Qual Life Res (2008) 17:603–611
DOI 10.1007/s11136-008-9328-3

Psychometric evaluation of the Taiwanese version of the Kiddo-KINDL® generic children's health-related quality of life instrument

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Accepted: 4 March 2008 / Published online: 27 March 2008

Abstract
Background Health-related quality of life measures are increasingly being used in evaluating health care outcome around the world. There is a demand for the development of quality of life measures to be used cross-culturally. The aim of this study is to evaluate the psychometric properties of the Taiwanese version of Kiddo-KINDL®, a health-related quality of life questionnaire.
Methods The original German-version of Kiddo-KINDL® was translated into Chinese (Taiwanese) via the forward/backward translation process. Psychometric testing was performed with a national sample of 1,985 healthy students between the ages of 12 and 16. Data were analyzed based on 1,675 usable questionnaires.
Results The reliability coefficients were $\alpha = 0.81$ (overall) and −0.31 to 0.84 for six subscales. The subscales with low Cronbach's α were "school" and "friends." Test–retest reliability was 0.77. Convergent validity was examined with the broadly used Taiwanese version of the Adolescent Depressive Mood Self-Detecting Scale. The result was satisfactory. Construct validity was further examined with exploratory factor analysis. The six-factor solution explained 45.2% of the variance. The construct of Kiddo-KINDL® (Taiwanese version) appeared to be appropriate for measuring health-related quality of life in healthy adolescents.
Conclusions Kiddo-KINDL® (Taiwanese version) is a relatively reliable and valid questionnaire of adolescents' health-related quality of life. However, items in the "school" and "friends" subscales need to be further modified to be more culturally appropriate.

Keywords Adolescents · Psychometric properties · Quality of life

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Introduction

Health-related quality of life has gradually been used as an indicator of health outcome around the world during the last couple of decades. In Taiwan, most of the studies have focused on adults and elders. It is only recently that the quality of life of children and adolescents has received the attention of health professionals [1, 2]. Examining health-related quality of life in adolescents can help to detect their well-being status and identify possible risk factors as well as prevent the impact of the identified risk factors on adolescents' quality of life. Generic and disease-specific measures are the two approaches to using quality of life measures to evaluate the impact of health on adolescents' lives. While disease-specific measures can detect the impact of a specific health problem or its treatment, they cannot assess quality of life for people who are free of disease; thus, the possibility of comparing scores among healthy counterparts is limited. A generic measure can facilitate the interpretation of a quality of life profile by comparing groups with contrasting scores [3]. The generic quality of life measures can also be used in large-scale surveys on health status and health outcome of the general population.

A large body of various generic health-related quality of life instruments for children and adolescents has been

developed in Western countries [4–6]. The Child Health Questionnaire (CHQ), the Pediatric Quality of Life Inventory (PedsQL™), and the KINDL® are the three most broadly used quality of life questionnaires for children and adolescents. The CHQ, developed by Landgraf et al. [7], includes a 50-item parent form (CHQ-PF 50) and an 87-item child form (CHQ-CF 87). It has been validated across cultures in American, Asia, and Europe. However, CHQ is an extensive questionnaire. A shorter instrument with acceptable psychometric properties that is easy to administer and score would be desirable for conducting mass surveys of adolescents' health.

PedsQL™ and the KINDL® questionnaires were the two generic quality of life measures with generic core scales and a variety of disease specific modules. Both of the questionnaires were short, had been translated into different languages, and have been broadly used across different cultures. The PedsQL™ generic core scale was originally developed by Varni et al. [4] in the US for healthy children and adolescents as well as for those with acute or chronic illness. The PedsQL™ generic core scale, quality of life questionnaire has a total of 23 items in four subscales, namely physical, emotional, social, and school functioning. It can be used to assess children between 2 and 18 years of age via self- or parental-proxy reports. Summary scores can be reported as total, physical, or psychosocial health scores. Meanwhile, KINDL® [6], originally developed in Germany, is also a self- or parental-proxy report, a generic quality of life questionnaire consisting of six domains with four items in each domain. It was originally developed for mass health surveys of children and adolescents. The questionnaire is available with self-report and parental-proxy forms for each of the three age groups: Kiddy-KINDL® (4–7 years), Kid-KINDL® (8–11 years), and Kiddo-KINDL® (12–16 years). The α coefficient for the KINDL® total scale was 0.84 and for the subscales between 0.63 and 0.76. Convergent validity was established with well-developed questionnaires, such as subscales from SF-36 and CHQ. Discriminant validity was established between healthy children and children with different diseases, and the sensitivity of KINDL® was also examined [8]. Since the KINDL® user's manual was published in 2000, it has been translated into English, Norwegian, Spanish, French, Japanese, and other languages, and has been broadly used for studies conducted in many countries. The psychometric properties of the English version of the KINDL® were tested and reported in an English-speaking Asian population. The reliability coefficient for the total scale was 0.84, and for the subscales it was between 0.31 and 0.75. Discriminant validity was investigated and established between diabetic and healthy adolescents [9]. Reliability and validity of the English version was tested in Singapore. The Cronbach α was 0.83 for the all 24 items and ranged from 0.44 to 0.84 for each of the six domains [10]. Internal consistency of the Norwegian version was also reported. The Cronbach α was 0.82 for the all 24 items and ranged from 0.53 to 0.78 for each of the six domains [11]. In the Spanish version, good Cronbach's α coefficient was reported on the total scale (>0.70), and acceptable (>0.50) on most of the subscales. The school subscale is the only one that shows poor reliability [12]. Although poorer reliabilities were reported in the English version when tested with an Asian population and in the Spanish version, previous studies have also shown that KINDL® is a valid tool for assessing children's and adolescents' health-related quality of life in Germany and in Norway.

Generic health-related quality of life measures for adolescents in Taiwan are limited. The TQOLQA (Taiwanese Quality of Life Questionnaire for Adolescents) is the only generic measures that had been published. The QOLQA (Quality of Life Questionnaire for Adolescents), originally developed in Japan, is a generic health-related quality of life measure that includes five domains with 70 items. The newly developed TQOLQA by Fuh et al. [1] for assessing quality of life in Taiwanese adolescents consists of 38 items and has seven domains. However, it is not an appropriate measure for a study intended to make cross-cultural comparisons. An appropriate, reliable, and easy to administer and score instrument for measuring and comparing adolescents' quality of life across cultures is in demand.

A person's culture and value systems play a significant role in his or her perception of quality of life. The broadly used definition from the World Health Organization Quality of Life (WHOQOL) Group emphasized the importance of culture and value systems when examining an individual's quality of life. The WHOQOL group defined quality of life as "individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" [13]. Hence, it is very important to transform the abstract concept of quality of life into a culturally appropriate measurable tool [10]. Meanwhile, the growth of multicentered studies conducted across different countries has also increased the need for cross-cultural adaptation of health-related quality of life measures. To be prepared for cross-cultural studies on adolescent's health-related quality of life, it is necessary to perform cross-cultural adaptations of health-related quality of life instruments. Beaton et al. [14] suggested that, when conducting cross-cultural adaptations, one should be concerned about both language and issues of cultural adaptation. Thus, both translation and cultural adaptation are required in adapting cross-cultural self-report measures.

The aim of this study is to evaluate internal consistency, test–retest reliability, convergent, and factorial validities of

the Kiddo-KINDL® (Taiwanese version), a health-related quality of life questionnaire for adolescents aged 12–16 years old.

Methods

Participants

The target population for this study are students in grades 6–9, and freshman in public senior high schools in Taiwan. The total number of students in these grades was 1,264,538. A stratified sampling method was used to represent the target population according to region and grade. A total of 1,985 students at 15 schools were asked to participate in this study. Of these, 198 students refused to participate, and 112 had to be excluded because of incomplete answers on the questionnaire or exclusion criteria (age <12 years). The final sample was 1,675. The study was reviewed and approved by the Institute Review Board of Taipei Medical University. Only students and their parents who agreed to participate in this study were included.

Instruments

Kiddo-KINDL®

In this study, we used the self-report versions of Kiddo-KINDL®. The Kiddo-KINDL® questionnaire was derived from a conceptual model with four main components representing quality of life: psychological well-being, social relationships, physical function, and everyday life activities. This 24-item Likert-scaled questionnaire includes items with both positive and negative wording on physical, emotional, self-esteem, family, friends, and school dimensions (Table 1). Each dimension contains 4 items. The score for each item ranges from 1 (never) to 5 (always); negatively worded items were reverse scored. Total scores were summarized and transformed to a 0–100 scale. Higher scores mean perceptions of a better quality of life.

Taiwanese version of Adolescent Depressive Mood Self-Detecting Scale (ADMSS)

Previous studies have revealed the correlation between depression and perceived quality of life [15–17]. The better the perceived quality of life in adolescents, the less depressed they felt. Thus, we use the Taiwanese version of the ADMSS as a criterion to examine the convergent validity of the Kiddo-KINDL, Taiwanese version. The ADMSS is a broadly used self-reported questionnaire in Taiwan for screening the depressive mood status of adolescents aged 13–18 years old. This 20-item questionnaire examines the symptoms that last more than 2 weeks in four dimensions: emotion, physiological, behavior, and cognitive. One standard deviation higher than the normal mean indicates that the respondent was at the border line of high risk for developing depression. We expected the higher score the adolescent reported on ADMSS, the lower score they reported on health-related quality of life. The ADMSS showed a good internal consistency (Cronbach $\alpha = 0.87$) and a fairly good convergent validity in a sample of 4,944 respondents [18].

Table 1 Items in Kiddo-KINDL® Taiwanese version

Physical well-being
1. I felt ill.
2. I was in pain.
3. I was tired and worn out.
4. I felt strong and full of energy.
Emotional well-being
5. I had fun and laughed a lot.
6. I was bored.
7. I felt alone.
8. I felt scared or unsure of myself.
Self-esteem
9. I was proud of myself.
10. I felt on top of the world.
11. I felt pleased with myself.
12. I had lots of good ideas.
Family
13. I got on well with my parents.
14. I felt fine at home.
15. We quarreled at home.
16. I felt restricted by my parents (or primary caretaker).
Friends
17. I did things together with my friends.
18. I was a "success" with my friends.
19. I got along well with my friends.
20. I felt different from the others.
School
21. Doing my schoolwork was easy.
22. I felt lessons were interesting.
23. I worried about my future.
24. I worried about getting bad marks.

Translation of the Kiddo-KINDL®

The translation procedures were as follows. First, two independent forward translations and a rating of the translation quality followed by a reconciliation meeting for a single developmental forward version. The Kiddo-KINDL®

was first translated into Mandarin Chinese (Taiwanese) by two native Taiwanese speakers who are also fluent in German but not familiar with the Kiddo-KINDL® questionnaire. They were also asked to rate the level of difficulty regarding translation. Both of them rated the translation to be as easy as possible except for item 11 ("I felt pleased with myself"), which needed carefully selected words. The next step was to rate the quality of translation. Two native Germans who are familiar with Chinese were asked to rate the quality of the translation (0 = no good at all, 100 = perfect) and to propose appropriate phrases or sentences if they thought the first translation was not acceptable. Their mean rating of the translation quality was 83.41. Second, back-translation of the reconciled forward version was done by two native Germans who are familiar with Chinese. Third, the reconciled back-translation was sent back to the developer of the German Kiddo-KINDL®. A telephone reconciliation meeting was conducted with the principal developer, investigators, and one of the back-translators. Finally, two focus group discussions were held with 16 students to check their understanding of the items on the final version.

Cultural adaptation

Traditional translation methodologies such as forward and backward translation with psychometric testing can no longer fulfill the cultural adaptation requirements of health-related quality of life instruments. Conceptual equivalence is a matter of concern and needs to be carefully examined. Methods to examine conceptual equivalence include consultation with experts and qualitative investigations, such as focus groups. We examined the cultural appropriateness of Kiddo-KINDL® from the Taiwanese perspective. Two elementary and junior high school teachers were invited to assess the appropriateness of the content in the Taiwanese version of Kiddo-KINDL® questionnaire for adolescents in Taiwan in terms of language used and culture relevance. Items on the Kiddo-KINDL® questionnaire were subsequently checked by two focus group discussions (8 girls and 8 boys, aged 12–16 years old) for their understanding of the meaning. Each focus group discussion lasted for about 40 min. Participants were also asked to identify words or phrases that they found difficult, irrelevant, or ambiguous and to suggest alternatives for these problematic items, words, or phrases. The focus group participants suggested several items that needed to be more carefully worded or needed clarification. For example, it was unclear to the students whether the item "I felt ill" was a physical or psychological construct. "I was proud of myself" was taken as a negative construct. "I had lots of good ideas" was unclear as to whether those ideas had been approved by others. "We quarreled at home" was taken as quarrels among family members other than the student. In discussing "I felt restricted by my parents," it was pointed out that some of the students were not living with their parents. "I felt different from the others" was unclear; the students did not know if it was a positive or negative construct. We reworded some of these items and consulted the developer of original German KINDL® and experts who are familiar with adolescents' language. For example, "I felt restricted by my parents" was reworded as "I felt restricted by my parents (or primary caretaker)."

Methods of analysis

Cronbach's α was calculated to examine the internal consistency of the questionnaire. We performed item-to-item correlation to examine the contribution of each item and to check any redundancy. Inter-item correlations between 0.30 and 0.70 were considered to be acceptable. Correlation above 0.70 suggested a redundancy. Ceiling and floor effects were computed for global and subscales of Kiddo-KINDL®. Test-retest reliability was examined in 134 adolescents in the city of Taipei who agreed to participate twice in the quality of life measures with an interval of 14–21 days. Of the 134 participants, 128 completed both the test and retest questionnaires. Reliability coefficients above 0.70 were considered to be satisfactory [19]. Convergent validity of the Kiddo-KINDL® (Taiwanese version) was measured by Pearson correlation coefficient between the scores of Kiddo-KINDL® (Taiwanese version) and the ADMSS. Factorial validity was assessed with exploratory factor analysis. The principal-axis method with promax rotation was applied.

Results

Descriptive analysis

A total number of 1,675 students (grades 6–10) completed the Kiddo-KIDNL® (Taiwanese version) questionnaires (male 53.2%, female 46.8%). Age distribution was as follows: 12-year-olds (17.1%); 13-year-olds (23.6%); 14-year-olds (26.0%); 15-year-olds (19.8%); and 16-year-olds (13.5%).

Table 2 presents the mean standard deviations of Kiddo-KINDL (Taiwanese version) in boys, girls, and in different age groups. Boys perceived better quality of life in total scale ($P = 0.005$), physical ($P = 0.000$), emotional ($P = 0.001$), and self-esteem ($P = 0.018$) subscales but poorer quality of life in the friends subscale ($P = 0.006$) than did the girls. Significant statistical differences were revealed among the different age groups on total scale ($P = 0.001$) and on the physical ($P = 0.000$), emotional

Table 2 Mean and SD for the sex and age on each item of Kiddo-KINDL® ($n = 1,675$)

Variable	Item		Total	*P*-value	Physical	*P*-value	Emotional	*P*-value	Self-esteem	*P*-value	Family	*P*-value	Friends	*P*-value	School	*P*-value
Sex	Boys	Mean	58.4	0.005	65.6	0.000	67.1	0.001	47.9	0.018	63.3	0.973	58.1	0.006	48.3	0.762
	$n = 887$	SD	11.6		17.3		19.0		22.9		18.9		16.4		12.7	
	Girls	Mean	56.9		59.7		64.2		45.4		63.3		60.3		48.6	
	$n = 784$	SD	10.9		16.7		19.0		21.1		18.7		15.2		11.9	
Age	a: 12 year	Mean	58.9	0.001	64.6	0.000	70.6	0.000	44.8	0.009	65.3	0.014	59.5	0.610	49.1	0.244
	$n = 282$	SD	11.9	a > d	17.6	a > d	17.8	a > d	23.6	a < e	18.5	a > d	17.5		13.6	
	b: 13 year	Mean	57.7	c > d	63.9	b > d	67.3	a > e	44.9		63.9		58.7		47.4	
	$n = 393$	SD	11.2		15.9		18.9	b > d	20.8		19.5		16.2		13.2	
	c: 14 year	Mean	58.6		64.4		66.9	c > d	47.7		63.7		60.0		48.9	
	$n = 433$	SD	10.9		16.8		18.6		22.0		18.3		15.7		11.6	
	d: 15 year	Mean	55.5		59.0		60.4		46.6		60.3		58.4		48.2	
	$n = 331$	SD	11.0		18.4		19.6		22.1		18.7		14.8		12.3	
	e: 16 year	Mean	58.0		61.5		63.3		50.8		63.9		59.6		49.1	
	$n = 226$	SD	10.7		17.0		18.1		21.9		18.2		14.6		10.1	

($P = 0.000$), self-esteem ($P = 0.009$), and family subscales ($P = 0.014$). The 12-year-old group had a better perception of their quality of life than the 15-year-old group did on the total scale and on the physical, emotional, and family subscales, but they scored lower than the group of 16-year-olds on the self-esteem subscale.

Internal consistency

The observed reliability coefficient was 0.81. The Cronbach's α of six subscales ranged from −0.31 to 0.84, with a mean of 0.61 (Table 3). Item-to-item correlation coefficients were calculated and the range was between 0.17 and 0.50 (Table 4). The floor and ceiling effects were generally below 10%. The test–retest reliability over a 14- to 21-day interval was 0.77 ($P < 0.001$) for the Kiddo-KINDL® global score and were between 0.43 and 0.74 ($P < 0.001$) for Kiddo-KINDL® subscales (Table 5).

Validity

The convergent validity was also established; the Kiddo-KINDL® global and subscales were negatively correlated with the scores of the Taiwanese version of the ADMSS (Table 4). Coefficients ranged from $r = -0.27$ (KINDL School, KINDL Self-esteem) to $r = -0.59$ (KINDL Total).

Table 3 Structure of subscales and reliability of Kiddo-KINDL® ($n = 1,675$)

Scale	No. of items	Mean	SD	Floor (%)	Ceiling (%)	α
Total	24	57.68	11.25	0.1	0.1	0.81
Physical	4	62.80	17.27	0.1	2.7	0.64
Emotional	4	65.76	19.02	0.4	3.6	0.72
Self-esteem	4	46.70	22.09	2.9	3.2	0.84
Family	4	63.31	18.79	0.3	2.4	0.67
Friends	4	59.17	15.87	0.1	0.5	0.46
School	4	48.43	12.32	0.1	0.1	−0.31

Table 4 Correlations among the six subscales, total scale of Kiddo-KINDL, and Taiwanese version ADMSS ($n = 1,675$)

	1	2	3	4	5	6	7	8
1. Physical		0.50	0.23	0.27	0.22	0.18	0.63	−0.48
2. Emotional			0.28	0.36	0.43	0.17	0.74	−0.54
3. Self-esteem				0.22	0.30	0.35	0.67	−0.27
4. Family					0.24	0.24	0.62	−0.39
5. Friends						0.19	0.61	−0.30
6. School							0.50	−0.27
7. Total scale								−0.59
8. ADMSS								

Table 5 Test–retest reliability of Kiddo-KINDL® ($n = 128$)

Item	Test–retest reliability
Total	0.77
Physical	0.56
Emotional	0.66
Self-esteem	0.74
Family	0.74
Friends	0.55
School	0.43

Exploratory factor analysis was used to examine the construct validity. The Kaiser-Meyer-Olkin (KMO) value for all 24 items was 0.84, which showed that those items were highly correlated. Result from Bartlett's test was $P < 0.001$. Both statistics showed that the test data were appropriate for conducting factor analysis. Principal-axis factoring for the total group resulted in six eigen values above 1.00: 5.38, 2.67, 1.76, 1.55, 1.35, and 1.07. Table 6 showed the pattern matrix for the six-dimensional promax solution. We eliminated items with coefficients less than 0.40 in each of the factors to make the table clearer and reported the eliminated items in the next section instead.

1. On Factor 1, the items of the "Self-esteem" factor were loaded with coefficients from 0.56 to 0.91. The interpretation is slightly weakened by 22 ("I felt lessons were interesting") with loadings of 0.26.
2. Except for item 20 ("I felt different from the others"), the "Friends" factor items loaded substantially (0.68–0.78) on factor 2. However, the loadings of items 5 ("I had fun and laughed a lot") and 21 ("Doing my schoolwork was easy") with coefficients of 0.39 and 0.20 upset this interpretation.
3. The "Family" item loaded substantially on factor 3, which legitimates a corresponding interpretation of the factor. However, the loading of item 21 ("Doing my schoolwork was easy") and 22 ("I felt lessons were interesting") with coefficients of 0.30 and 0.26 slightly disturb this interpretation.
4. Factor 4 is a "Physical" factor (coefficients from 0.48 to 0.78), but item 8 ("I felt scared or unsure of myself") had low loadings (0.24) on this factor.

Table 6 Pattern matrix of Kiddo-KINDL® Taiwanese version

Subscale (item of no.)	Factor (total variance %)					
	Factor 1 (20.4%)	Factor 2 (9.0%)	Factor 3 (5.4%)	Factor 4 (4.3%)	Factor 5 (3.5%)	Factor 6 (2.6%)
Self-esteem						
11.	0.912					
10.	0.826					
9.	0.773					
12.	0.561					
Friends						
17.		0.779				
19.		0.755				
18.		0.684				
Family						
13.			0.811			
14.			0.712			
15.			0.490			
16.			0.410			
Physical well-being						
1.				0.780		
2.				0.747		
3.				0.476		
Emotional well-being						
6.					1.003	
7.					0.562	
School						
24.					.	0.776
23.						−0.690

Extraction method: principal-axis factoring. Rotation method: promax

5. Factor 5 is an "Emotional" factor with loadings of 0.56 and 1.00. However, the item 8 ("I felt scared or unsure of myself") and 20 ("I felt different from the others") had moderate to low loading on this factor as well.
6. Factor 6 is a "School" factor characterized by items about worries and the future loading with −0.69 and 0.78 while other "school" items loaded only −0.01 and −0.20.

Discussion

The Cronbach's α coefficient varied greatly across six subscales of the Kiddo-KINDL® (Taiwanese version). For the newly translated Taiwanese Kiddo-KINDL®, the acceptable reliability was set at an α level of 0.65 [20]. The Cronbach's α coefficient for the total score of KINDL® was 0.81. Only three subscales of Taiwanese Kiddo-KINDL® meet the acceptable reliability: emotional well-being ($\alpha = 0.72$), self-esteem ($\alpha = 0.84$), and family ($\alpha = 0.67$). The other three subscales KINDL®, namely, physical well-being ($\alpha = 0.64$), friends ($\alpha = 0.46$), and school ($\alpha = -0.31$) showed low reliability.

The "Friends" subscale in the Taiwanese version of Kiddo-KINDL® showed low internal consistency ($\alpha = 0.46$). As Wee et al. [9] suggested, item 20 ("I felt different from the others") may be a positive construct for Asian children rather than a negative construct as it is for European children. We recalculated internal consistency with treating item 20 as a positive construct. The Cronbach's α increased from 0.46 to 0.62. Our result was somewhat similar to Wee's study in Singapore, which suggested that item 20 might be a positive construct for Asian students. On the other hand, as in Helseth and Lund's [11] study, the internal consistency (Cronbach's α) of the "Friends" subscale increased from 0.58 to 0.62 when item 20 was deleted. We also recalculated the internal consistency (Cronbach's α) of the "Friends" subscale after eliminating item 20 based on factor analysis. The Cronbach's α increased from 0.46 to 0.76, indicating that item 20 may not be in the same construct of the "Friends" subscale. Deleting item 20 from the "Friends" subscale might be a solution for building a stronger measure of the "friends" construct.

The psychometric property reports from both the Spanish version and English version tested on an Asian population revealed the "school" subscale a lower Cronbach's α than other subscales. In the Taiwanese version, an unusual negative Cronbach's α was revealed in the "School" subscale ($\alpha = -0.31$). We checked the data again to make sure there were no data entry errors and to make sure data were reversely coded as instructed in the KINDL manual. We then suspected that item 24 ("I worried about getting bad marks") might be the issue. Children's academic achievement is given a more central role in some cultures than in others. In Asian countries, such as Taiwan, personal advancement is closely linked to one's level of education, and, therefore, a great emphasis was put on one's academic achievement. Taiwanese students must go through a series of rigorous entrance exams in order to get into top universities, and thus they are very competitive in their academic performance. Adolescents are at a critical period of time regarding their academic achievement [21]. Item 24 in the "School" subscale was the only item that concerned academic performance. It was originally designed as a reverse-coding item in the German Kiddo-KINDL®. In consideration of the Taiwanese culture of academic performance, we decided not to reverse the coding as suggested in the KINDL® manual [8], and the internal consistency on the school subscale increased dramatically ($\alpha = 0.49$).

Herdman et al. [22] proposed a model of equivalence in the cultural adaptation of health-related quality of life measures. In their model, they suggest that six areas of equivalence be carefully examined during the adaptation process: (1) conceptual equivalence, (2) item equivalence, (3) semantic equivalence, (4) operational equivalence, (5) measurement equivalence, and (6) functional equivalence. We have followed this model and carefully examined the equivalences between the two versions of Kiddo-KINDL®. We did not detect any possible opposite constructs for adolescents between the two cultures during the focus group and expert consultations. Furthermore, the Cronbach's α of the "School" subscale increased again to 0.68 upon eliminating items 21 ("Doing my schoolwork was easy") and 22 ("I felt lessons were interesting"). Although the "School" subscale in the Taiwanese version of Kiddo-KINDL® was considered to be cross-culturally problematic, the value and necessity of a cross-cultural, usable questionnaire with both cultural and language adaptation cannot be ignored [23]. More work is needed to examine the school items in the Taiwanese version of the Kiddo-KINDL® in terms of the construct and scoring system. In-depth discussion in the focus group focusing on scoring directions (positive or negative construct) of items might be able to prevent this kind of issues.

The other factor that contributed to the negative internal consistency of the "School" subscale may be twofold: the internal and external focal points in one subscale. Helseth and Lund [11] suggested that three of the items (items 21, 23, and 24) in the "School" subscale tended to evaluate the respondent's perceived self-mastery and worries regarding academic performance while item 22 may be more externally focused. It contains a more complex opinion regarding school lessons. In our study, item 22, "I felt lessons were interesting," can be interpreted as asking if

they could "enjoy" the lessons. However, some may take it as assessing the quality of teaching. One item with a twofold perspective might make it difficult for the adolescent to synthesize the complex experiences associated with school. Finally, it is possible that the word "interesting" may confuse adolescents. More work is needed on the studies of how the "Family" or "School" subscales function among Taiwanese adolescents before any changes in the scoring system can be recommended.

Cultural values in Taiwan and Singapore are both influenced by traditional Chinese culture. Although the measurements were done with versions of Kiddo-KINDL® in two different languages, we compared adolescents' self-perceived quality of life in Taiwan (Taiwanese version) and in Singapore (English version) [10]. Adolescents in Taiwan perceived they had a better quality of life in both self-esteem (46.7 vs 39.7) and the school dimension (48.4 vs 41.4) and a poorer quality of life in the "family" dimension (63.3 vs 68.3) than their counterparts in Singapore. On the other hand, both female and male adolescents in Taiwan reported lower quality of life scores than their peers in Germany [8]. While further study may be needed to examine possible cultural differences between Taiwan and Germany, efforts should be put into improving adolescents' health-related quality of life in Taiwan.

Test–retest reliability was 0.77. This is higher than the report in Ravens-Sieberer and Bullinger's [24] study. However, the test–retest reliability of the "Physical," "Friends," and "School" subscales are lower that the other subscales, with the "School" subscale being the lowest. A possible reason contributing to the low stability is that the retest was conducted close to final exams, and students may experience school and friends differently at that time.

Exploratory factor analysis was conducted to establish construct validity. Factors that loaded greater than 0.4 were selected. Most of the items are clustered in the selected factor; only a few items were clustered at the same time in two different factors. However, the result showed that six factors explained 45.2% of variance. Although not all six of the factors matched to the structure of the original questionnaire, the related characteristics among clustered items showed the purpose of factor analysis. This indicated acceptable construct validity in the Taiwanese version of Kiddo-KINDL®.

There are a couple of limitations to our study. First, no discriminate validity or predicted validity was established; a future study should focus on the sensitivity and specificity test between adolescents with and without disease. Interventional study can also examine the outcome of intervening on health-related quality of life [8]. Second, some subscales on Kiddo-KINDL® (Taiwanese version) showed low reliability. The major reason could be the homogeneity of sample (all from public schools and half of the sample are between ages 13 and 14 year olds) or that reliability could not be established among Asian students [9]. Further investigation of internal consistency reliability is recommended in a more heterogeneous sample. In addition to the actual exploratory factor analysis, which can only offer hints on the appropriateness of the theoretical measurement model, further examination using means of confirmatory factor analysis could be applied to explicitly test the Goodness of fit on the 6-dimensional measurement model of KINDL for Taiwanese adolescents self-reported health-related quality of life.

Conclusion

Our results indicated good reliability on the total scale of the Taiwanese version of Kiddo-KINDL®. However, low internal consistency was observed in two subscales, "Friends" and "School." With un-reversed coding of item 24 and eliminating items 20–22 it is possible to increase the internal consistency of subscales. Convergent validity was satisfactory. Exploratory factor analysis explained 45.2% of variance. More studies are needed to prove the psychometric properties of the Taiwanese version of Kiddo-KINDL® before it can be broadly used.

Acknowledgements We would like to extend sincere appreciation to the people who participated in the study. Thanks also to the College of Nursing, Taipei Medical University (TMUN-094-001) in Taiwan, who funded the study.

References

1. Fuh, J. L., Wang, S. J., Lu, S. R., & Juang, K. D. (2005). Assessing quality of life for adolescents in Taiwan. *Psychiatry & Clinical Neurosciences, 59*(1), 11–18.
2. Yeh, C. H., & Hung, L.C. (2003). Construct validity of newly developed quality of life assessment instrument for child and adolescent cancer patients in Taiwan. *Psycho-Oncology, 12*(4), 345–356.
3. Bullinger, M., Petersen, C., Schmidt, S., Baars, R. M., & The DISABKIDS Group. (2002). European pediatric health-related quality of life assessment. *Quality of Life Newsletter, 29*, 5–6.
4. Varni, J. W., Seid, M., & Kurtin, P. S. (2003). The PedsQoL™ 4.0: Reliability and validity of the Pediatric Quality of Life Inventory™ Version 4.0 Generic Core Scales in healthy and patient populations. *Medical Care, 39*, 800–812.
5. Landgraf, J. M., Maunsell, E., Nixon-Speechley, K., et al. (1998). Canadian-French, German, and United Kingdom versions of the Child Health Questionnaire (CHQ-PF50): Methodology and preliminary item scaling results. *Quality of Life Research, 7*(5), 433–445.
6. Ravens-Sieberer, U., & Bullinger, M. (1998). Assessing health-related quality of life in chronically ill children with the German KINDL: First psychometric and content analytical results. *Quality of Life Research, 7*(5), 399–407.
7. Landgraf, J. M., Abetz, L., & Ware, J. E. (1999). *The CHQ user's manual* (2nd ed.). Boston: HealthAct.

8. Ravens-Sieberer, U., & Bullinger, M. (2000). Manual of KINDL® questionnaire for measuring health-related quality of life in children and adolescents - revised version. Retrieved October 9, 2006, from http://www.kindl.org/fragebogenE.html.
9. Wee, H. L., Lee, W. W. R., Ravens-Seiberer, U., Erhart, M., & Li, S. C. (2005). Validation of the English version of the KINDL R generic children's health-related quality of life instrument for an Asian population – results from a pilot study. *Quality of Life Research, 14*, 1193–1200.
10. Wee, H. L., Ravens-Sieberer, U., Erhart, M., & Li, S. C. (2007). Factor structure of the Singapore English version of the KINDL® children quality of life questionnaire. *Health & Quality of Life Outcomes, 5*(4), 1–8.
11. Helseth, S., & Lund, T. (2005). Assessing health-related quality of life in adolescents: Some psychometric properties of the first Norwegian version of KINDL®. *Scandinavian Journal of Caring Sciences, 19*(2), 102–109.
12. Fernandez-Lopez, J. A., Fernandez Fidalgo, M., Cieza, A., & Ravens-Sieberer, U. (2004). Measuring health-related quality of life in children and adolescents: Preliminary validation and reliability of the Spanish version of the KINDL questionnaire. *Atencion Primaira, 33*(8), 434–442.
13. The WHOQOL Group. (1995). The world health organization quality of life assessment (WHOQOL): Position paper from the world health organization. *Social Science & Medicine, 41*(10), 1403–1409.
14. Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-reported measures. *Spine, 25(*24), 3186–3191.
15. Berle, J., & McKenna, S. P. (2004). Quality of life in depression scale: Adaptation and evaluation of the psychometric properties of the Norwegian version. *Journal of Psychiatry, 58*(6), 439–446.
16. Goldney, R. D., Fisher, L. J., Grande, E. D., & Taylor, A. W. (2004). Subsyndromal depression: Prevalence, use of health services and quality of life in Australian population. *Social Psychiatry Psychiatric Epidemiology, 39*, 293–298.
17. Wegener, S., Redoblado-Hodge, M. A., Lucas, S., et al. (2005). Relative contribution of psychiatric symptoms and neuropsychological function to quality of life in first-episode psychosis. *Australian and New Zealand Journal of Psychiatry, 39*, 487–492.
18. John Tung Foundation. (2006). *The develop of Adolescent Depressive Mood Self-Detecting Scale (ADMSS) and it's reliability, validity and index scores*. Taipei: John Tung Foundation.
19. Polit, D. E., & Beck, C. T. (2004). Assessing data quality. In D. E. Polit & C. T. Beck (Eds.), *Nursing research: Principle and methods* (7th ed.). Philadelphia: Lippincott Williams & Wilkins.
20. Carmines, E. G., & Zeller, R. A. (1979). *Reliability and validity*. Thousand Oak, CA: Sage publications.
21. Tsao, Y. L. (2004). A comparison of American and Taiwanese students: Their math perception. *Journal of Instructional Psychology, 31*(3), 206–213.
22. Herdman, M., Fox-Rushby, J., & Badia, X. (1998). A model of equivalence in the cultural adaptation of HRQoL instruments: The universalist approach. *Quality of Life Research, 7*, 323–335.
23. Guillemin, F., Bombardier, C., & Beaton, D. (1993). Cross-cultural adaptation of health-related quality of life measures: Literature review and proposed guidelines. *Journal of Clinical Epidemiology, 46*(12), 1417–1432.
24. Ravens-Sieberer, U., & Bullinger, M. (2001). The revised KINDL-R: Final results on reliability, validity and responsiveness of a modular HRQOL instrument for children and adolescents. *Quality of Life Research, 10*(3), 199.