rho=0.017$; $p=0.304$), nor between FAS and social capital ($\rho=0.023$; $p=0.159$).

Univariate analysis. Table 2 compares the mean KIDSCREEN-10 indices according to the study year and sample group. In 2014, this index among 13-year-olds improved compared with 2010, and subsequently deteriorated slightly.

These results verified that the comparison of the results of the three studies was not biased by the limitation of the 2014 data to 967 out of 1,536 cases. The mean for the full sample was 25.63 (SD=6.98) and was not significantly different from the subsample study ($p=0.428$).

In all subgroups of adolescents, there was a significant improvement in HRQL between 2010 – 2014. However, only some of the groups showed significant deterioration in the KIDSCREEN-10 index between 2014 – 2018. Despite a slight

Table 1. Characteristics of 13-year-old students (%) participating in HBSC surveys in 2010–2018

Factor (points)	N (%)	2010	2014	2018	<i>p</i> *
Total	3937	1464	967	1506	
Gender					
Boys	1869 (47.5)	47.1	48.5	47.1	0.762
Girls	2068 (52.5)	52.9	51.5	52.9	
Chronic conditions					
Yes	642 (16.5)	18.3	18.0	13.7	0.001
No	3255 (83.5)	81.7	82.0	86.3	
Family affluence					
Low (0–3)	694 (17.9)	21.5	21.6	12.0	
Average (4–6)	2122 (54.7)	49.9	57.7	57.5	<0.001
High (7–9)	1063 (27.4)	28.5	20.8	30.6	
Local deprivation					
High (0–2)	1144 (29.4)	30.2	25.6	30.9	
Average (3–4)	1768 (45.4)	43.9	44.8	47.2	<0.001
Low (5–6)	985 (25.3)	25.9	29.6	21.9	
Social capital					
Low (0–5)	597 (15.2)	12.0	19.5	15.5	
Average (6–9)	2257 (57.3)	57.3	60.8	55.1	<0.001
High (10–12)	1083 (27.5)	30.7	19.6	29.4	

*chi-sq test

Table 2. Mean KIDSCREEN-10 index in 13-year-old students participating in HBSC surveys in 2010–2018 (M±SD)

Factor (points)	2010	2014	2018	Kruskal-Wallis (post-hoc 'p')	
				2010–2014	2014–2018
Total	22.36±4.54	25.41±6.75	24.74±6.53	<0.001	0.007
Gender					
Boys	22.87±4.74	26.71±6.70	26.20±6.31	<0.001	0.144
Girls	21.92±4.30	24.17±6.56	23.44±6.45	<0.001	0.022
Chronic conditions					
Yes	21.28±4.44	22.76±7.04	24.08±6.25	0.008	0.026
No	22.63±4.53	25.99±6.57	24.85±6.58	<0.001	<0.001
Family affluence					
Low (0–3)	21.68±4.34	23.86±6.55	24.16±6.92	<0.001	0.496
Average (4–6)	22.34±4.45	25.49±6.72	24.65±6.44	<0.001	0.016
High (7–9)	22.95±4.68	26.92±6.77	25.19±6.57	<0.001	0.004
Local deprivation					
High (0–2)	21.18±4.42	23.92±6.93	22.85±6.53	<0.001	0.067
Average (3–4)	22.42±4.48	25.24±6.46	25.11±6.10	<0.001	0.679
Low (5–6)	23.63±4.29	26.92±6.75	26.56±6.73	<0.001	0.285
Social capital					
Low (0–5)	20.94±4.65	23.11±7.40	21.43±6.48	0.003	0.018
Average (6–9)	22.07±4.15	25.34±6.06	24.20±5.98	<0.001	<0.001
High (10–12)	23.46±4.93	27.88±7.26	27.51±6.49	<0.001	0.321

* M – mean; SD – standard deviation

decrease, there was no significant change in the group of boys and children from the poorest families and those living in areas with high social capital. Children with chronic conditions were the only subpopulation with significant

improvement between 2014 – 2018. After stratification by the structural characteristics of the environment, no significant changes were shown between 2014 – 2018 in all three groups distinguished according to local deprivation. Deterioration of HRQL at borderline-insignificant values was found in the most deprived regions.

Table 3. Change in the level of inequality in KIDSCREEN-10 scores in 2010–2018

Factor	Glass's delta with 95% confidence interval		
	2010	2014	2018
Gender	0.220 (0.107 – 0.323)	0.387 (0.258 – 0.515)	0.428 (0.324 – 0.531)
Chronic conditions	0.297 (0.161 – 0.433)	0.457 (0.285 – 0.628)	0.123 (-0.025 – 0.270)
Family affluence	0.292 (0.143 – 0.441)	0.467 (0.267 – 0.667)	0.149 (-0.026 – 0.323)
Local deprivation	0.554 (0.411 – 0.697)	0.432 (0.257 – 0.606)	0.568 (0.422 – 0.715)
Social capital	0.542 (0.358 – 0.725)	0.646 (0.433 – 0.857)	0.938 (0.757 – 1.118)

Table 3 shows the differences related to gender, health status, and social characteristics separately for each year of data collection. The measure of the effect size is Glass' delta coefficient. It is noteworthy that differences in HRQL scores related to gender and social capital of the neighbourhood increased. In considering the data in Table 2 and Table 3, the disparities related to family wealth and the prevalence of chronic diseases decreased significantly in 2018. On the other hand, the improvement in HRQL in 2014 was accompanied by an increase in disparities in health status and family wealth, and a decrease in disparities in local deprivation.

Multivariate analysis. Multivariate analysis conducted using the GLM model (Tab. 4) indicated that the main effects

Table 4. Results of GLM (generalized linear model) estimation with the KIDSCREEN-10 score as a dependent variable presented as tests of between subjects' effects

Source	Type III sum of squares	df	Mean square	F	Sign.
Corrected model	26078,8	26	1003,0	33,2	<0,001
Intercept	807194,2	1	807194,2	26741,4	<0,001
Main effect:					
HBSC year of survey	2289,1	2	1144,6	37,9	<0,001
Gender	2614,1	1	2614,1	86,6	<0,001
Chronic conditions	1226,1	1	1226,1	40,6	<0,001
Local deprivation	949,2	2	474,6	15,7	<0,001
Social capital	5157,5	2	2578,7	85,4	<0,001
Family affluence	970,6	2	485,3	16,1	<0,001
2-way interactions:					
1*2	361,1	2	180,6	6,0	0,003
1*3	392,5	2	196,3	6,5	0,002
1*5	989,7	4	247,4	8,2	<0,001
1*6	358,3	4	89,6	3,0	0,018
2*5	227,3	2	113,6	3,8	0,023
2*6	345,8	2	172,9	5,7	0,003

R squared = 0.184 (Adjusted R squared = 0.179)

(study year, gender, chronic diseases, FAS, and both location attributes) are significant. In the best model, six significant two-way interactions were also identified. There were significant interactions between the year of data collection and gender, health status, social capital, and family wealth. In addition, the interaction between gender and social capital and family wealth was found to be significant. The model explains 18% of the variability of the KIDSCREEN-10 index.

Two significant interactions are shown in the Figures. Figure 1 illustrates the effect of the increasing differences between the HRQL of children living in areas with lower and higher social capital in the subsequent years. In turn, Figure 2 illustrates the disappearance of health inequalities associated with family wealth. At the same time, it effectively shows how in 2014 the improvement in HRQL was accompanied by an increase in health inequality.

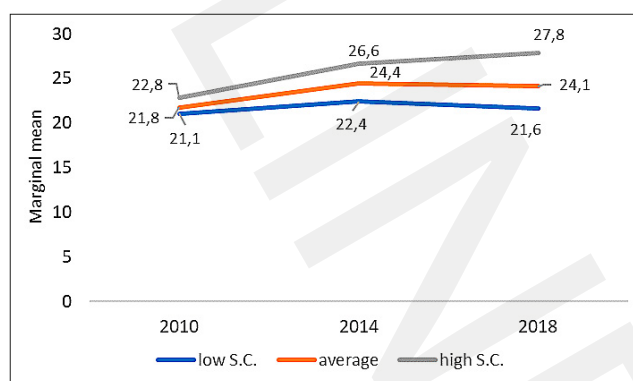


Figure 1. Marginal means of the KIDSCREEN-10 score estimated in the GLM model showing the two-way interaction between the year of data collection and social capital (S.C.).

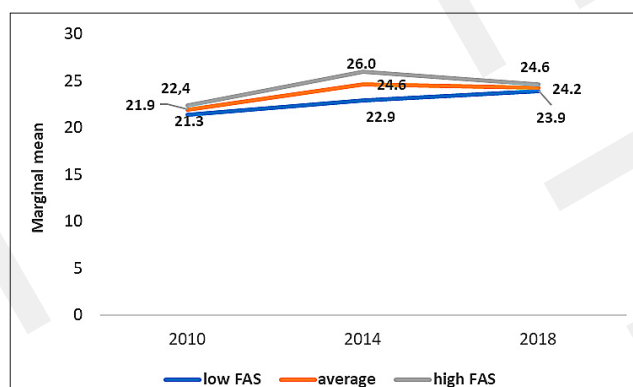


Figure 2. Marginal means of the KIDSCREEN-10 score estimated in the GLM model showing the two-way interaction between the year of data collection and family affluence (FAS).

DISCUSSION

Data describing an age-homogenous group of nearly 4,000 Polish 13-year-olds participating in three subsequent rounds of HBSC research was used in this study. This allowed identification of changes in the KIDSCREEN-10 scores describing the overall quality of life, as well as determination of the extent to which HRQL (and its changes) is affected by chronic diseases, family affluence, and two neighbourhood attributes. Referring to the previous research questions, it can be concluded that HRQL of 13-year-old students as measured

by the KIDSCREEN-10 index improved between 2010 – 2014, and then deteriorated between 2014 – 2018. Similar changes were observed in all subgroups of 13-year-olds between 2010 – 2014, with different patterns of change in 2014 – 2018. In the latter case, HRQL improved only in the group of children with chronic diseases. Gender-related differences in HRQL levels and those related to neighbourhood attributes persisted across the three study periods. However, in 2018, the disparities arising from chronic conditions and family affluence narrowed significantly.

Commenting on the results of the current study, attention should be drawn to the following topics: trends in adolescents' health outcomes based on HBSC data and the relationship between HRQL, and the selected factors considered in the study (chronic disease, family wealth, local deprivation, neighbourhood social capital). A separate commentary is also required on the part of the results dealing with social inequalities in health and their changes over the study period. In addition to these main themes, it is worth addressing the methodological aspects of the trend analyses and the practical implications of the study.

The findings of the study are in line with over 40 years of history of HBSC research carried out in schools analyzing self-reported health and health-related behaviours in adolescents aged 11–15. The broad range of data collected in every four-year cycle allows the presentation of trends in various aspects of adolescents' well-being. It also makes it possible to look for their determinants within the individual and social realms of teenagers' lives, such as in the trend analysis of life satisfaction among European and North American adolescents completed by Cavallo et al. [32]. Other HBSC data analyses presented trends in subjective complaints, physical activity, eating behaviours, and the occurrence of risk behaviours [33–37]. Analyses of changes in the quality of life, as measured by Cantril's ladder and the prevalence of repeated psychological complaints, are the most thematically consistent with this publication [32, 38]. However, Cantril's ladder is a single-item tool, with the published trend analyses not extending beyond 2010.

The presence of chronic diseases was adopted in the current study as one of the key variables, which achieved an average of 16.5% across the three rounds of the study. Students suffering from chronic diseases evaluated their HRQL less favourably than their healthy peers. Adolescence poses numerous developmental challenges, given the biological, cognitive, and emotional changes that occur during this period [39]. Several studies have pointed to the deteriorating mental state of the young generation, and chronic diseases may constitute an additional adverse factor. Many of them were included in a broad systematic review of 48 studies conducted by Ow et al. [40] which covered 48 studies that involved the life experiences of children and adolescents with disabilities. The authors concluded that the quality of life of children with disabilities includes thoughts and feelings, fitting in, self-image, thoughts about the future, independence, being accepted by society, being able to forge an identity that is beyond their disability, having autonomy, and having hope for the future.

Findings from studies carried out earlier also point to the exacerbation of numerous issues among adolescents living in more deprived areas with low social capital [41]. Outcomes include worse school performance, more frequent participation in risk and anti-social behaviours, and contact

with violence, as well as mental health issues [42–45]. An unfavourable economic situation in the family and the local area may be the cause of psychological stress which, in turn, leads to depression [46, 47].

Results of various studies indicate that inferences concerning the relationship between neighbourhood attributes and the quality of life of children and young people are ambiguous in terms of relevance and effect size. These relationships depend on the age group, country, and year of the study, as well as the applied measures of HRQL and neighbourhood attributes. When interpreting the results, it is advisable to consider the interpretation of the KIDSCREEN-10 overall score. According to the authors of this tool, the higher the values of the index, the happier and fitter the adolescent, the more independent they feel, and the more satisfied they are with family life, their peers, and school life [48]. A friendly neighbourhood can thus enhance a child's well-being by improving their self-image and the above-mentioned relationships with other people. It provides a sense of belonging, as well as social support networks, an important determinant of mental health. A favourable environment is associated with greater social cohesion and better informal control, which in turn promotes stress reduction. In more deprived areas, there is exposure to negative stimuli and the sense of security is compromised, also due to increased crime or aggressive behaviours [49].

In earlier studies comparing the results of the full version of the KIDSCREEN-52 index with life satisfaction scores on the Cantril scale, it was shown that it is particularly important for adolescents to have good relationships with family and peers, which largely depend on the living conditions and environment discussed [50]. However, in recent years, online contacts have started to compete with the common outside activities of adolescents, which is linked to the so-called digital revolution [51].

Living in better conditions also has an impact on parents, improving the way families function. The deterioration of teenagers' quality of life may also be influenced by the fact that seeing various risks, parents are less willing to offer their teenage children independence [52]. If they see their community as safe and supportive, they may be more inclined to allow adolescents to go outside and interact with their peers unsupervised [53].

A multivariate analysis of the determinants of variation in the mean KIDSCREEN-10 index in the combined sample from 2010–2018, adjusted for the year of the survey, still points to girls, children from poor families, children with chronic conditions, and those living in less privileged regions, as disadvantaged and vulnerable groups. The relationship with family wealth was found to be the weakest, with the value of Glass' coefficient declining greatly in 2018. This leads us to conclude that when examining social inequalities in adolescent health, one cannot be limited by family wealth status. The diminishing importance of income as a determinant of well-being has been pointed out in earlier studies [54]. Contrary to expectations, a relationship between family wealth and neighbourhood characteristics was not revealed in this age group. There was also no significant interaction between the two groups of social determinants, indicating that there was no cumulative effect on the variability of the KIDSCREEN-10 index. Also worth noting is the interaction between the level of FAS and the year of the study. As shown in Figure 2, the highest HRQL level was

recorded in 2014, but this was associated with an increase in social health inequalities. This is consistent with reports stating that health inequalities may be increasing in more prosperous societies [55].

Limitations of the study. The conducted analyses faced limitations due to the cross-sectional nature of the study, as well as the limited number of analyzed factors. Data from repeated cross-sectional studies were available only for a single age group. It was also not possible to compare, like in other countries, the KIDSCREEN-10 results obtained before and during the COVID-19 pandemic [56]. The percentage of adolescents with chronic diseases reported in the school surveys is mostly underestimated because only students participating in standard compulsory school education and present at school on the survey date completed the questionnaire [28].

The changes in HRQL in 2010–2018 may have also been affected by other social factors, which have not been analyzed in this study, such as parental education and social media involvement [11]. National publications from other countries indicate an increased prevalence of overweight and obesity, as well as deterioration of physical activity, which may have affected the well-being of adolescents [57]. Being restricted to the information that could be obtained from young people, physical features of the environment that also affect mental health and HRQL, such as the availability of green spaces, contact with nature, or air quality, were not taken into account [58].

Strengths of the study. Despite the above limitations, the analysis of the current stratified by socio-economic factors offers important implications for further research, as well as policymaking and practice. Considering the limited mobility of teenagers and their participation in compulsory education, the local neighbourhood and school provide a crucial environmental context. These two factors should be combined with family characteristics [59]. However, the omission of the school context or family and peer support in the analyses is a strength of the study. These issues are included in the component questions of the KIDSCREEN-10 index. Excluding these factors allowed the authors to protect the finding against emphasizing a strong relationship of an evident nature. The study also has the advantage of a large sample of students and the use of multivariate analyses with interaction effects.

Implications for practice and research. While projecting actions focused on adolescents' well-being that consider their HRQL, it is worth bearing in mind the presence of chronic diseases and neighbourhood adversity. The study should provide another voice in the discussion on the reliability of trends analyzed in repeated cross-sectional surveys such as the HBSC study [60, 61]. It also promotes the concept of bio-ecological framing when mental health determinants are analyzed [62]. Additionally, it confirmed the need for epidemiological studies to combine data on health status and prevailing disabilities with data on material status and living conditions [63].

CONCLUSIONS

Referring to the aim of the study and the research questions posed at the beginning, it can be concluded that:

- 1) HRQL of 13-year-old children fluctuated from time to time in Poland, and after an initial improvement between 2010 – 2014, a decrease in the mean KIDSCREEN-10 index was recorded between 2014 – 2018.
- 2) Subpopulations distinguished based on gender, health status, family wealth differed in the level of change in HRQL over the study period.
- 3) The association of HRQL with demographic and social factors is not stable over time.
- 4) Changes in the level of HRQL in successive years were accompanied by changes in the level of social inequalities analyzed in the context of family and neighbourhood, and in 2018 the differences in the assessment of quality of life of children living in areas with low and high social capital were particularly exacerbated.
- 5) There was a significant interaction between the year of the study and three predictors of HRQL (gender, chronic conditions status and neighborhood social capital).

Thus, the importance of conducting analyses to track changes in the well-being of adolescents over time using HRQL has been proven. It is also reasonable to follow changes in different groups of adolescents. The results of the surveys can be used in further research, as well as in the formation of health policies and the design of targeted interventions for different populations.

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REFERENCES

1. Fisher JR, Cabral de Mello M. Using the World Health Organization's 4S-Framework to Strengthen National Strategies, Policies and Services to Address Mental Health Problems in Adolescents in Resource-Constrained Settings. *Int J Ment Health Syst.* 2011;(1)16;5:23.
2. While AE, Heery E, Sheehan AM, et al. Health-related quality of life of young people with long-term illnesses before and after transfer from child to adult healthcare. *Child Care Health Dev.* 2017;43(1):144–151.
3. Haverman L, Limperg PF, Young NL, et al. Paediatric health-related quality of life: what is it and why should we measure it? *Arch Dis Child.* 2017;102(5):393–400.
4. Bakas T, McLennon SM, Carpenter JS, et al. Systematic review of health-related quality of life models. *Health Qual Life Outcomes.* 2012;6;10:134.
5. Wallander JL, Koot HM. Quality of life in children: A critical examination of concepts, approaches, issues, and future directions. *Clin Psychol Rev.* 2016; 45:131–43.
6. Haraldstad K, Wahl A, Andenaes R, et al. A systematic review of quality of life research in medicine and health sciences. *Qual Life Res.* 2019; 28(10):2641–2650.
7. Rajmil L, Herdman M, Fernandez de Sanmamed MJ, et al. Kidscreen Group. Generic health-related quality of life instruments in children and adolescents: a qualitative analysis of content. *J Adolesc Health.* 2004;34(1):37–45.
8. Ravens-Sieberer U, Herdman M, Devine J, et al. The European KIDSCREEN approach to measure quality of life and well-being in children: development, current application, and future advances. *Qual Life Res.* 2014;23(3):791–803.
9. Ravens-Sieberer U, Gosch A, Rajmil L, et al. The KIDSCREEN-52 quality of life measure for children and adolescents: Psychometric results from a cross-cultural survey in 13 European countries. *Value Health.* 2008;11:645–658.
10. Befus EG, Helseth S, Molland E, et al. Use of KIDSCREEN health-related quality of life instruments in the general population of children

- and adolescents: a scoping review. *Health Qual Life Outcomes*. 2023; 20;21(1):6.
11. Magiera A, Pac A. Determinants of Quality of Life among Adolescents in the Małopolska Region, Poland. *Int J Environ Res Public Health*. 2022;19:8616.
 12. Ottova V, Erhart M, Rajmil L, et al. Overweight and its impact on the health-related quality of life in children and adolescents: results from the European KIDSCREEN survey. *Qual Life Res*. 2012;21(1):59–69.
 13. Silva N, Pereira M, Otto C, et al. Do 8-to 18-year-old children/adolescents with chronic physical health conditions have worse health-related quality of life than their healthy peers? a meta-analysis of studies using the KIDSCREEN questionnaires. *Qual Life Res*. 2019;28:1725–1750.
 14. Arcaya MC, Arcaya AL, Subramanian SV. Inequalities in health: definitions, concepts, and theories. *Glob Health Action*. 2015;24:8:27106.
 15. Erhart M, Ottova V, Gaspar T, et al. Measuring mental health and well-being of schoolchildren in 15 European countries using the KIDSCREEN-10 Index. *Int J Public Health*. 2009;54:160–166.
 16. Rajmil L, Herdman M, Ravens-Sieberer U, et al. Socioeconomic inequalities in mental health and health-related quality of life (HRQOL) in children and adolescents from 11 European countries. *Int J Public Health*. 2014;59:95–105.
 17. Martin G, Inchley J, Humphris G, et al. Assessing the psychometric and econometric properties of neighborhood scales using adolescent survey data from urban and rural Scotland. *Popul Health Metr*. 2017;15.
 18. Bourdieu P. The forms of capital. In: Richardson J, editor. *The Handbook of Theory: Research for the Sociology of Education*. New York: Greenwood Press; 1986. pp. 241–258.
 19. Ahlborg MG, Nyholm M, Nygren JM, et al. Current Conceptualization and Operationalization of Adolescents' Social Capital: A Systematic Review of Self-Reported Instruments. *Int J Environ Res Public Health*. 2022; 24;19(23):15596.
 20. Kurani S, Webb L, Cadet K, et al. Area-level deprivation and adverse childhood experiences among high school students in Maryland. *BMC Public Health*. 2022;23;22(1):811.
 21. Jang SJ, Johnson BR. Neighborhood disorder, individual religiosity, and adolescent use of illicit drugs: A test of multilevel hypotheses. *Criminology*. 2001;39:109–144.
 22. Sitaresmi MN, Indraswari BW, Rozanti NM, et al. Health-related quality of life profile of Indonesian children and its determinants: a community-based study. *BMC Pediatr*. 2022;22.
 23. Currie C, Nic Gabhainn S, Godeau E. International HBSC Network Coordinating Committee. *The Health Behaviour in School-aged Children: WHO Collaborative Cross-National (HBSC) study: origins, concept, history and development 1982–2008*. *Int J Public Health*. 2009;54 Suppl 2:131–9.
 24. Inchley J, Currie D, Cosma A, et al. editors. *Health Behaviour in School-aged Children (HBSC). Study Protocol: Background, Methodology and Mandatory Items for the 2017/18 Survey; Child and Adolescent Health Research Unit*. St. Andrews, UK, 2018.
 25. Mazur J, Dzielska A, Małkowska-Szkutnik A. Health and Health Behaviours of 17-Year-Old Students against the Changes in the Second Decade of Life; Warszawa, Poland: Instytut Matki i Dziecka; 2020. Available online: <https://imid.med.pl/files/imid/Do%20pobrania/Raport%20Zdrowie%20i%20zachowania%20zdrowotne%20uczni%C3%B3w%2017.pdf> (accessed on 27 December 2022). (In Polish)
 26. Ravens-Sieberer U, Erhart M, Rajmil L, et al. Reliability, construct and criterion validity of the KIDSCREEN-10 score: a short measure for children and adolescents' well-being and health-related quality of life. *Qual Life Res*. 2010;19:1487–1500.
 27. Kleszczewska D, Porwit K, Boberova Z, et al. Adolescent Health Literacy and Neighbourhood Features: HBSC Findings from Czech Republic, Poland, and Slovakia. *Int J Environ Res Public Health*. 2021;18:7388.
 28. Mazur J, Sentenac M, Brooks F, et al. Burden of chronic health conditions in adolescence measured by school surveys. *Dev Period Med*. 2013;17:157–164.
 29. Sentenac M, Santos T, Augustine L, et al. Chronic health conditions and school experience in school-aged children in 19 European countries. *Eur Child Adolesc Psychiatry*. 2022;1–11.
 30. Huang L, Freed GL, Dalziel K. Children With Special Health Care Needs: How Special Are Their Health Care Needs? *Acad Pediatr*. 2020; 20(8):1109–1115.
 31. Torsheim T, Cavallo F, Levin KA, et al. Psychometric Validation of the Revised Family Affluence Scale: a Latent Variable Approach. *Child Indic Res*. 2016;9:771–784.
 32. Cavallo F, Dalmasso P, Ottova-Jordan V, et al. Trends in life satisfaction in European and North-American adolescents from 2002 to 2010 in over 30 countries. *Eur J Public Health*. 2015;25:80–82.
 33. Ottová-Jordan V, Smith OR, Gobina I, et al. Trends in multiple recurrent health complaints in 15-year-olds in 35 countries in Europe, North America and Israel from 1994 to 2010. *Eur J Public Health*. 2015;2:24–7.
 34. Hobza V, Maracek M, Hamrik Z. Organized Sport Activities of 11 to 15-Year-Old Adolescents: Trends from 2010–2018 and Socioeconomic Context. *Int J Environ Res Public Health*. 2022;19:6074.
 35. Chatelan A, Lebacqz T, Rouche M, et al. Long-term trends in the consumption of sugary and diet soft drinks among adolescents: a cross-national survey in 21 European countries. *Eur J Nutr*. 2022;6: 2799–2813.
 36. Kjeld SG, Lund L, Madsen KR, et al. Trends in Use of Alcohol and Cigarettes among Danish Adolescents, 2002–2018: Exclusive and Dual Use. *Int J Environ Res Public Health*. 2022;19:3490.
 37. Cosma A, Walsh SD, Chester KL, et al. Bullying victimization: time trends and the overlap between traditional and cyberbullying across countries in Europe and North America. *Int J Public Health*. 2020;65:75–85.
 38. Ottova-Jordan V, Smith ORF, Augustine L, et al. Trends in health complaints from 2002 to 2010 in 34 countries and their association with health behaviours and social context factors at individual and macro-level. *Eur J Public Health*. 2015;25:83–89.
 39. Patton GC, Sawyer SM, Santelli JS, et al. Our Future: A Lancet Commission on adolescent health and wellbeing. *Lancet*. 2016:1–57.
 40. Ow N, Appau A, Matout M, et al. What is QOL in children and adolescents with physical disabilities? A thematic synthesis of pediatric QOL literature. *Qual Life Res*. 2021;30:1233–1248.
 41. Askari MS, Rutherford CG, Mauro PM, et al. Structure and trends of externalizing and internalizing psychiatric symptoms and gender differences among adolescents in the US from 1991 to 2018. *Soc Psychiatry Psychiatr Epidemiol*. 2022;57:737–748.
 42. Waverijn G, Heijmans M, Groenewegen PP. Neighbourly support of people with chronic illness; is it related to neighbourhood social capital? *Soc Sci Med*. 2017;173:110–117.
 43. Martin-Storey A, Bizier-Lacroix R, Temcheff C, et al. Understanding Youth Perceptions of Neighborhood Disorder: The Role of Conduct Problems. *J Youth Adolesc*. 2021;50:952–964.
 44. Pinchak NP, Swisher RR. Neighborhoods, Schools, and Adolescent Violence: Ecological Relative Deprivation, Disadvantage Saturation, or Cumulative Disadvantage? *J Youth Adolesc*. 2022;51:261–277.
 45. King C, Huang X, Dewan NA. Continuity and change in neighborhood disadvantage and adolescent depression and anxiety. *Health Place*. 2022;73.
 46. Vidal C, Jun HJ, Latkin C. The Effects of Social Rank and Neighborhood and School Environment on Adolescent Depression and Suicidal Ideation: A Structural Equation Modeling Approach. *Child Psychiatry Hum. Dev.* (ahead of print).
 47. Choi JK, Teshome T, Smith J. Neighborhood disadvantage, childhood adversity, bullying victimization, and adolescent depression: A multiple mediational analysis. *J Affect Disord*. 2021;279:554–562.
 48. KIDSCREEN Group. *The KIDSCREEN questionnaires—Quality of life questionnaires for children and adolescents—Handbook*. 2016. Lengerich: Papst Science Publisher.
 49. Carrillo-Alvarez E, Andrés A, Riera-Romani J, et al. The association between social capital indicators and psychological distress in Catalan adolescents. *Front Psychol*. 2022;17;13:964689.
 50. Mazur J, Szkultecka-Dębek M, Dzielska A et al. What does the Cantril Ladder measure in adolescence? *Arch Med Sci*. 2018;14(1):182–189.
 51. De Looze M, van Dorsselaer S, Stevens GWJM, et al. The decline in adolescent substance use across Europe and North America in the early twenty-first century: A result of the digital revolution? *Int J Public Health*. 2019;64(2):229–240.
 52. Ayllón E, Moyano N, Lozano A, et al. Parents' Willingness and Perception of Children's Autonomy as Predictors of Greater Independent Mobility to School. *Int J Environ Res Public Health*. 2019;28;16(5):732.
 53. Riazi NA, Wunderlich K, Yun L, et al. Social-Ecological Correlates of Children's Independent Mobility: A Systematic Review. *Int J Environ Res Public Health*. 2022;19,1604.
 54. Lamu AN, Olsen JA. The relative importance of health, income and social relations for subjective well-being: An integrative analysis. *Soc Sci Med*. 2016;152:176–85.
 55. Mackenbach JP. Re-thinking health inequalities. *Eur J Public Health*. 2020;30(4):615.
 56. Ravens-Sieberer U, Kaman A, Erhart M, et al. Quality of life and mental health in children and adolescents during the first year of the COVID-19 pandemic: results of a two-wave nationwide population-based study. *Eur Child Adolesc Psychiatry*. 2022;12:1–14.

57. Rasmussen M, Damsgaard MT, Morgen CS, et al. Trends in social inequality in overweight and obesity among adolescents in Denmark 1998–2018. *Int J Public Health*. 2020;65:607–616.
58. Zhang Y, Mavoa S, Zhao J, et al. The association between green space and adolescents' mental well-being: a systematic review. *Int J Environ Res Publ Health*. 2020;17(18):6640.
59. Brons ME, Bolt GS, Helbich M, et al. Independent associations between residential neighbourhood and school characteristics and adolescent mental health in the Netherlands. *Health Place*. 2022;74:102765.
60. Sigmund E, Badura P, Sigmundová D, et al. Methodological Aspects of Trend Studies and Development of the HBSC Study in the Czech Republic. *Cent Eur J Public Health*. 2017;Suppl 1:S4–S9.
61. Schnohr CW, Molcho M, Rasmussen M, et al. Trend analyses in the health behaviour in school-aged children study: methodological considerations and recommendations. *Eur J Public Health*. 2015; Suppl 2:7–12.
62. Currie C, Morgan A. A bio-ecological framing of evidence on the determinants of adolescent mental health – A scoping review of the international Health Behaviour in School-Aged Children (HBSC) study 1983–2020. *SSM Popul Health*. 2020;12:100697.
63. Kołłątaj B, Kołłątaj WP, Cipora E, et al. Research priorities in the domain of disability – correlation between health and social characteristics. A Polish example. *Ann Agric Environ Med*. 2022;27;29(4):463–470.