Original Article

Reliability and validity of a Nepalese version of the Kiddo-KINDL in adolescents

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Summary **The objective of this study was to assess the reliability and validity of a Nepalese version of the Kiddo-KINDL to measure Health-Related Quality of Life (HRQOL) in adolescents. We collected data from 204 students between 13 to 16 years old from four secondary schools in Lalitpur district, Nepal. The students answered a Nepalese version of the Kiddo-KINDL and the Center for Epidemiological Studies-Depression Scale (CES-D) with a self-administrated questionnaire. We conducted a test-retest study on the instrument at an interval of 10 days and then compared the Kiddo-KINDL scores between the low CES-D score group and the high CES-D score group students. The instrument showed good reliability and a small response variation. The internal consistency (Cronbach's alpha) of the total score was 0.93. Corrected item-total correlations showed that all items ranged from 0.47 to 0.79. The reproducibility was satisfactory with an Intraclass Correlation Coefficient (ICC) of 0.88-0.95. The Kiddo-KINDL scores in the low CES-D score group were significantly lower than those in the high CES-D score group students. The optimal cut-off score of the Kiddo-KINDL was estimated at 54.7, with an Area Under the Curve (AUC) score of 0.83 and both sensitivity (73.5%) and specificity (71.8%) were acceptably high. We recommended a mean change in Kiddo-KINDL total scores of 4.0 to be used to define a minimal important difference according to two-point CES-D score changes. Our results showed that a Nepalese version of the Kiddo-KINDL has internal consistency, reproducibility, responsiveness, interpretability, and discriminant validity.**

Keywords: School adolescent, quality of life, Nepal, reliability, validity

1. Introduction

The Health-Related Quality of Life (HRQOL) scales for adolescents have been used to assess the influence of a disease in several industrialized countries in the 1980's (*1*). HRQOL scales are used based on a broad range of domains: physical, psychological, social and spiritual focusing on personal life including the concept of the World Health Organization (WHO) definition of health as 'a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity' (*2*,*3*).

In the early 1990s, several disease-specific HRQOL instruments were developed. For example, the Diabetes Quality of Life Instrument (DQOL) measures satisfaction with treatment, impact of treatment, worry about social/vocational issues, and worry related to long-term effects of diabetes for adolescents in USA (*4*). The Childhood Asthma Questionnaires (CAQ) was developed in the UK and is commonly used to measure HRQOL in treatment of chronic childhood asthma (*5*).

The Kiddo-KINDL is a comprehensive HRQOL

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assessment, tapping not only physical and psychological aspects but also social environmental factors such as interpersonal relations with friends and family members, especially parents (*6,7*). This instrument was developed in Germany, and has been translated and validated in many areas including Asian countries and areas such as Singapore (*8*), Taiwan (*9*), and Japan (*10*).

Psychometric properties of these HRQOL instruments were revealed by feasibility with ceiling/floor effects (*6-9*), internal consistency (*4,6-10*), intercorrelations of the scale (*4,6,9,10*), reproducibility in test-retest (*6,9*), construct validity with factor analysis (*5,7,9*), correlation with external criteria (*9,10*), and discriminant validity when comparing healthy and chronically ill children/adolescents (*5,6,8*).

HRQOL instruments are widely used in Asian countries as we have described previously. However, a generic HRQOL instrument which includes school and home environment has not been used for adolescents in Nepal. In Nepal, university students' depressive symptoms, life satisfaction, and the General Health Questionnaire (GHQ) were once measured; in these studies, however, the HRQOL was not used (*11,12*).

The objective of this study was to assess the reliability and validity of a Nepalese version of the Kiddo-KINDL to measure HRQOL in adolescents.

2. Materials and Methods

2.1. *Study design*

This is a cross-sectional and self-administrated, questionnaire-based test-retest study.

2.2. *Instruments and translation procedures*

The Kiddo-KINDL is a self-report questionnaire which has 24-items referring to the past week on a 5-point response scale with the following variables: "1 = never, 2 = seldom, 3 = sometimes, 4 = often, 5 = all the time" (11-items are reverse-coded). It covers the physical, emotional, self-esteem, family, friends, and school domains, targeted for adolescents 13-16 years old (*8-10*). The instrument can be referenced from: *http://www.kindl.org/indexE.html* (*13*).

We measured the depression status of the participants using the Center for Epidemiological Studies-Depression Scale (CES-D). The scale consists of 20-items with a 4-point ordinal scale. The scores range from 0 to 60, where higher scores indicate a higher tendency for depression. This scale has been widely used in measuring depression. It has been applied both as a primary screening tool (*14*) and for clinical and research purposes in general populations (*15,16*). The depressive mood scales are often used for psychometric evaluation as an external criterion for the Kiddo-KINDL (*9,10*). Cronbach's alpha reliability coefficient and construct validity of the CES-D has been described in Nepal from an investigator administrated survey (*17*).

The original version of the Kiddo-KINDL was translated into the Nepali language with permission from the copyright holder (Ravens-Sieberer and Bullinger, 1999). First, two bilingual Nepalese researchers translated the Kiddo-KINDL into Nepali. Then, another Nepali, who was not involved in the forward translation, checked the reconciliation of each translation. Finally, a native Nepali speaker back translated the reconciled Nepali version of the questionnaire. The questionnaire was tested with ten students between 13 to 16 years old and the comprehensiveness of each item was verified.

2.3. *Sample and data collection*

We conducted this study in four schools (two private and two public) in Lalitpur district, the Central Region in Nepal. In Lalitpur district, there were 199 secondary schools with student numbers totalling 14,884 in 2002 (*18*). After receiving approval from the principals, we informed the 320 potential participants about the study in their respective classrooms. We distributed the informed consent forms and asked the students to collect a signature from one of their parents. Of the potential participants, 204 voluntarily participated with parental consent. The questionnaire consisted of the Kiddo-KINDL and the CES-D. After 10 days passed since the initial survey, we administered the same questionnaires to students to evaluate the results using a test-retest study. The study protocol was approved by the Ethical Committees of the University of Tokyo and the Nepal Health Research Council.

2.4. *Statistical analysis*

We first compared the difference of the students who had low depressive symptoms (CES-D < 16) or high depressive symptoms (CES-D ≥ 16); we used this cut-off point as suggested by Radloff (*16*). Of 24 items on the Kiddo-KINDL, we reversed 11 and transformed the raw scores into a linear scale from 0-100. The mean score of the total and all subscales were assessed by gender. We then examined the range and distribution of responses for each item from total scores using ceiling and floor effects.

To check the internal consistency of the Kiddo-KINDL, we used Cronbach's alpha values and the corrected item-total correlation between scores of six dimensions. To examine reproducibility, we calculated the Intraclass Correlation Coefficient (ICC) with 95% Confidence Intervals (CI) from the test-retest study. To examine the discriminate validity, we compared the Kiddo-KINDL scores between the low depressive symptoms group and high depressive symptoms group.

For group comparisons, we used a Student's *t*-test with effect size.

To assess the responsiveness of the Kiddo-KINDL, we measured the sensitivity and specificity of the instrument against an external criterion of the CES-D by suggesting that information be synthesised into Receiver Operating Characteristics (ROC) analysis with an optimal cut-off score.

Score interpretability is defined as the ability of an instrument to detect clinical changes. We estimated the minimal important difference for the Kiddo-KINDL using the deference of CES-D total scores between test and retest at an interval of 10 days. First, we created categories of the CES-D: "improvement" for CES-D scores ≤ -2, "stable" for CES-D scores from -1 to 1 and "worsening" for CES-D scores ≥ 2. Then, we compared the change in test and retest scores of Kiddo-KINDL among these groups.

For all statistical analysis, we used the software package SPSS ver.16.0 (SPSS Inc., Chicago, USA).

3. Results

3.1. *Study participants*

The response rate was 63.8% (n = 204/320). For the retest, 189 of the 204 students participated; its response rate was 92.6%. Table 1 shows the demographic characteristics of the participants by low and high CES-D score and gender. In the low CES-D score group, the mean age of the 92 boys and 74 girls was 14.5 years (S.D. 1.0) and 14.4 years (S.D. 1.1), respectively. In the high CES-D score group, the mean age of the 17 boys and 21 girls was 14.2 years (S.D. 1.0) and 14.4 years (S.D. 1.1), respectively.

3.2. *Score distribution and ceiling/floor effects*

Table 2 shows the score distribution and ceiling and floor effects of the Kiddo-KINDL by gender. The mean total scores were 62.4 (S.D. 16.6) and 59.6 (S.D. 17.3) for boys and girls, respectively. Overall, the total and subscale scores among girls were lower than those among boys. The lowest scores were the "self-esteem" subscale scores for both groups (boys: 56.6, girls: 54.9), followed by "school" (boys: 56.8, girls: 55.3), and "physical well-being" (boys: 58.4, girls: 56.3). The highest scores were in the "family" subscale for both groups (boys: 72.0, girls: 70.9). The differences in scores between the groups were not statistically significant. Ceiling and floor effects of the total scores were not strongly skewed in this study. Though scores on the "family" subscales had slightly higher proportions of ceiling and floor effects (15.1% and 1.4%), other subscales had 10% or fewer scores. Effect of size between boys and girls in the mean of total and subscale scores ranged from 0.05 to 0.22.

3.3. *Reliability*

We evaluated the internal consistency of the Kiddo-KINDL using Cronbach's alpha values (Table 3).

Table 1. Demographic characteristics of the participants

		CES-D low score group (Total score < 16)				CES-D high score group (Total score ≥ 16)			
		Boys (n = 92)		Girls (n = 74)		Boys (n = 17)		Girls (n = 21)	
		n	(%)	n	(%)	n	(%)	n	(%)
Year	13	20	(21.7)	18	(24.3)	5	(29.4)	5	(23.8)
	14	23	(25.0)	22	(29.7)	5	(29.4)	6	(28.6)
	15	33	(35.9)	17	(23.0)	5	(29.4)	6	(28.6)
	16	16	(17.4)	17	(23.0)	2	(11.8)	4	(19.0)
Age	(mean)(S.D.)	14.5	(1.0)	14.4	(1.1)	14.2	(1.0)	14.4	(1.1)

The participants are divided by low (Total score < 16) and high (Total score ≥ 16) CES-D score and gender.

Table 2. Comparisons of score distribution and ceiling and floor effects of the Kiddo-KINDL by gender

	Total (n = 204)		Boys (n = 109)		Girls (n = 95)		Ceiling effect (%)	Floor effect (%)	p	Effect Size[a]
	Mean	S.D.	Mean	S.D.	Mean	S.D.				
Total	61.1	16.9	62.4	16.6	59.6	17.3	0.4	0.0	0.249	0.16
Subscales										
Physical well-being	57.4	20.3	58.4	20.6	56.3	19.9	6.8	0.0	0.457	0.10
Emotional well-being	62.6	22.4	64.9	21.1	59.9	23.6	8.8	0.9	0.109	0.21
Self-esteem	55.8	24.0	56.6	24.0	54.9	24.1	7.8	0.9	0.609	0.07
Family	71.5	22.9	72.0	21.6	70.9	24.1	15.1	1.4	0.718	0.05
Friends	63.2	20.5	65.5	19.7	60.6	24.4	6.3	0.9	0.090	0.22
School	56.1	21.1	56.8	22.7	55.3	19.2	7.3	0.0	0.599	0.07

[a] Effect sizes are calculated from boys and girls.

Subscale alphas ranged from 0.73 to 0.84, and the total alpha score was 0.93. Corrected item-total correlations showed that all items ranged from 0.47 to 0.79 and Cronbach's alpha values if an item was deleted ranged from 0.82 to 0.87. A 10-day test-retest ICC (n = 189) ranged from 0.88 to 0.94 for the subscales, and was 0.95 for the total scale. Internal consistency of CES-D scales was 0.70 (n = 204).

3.4. *Validity*

Table 4 shows the total and subscale scores of the Kiddo-KINDL by gender and the CES-D score group. Except for the "school" subscale, the total and subscale scores of the Kiddo-KINDL were significantly different between the high and low CES-D score groups, for both girls and boys. In the high CES-D score group, the mean scores of "physical well-being", "emotional well-being", and "self-esteem" subscales were lower than those in the other subscales, and ranged from 35.7 to 39.7 in both gender groups. On the other hand, the highest scores in the high CES-D score groups were "school" for boys and "family" for girls. The effect of size for the six subscales ranged from 0.17 to 1.76 for both gender groups, and the total scale effect size for boys and girls were 1.28 and 1.42, respectively. The largest effect size among subscales occurred in the "emotional well-being" subscale for both boys (1.76) and girls (1.41).

3.5. *Responsiveness*

Figure 1 shows the ROC curve of the Kiddo-KINDL mean scores. The optimal cut-off score of the Kiddo-KINDL was estimated at 54.7, with an Area Under the Curve (AUC) score of 0.83 (95% CI 0.76 to 0.90, $p < 0.001$). The sensitivity and specificity at this cut-off score were 73.5% and 71.8%, respectively.

3.6. *Interpretability*

A total of 73 adolescents were classified as improved, 69 as stable, and 47 as worse according to the CES-D total scores between test and retest (Table 5). Among adolescents defined as the "improved" group, an increased difference of the Kiddo-KINDL mean total score was 7.4 and effect size was 0.48. For adolescents defined as the "stable" group, the score was almost the same. Among adolescents defined as the "worse" group, a decreased difference of the Kiddo-KINDL mean total scores was –5.2 and effect size was 0.53.

In addition, we classified these data into nine categories in detail (Figure 2). The mean changes in the Kiddo-KINDL scores according to a two-point

Table 3. Internal consistency and intraclass correlations of the Kiddo-KINDL subscales

Subscales	Cronbach's alpha coefficient	Corrected item-total correlation	Cronbach's alpha coefficient if item deleted	ICC (95% Confidence Intervals)[a] between test-retest
	n = 204			n = 189
Physical well-being	0.81	0.62	0.85	0.90 (0.86-0.92)
Emotional well-being	0.82	0.79	0.82	0.93 (0.91-0.95)
Self-esteem	0.83	0.74	0.83	0.94 (0.92-0.96)
Family	0.84	0.71	0.83	0.94 (0.93-0.96)
Friends	0.81	0.65	0.85	0.88 (0.84-0.91)
School	0.73	0.47	0.87	0.93 (0.91-0.95)

[a] ICC: Intraclass correlation coefficient by test-retest at an interval of 10 days.

Table 4. Comparisons of the Kiddo-KINDL scores between CES-D high score and low score groups

	Boys						Girls					
	CES-D score < 16 (n = 92)		CES-D score ≥ 16 (n = 17)		p	Effect size[a]	CES-D score < 16 (n = 74)		CES-D score ≥ 16 (n = 21)		p	Effect size[b]
	Mean	S.D.	Mean	S.D.			Mean	S.D.	Mean	S.D.		
Total	65.5	14.6	45.3	17.1	< 0.001	1.28	64.3	14.9	43.0	15.1	< 0.001	1.42
Subscales												
Physical well-being	61.8	18.9	39.7	19.8	< 0.001	1.14	61.2	17.4	39.0	19.2	< 0.001	1.21
Emotional well-being	69.8	17.7	38.2	18.1	< 0.001	1.76	66.1	20.9	37.8	19.2	< 0.001	1.41
Self-esteem	60.0	23.2	38.2	19.6	< 0.001	1.02	60.3	23.2	35.7	16.4	< 0.001	1.24
Family	76.0	18.3	50.4	25.8	< 0.001	1.16	76.5	20.5	50.9	26.9	< 0.001	1.08
Friends	68.0	18.5	51.8	21.2	0.002	0.82	64.4	19.5	47.0	22.0	0.001	0.84
School	57.4	22.8	53.7	22.3	0.536	0.17	57.4	18.8	47.6	19.0	0.038	0.52

Total and subscale scores are calculated by CES-D high score and low score groups based on cut-off of 16 points in total CES-D score. [a] Effect sizes are calculated from CES-D score < 16 and CES-D ≥ 16 in boys; [b] Effect sizes are calculated from CES-D score < 16 and CES-D ≥ 16 in girls.

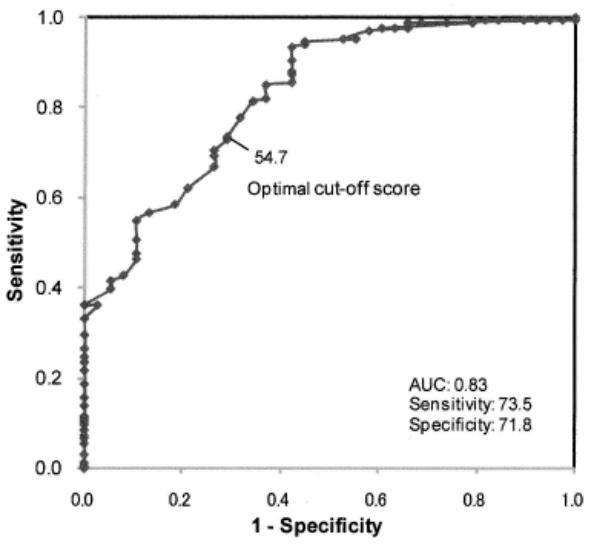

Figure 1. ROC curve of the Kiddo-KINDL mean scores. ROC curve calculated from 204 students. The mean scores of the Kiddo-KINDL were compared between adolescents with and without depressive symptoms.

difference on the CES-D scores are shown for each category. When the score of CES-D was improved (–3 and –2), the mean change in Kiddo-KINDL total scores increased by 4.4 (S.D. 4.6, 95% CI 2.85 to 6.02). Meanwhile, when the score of CES-D was worse (2 and 3), the mean change in Kiddo-KINDL total scores decreased by –4.0 (S.D. 2.9, 95% CI –5.16 to –2.76). We defined that a mean change of 4.0 for two-point CES-D scores was the minimal change.

4. Discussion

Our study results suggest that a Nepalese version of the Kiddo-KINDL could be a reliable and valid assessment tool for measuring HRQOL of Nepalese teenage adolescents. The psychometric properties of the Kiddo-KINDL are sound, and the percent of ceiling and floor effects for the subscales are not regarded to be high because the total scores of the ceiling and floor effects do not exceed 10%. Lamping *et al*. (*19*) have suggested that less than 10% ceiling and floor effects are criteria for acceptability of the scale. The variation

Table 5. Mean change in Kiddo-KINDL total score according to change in CES-D

Change in CES-D score[a]	*n* = 189	Kiddo-KINDL total score				Differences	Effect size[b]
		Test		Retest (10 days)			
		Mean	S.D.	Mean	S.D.		
Improvement	73	52.2	14.7	59.6	14.6	7.4	0.48
Stable	69	63.7	19.6	63.1	19.4	–0.6	0.03
Worsening	47	67.9	10.1	62.7	9.7	–5.2	0.53

[a] Change in health status according to CES-D total scores between test and retest. Improvement for CES-D scores ≤ –2, stable for CES-D scores between –1 and 1, worsening for CES-D scores ≥ 2; [b] Effect sizes are calculated from test and retest at an interval of 10 days.

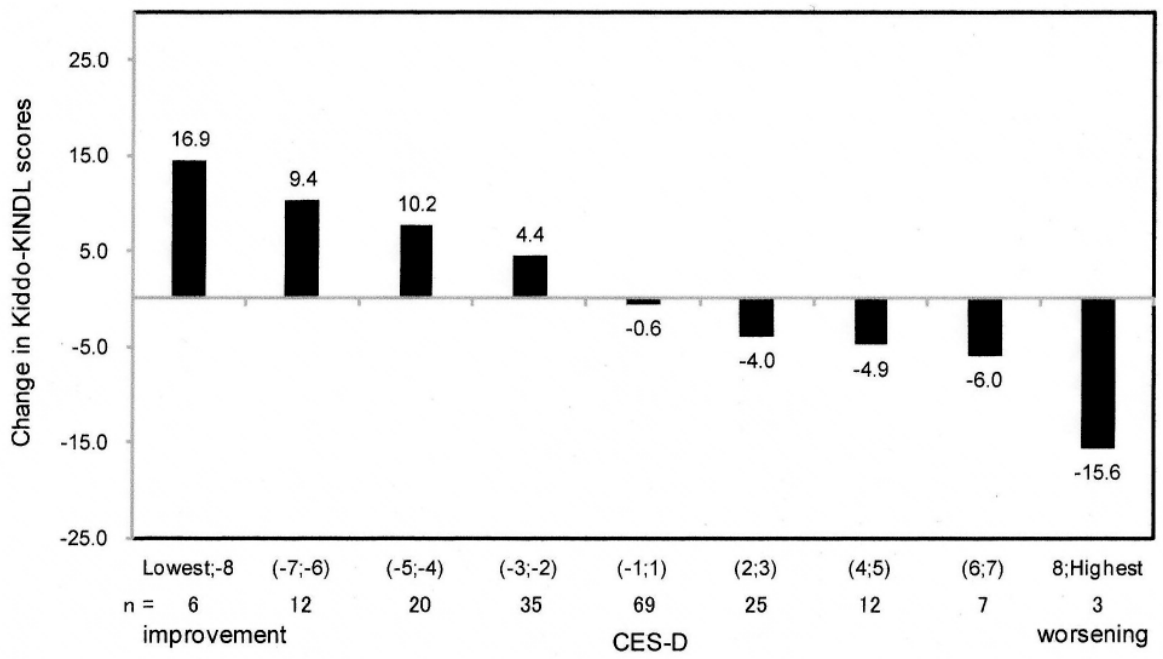

Figure 2. Minimal important difference of the Kiddo-KINDL according to a two-point CES-D score changes. Score between baseline test and 10 days retest. X axis shows extent of change in CES-D score from improvement to worsening between test and retest. Y axis shows mean change in Kiddo-KINDDL total score between test and retest.

of the ceiling and floor effects among the subscales suggests that the instrument is not inclined to distort study findings in one direction or another (*6*,*8*).

"Self-esteem" was the lowest scoring subscale in the overall HRQOL in Nepalese adolescents. Among young people in general, especially during early adolescence, body image and its satisfaction correlates with self-esteem. Girls are more sensitive and dissatisfied with their body (*20*). The "family" subscale score showed a slightly higher ceiling effect compared with the other subscales. This finding was similar to the previous study undertaken using the Kiddo-KINDL in Singapore (*21*). In Nepal, many teenage adolescents, especially girls, remain in the home until their adulthood. Intimacy within domestic relationships and support might have influenced this distributional skew.

Regarding instrument acceptability and usability, the Kiddo-KINDL is short and uses simple grammatical structures with common words, and is therefore easy for teenagers to understand. In our study, there was no missing data and none of the respondents failed to answer any question. Thus, the overall usability and acceptability of the Kiddo-KINDL was considered appropriate.

The Kiddo-KINDL is also reliable, as shown by a high level of Cronbach's alpha coefficient values above 0.70. High values for internal consistency indicates that whole and specific items are mutually consistent (*22*). Corrected item-total correlations indicate the extent to which each item relates to the construct measured by total score. The usual rule of thumb is that an item should correlate with a total score above 0.20 (*23*). A low item-total correlation means the item is slightly correlated with the overall scale and the researcher should consider dropping it. These internal reliability findings refer to the extent to which individual items of the Kiddo-KINDL satisfy scaling criteria as six dimensions in this study.

Assessing reproducibility becomes a defining feature of the precision of the instrument, which assesses the consistency of the repeated measurement. Acceptable test-retest reliability is an ICC of 0.85 (*24*), and the values in this study indicate substantial reproducibility and reliability. According to Marx *et al*. (*25*), a time interval of between two days to two weeks is suitable for test-retest administration. Previous studies on HRQOL have used an interval of one week to 10 days for the test-retest (*26*,*27*).

We used the CES-D in this study to demonstrate the discriminant validity of the Nepalese version of the Kiddo-KINDL. Comparisons based on low and high CES-D score groups showed that the adolescents with depressive symptoms scored lower in HRQOL than adolescents without depressive symptoms. The difference between the mean subscale scores between low and high CES-D score groups was the largest for "emotional well-being". The HRQOL of the adolescents with depressive symptoms tended to be lower in the physical and mental condition domains than for social and human relationship domains. Depression in children and adolescents appears to manifest in somatic symptoms or an emotional disorder in the early phases of the disease; the results from this study are in excellent agreement with this general understanding.

In this study, the subscale of "school" in boys was not statistically different between two groups. The boys with depressive symptoms might have avoided the negative impact of reporting the truth similar to a previous Kiddo-KINDL study among adolescents with diabetes (*8*). This is because parents have higher expectations for the academic performance of their boys than girls in general in Nepal (*28*).

Using the Kiddo-KINDL, we can reflect the features of two different groups appropriately and discriminate those with and without depressive tendencies. The indices are small (d = 0.20), medium (d = 0.50) and large (d = 0.80) (*29*); the results of this analysis in our study show a large effect of size occurring in all subscales except "school". The effect of size is a measure of the strength of the relationship between two variables regardless of sample size. Based on these findings of the Kiddo-KINDL instrument, one can distinguish between groups with and without depressive symptoms by t-test significance. Thus, our result suggests that the Nepalese version of the Kiddo-KINDL has high discriminant validity.

To assess the responsiveness, we first obtained the cut-off score of the Kiddo-KINDL for the CES-D score with ROC analysis. Sensitivity and specificity were acceptably high. The AUC is indexed from 0 to 1, the greater the total AUC from all cut-off points, the greater the instrument's responsiveness (*30*).

Our results indicate that the Kiddo-KINDL is responsive to changes in the CES-D scale. It can discriminate between improvement and worsening in depressive symptoms. We recommended a mean change in Kiddo-KINDL total scores of 4.0 to be used to define a minimal important difference according to two-point CES-D score changes. To assess interpretability in this study, HRQOL changes between test and retest were examined in relation to their benchmark for a minimal important difference, which was the adolescent's depressive tendency in a transition score. Interpretability is concerned with how meaningful are the scores from an instrument (*30*). Therefore, we determined the differences in Kiddo-KINDL scores that may be regarded as the minimal important difference for CES-D scores.

Traditionally, the minimal important difference of HRQOL scales found in patient-reported continuous outcomes, is used to assess chronic disorders (*31*,*32*). Since we did not have sufficient longitudinal data to confirm the minimal important difference in this study, we might go on to an even more detailed examination

of interpretability with clinical intervention followed over time among adolescents with depression.

There are some limitations in this study. First, this is a cross-sectional study based on convenience sampling. Moreover, small sample size and slightly lower response rate (63.8%) of the students is another concern. Therefore, the findings of this study may not be generalized to a larger population of Nepalese adolescents. In particular, one must consider the applicability of HRQOL studies for illiterate young people who do not have opportunities for education and learning, as approximately 19% of children aged between 6 to 10 years old are not in school in Nepal due to extreme poverty (*33*).

Second, the CES-D is a self-rating instrument to identify depressive symptoms during the previous week, and is not a diagnosis tool to identify depression by a suitably trained professional.

Finally, the original Kiddo-KINDL questionnaire included a question for adolescents with long term illness or hospitalization. In this study, we tested the instrument in teenage school adolescents, not in clinical settings. Previous studies have also evaluated the psychometrics of the Kiddo-KINDL with healthy adolescents and adolescents with chronic disease (*6,8,21*).

5. Conclusion

In conclusion, we have validated a Nepalese version of the Kiddo-KINDL to measure the HRQOL of school-attending adolescents. The results of tests of internal consistency, test-retest reproducibility, responsiveness, interpretability, and discriminant validity suggest that the instrument is valid and reliable among school adolescents in Nepal.

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