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Health-related quality of life in children and adolescents in Germany: results of the BELLA study

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Introduction

The understanding of self-perceived health – also known as health-related quality of life – as a key descriptive criterion of the health state has been

■ **Abstract** *Background* The self-perceived health or health-related quality of life of children and adolescents is increasingly recognised as a relevant outcome in medical practice and public health research. Identifying children and adolescents with particularly low health-related quality of life allows for an early detection of hidden morbidity and health care needs. *Objectives* The present study investigates health-related quality of life in children and adolescents in Germany. *Methods* In the Mental Health Module (BELLA study) of the German National Health Interview and Examination Survey for Children and Adolescents (KiGGS), the parents of 2,863 children and adolescents aged 7–17 years, and 1,700 children and adolescents aged 11–17 years completed the KINDL-R quality of life questionnaire. *Results* The reliability (Cronbach's $\alpha = 0.86$) and validity of the measurements using the parent-reported KINDL-R were

confirmed. Means and percentiles were calculated for the total sample as well as for strata defined by age, sex, geographical region (east/west), migration status and socioeconomic status. Expected differences in health-related quality of life of children and adolescents from different social backgrounds and with different health statuses were demonstrated by differences in the KINDL-R scores (effect size d up to 1.29). *Conclusion* This study provides representative, normative data (self-report and parent-report) on the test scores of health-related quality of life (KINDL-R) for the population of children and adolescents in Germany in general, as well as in sociodemographic and socioeconomic subpopulations.

■ **Key words** health survey – children and adolescents – KINDL-R – health-related quality of life

stressed on numerous occasions [22]. Unlike the classical medical criteria for determining the health state of a person, this concept includes the perspective of the individual with regards to his/her physical functioning and psychological well-being, which is of interest in many areas [3, 4, 13]. Health-related

quality of life (HRQoL) is generally understood as a multidimensional concept, which consists of various components of well-being and functionality from the subjective perspective of the individual. In this way, health-related quality of life describes the self-perceived health state or the 'experienced health' [22]. The components of the quality of life assessments include the dimensions through which the individuals perceive and judge their health situation. In general, the physical, mental-emotional and social dimensions are assumed to be the main components [25]. These main components can be further subdivided into more specific dimensions. For children and adolescents, relevant dimensions are, for example, self-perception/self-worth, perceived quality of the relationship to one's parents or friends, as well as school-related well-being [14].

Unlike in adults, the assessment of health-related quality of life in children and adolescents has been neglected for a long time. However, in recent years, it has received more attention from health researchers, and, at the community and national levels, it has increasingly gained importance, especially with regards to disease prevention and health promotion. The assessment of health-related quality of life can help identify subgroups or individuals who are at higher risk of health problems [19]. Furthermore, it helps in determining the burden associated with a specific disorder or illness [12], and it can help in the early identification of possible impairments in well-being and functioning. Moreover, the identification of important determinants of health-related quality of life, such as the socioeconomic factors, health behaviours, pain, and acute as well as chronic disorders, can provide the basis for early interventions [7].

Until now, epidemiological studies on the health state and health behaviour of children and adolescents in Germany have for the most part neglected subjective health parameters, such as the health-related quality of life. Representative norm data on this topic are not yet available. In the rediscovered research field of Public Health, studies with a focus on health promotion and prevention are needed. Therefore, detailed descriptions of HRQoL in children are needed as well as information on the important factors such as health behaviour. For this reason, the assessment of health-related quality of life was conducted within the German National Health Interview and Examination Survey for Children and Adolescents [20, 21].

The goal of the present article is to provide reference data regarding health-related quality of life in children and adolescents in Germany by using the KINDL-R questionnaire on HRQoL in children and adolescents [15, 17]. This study presents representative norm data for the children and adolescent pop-

ulation in Germany in general, as well as stratified for sociodemographic and socioeconomic subpopulations, for the interpretation of the test scores of the KINDL-R instrument in future applications.

Methods

■ Design and sample

Conceptualisation, design and procedure of the mental health module (BELLA study) are described in detail elsewhere [20]. The participants of the BELLA study were randomly recruited from the national representative sample of 17,641 families participating in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) conducted by the Robert Koch-Institute. The KiGGS and the BELLA surveys took place between May 2003 and May 2006 in 167 cities and communities, representative for Germany. The overall response rate was 66.6% (KiGGS). A random selection of 4,199 families from the KiGGS sample with children aged 7–17 were asked to participate in the BELLA study. Of these eligible families, 70% agreed to participate, and 68% (1,389 girls and 1,474 boys) were surveyed. Of these 2,863 families that participated in the BELLA study, 1,142 had children aged 7–10, 780 had children aged 11–13, and 941 had children aged 14–17. In each family, one parent was questioned with a standardised computer-assisted telephone interview. Children aged 11 and older were interviewed as well. In addition, the participants were asked to fill in a mailed written questionnaire. Sample data were weighted to correct for deviation of the sample from the age-, gender-, regional- and citizenship-structure of the German population (reference data 31.12.2004).

■ Instruments

Health-related quality of life

In the mental health module (BELLA study), health-related quality of life was assessed using the KINDL-R questionnaire [15], which has already been tested in smaller epidemiological studies for its psychometric properties as a health-related quality of life screening instrument [16]. While most of the HRQoL instruments for children were developed in English and later translated by means of a complex translation process, the generic KINDL-R questionnaire was developed in the German language for the assessment of health-related quality of life in children and adolescents and can be used in clinical as well as in healthy populations of children and adolescents. The

KINDL-R questionnaire consists of 24 items enquiring into the following six dimensions of quality of life (referring to the past week):

- 'Physical well-being' (e.g. 'I felt ill', 'I was tired and worn-out'),
- 'Emotional well-being' (e.g. 'I had fun and laughed a lot', 'I was scared'),
- 'Self-esteem' (e.g. 'I was proud of myself', 'I had lots of good ideas'),
- 'Family' (e.g. 'I got on well with my parents', 'I felt fine at home'),
- 'Friends' (e.g. 'Other kids liked me', 'I got along well with my friends'), and
- 'Everyday functioning (school or nursery school/ kindergarten)' (e.g. 'Doing my schoolwork was easy', 'I worried about bad marks or grades').

The KINDL-R questionnaire takes the child's developmental process into account by providing different versions for the different age groups, and it encompasses a self-assessment version as well as a parent-proxy version. Each of the items offers five answer categories (never, seldom, sometimes, often, always) from which the participant can choose an answer. For all six dimensions, a score can be calculated, resulting in a profile of HRQoL. Furthermore, a total score of overall health-related quality of life can be calculated from all 24 items. All scores were transformed to values between 0 to 100, whereby a larger score indicates better quality of life.

Determinants of health-related quality of life

Sociodemographic characteristics (age, gender, residence of location, migration background) as well as information on health status (special health care needs, presence of pain, asthma, symptoms of mental health problems) were analysed as determinants of health-related quality of life.

Children and adolescents from the BELLA study were collapsed into three age groups from 7–10, 11–13, and 14–17 years. Residence of location, either in West or East Germany (former German Democratic Republic), was assessed according to the current place of residence. For migration status, children and adolescents were considered to have a migratory background if they came from another country and had at least one parent who was not born in Germany, or if both parents originally came from another country or do not hold German citizenship. Socioeconomic status was determined using the 'Winkler Index' [26], which takes into account income, education and occupational status and classifies households into those with a low, middle and high socioeconomic status.

Special health care needs, as an expression of a chronic illness, were assessed with the Children with Special Health Care Needs (CSHCN) Screener [1]. The CSHCN comprises an array of five questions that are answered by the parents. These questions refer to (a) the intake or the need of prescription medicine, (b) an increased need of medical, psychosocial or pedagogical support as well as (c) functional limitations in the possibilities to do the things that most of the children in the age group are capable of doing. Furthermore, part (d) asks about the usage of or the need of special therapies (physiotherapy, ergotherapy or speech therapy), and part (e) assesses the usage of or the need for treatments and consultations associated with emotional, developmental or behavioural problems. Depending on the answers to these questions, the children were classified into two categories: those with and those without a need for special health-related services.

The presence of pain was identified by the question, 'Did you have pain in the last three months?' with answer options 'yes' or 'no'.

The presence of asthma was identified during a physician's interview with the parents.

Symptoms of mental health problems were operationalised by means of the total problem score in the strengths and difficulties questionnaire (SDQ) [9] from the parental perspective. The SDQ includes 20 items on four problem scales measuring behavioural problems, emotional problems, hyperactivity, and peer-problems. By adding up the problem scale scores, a total difficulties score can be calculated and assigned to the categories 'normal', 'borderline' and 'abnormal', based on the cut-off scores from the British norm sample (<http://www.sdqinfo.com/ScoreSheets/e5.pdf>).

■ Statistical analyses

The testing of the reliability and factorial validity of the KINDL-R questionnaire was done with the help of the Multitrait Analysis Program of the New England Medical Center of the Tufts University in Boston (MAP) [10]. The MAP program uses Campbell's Multitrait approach [6] and allows for a confirmatory testing of the postulated scale structure of the questionnaire. For each item, it provides success statistics for the frequency of the cases with a higher or significantly higher correlation of an item with its own scale compared with the correlation with other scales. This scale fit takes on values between 0 and 100% (optimal), showing the factorial validity of the questionnaire on the item level. Additionally, the internal consistency coefficient, Cronbach's α , is listed.

Table 1 Internal consistency (Cronbach's α) and factorial validity (scaling success results of the MAP analysis) of the KINDL-R scales (parent-report)

	7–10 years (N = 960)	11–13 years (N = 750)	14–17 years (N = 1,153)	Boys (N = 1,467)	Girls (N = 1,396)	Migrants (N = 347)	Non-migrants (N = 2,513)	Total (N = 2,863)
Physical								
Alpha	0.72	0.70	0.75	0.74	0.73	0.73	0.73	0.73
Success (%)	100	95	100	100	95	100	100	100
Emotional								
Alpha	0.62	0.66	0.67	0.65	0.65	0.55	0.66	0.65
Success (%)	90	90	95	90	90	80	95	95
Self-esteem								
Alpha	0.56	0.67	0.67	0.65	0.62	0.54	0.65	0.64
Success (%)	95	95	100	100	100	100	100	100
Family								
Alpha	0.69	0.76	0.75	0.74	0.73	0.65	0.75	0.74
Success (%)	100	100	100	100	100	100	100	100
Friends								
Alpha	0.67	0.70	0.65	0.68	0.66	0.58	0.69	0.67
Success (%)	95	100	95	95	90	85	95	95
School								
Alpha	0.61	0.63	0.66	0.67	0.67	0.61	0.68	0.67
Success (%)	100	95	100	100	100	100	100	100
Total QoL								
Alpha	0.84	0.87	0.86	0.86	0.86	0.81	0.87	0.86
Success (%)	97	96	98	98	96	94	98	98

N's refer to the weighted cases

Additional statistical analyses included ANOVAs to compare group mean differences. *P*-values < 0.05 were considered to be statistically significant. The *d*-effect size measure was calculated to enable classification of the observed effects, as either 'small' ($0.10 \geq d < 0.50$), 'medium' ($0.50 \geq d < 0.80$), or 'large' ($0.80 \geq d$). The statistical analyses are based on the weighted sample-data to represent the age-, gender-, regional- and citizenship-structure of the German population (reference data 31.12.2004). The number of cases reported in tables and in the text refers to weighted data and thus might deviate from the number of cases reported in the former description of the sample. Age refers to the age of the children during the visit in the examination centre.

Results

■ Psychometric properties

A deeper examination of the psychometric properties of the KINDL-R was conducted in another paper of this supplement [5]. In the current paper, only some psychometric analyses were performed. The analysis of the questionnaire with the MAP program showed a good use of the scale width, with only small ceiling or floor effects ranging from 0% to 17% for the self-report and from 0 to 9% for the parent-report ver-

sion. The parents of the children judged the quality of life positively for the most part. The scores on the 0–100 transformed subscales had values around 80. For the whole measurement model of the KINDL-R, the scale fit according to MAP is 98%. The scale fit was 90% for all subscales, although it varied between scales and various subgroups from 90 to 100%; in this way, the scale satisfies the criteria specified in international literature [10]. Cronbach's α as a measure of internal consistency reached values between $\alpha = 0.64$ and $\alpha = 0.74$ for the parent-reported subscales, while for the overall scale, the internal consistency coefficient measure was $\alpha = 0.86$ (Table 1). This overall coefficient varied only slightly over the age groups: $\alpha = 0.84$ (7–10 years) and $\alpha = 0.87$ (11–17 years).

Overall, the items of the KINDL-R are answered by the parents in a consistent manner. For the overall value and the scales of 'physical well-being' and 'self-esteem', the accuracy of the resulting measure exceeded 0.70, fulfilling the requirements for group comparisons by [11]. In the other scales, the accuracy lay slightly below this threshold [11]. The values for younger children are generally somewhat lower. Only very small differences ($\text{delta-} \alpha \leq 0.03$) between the sexes were detected. The children with a migration background show somewhat lower Cronbach's α values on some subscales compared with non-migrants, but the differences are rather small in magnitude ($\text{delta-} \alpha \leq 0.11$) (see Table 1).

Table 2 Average scale scores of the KINDL-R scales stratified for age groups and gender (parent-reports)

	Physical		Emotional		Self-esteem		Family		Friends		School		Total QoL	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
7–10 years (<i>N</i> = 960)														
Boys	80.6	17.4	82.6	11.7	71.4	13.3	79.9	12.4	78.6	12.8	82.7	13.7	79.3	9.0
Girls	80.6	15.1	82.7	12.5	71.4	13.1	79.9	12.8	78.3	13.3	83.5	14.8	79.4	9.2
Total	80.6	16.3	82.7	12.1	71.4	13.2	79.9	12.6	78.5	13.0	83.1	14.2	79.4	9.1
11–13 years (<i>N</i> = 750)														
Boys	76.8	16.1	80.6	12.2	68.2	14.6	76.7	14.9	77.6	13.4	75.4	15.8	75.8	9.9
Girls	75.4	15.5	79.1	13.3	68.0	13.0	76.6	14.4	76.6	13.4	78.2	13.5	75.6	9.9
Total	76.1	15.8	79.8	12.8	68.1	13.8	76.7	14.6	77.1	13.4	76.8	14.8	75.7	9.9
14–17 years (<i>N</i> = 1,153)														
Boys	78.0	17.0	80.0	12.7	66.9	15.5	76.4	15.7	79.1	13.4	68.9	15.7	74.8	10.6
Girls	68.6	18.4	79.6	13.5	67.4	14.5	76.8	14.8	77.3	13.8	70.3	15.6	73.4	10.1
Total	73.3	18.3	79.8	13.1	67.2	15.0	76.6	15.2	78.2	13.6	69.6	15.7	74.1	10.4
Total (<i>N</i> = 2,863)														
Boys	78.6	16.9	81.0	12.3	68.8	14.7	77.7	14.5	78.6	13.2	75.3	16.2	76.6	10.1
Girls	74.3	17.4	80.5	13.2	68.9	13.8	77.8	14.1	77.5	13.5	76.8	15.9	76.0	10.0
Total	76.5	17.3	80.8	12.8	68.8	14.2	77.7	14.3	78.0	13.4	76.0	16.0	76.3	10.1

N's refer to the weighted cases

Health-related quality of life in children and adolescents under study

The average overall value for quality of life in children and adolescents, as reported by the parents, is $m = 76.3$ ($SD = 10.1$), with the averages of the subscales varying between $m = 68.8$ and $m = 81.0$. Taking the age into account, the total score varies from $m = 79.4$ in the 7–10 year olds to $m = 75.8$ in the 11–13 year olds and $m = 74.8$ in the 14–17 year olds. This trend of decreasing HRQoL with age can also be found in the dimensions 'school' and 'physical well-being' and to a smaller degree in the scales 'self-esteem', 'family', and 'emotional well-being'. The decrease of HRQoL with increasing age is more distinctive in girls than in boys; e.g., regarding the dimensions of 'physical well-being', the decrease is 2.6 points in boys, while in girls, the decrease is 7.3 points. Among the 7–10 years olds, there was no statistically significant difference found between the sexes. While among the 11–13 years olds, a significant difference was only observed for the 'everyday functioning (school)' dimension, among the 14–17 year olds, the girls' scores for the scales 'physical', 'emotional', and 'friends' as well as the total score were significantly lower than those of boys (see Table 2).

Table 3 shows the total score by various sociodemographic and socioeconomic subgroups. It shows that children with a higher social status obtained higher overall HRQoL scores than children with a middle or low social status. The d -effect strength measure was 0.09, which is considered to be a small effect. Based on parents' reports, children with a migration background have lower health-related

quality of life than non-migrant children of the same age.

The 11- to 17-year-old children and adolescents had the opportunity to report their quality of life in a self-administered version of the KINDL-R questionnaire. The results are shown in Table 4; the mean overall health-related quality of life (KINDL-R total score) was $m = 73.0$ points ($SD = 10.2$). The means of the subscales varied between $m = 58.4$ and $m = 81.6$ points. No statistically significant sex-specific differences can be observed only for the scales 'family' and 'everyday functioning (school)'. In all other dimensions, boys reported statistically significantly higher HRQoL than girls. Similar to the parent-reported data, the self-reported data showed a decrease of HRQoL with increasing age, with the only exception being the 'friends' scale. This effect of decreasing HRQoL with age tended to be stronger for girls than for boys.

Figure 1 displays the impact of various factors (special health care needs, pain, asthma, mental health problems) on HRQoL. Children and adolescents with special health care needs, assessed by the CSHCN instrument, reported greatly reduced quality of life compared with children who do not have such needs, based on the total score of the KINDL-R according to the parents' report (effect size $d = 0.58$). Also, the presence of pain in the last three months was negatively associated with quality of life ($d = 0.40$); i.e., children with chronic pain reported lower HRQoL. However, no statistically significant impairment in HRQoL accompanying asthma was observed.

Children and adolescents who had symptoms of mental health problems according to the SDQ had

Table 3 KINDL-R total score of various sociodemographic groups (parent-report)

	Mean	SD	Effect size <i>d</i> (<i>P</i> -value)	P10	P25	P50	P75	P90	Valid cases (weighted) <i>n</i>	Missings (%)
7–10 years										
Boys	79.3	9.0	0.01	67.9	75.0	80.2	85.4	89.6	487	1.23
Girls	79.4	9.2	(0.931)	67.7	75.0	80.2	86.5	89.6	459	1.52
East	79.1	9.0	0.03	66.1	74.0	80.2	85.4	89.6	129	1.66
West	79.4	9.1	(0.746)	67.7	75.0	80.2	85.4	89.6	818	1.33
Migrants	78.5	68.1	0.01	72.8	77.9	86.3	88.5	8.2	111	4.47
Non-migrants	79.5	67.7	(0.312)	75.0	80.2	85.4	89.6	9.2	835	0.87
Low SES	78.4	65.2	0.01	71.9	79.2	86.5	89.2	10.0	227	1.04
Medium SES	79.2	68.3	(0.080)	75.0	80.2	85.4	89.6	9.0	429	1.74
High SES	80.2	69.8		76.0	81.3	85.5	89.6	8.4	289	0.15
11–13 years										
Boys	75.8	9.9	0.02	63.5	69.8	77.1	82.3	88.5	372	3.45
Girls	75.6	9.9	(0.769)	61.5	69.8	77.1	82.4	86.5	362	0.88
East	74.7	9.8	0.13	61.5	68.8	76.0	81.3	85.4	100	3.00
West	75.9	9.9	(0.248)	63.5	69.8	77.1	82.3	87.5	633	2.00
Migrants	74.9	9.5	0.10	63.5	69.1	75.0	80.2	88.4	81	12.02
Non-migrants	75.8	9.9	(0.428)	62.5	69.8	77.1	82.3	87.5	653	0.83
Low SES	61.5	67.7	0.01	75.0	82.3	89.2	74.8	11.2	185	3.92
Medium SES	62.0	70.8	(0.318)	78.1	83.1	86.5	75.8	9.7	337	0.90
High SES	65.6	71.9		77.1	82.3	87.5	76.3	8.9	211	0.00
14–17 years										
Boys	74.8	10.6	0.14	60.4	68.8	76.0	82.3	87.5	578	1.67
Girls	73.4	10.1	(0.018)	59.6	66.7	74.0	80.2	85.4	562	0.46
East	74.9	9.3	0.10	62.5	68.8	75.0	82.3	86.1	254	0.63
West	73.9	10.7	(0.200)	59.4	67.7	75.0	81.3	86.5	887	1.20
Migrants	72.3	9.7	0.21	60.6	66.7	71.1	79.2	84.1	131	6.10
Non-migrants	74.3	10.5	(0.038)	60.2	67.7	76.0	82.3	86.5	1,010	0.27
Low SES	73.3	10.2	0.11	59.4	66.7	73.9	80.6	86.5	289	1.56
Medium SES	74.5	10.1	(0.277)	60.6	67.7	75.0	82.3	87.5	554	0.00
High SES	74.4	11.1		60.0	68.8	76.0	82.3	85.4	288	0.15
Total										
Boys	76.6	10.1	0.06	63.5	70.8	78.1	83.3	88.5	1,437	1.99
Girls	76.0	10.0	(0.085)	62.5	69.8	77.1	83.3	87.5	1,383	0.93
East	76.0	9.5	0.04	63.5	69.8	77.1	83.3	87.5	483	1.35
West	76.4	10.2	(0.414)	63.5	70.8	78.1	83.3	88.5	2,338	1.49
Migrants	75.1	63.6	0.02	68.9	75.0	81.3	87.5	87.5	322	7.00
Non-migrants	76.4	63.5	(0.026)	70.8	78.1	83.3	88.5	88.5	2,497	1.00
Low SES	75.4	10.6	0.09	61.5	67.7	76.1	83.3	88.5	702	2.03
Medium SES	76.4	9.8	(0.006)	62.5	70.8	78.1	83.3	88.5	1,320	0.80
High SES	77.0	9.9		65.6	71.9	78.1	83.3	88.5	789	0.11

N's refer to the weighted cases and might be lower than in Tables 1 and 2 due to missing values in the additional information

statistically significantly lower KINDL-R total scores than children who did not have such symptoms. Markedly lower HRQoL scores (based on parent-reports) were observed in children and adolescents who were classified as abnormal by the SDQ, compared with those who did not show any signs of mental health problems in the SDQ ($d = 1.29$). Children and adolescents who were classified as borderline had HRQoL total scores that were, on average, about seven points higher than those of children who were classified as abnormal. However, these HRQoL scores from children considered borderline were still eight points below those of children who were classified as normal in the SDQ parents' report.

Discussion

Overall, the results found good psychometric properties as well as good validity of the KINDL-R test scores, which confirmed that the questionnaire was suitable for the assessment of health-related quality of life in surveys of children and adolescents. The psychometric testing confirmed the KINDL-R measurement model. The assignment of the items to the six areas of the health-related quality of life seemed reasonable since the correlation patterns between the items reflected the theoretically assumed scale structure of the instrument. The structure of the KINDL-R could be confirmed also in different age groups, for boys and for girls, as well as for migrants and non-

Table 4 KINDL-R subscales means stratified for age and gender (self-report)

	Physical		Emotional		Self-esteem		Family		Friends		School		Total HRQoL	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
11–13 years (N = 747)														
Boys	76.1	14.8	83.2	10.3	57.9	18.7	84.3	13.5	82.1	12.6	71.1	17.3	75.7	9.2
Girls	71.7	16.9	83.3	11.1	54.6	18.2	84.9	13.3	79.7	14.1	72.6	15.8	74.5	9.4
Total	74.0	16.0	83.2	10.7	56.3	18.5	84.6	13.4	80.9	13.4	71.8	16.6	75.1	9.3
14–17 years (N = 1,148)														
Boys	73.6	15.2	82.0	11.9	63.0	16.0	82.2	15.9	76.5	15.1	64.7	14.9	73.6	9.5
Girls	63.3	17.0	78.9	15.1	56.6	19.5	80.0	16.7	73.9	14.7	63.6	17.8	69.4	11.2
Total	68.5	16.9	80.5	13.7	59.9	18.1	81.1	16.4	75.2	15.0	64.2	16.4	71.5	10.6
Total (N = 1,895)														
Boys	74.6	15.1	82.5	11.3	61.0	17.3	83.0	15.1	78.7	14.4	67.2	16.2	74.5	9.4
Girls	66.6	17.4	80.6	13.9	55.8	19.0	82.0	15.6	76.2	14.8	67.1	17.6	71.4	10.8
Total	70.7	16.8	81.6	12.6	58.4	18.3	82.5	15.3	77.5	14.6	67.2	16.9	73.0	10.2

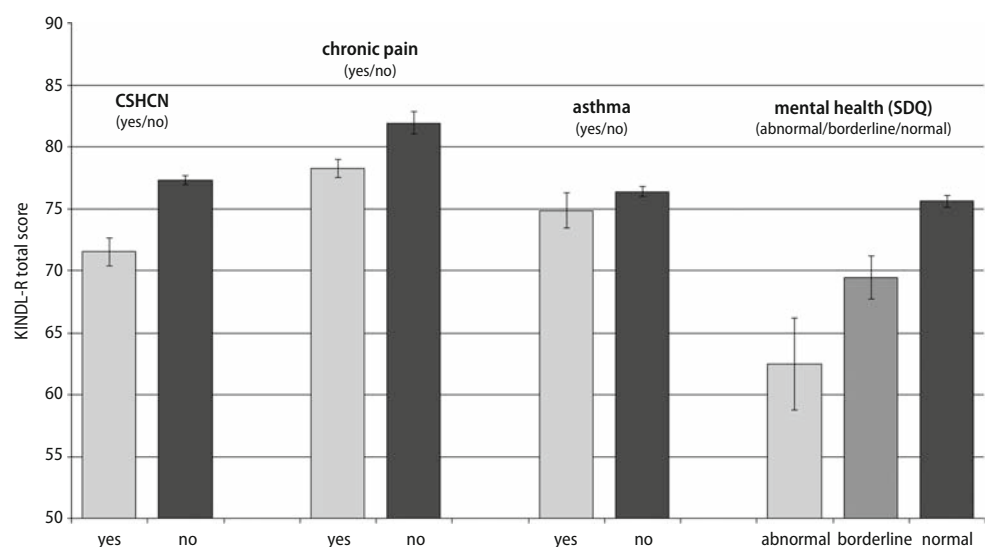
migrants. Therefore, the presented results support the utility of the KINDL-R as a measurement tool for health-related quality of life in children and adolescents of the subgroups specified above. The internal consistency for some scales was below the required thresholds of 0.70 for group comparisons, thus precluding the use of these scores in small samples.

The representative norm data for the KINDL-R scales from this survey showed a range from 69.7 to 80.3 points for the parent-scales, and 58.3–81.9 points for the self-reported data of children and adolescents, based on a scale from 0 to 100 points. Differences existed between girls and boys, as well as between younger and older children and adolescents. It could be also observed that gender differences become more salient with increasing age, which might be attributed to increasing gender role pressures. This was especially burdensome for girls who were affected particularly in their emotional lives. No statistically

significant differences could be found in the health-related quality of life between those residing in former East Germany versus those residing in former West Germany.

From a theoretical perspective, it has to be assumed that children with migration backgrounds and children from families with low socioeconomic status [8, 27] display impairments in their HRQoL. Interestingly, no sizeable differences could be found in this study. Regarding the migrant population, this result could be potentially explained by selection bias, since the BELLA study data collection was carried out in the German language only, which might have excluded participants who are insufficiently fluent in the German language or who at least feel insecure in speaking German. Despite this limitation, results of participating migrants were reported in order to show how the KINDL-R works in migrant families who actually fill out the questionnaire in practice.

Fig. 1 Determinants of HRQoL. Mean KINDL-R total score (95% confidence interval) in different subgroups (parent-report). (Effect size d : CSHCN = 0.58; Chronic pain = 0.40; Asthma = not significant; SDQ abnormal versus normal = 1.29; the total HRQoL scores range from 0–100, Fig. 1 only shows the range between 50 and 90)



Socioeconomic status differences that were theoretically expected and previously observed in other studies [23] were confirmed, although the differences were small. Children with a lower social status were found to have, on average, a lower health-related quality of life than children with a middle social status, who, in turn, were surpassed by children with a high social status. Currently, various mechanisms that explain the connection between the socioeconomic status and well-being in terms of the health-related quality of life of children and adolescents are being discussed. Most of the mechanisms refer to the differences in the access to material and social resources or to the reactions to stress-induced conditions to which children and adolescents are exposed [2].

Further evaluations of the study data will focus on a deeper examination of the issue, e.g., by trying to identify factors that discriminate between children where the theoretical expected differences could be observed and those where no differences were found.

The impairment of health-related quality of life in children and adolescents with special health care needs (chronic disease or handicap) and self-reported chronic pain was expected from a theoretical standpoint, since chronic diseases in childhood and adolescence can function as a stressor that impacts on the physical, emotional, social and functional well-being of the individual [24]. However, this could not be seen for children with asthma. Chronic pain, on the other hand, did show an association with lower HRQoL ratings. Further examinations of the study data might again focus on investigating the potential differences between asthmatics with decreased HRQoL rating and those reporting no HRQoL impairments.

However, the strongest association was observed between mental health and health-related quality of life. A substantial number of symptoms of mental health problems were connected to a considerable impairment of health-related quality of life ($d = 1.29$ for the SDQ) while other chronic conditions had smaller effects ($d = 0.58$ for CSHCN and $d = 0.40$ for chronic pain). Symptoms of mental health problems might have either a direct association (such as anxieties or depressiveness) or an indirect association

(mediated through disadvantages in the social life, such as problems in the interaction with peers) on the well-being of the individual. These results emphasise the importance of taking into account the so-called 'new morbidity' and the increasing importance of mental health problems in the health and illness profile of the population of children. The BELLA study was designed to address this issue [20]: besides estimating the prevalence of specific mental health problems [21], the determinants of such mental health problems were also studied [27] to identify aspects potentially modifiable by early prevention. Such prevention is necessary to enable children and adolescents to live a life with good well-being.

In summary, the KINDL-R is capable of detecting differences in the health-related quality of life from various social and health-related conditions. This result could be considered as providing more support for the validity of the KINDL-R. Beyond clinical diagnoses, the measurement of HRQoL provides a detailed picture of the individual profile of well-being associated with several chronic conditions. Thus, unidentified health care needs can be detected and interventions can be evaluated. Of course, in general, the measurement of health-related quality of life by means of the KINDL-R cannot substitute the classical patient and physician interaction. With respect to the differences between parent-report and self-reports, recommendations from other studies (see, e.g., Ravens-Sieberer et al. [18]) emphasising the need to take both informant versions into account were confirmed.

The employment of the KINDL-R provided detailed information on HRQoL in different subgroups of children and adolescents from different perspectives. Furthermore, means and percentiles for HRQoL of children and adolescents were provided for various age groups and for both genders, as well as for sociodemographic and socioeconomic subpopulations; the results can be used in the future as representative norm data that can be used as a reference for interpreting health-related quality of life test data.

■ **Conflict of interest** All authors declare no conflict of interest.

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