Is the Kidscreen-27 a valid measure of health-related quality of life in 10-year-old Norwegian children?

John Roger Andersen, Gerd Karin Natvig, Kristin Haraldstad, Turid Skrede, Eivind Aadland, Geir Kåre Resaland

The aim of this study was to investigate the reliability and validity of the Norwegian Kidscreen-27 questionnaire, a measure of generic health-related quality of life, in 10 year-old children. The Kidscreen-27 consists of five domains and was validated in a sample of 56 school children (29 boys). The children completed the questionnaire at three different time points during two consecutive school days. For convergent validity, the study was powered to detect a statistically significant correlation coefficient of 0.4. Cronbach's alpha values ranged from 0.73 to 0.83. Floor effects were all zero and ceiling effects ranged from 1.7% to 23.7%. Intraclass correlation values over time ranged from 0.71 to 0.81. However, some individual variability over time occurred and was illustrated by Bland Altman plots. The domains of physical well-being, psychological well-being and autonomy & parents improved over time (Ps < 0.05), while social support and school environment domains did not. We assessed convergent validity using general life satisfaction scores obtained by administering the Cantrils Ladder. All the Kidscreen-27 domains were significantly associated with general life satisfaction (Spearman rank correlations ranged from 0.29 to 0.59, Ps < 0.05). In conclusion, the Norwegian version of Kidscreen-27 has good reliability and validity.

Is the Kidscreen-27 a valid measure of health-related quality of life in 10-year-old Norwegian children?

John Roger Andersen [1,2], Gerd Karin Natvig [3], Kristin Haraldstad [4], Turid Skrede [5], Eivind Aadland [5], Geir Kåre Resaland [2, 5]

[1] Department of health studies, Sogn og Fjordane University College, Førde, Norway

[2] Centre of Health Research, Førde Hospital Trust, Førde, Norway

[3] Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway

[4] Department of Health and Nursing Sciences, University of Agder, Kristiansand, Norway

[5] Faculty of Teacher Education and Sport, Sogn og Fjordane University College, Sogndal, Norway

Correspondence. John Roger Andersen. Department of Health Studies, Sogn og Fjordane University College, Førde, Norway. Address: Svanehaugvegen 1, 6812 Førde, Norway. Telephone: +47 57722522. E-mail: johnra@hisf.no

Abstract

The aim of this study was to investigate the reliability and validity of the Norwegian Kidscreen-27 questionnaire, a measure of generic health-related quality of life, in 10 year-old children. The Kidscreen-27 consists of five domains and was validated in a sample of 56 school children (29 boys). The children completed the questionnaire at three different time points during two consecutive school days. For convergent validity, the study was powered to detect a statistically significant correlation coefficient of 0.4. Cronbach's alpha values ranged from 0.73 to 0.83. Floor effects were all zero and ceiling effects ranged from 1.7% to 23.7%. Intraclass correlation values over time ranged from 0.71 to 0.81. However, some individual variability over time occurred and was illustrated by Bland Altman plots. The domains of physical well-being, psychological well-being and autonomy & parents improved over time (Ps < 0.05), while social support and school environment domains did not. We assessed convergent validity using general life satisfaction scores obtained by administering the Cantrils Ladder. All the Kidscreen-27 domains were significantly associated with general life satisfaction (Spearman rank correlations ranged from 0.29 to 0.59, Ps < 0.05). In conclusion, the Norwegian version of Kidscreen-27 has good reliability and validity.

Key-words. Children, Health-related quality of life. Kidscreen-27, Norway, Reliability, Validity

Background

The Kidscreen-27 is a well-validated, short, multidimensional measure of generic health-related quality of life (HRQoL) in children and adolescents (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007). It is available in many languages, including Norwegian. However, unlike the longer Kidscreen-52, the Norwegian version of the Kidscreen-27 has not yet been validated (Haraldstad et al. 2011). The Kidscreen-27 is a particularly useful instrument for assessing HRQoL in younger children as a consequence of its content, ease of completion and the volume of available data with which international comparisons can be made. The aim of this study was to investigate the reliability and validity of the Norwegian Kidscreen-27 questionnaire in 10-year-old children.

Material and Methods

This was a prospective validation study, and was approved by the regional ethical research committee (2012/1089). We obtained written informed consent from the parents or guardians of the participants. We used G-POWER to calculate that a minimum sample size of 44 children would be required. This assumed an alpha value of 0.05, a power of 0.80, and a minimum correlation of 0.4 for a two-tailed test. The proposed effect size was based on reported correlations between the Kidscreen-27 and other quality of life measures (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007). We recruited children aged 10 years from the same school in Western Norway.

The Kidscreen-27 was administered to the children at three time points: at the beginning of the school day (Test 1); at the end of the same school day (Test 2); and during the middle of the following school day (Test 3). The children were given brief information about the questionnaire, and then completed it while they sat at their desks in the classroom. After doing so, they were told to carry on with their school work in order to minimize any noise until all the other children were finished. They were allowed to ask the teacher for help if they did not understand any of the questions. Children with reading difficulties were helped by a teaching assistant, as would be the case normally.

Kidscreen-27

Items of the Kidscreen-27 are derived from the Kidscreen-52 questionnaire(Ravens-Sieberer 2006). It has five domains: (1) physical well-being; (2) psychological well-being; (3) autonomy & parents; (4) social support & peers; and (5) school environment. We used the methodology given in the manual to obtain the T-scores; mean (±SD) scores of 50 ± 10 define normality for children and adolescents aged 8-18 years across Europe (Ravens-Sieberer 2006). Higher scores indicate a better HRQoL. The Kidscreen-27 is standardized so that a difference of <0.2 points is considered trivial, 2.0 – 4.9 as small, 5.0 - 7.9 as moderate and ≥8 as large effects (Cohen 1988; Ravens-Sieberer 2006). There are two official forms of written Norwegian, Bokmål and Nynorsk. They are very similar, and it is mandatory that they are both taught in Norwegian schools. The Kidscreen-52 questionnaire is only available in Bokmål (Haraldstad et al. 2011). We decided to use Nynorsk in this study. The linguistic skills required to produce a Nynorsk version of

Kidscreen-27 from the Kidscreen-52 are minimal. The translation was undertaken by the first three authors and modified after discussion with a professor of Norwegian languages (see acknowledgements). This process was approved by the European Kidscreen Group.

Cantrils Life Satisfaction Ladder

In order to study convergent validity we assessed general life satisfaction using the adapted version of the Cantrils Life Satisfaction Ladder. This has been used in World Health Organisation surveys of children and adolescents, including in Norway (Levin & Currie 2014). The child is presented with a picture of a ladder with steps ranging from 0 to 10. They are told that the top step (10) represents the best possible quality of life, while the bottom (0) represents the worst. They are asked to indicate where on the ladder they currently consider themselves to be. This question was assessed three times together with the Kidscreen-27.

Statistical analysis

Continuous variables were given as means ± standard deviations (SDs). Categorical variables were given as numbers and percentages. An independent t-test was used to study gender differences in the Kidcreen-27 scores (Test 1). Internal consistency was assessed by calculating Cronbach's alpha values (Test 1); values ≥0.7 were considered satisfactory (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007). Floor and ceiling effects were demonstrated by the numbers and percentages of children with the lowest and highest possible scores (Test 1). Test-retest

reliability (Tests 1 - 3) was assessed by calculating single measures intraclass correlation coefficients (ICC), using a two-way mixed model with an absolute agreement definition; ICC values ≥0.7 were considered satisfactory (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007). Individual variability was described by presenting mean differences ± SDs and 95% limits of agreement; Bland Altman plots were used to graphically display the variation (Tests 1 - 3). A linear mixed model based on restricted maximum likelihood estimation with random intercept for subjects was used for analysis of change in Kidscreen-27 scores over the three time points (Tests 1 - 3).

For convergent validity, we used the Spearman rank correlation (r_s) to test whether the Kidscreen-27 scores were positively correlated with the Cantrils Ladder score (test 1). Based on previous research, we hypothesized that the Kidscreen-27 psychological well-being domain would be the one most strongly correlated with the Cantrils Ladder score (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007). Correlation coefficients <0.1 were considered trivial, 0.1 – 0.29 as small, 0.30 – 0.49 as moderate, and ≥0.5 as high(Cohen 1988). The software Prism version 6.05 for Windows was used to calculate and display the results shown in Table 3 and Figure 1. Other statistical analyses were performed using IBM SPSS version 21 for Windows. Two-sided P-values <0.05 were considered statistically significant.

Results

A total of 56 children (29 boys) were present at school when the study was conducted. This represents an attendance rate of 88%; all participated in the study. Boys scored significantly

higher than girls on physical well-being, autonomy & parents, and social support & peers (Table 1). Table 2 shows the Kidscreen-27 mean T-value scores, the percentages of children who had floor and ceiling scores, and Cronbach's alpha values. Reliability for the various domain scores ranged from 0.73 to 0.81. Floor effects were all zero and ceiling effects ranged from 1.7% to 23.7%. The variability over time in the five Kidscreen-27 domain scores is shown in Table 3. By way of an illustrative example, Figure 1 shows Bland Altman plots for the physical well-being domain. Bland Altman plots for the other Kidscreen-27 domains can be produced from the dataset which we have made publically available. Trends in the domain scores over time between the three tests are shown in Table 4. Physical well-being, psychological well-being and autonomy & parents significantly improved over time.

The Kidscreen-27 scores were positively and significantly correlated with the Cantrils Ladder scores. The correlations for the various Kidscreen-27 domains were as follows (N = 55 to 56): physical well-being, $r_s = 0.29$ (P = 031); psychological well-being, $r_s = 0.59$ (P <0.001); autonomy & parents, $r_s = 0.31$ (P = 0.025); social support & peers, $r_s = 0.53$ (P < 0.001); and school environment, $r_s = 0.48$ (P < 0.001).

Discussion

The findings of this study demonstrate that the reliability and validity of the Norwegian version of the Kidscreen-27 are good. A large body of research findings regarding the Kidscreen-27 enables a direct comparison with our current results (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007). We found that boys had higher scores than girls on three of the five Kidscreen-27

144 domains. This is in accordance with previous findings (Ravens-Sieberer 2006; Ravens-Sieberer
145 et al. 2007). Furthermore, the Cronbach alpha values in the current study ranged from 0.73 to
146 0.83. This compares to 0.80 to 0.84 reported in the literature when the instrument was
147 administered to children aged between 8 and 18 years (Ravens-Sieberer 2006). We found no
148 floor effects, but a moderate ceiling effect in the social support & peers domain. This is similar
149 to previously reported findings (Ravens-Sieberer 2006).

150 The ICC values in the current study ranged from 0.72 to 0.80, which were slightly higher than
151 the range of 0.61 to 0.66 reported previously (Ravens-Sieberer et al. 2007). This finding may be
152 a consequence of different test-retest intervals (1 day vs. 2 weeks). Additionally, our study
153 showed variability in Kidscreen-27 scores over time in some individuals. This has been reported
154 with other HRQoL measures and in various populations (van der Velde et al. 2009; Wink et al.
155 2013). Although it could be a consequence of measurement error, natural fluctuations in
156 HRQoL could also be responsible(Fayers & Machin 2007). Previous research has suggested that
157 there is a small retest effect, in order that Kidscreen-27 scores tend to rise if assessed multiple
158 times, even without any interventions (Ravens-Sieberer 2006). Our study demonstrated this in
159 three of the domains, even though the test-retest intervals were short. Whether this effect is
160 still present if the test-retest interval is longer, is unknown. It means that studies using
161 Kidscreen-27 to assess the effectiveness of interventions must have a control group.

162 Finally, we found that all the Kidscreen-27 domains were significantly associated with general
163 life satisfaction as measured with the Cantrils Ladder. The sizes of the correlation coefficients
164 are similar to those that have been reported previously when assessing convergent validity

using a range of instruments and in various populations (Ravens-Sieberer 2006; Ravens-Sieberer et al. 2007).

This study was limited as only children aged 10 years were included. It is more usual to assess a wider age group. Our decision to do so was a pragmatic one, as we required a validated instrument to assess HRQoL in 10-year-olds, for the purpose of a randomized controlled trial[10]. However, we propose that if good reliability and validity levels of an assessment instrument are demonstrated in younger children, it is likely that these will also be the case in older children and adolescents. Our short test–retest intervals might be criticized. However, in addition to the points made above, it should be noted that a previous study found that test-retest effects were similar whether the interval is 2 days or 2 weeks (Marx et al. 2003).

Conclusions

Our findings suggest that the Kidscreen-27 works well in Norwegian context, and has good reliability and validity. Further larger studies are needed to assess the Kidscreen-27 more fully with regards to its clinical and research utility, and its ability to detect changes in HRQL following interventions.

Acknowledgements

We thank Associate Professor Jan Olav Fretland from the Faculty of Teacher Education and Sport, Sogn og Fjordane University College, for his assistance with the preparation of the 'Nynorsk' Kidscreen-27.

References

Cohen J. 1988. *Statistical Power Analysis for the Behavioral Sciences.* New York: Academic Press.

Fayers PM, and Machin D. 2007. *Quality of life: the assessment, analysis and interpretation of patient-reported outcomes*. Chichester: John Wiley.

Haraldstad K, Christophersen KA, Eide H, Nativg GK, Helseth S, and Europe KG. 2011. Health related quality of life in children and adolescents: reliability and validity of the Norwegian version of KIDSCREEN-52 questionnaire, a cross sectional study. *Int J Nurs Stud* 48:573-581.

Levin KA, and Currie C. 2014. Reliability and Validity of an Adapted Version of the Cantril Ladder for Use with Adolescent Samples. *Social Indicators Research* 119:1047-1063.

Marx R, Menezes A, Horovitz L, Jones E, and RF W. 2003. A comparison of two time intervals for test-retest reliability of health status instruments. *J Clin Epidemiol* 56:730-735.

Ravens-Sieberer U. 2006. *The Kidscreen Questionnaires* Lengerich: Pabst Science Publishers.

Ravens-Sieberer U, Auquier P, Erhart M, Gosch A, Rajmil L, Bruil J, Power M, Duer W, Cloetta B, Czemy L, Mazur J, Czimbalmos A, Tountas Y, Hagquist C, and Kilroe J. 2007. The KIDSCREEN-27 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Qual Life Res* 16:1347-1356.

van der Velde J, Flokstra-de Blok BJ, Vlieg-Boerstra B, Oude Elberink JG, Schouten J, DunnGalvin A, Hourihane JB, Duiverman E, and Dubois AJ. 2009. Test–retest reliability of the Food Allergy Quality of Life Questionnaires (FAQLQ) for children, adolescents and adults. *Quality of Life Research* 18:245-251.

Wink F, Arends S, McKenna S, Houtman P, Brouwer E, and Spoorenberg A. 2013. Validity and Reliability of the Dutch Adaptation of the Psoriatic Arthritis Quality of Life (PsAQoL) Questionnaire. *PLoS One*.

Table 1 (on next page)

Table 1: Physiological measurements, Kidscreen-27 domain scores, and Cantrils Ladder scores of the participants

These results are from Test 1. Variables are means ± SD.

Variables	Boys (n = 29)	Girls (n = 27)	P-value
Physical well-being (n = 55)	51.4 ± 9.8	46.6 ± 6.7	0.039
Psychological well-being (n = 56)	53.3 ± 8.7	51.0 ± 7.9	0.305
Autonomy & parents (n = 55)	52.6 ± 8.6	47.5 ± 6.0	0.014
Social support & peers (n = 56)	56.2 ± 9.5	50.9 ± 9.4	0.043
School environment (n = 56)	55.3 ± 10.8	52.6 ± 8.7	0.301
Cantrils Ladder score (n = 56)	8.9 ± 1.5	8.1 ± 2.1	0.152

2

Table 2(on next page)

Table 2: Kidscreen-27 T-value domain scores, floor and ceiling effects, and internal consistency

These results are from Test 1. Variables are means ± SD.<!--��;WqW�-->

Domains	T-value	% Floor	% Ceiling	Cronbach's alpha
Physical well-being (N= 55)	49.1 ± 9.0	0	3.4	0.73
Psychological well-being (N = 56)	52.3 ± 8.7	0	3.4	0.73
Autonomy & parents (N = 55)	50.0 ± 7.8	0	1.7	0.79
Social support & peers (N = 56)	53.5 ± 9.5	0	23.7	0.83
School environment (N = 56)	54.2 ± 9.9	0	13.6	0.81

2

Table 3(on next page)

Table 3: Variation in the Kidscreen-27 scores over time

The results are from Tests 1 - 3.

Domains	Differences ± SD	95% limits of agreement
Physical well-being		
Test 2 - 1 (N = 52)	1.9 ± 7.3	-12.4, 16.2
Test 3 - 1 (N = 51)	5.4 ± 8.6	-11.47, 22.3
Test 3 - 2 (N = 49)	2.8 ± 6.0	-8.9, 14.5
Psychological well-being		
Test 2 - 1 (N = 56)	2.5 ± 7.1	-11.4, 16.3
Test 3 - 1 (N = 51)	2.2 ± 8.5	-14.5, 18.7
Test 3 - 2 (N = 51)	-0,1 ± 6.9	-13.6, 13.4
Autonomy & parents		
Test 2 - 1 (N = 54)	1.2 ± 5.3	-9.1, 11.5
Test 3 - 1 (N = 50)	3.8 ± 8.3	-12.4, 19.9
Test 3 - 2 (N= 50)	2.5 ± 7.7	-12.7, 17.6
Social support & peers		
Test 2 - 1 ((N = 56)	-0.9 ± 4.9	-10.5, 8.7
Test 3 - 1 (N = 53)	-1.4 ± 5.9	-13.0, 10.2
Test 3 - 2 (N = 53)	-0.6 ± 8.5	-12.1, 10.9
School environment		
Test 2 - 1 (N = 55)	0.6 ± 4.4	-8.1, 9.3
Test 3 - 1 (N = 50)	1.0 8.4	-15.4, 17.4
Test 3 - 2 (N = 49)	0.4 ± 6.8	-12.9, 13.8

2

Table 4(on next page)

Table 4: Time trends for changes in the Kidscreen-27 domain scores

The results are from Tests 1 - 3. The scores are presented as mean change values and 95% CIs.

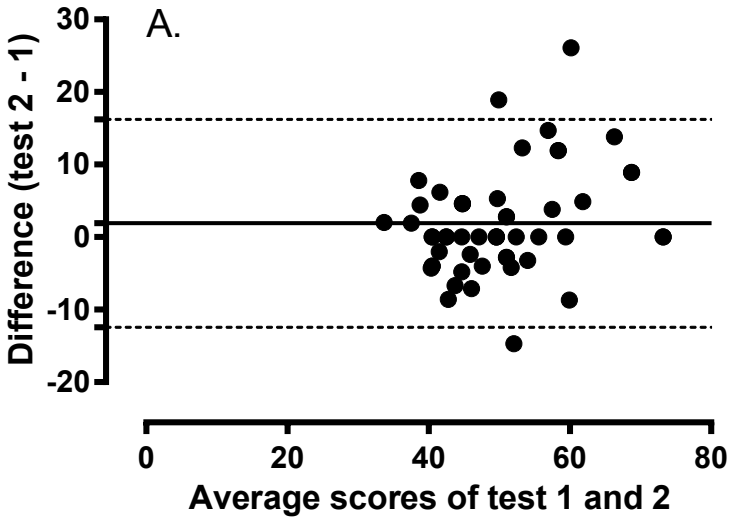
Domains	Change (Test 2 - 1)	Change (Test 3 - 1)	P for trend
Physical well-being (N= 55)	2.1 (0.1, 4.1)	5.3 (3.3, 7.3)	<0.001
Psychological well-being (N = 56)	2.5 (0.5, 4.5)	2.3 (0.3, 4.4)	0.025
Autonomy & parents (N = 55)	1.1 (-0.8, 3.1)	3.8 (1.8, 5.8)	<0.001
Social support & peers (N = 56)	-0.9 (-2.3, 0.6)	-1.4 (-2.9, 0.1)	0.188
School environment (N = 56)	0.6 (-1.1, 2.4)	1.1 (-0.7, 2.9)	0.480

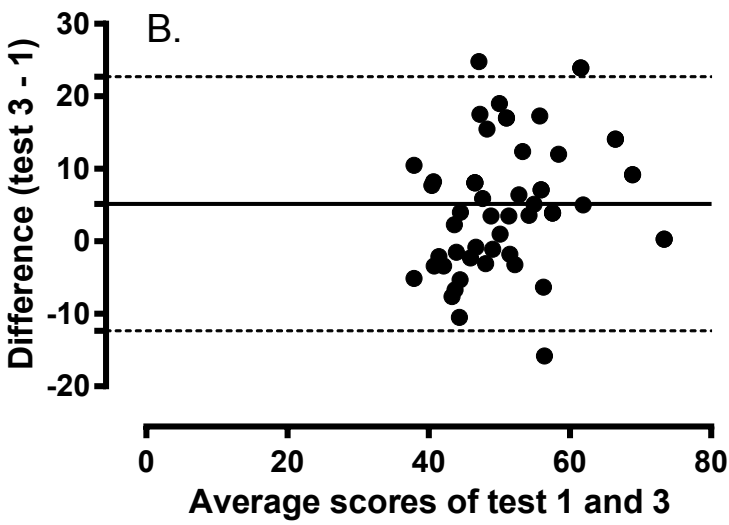
2

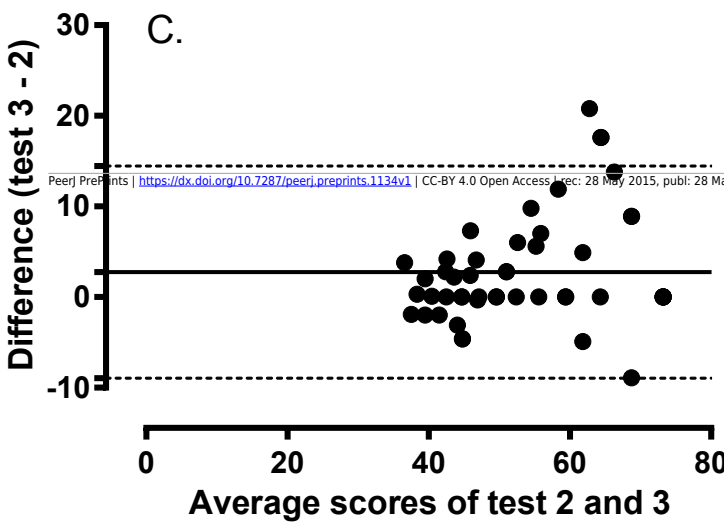
Figure 1(on next page)

Figure 1: Bland Altman plots

Bland Altman plots showing differences between: Tests 1 and 2 (A); 1 and 3 (B); and 2 and 3 (C), as a function of the mean of the corresponding tests on the Kidscreen-27 physical well-being domain.







PeerJ PrePrints | https://dx.doi.org/10.7287/peerj.preprints.1134v1 | CC-BY 4.0 Open Access | rec: 28 May 2015, publ: 28 May 2015