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The KIDSCREEN-27 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries

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Abstract
Objective To assess the construct and criterion validity of the KIDSCREEN-27 health-related quality of life (HRQoL) questionnaire, a shorter version of the KIDSCREEN-52.
Methods The five-dimensional KIDSCREEN-27 was tested in a sample of 22,827. For criterion validity the correlation with and the percentage explained variance of the scores of the KIDSCREEN-52 instrument were examined. Construct validity was assessed by testing a priori expected associations with other generic HRQoL measures (YQOL-S, PedsQL, CHIP), indicators of physical and mental health, and socioeconomic status. Age and gender differences were investigated.

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Results Correlation with corresponding scales of the KIDSCREEN-52 ranged from $r = 0.63$ to $r = 0.96$, and r^2 ranged from 0.39 to 0.92. Correlations between other HRQoL questionnaires and KIDSCREEN-27 dimensions were moderate to high for those assessing similar constructs ($r = 0.36$ to 0.63). Statistically significant and sizeable differences between physically and mentally healthy and ill children were found in all KIDSCREEN-27 dimensions together with strong associations with psychosomatic complaints ($r = –0.52$). Most of the KIDSCREEN-27 dimensions showed a gradient according to socio-economic status, age and gender.

Conclusions The KIDSCREEN-27 seems to be a valid measure of HRQoL in children and adolescents. Further research is needed to assess longitudinal validity and sensitivity to change.

Keywords Children's and adolescent's health · Cultural sensitivity · Measurement · Quality of life · Research methodology

Abbreviations

CHIP-AE	Child Health and Illness Profile-Adolescent Edition
CSHCN	Children with Special Health Care Needs Screener
DIF	Differential Item Functioning
FAS	Family Affluence Scale
HBSC	Health Behavior in School-aged Children
HRQoL	Health-Related Quality of life
IRT	Item Response Theory
OLS	Ordinal Logistic Regression
PedsQoL	Pediatric Quality of Life Inventory
SDQ	Strengths and Difficulties Questionnaire
WHO	World Health Organization
YQOL-S	Youth Quality of Life Instrument-Surveillance Version

Introduction

Generic HRQoL measures for children and adolescents can be useful in identifying subgroups of children and adolescents who are at risk for health problems, and can assist in determining the burden of a particular disease or disability [1]. Most of the currently available cross-cultural HRQoL questionnaires for children and adolescents have been generated within one country and have subsequently been translated into other languages [2, 3]. An exception is the generic KIDSCREEN-52 HRQoL questionnaire which is the first instrument for children and adolescents that was developed simultaneously in several different countries and tested in a large representative sample of children and adolescents [4], thereby helping to provide a broad perspective on the understanding and interpretation of HRQoL across different countries. The KIDSCREEN-52 contains 52 items covering 10 HRQoL dimensions, and has demonstrated its reliability and validity based on classical test theory as well as modern item response theory [5].

Although the KIDSCREEN-52 achieved most of the attributes proposed by the Scientific Advisory Committee of the Medical Outcome Trust [6], a shorter HRQoL questionnaire for use in epidemiological and clinical studies was warranted to reduce response burden and to save administration costs. It should enable a wider range of application of a cross-cultural comparable assessment of children and adolescents HRQoL but still permit measurement of the most important components of HRQoL covered by the measurement model of the original KIDSCREEN-52 [7]. The aim of this paper is to give an overview on the psychometric results of the KIDSCREEN-27 HRQoL questionnaire, obtained in a survey that was carried out in 13 European countries. The aim of the study was to examine the new questionnaire's criterion validity, convergent validity, and known groups validity. The way in which the shorter version was developed is described in a companion paper [8]. The results of analyzing the instrument's structural and cross-cultural validity are also reported in that paper [8].

Methods

Subjects and settings

The following countries participated in the KIDSCREEN study: Austria (AT), Czech Republic (CZ), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Poland (PL), Spain (ES), Sweden (SE), Switzerland (CH), the Netherlands (NL), and the United Kingdom (UK). The target population for the KIDSCREEN study was children and adolescents aged 8–18.

Three approaches to sample selection and administration were followed: (1) telephone sampling followed by mail survey (AT, CH, DE, ES, FR, and NL), (2) school sampling and administration (EL, HU, IE, and SE), or school sampling and mail administration (PL), and (3) multistage random sampling of communities and households (CZ). In the UK, a combination of telephone and school sampling methods was used.

Fieldwork was carried out between May and September 2003 except in IE, where data was collected in 2005. Some data was collected on those who refused to participate. In 11 countries, a retest with a 2-week interval for all participants

was performed in random sub-samples of the overall sample. A total of 559 respondents participated in the test–retest study.

All procedures were carried out following the data protection requirements of the European Parliament (Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data). Each country was asked to respect ethical and legal requirements in their country for this type of survey and to obtain signed informed consent from participants. A more detailed description of the KIDSCREEN sampling methods is provided elsewhere, together with a detailed analysis on sample representativeness based on Eurostat data [9].

Measures

KIDSCREEN-27 HRQoL questionnaire for children and adolescents

The KIDSCREEN-27 is embedded within the KIDSCREEN-52 and consists of 27 items which are used to assess HRQoL across 5 dimensions: *Physical Well-Being* (5 items) explores the level of the child's/adolescent's physical activity, energy and fitness; *Psychological Well-Being* (7 items) includes items on positive emotions, satisfaction with life, and feeling emotionally balanced; *Parent Relations & Autonomy* (7 items) examines relationships with parents, the atmosphere at home, and feelings of having enough age-appropriate freedom, as well as degree of satisfaction with financial resources; *Social Support & Peers* (4 items) examines the nature of the respondent' relationships with other children/adolescents, and; *School Environment* (4 items) explores the child's/adolescent's perceptions of his/her cognitive capacity, learning and concentration, and their feelings about school. Rasch-scores are computed for each dimension and are transformed into values with a mean of 50 and a standard deviation of 10; higher scores indicate better HRQoL and well-being. The distribution of the Rasch scores is slightly skewed and thus deviates from a normal distribution. On average respondents need 15–20 min to fill in the KIDSCREEN 52. We estimate that the KIDSCREEN 27 takes 10–15 min to complete.

Self-report and parent proxy versions are available for both the KIDSCREEN-27 and KIDSCREEN-52 instruments. In the KIDSCREEN study, both child and parent-proxy versions were administered, but for the purposes of the present analysis only the results from the child self-report version are used.

Standardized HRQoL measures used for validation

Convergent validity was assessed by comparing KIDSCREEN-27 dimension scores to other known and validated questionnaires measuring similar concepts. It was tested if scales measuring similar HRQoL-dimensions display a moderate to high correlation ($r > 0.30$).

Pediatric Quality of Life Inventory (PedsQL). The PedsQL 4.0 Generic child self-reported Core Scales [10] consist of 23 items measuring Physical, Emotional, Social, and School aspects of health-related quality of life (HRQoL) in healthy and ill children and adolescents. The PedsQL was included in the UK and IE survey. The highest correlations were expected for PedsQL-Physical with KIDSCREEN *Physical Well-Being*; PedsQL-Emotional with KIDSCREEN *Psychological Well-Being*; PedsQL-Social with KIDSCREEN *Social Support & Peers* and PedsQL-School with KIDSCREEN *School Environment*.

Child Health and Illness Profile-Adolescent Edition (CHIP-AE). The domain of satisfaction of the CHIP-AE a generic measure of health status [11] was administered to adolescents aged 12 years or older in all countries. The highest correlations between the CHIP-AE satisfaction domains and the KIDSCREEN were expected for the KIDSCREEN dimensions *Psychological Well-Being* and *Physical Well-Being*.

The Youth Quality of Life Instrument-Surveillance Version (YQOL-S). The Youth Quality of Life Instrument-Surveillance Version (YQOL-S) is a 13-item generic quality of life (QoL) questionnaire [12, 13]. The YQOL-S provides one overall perceptual QoL-score. The YQOL-S was completed by adolescents aged 12 years and older in all countries. A high correlation was expected between the YQOL-S and the KIDSCREEN dimension *Psychological Well-Being*.

The HBSC Symptom Checklist. To assess psychosomatic health complaints, the Health Behavior in School-Aged Children (HBSC) psychosomatic complaints symptom checklist [14] was used, a brief screening instrument that asks children and adolescents about the frequency of occurrence of symptoms like headache, stomachache, irritability/bad temper, feeling nervous etc. An index score is calculated. Surveys in all participating countries except IE included the symptom checklist. Moderate to high correlation with all KIDSCREEN dimensions but especially with *Physical Well-being* and *Psychological Well-Being* were expected.

HRQoL Influencing Factors Used for Known Group Validation

Construct validity was further examined through comparing the KIDSCREEN-27 scores of respondents belonging to groups with a-priori expected different levels of HRQoL.

Physical Health Status. The Children with Special Health Care Needs Screener (CSHCN) [15, 16] was included in the surveys of all participating countries except IE and SE as a measure of physical and general chronic health status. The CSHCN contains five question sequences: addressing the use or need of prescribed medication; medical, mental health, or educational services; specialized therapies; functional limitations and treatment or counseling for emotional or developmental problems. The items were filled in by the parents. From existing literature it was expected that children with a chronic condition would display poorer HRQoL in all KIDSCREEN dimensions but especially in *Physical Well-being* [17].

Mental Health Status. The Strength and Difficulties Questionnaire (SDQ) is a brief screening questionnaire that asks about children's and teenagers' symptoms and positive attitudes [18]. The SDQ ask about positive or negative attributes in 20 items regarding emotional symptoms, conduct problems, hyperactivity/inattention and peer relationship problems. A total difficulties score is generated. Using cut-off values provided by the developer of the SDQ [19], children and adolescents were classified as normal, borderline and abnormal. The SDQ was filled in by the parents. The SDQ was not included in IE and SE. The presence of mental disorders was expected to be associated with lower scores in all KIDSCREEN dimensions but especially in *Psychological Well-being*.

Familial Socio-Economic Status. The Family Affluence Scale (FAS), a socio-economic indicator to be filled in by children, includes family car ownership, having own unshared room, the number of computers at home, and times the child spent on holidays in the past 12 months [20]. The cross-cultural validity of the FAS has been shown in multinational surveys across 35 countries [20]. The FAS was collected in eight categories ranging from 0 to 7 which were recoded into 3 groups in the analysis (low [0–3], intermediate [4–5], and high [6–7] FAS level). Low familial affluence was expected to be associated with lower scores in all KIDSCREEN dimensions but especially for *Autonomy & Parents Relations*.

Statistical analysis

All analyses were conducted across the whole sample and for some analyses were repeated separately for the two age groups 8–11 years and 12–18 years.

Reliability

The test–retest reliability was assessed with the intra class correlation coefficient (ICC = ([mean-square between subjects] – [mean-square within subjects])/([mean-square between subjects] + [mean-square within subjects])). Due to the 2-week test–retest interval and taking into account the 1-week timeframe of the KIDSCREEN items ICCs of 0.6 or higher were considered as acceptable.

Validity

Criterion validity was assessed by determining the degree of correlation between the KIDSCREEN-27 scales and the KIDSCREEN-52 scales assessing similar dimensions of HRQoL. Coefficients exceeding $r = 0.70$ were considered satisfactory. How well the short version replicated the KIDSCREEN-52 was also evaluated by examining the proportion of variance in each score that was explained by the corresponding dimension in the KIDSCREEN-27. To analyze convergent and discriminant validity, Pearson correlation coefficients between KIDSCREEN-27 dimensions and similar dimensions of or overall scores on other similar instruments were computed. Convergent validity was considered to be demonstrated when correlations between comparable dimensions exceeded correlations between theoretically different dimensions. Correlation coefficients between 0.1 and 0.3 were considered low, those from 0.31 to 0.5 moderate, and those exceeding 0.5 were considered high [21].

Construct validity was further evaluated based on previously developed hypotheses regarding expected differences between healthy and physically or mentally ill children and adolescents, and between high and low familial socioeconomic status.

Cohen's "*d*" was calculated as a measure of effect size by dividing the difference between the adjusted means by the overall standard deviation. Effect sizes of 0.2 to 0.5 were considered small; those between 0.51 and 0.8 moderate, and those over 0.8 were considered large [22]. A multiple analysis of covariance according to the general linear model was performed controlling different variables such as age and gender, which were included as covariates.

Results

Sample characteristics

The final sample included 22,827 children and adolescents. The overall response rate was 68.9% and varied according to the sampling approach taken, from 24.2% to 68% for telephone sampling and from 72% to 91.2% using the school sampling approach. Table 1 shows the socio-demographic characteristics of the sample, overall and by country. The child and adolescent samples were in general similar across all participating countries. The most notable

Table 1 Response rate and socio-demographic characteristics of the KIDSCREEN sample

Country*	Total	AT	CH	CZ	DE	ES	FR	GR	HU	IE	NL	PL	SE	UK
Response rate %	68.9	35.3	40.2	71.5	40.6	24.2	26.4	72.0	90.0	82.5	68.0	59.6	91.2	42.4
N (valid cases)	22,827	1,475	1,701	1,592	1,723	876	1,049	1,174	3,237	1,240	1,885	1,715	3,283	1,877
Children														
Age range: 8–11														
Mean age years (*SD*)	9.7 (1.1)	9.7 (1.1)	9.8 (1.0)	9.6 (1.0)	9.7 (1.1)	9.7 (1.1)	9.5 (1.1)	–	9.5 (1.1)	10.4 (0.7)	9.6 (1.1)	9.9 (1.0)	–	9.5 (1.0)
Female (%)	51.3	53.5	52.4	50.5	50.0	46.1	50.3	–	55.2	52.6	49.3	53.3	–	47.3
Socio-economic status **														
Low FAS (%)	20.0	14.4	10.9	49.5	10.1	17.7	7.5	–	26.7	18.2	11.2	35.7	–	11.2
Medium FAS (%)	45.4	49.2	44.7	41.6	46.5	47.6	44.4	–	47.2	48.9	49.0	48.8	–	36.7
High FAS (%)	34.6	36.4	44.4	8.9	43.4	34.7	48.1	–	26.1	32.9	39.9	15.5	–	52.2
Adolescents														
Age range: 12–18														
Mean age years (SD)	14.4 (1.7)	14.5 (1.8)	14.5 (1.8)	14.9 (1.9)	14.6 (1.9)	14.7 (1.9)	14.6 (1.9)	14.6 (1.7)	14.6 (1.8)	14.6 (1.4)	14.6 (1.8)	14.8 (1.9)	13.7 (1.0)	14.1 (1.6)
Female (%)	53.8	53.9	54.2	48.9	52.0	50.8	52.8	59.7	60.8	62.2	52.2	55.5	49.0	49.7
Socio-economic status**														
Low FAS (%)	23.3	14.1	11.3	48.9	12.5	21.7	9.0	37.3	32.3	14.4	9.4	39.1	–	14.2
Medium FAS (%)	46.5	50.2	47.1	41.4	49.3	51.3	44.0	45.1	46.5	44.4	49.2	48.0	–	41.0
High FAS (%)	30.3	35.7	41.7	9.7	38.2	27.0	47.0	17.6	21.2	41.2	41.4	12.9	–	44.8

* Countries: AT—Austria, CH—Switzerland, CZ—Czech Republic, DE—Germany, ES—Spain, FR—France, GR—Greece, HU—Hungry, IE—Ireland; NL—Netherlands, PL—Poland, SE—Sweden, UK—United Kingdom

** FAS: Family Affluence scale (0–3 = low; 4–5 = medium; 6–7 = high)

differences between countries occurred in socio-economic status (FAS) with, for example, 45.5% of the Czech Republic child sample reporting low FAS compared to only 7.5% of the French sample.

Test–retest reliability and criterion Validity

Table 2 shows results on test-retest reliability and criterion validity of the KIDSCREEN-27 HRQoL questionnaire dimensions for the overall sample. ICCs ranged from 0.61 to 0.74 for the different KIDSCREEN-27 dimensions. Correlations between KIDSCREEN-27 scales and scales of the KIDSCREEN-52 measuring similar dimensions ranged from 0.71 to 0.96 and only the KIDSCREEN-52 dimension *Self-Perception* was slightly below the a priori specified threshold of 0.70. The KIDSCREEN-27 dimensions explained 39–92% of the variance in the corresponding dimensions in the KIDSCREEN-52.

Construct validity

Convergent validity

Table 3 shows the results of the convergent validity analyses. KIDSCREEN-27 HRQoL and PedsQL dimensions generally displayed a moderate to high level of correlation in the expected direction: the PedsQL Physical Functioning dimension correlated highest with the KIDSCREEN-27 *Physical Well-Being* dimension ($r = 0.44$), and the PedsQL Emotional Functioning Scale showed the highest correlations with the KIDSCREEN-27 *Psychological Well-Being* dimension ($r = 0.54$). The PedsQL Social Functioning Scale correlated highest with the KIDSCREEN-27 *Psychological Well-Being* dimension ($r = 0.44$), rather than with the dimension which was *a priori* expected to show the highest correlations: *Social Support & Peers* ($r = 0.36$). Finally, the PedsQL School Functioning Scale correlated highest with the KIDSCREEN-52 *School Environment* dimension ($r = 0.48$).

The *Satisfaction* domain of the CHIP showed the highest correlation with the KIDSCREEN-27 *Psychological Well-Being* dimension ($r = 0.62$), followed by the *Physical Well-Being* ($r = 0.60$) dimension of the KIDSCREEN-27. The Youth-QoL Perceptual scale correlated most highly with KIDSCREEN-27 *Psychological Well-Being* ($r = 0.62$).

Most associations between the HBSC Symptom Checklist psychosomatic complaints index and the KIDSCREEN-27 dimensions were moderate to high. The HBSC Symptom Checklist correlated with the KIDSCREEN *Physical Well-Being* dimension ($r = –0.42$), with Psychological Well-Being ($r = –0.52$), Parent Relation & Autonomy ($r = –0.40$), and School Environment ($r = –0.39$).

Differences in HRQoL by physical and mental health status (known groups validity)

Table 4 shows the differences in KIDSCREEN-27 dimension scores by physical and mental health status. Statistically significant differences between healthy and ill children on the CSHCN Screener instrument were found for all KIDSCREEN-27 dimensions. Whilst the difference in *Physical Well-Being* corresponds to a medium effect size of $d = 0.44$, the remaining differences corresponded to small effect sizes ($d = 0.22$ to 0.29). Effects were slightly higher for children than for adolescents.

The comparison between respondents categorized as healthy/normal with those identified with noticeable mental health problems (SDQ) revealed statistically significant lower HRQoL on all KIDSCREEN-27 dimensions for the children and adolescents with mental health problems. This was particularly true in the *Psychological Well-Being, School Environment, Parents & Autonomy* and *Social Support & Peers* domains, in which moderate effect sizes exceeding 0.50 were observed.

Differences in HRQoL by socio-economic status, age and gender

Table 5 shows mean T-values for the KIDSCREEN-27 dimensions stratified by FAS. A gradient was observed in all KIDSCREEN-27 dimensions. The higher the FAS category the higher the scores on the KIDSCREEN-27 dimensions. Effect sizes between those in high and low FAS categories ranged from 0.28 (*Social Support & Peers*) to 0.53 (*Parents Relation & Autonomy*) and were higher for adolescents.

Table 6 shows that children aged 8–11 scored higher than adolescents aged 12–18 in all KIDSCREEN-27 dimensions, but especially in the dimensions *Physical Well-Being* and *Psychological Well-Being* (effect size = 0.52 and 0.42). The smallest gender difference was found for the *Social Support & Peers* dimension (effect size = 0.14). Boys reported higher HRQoL in the dimensions *Physical-Well-Being*, *Psychological Well-Being* and *Parents Relation & Autonomy*. Effect sizes for these differences were 0.32; 0.27 and 0.14. These effects were especially pronounced for adolescents. The difference in *Parents Relation & Autonomy* was statistically non-significant in children. Girls between 12 and 18 years scored slightly higher in the *Social Support & Peers* dimension (effect size = 0.11). Girls between 8 and 11 years had higher values on the *School Environment* dimension (effect size = 0.22).

Table 2 Reliability of the KIDSCREEN-27 dimensions and correlation with KIDSCREEN-52 scales

KIDSCREEN-27 Dimensions (N items)	Retest reliability	Correlation and regression analyses with the corresponding KIDSCREEN-52 scales (dimensions of the 52-item version)		
	ICC	r/r^2	r/r^2	r/r^2
Physical Well-Being (5)	0.65	Identical with 52 Physical		
Psychological Well-Being (7)	0.64	0.87/0.75 (52 Psychological)	0.81/0.65 (52 Moods)	0.63/0.39 (52 Self-percept.)
Parents & Autonomy (7)	0.66	0.78/0.60 (52 Parents)	0.73/0.53 (52 Autonomy)	0.71/0.50 (52 Financial)
Social Support & Peers (4)	0.61	0.94/0.88 (52 Social-support)		
School Environment (4)	0.74	0.96/0.92 (52 School)		

The KIDSCREEN-52 dimensions are: Physical well-being; Psychological well-being; Moods & emotions; Self-perception; Parents & home life; Autonomy; Financial resources; Peers & social support; School environment, and Bullying

r/r^2 Pearson correlation coefficient/variance explained in the KIDSCREEN-52 scores (squared Pearson correlation)

Table 3 Convergent validity of the KIDSCREEN-27. Pearson correlation coefficients of the KIDSCREEN-27 dimensions and other HRQoL/Health status instruments

KIDSCREEN-27 dimensions	PedsQL				CHIP	YQOL-S	HBSC Symptom Checklist
	Physical Functioning[a] *r* (8 to 11—12 to 18)	Emotional Functioning[b] *r* (8 to 11—12 to 18)	Social Functioning[c] *r* (8 to 11—12 to 18)	School Functioning[d] *r* (8 to 11—12 to 18)	Satisfaction domain[e] *r* (12 to 18)	Perceptual scale[f] *r* (12 to 18)	Psycho-somatic Compl.[g] *r* (abs[8 to 11]–abs[12 to 18])
Physical Well-Being	***0.44*** (0.43–0.46)	0.33 (0.29–0.36)	0.29 (0.30–0.29)	0.31 (0.28–0.30)	*0.60*	0.41	–0.42 (0.30–0.43)
Psychological Well-Being	0.37 (0.39–0.37)	***0.54*** (0.49–0.57)	**0.44** (0.48–0.42)	0.36 (0.40–0.33)	***0.62***	***0.63***	–0.52 (0.44–0.53)
Parents & Autonomy	0.32 (0.34–0.31)	0.39 (0.40–0.40)	*0.39* (0.43–0.38)	0.33 (0.33–0.32)	0.51	0.54	–0.40 (0.32–0.42)
Social Support & Peers	0.22 (0.27–0.20)	0.25 (0.26–0.24)	*0.36* (0.35–0.36)	0.16 (0.22–0.11)	0.39	0.37	–0.25 (0.20–0.25)
School Environment	0.25 (0.23–0.27)	0.31 (0.32–0.31)	0.27 (0.33–0.24)	***0.48*** (0.43–0.49)	0.46	0.48	–0.39 (0.65–0.65)

[a] Range of n = 2818–2878; [b] Range of n = 2779–2835; [c] Range of n = 2776–2838; [d] Range of n = 2750–2819; [e] Range of n = 11549–11717; [f] Range of n = 10610–10763; [g] Range of n = 20503–20956

Values in bold indicates the highest correlations; Values in italics indicates the a priori expected highest correlations

Discussion

This study reports on the test–retest reliability, criterion, and construct validity of the KIDSCREEN-27 questionnaire, a new short version of the KIDSCREEN-52 questionnaire. The KIDSCREEN-52 HRQoL questionnaire was the first instrument for children and adolescents that was developed simultaneously in several countries and tested in a large representative, multi-national sample of children and adolescents. This method ensures that different perspectives are taken into account during instrument development, avoid the imposition of possible cultural biases regarding instrument content, and permit valid cross-cultural comparisons. Moreover, it guarantees that the content will be important and relevant for all cultures. The KIDSCREEN-27 provides many of the advantages of the original instrument but is easier to administer.

Psychometric analyses confirmed acceptable internal consistency [8] and test-retest reliability.

Convergence between the KIDSCREEN-27 scales and corresponding dimensions of the original version were acceptable with only a few exceptions. In particular, the KIDSCREEN-52 *Self-Perception* dimension correlated slightly below the a priori specified threshold with the corresponding dimension of Psychological Well-being, but this is likely to be because few items from this scale were incorporated into the shorter version, and the Psychological Well-being dimension in the KIDSCREEN-27 groups items from the self-perception, moods and emotions and Psychological well-being dimensions from the longer version.

Table 4 Differences in KIDSCREEN-27 dimension scores by chronic health conditions, psychosomatic complaints, and mental health status

KIDSCREEN-27 dimensions	CSHCN[a]					SDQ Parents[c]					
	No condition[a]		Some Conditions[b]			Normal[c]		Borderline[d]		Abnormal[e]	
	Mean *T*-value	SD	Mean *T*-value	SD	Effec size[f] (8 to 11—12 to 18)	Mean *T*-value	SD	Mean *T*-value	SD	Mean *T*-value	SD	Effect size[f,g] (8 to 11—12 to 18)
Physical Well-Being	51.01	9.77	46.96	10.02	0.41 (0.46–0.42)	51.10	9.75	48.06	9.50	46.95	10.74	0.42 (0.38–0.45)
Psychological Well-Being	50.29	9.30	47.59	9.24	0.29 (0.36–0.28)	50.77	9.18	46.10	8.79	44.46	8.94	0.68 (0.76–0.66)
Parents & Autonomy	49.98	9.80	47.87	9.44	0.22 (0.27–0.20)	50.44	9.71	46.15	8.95	44.94	9.00	0.56 (0.54–0.59)
Social Support & Peers	49.83	9.88	47.11	10.29	0.27 (0.32–0.26)	50.18	9.70	46.41	10.11	44.68	11.12	0.55 (0.58–0.50)
School Environment	50.30	9.96	47.86	10.03	0.24 (0.30–0.24)	50.79	9.85	46.09	9.59	44.63	9.79	0.62 (0.75–0.61)

[a] Range of n = 13543–13877; [b] Range of n = 1611–1659; [c] Range of n = 13173–13508; [d] Range of n = 1018–1049; [e] Range of n = 1089–1116; All mean differences are statistically significant at <0.01 level

[f] effect size is calculated dividing the adjusted means difference by the overall standard deviation

[g] Effect sizes in the SDQ column are for comparisons between the highest and lowest categories Multivariate analysis included age, gender, socioeconomic status, country. Means included in the table are adjusted for age 12.9

Table 5 Differences in KIDSCREEN-27 dimension scores by socio-economic categories

KIDSCREEN-27 dimensions	FAS						
	Low[a]		Medium[b]		High[c]		Effect size
	Mean *T*-value	SD	Mean *T*-value	SD	Mean *T*-value	SD	(High vs Low) (8 to 11—12 to 18)
Physical Well-Being	48.12	10.15	50.21	9.81	51.57	9.85	0.35 (0.24–0.37)
Psychological Well-Being	47.36	9.70	50.01	9.81	51.41	9.71	0.41 (0.32–0.44)
Parents & Autonomy	46.38	9.62	49.84	9.86	51.64	9.86	0.53 (0.41–0.57)
Social Support & Peers	48.11	10.42	49.88	9.88	50.89	9.75	0.28 (0.23–0.29)
School Environment	47.45	9.93	49.84	9.97	50.79	10.02	0.33 (0.25–0.35)

[a] Range of n = 4116–4180; [b] Range of n = 8513–8708; [c] Range of n = 5843–6007; All mean differences are statistically significant at $p < 0.01$ level

Table 6 Differences in KIDSCREEN-27 dimension scores by age group and gender

	Age					Gender				
	8–11 years[a]		12–18 years[b]			Girls[c]		Boys[d]		
	Mean *T*-value	SD	Mean *T*-value	SD	Effect size	Mean *T*-value	SD	Mean *T*-value	SD	Effect size (8 to 11—12 to 18)
Physical Well-Being	53.66	9.92	48.49	9.61	0.52	48.41	9.73	51.63	9.97	0.32 (0.15–0.39)
Psychological Well-Being	52.99	9.97	48.77	9.71	0.42	48.68	9.96	51.35	9.78	0.27 (0.08–0.34)
Parents & Autonomy	51.64	10.38	49.37	9.82	0.23	49.34	10.07	50.71	9.92	0.14 (0.03–0.19)
Social Support & Peers	51.07	10.03	49.66	9.95	0.14	50.46	10.01	49.58	9.94	0.09 (0.04–0.11)
School Environment	53.91	10.41	48.31	9.39	0.56	50.18	9.90	49.51	10.10	0.07 (0.22–0.02)

[a] Range of n = 5973–6240; [b] Range of n = 16022–16265; [c] Range of n = 11655–11928; [d] Range of n = 10310–10546; All mean differences are statistically significant at $p < 0.01$ level

Convergent and discriminant validity was indicated by the pattern of association between the KIDSCREEN-27 scales and scales from other generic HRQoL instruments. Correlations were generally highest for those pairs of scales where higher correlations were *a priori* expected. An exception was the PedsQL Social Functioning Scale which correlated highest with the KIDSCREEN-27 *Psychological Well-Being* dimension ($r = 0.44$), rather than *Social Support & Peers* ($r = 0.36$). Nevertheless, there was no real meaningful sizeable differences between these correlations. Furthermore, a qualitative analysis of the PedsQL Social Functioning scale revealed items mainly addressing being teased by others, a factor that eventually would have a similar important for psychological and emotional well-being as well as for social-wellbeing of the children or adolescents.

The KIDSCREEN-27 HRQoL questionnaire discriminated well and in the hypothesized direction between children and adolescents in good health and those with poorer physical or mental health status as measured by the CSCHN and SDQ. This was especially true for mental health with relatively high effect sizes on many KIDSCREEN-27 dimensions between respondents with poor versus good mental health. This difference in the magnitude of effect sizes when comparing physically and mentally healthy children with those reporting problems, might be because many of the KIDSCREEN-27 dimensions focus more on mental and social 'health'. These results should be confirmed in further research using the KIDSCREEN-27 HRQoL questionnaire in clinical settings.

Although other studies have shown that HRQOL instruments are capable of discriminating between children and adolescents in different socio-economic categories [24], this is one of few which supports the idea that socioeconomic status might be more important for HRQoL in adolescents than in children.

The observed differences between younger and older responders have been reported in previous HRQoL studies [25]. The investigation of gender differences revealed the ability of the instrument to capture differences associated with different gender roles. These KIDSCREEN-27 results also confirm previous findings which showed that girls have a higher risk of self-perceived poor health as they grow through adolescence, and that the risk increases through to older adolescence [26, 27].

Limitations of the study included the fact that physical and mental health status were determined using self-report measures. This may be less reliable than using clinical records or clinical diagnoses to define children with physical and/or mental health conditions, and future studies should investigate the presence and size of differences in KIDSCREEN 27 scores when clinical diagnoses are used [23]. Another study limitation was that sensitivity to change could not be tested due to the cross-sectional survey study design. This should be tested in future studies which might focus on testing the KIDSCREEN-27's sensitivity to change within a randomized longitudinal intervention study with a control-group. Finally, a potential limitation of the KIDSCREEN-27 instrument is that the *Self-Perception* dimension is less well represented. Researchers should take into account this limitation when deciding which KIDSCREEN version to use.

In summary, the KIDSCREEN-27 HRQoL questionnaire for children and adolescents achieves most of the attributes proposed by the Scientific Advisory Committee of the Medical Outcome Trust [6] and was able to capture the theoretically expected relationships between the HRQoL construct and concepts or aspects associated with it, thereby confirming its construct validity. The KIDSCREEN-27 HRQoL questionnaire may contribute to European policies by providing information on children and adolescents' quality of life both nationally and Europe-wide.

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