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BRIEF COMMUNICATION

# Confirmatory factor analysis of the PedsQL among youth in a residential treatment setting

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**Abstract**
*Purpose* The Pediatric Quality of Life assessment (PedsQL$^{TM}$) is the most widely used measure for assessing adolescent health-related quality of life (HRQoL). While youth in residential treatment facilities face many physical and mental health, behavioral, education, and familial challenges that could impact their HRQoL, no research has sought to assess the factor structure of the PedsQL$^{TM}$ among youth receiving residential care.
*Methods* High school–aged youth ($N = 229$) attending a large residential treatment center in Omaha, NE were recruited to complete a data collection packet comprised of various health assessments including the PedsQL. Four competing confirmatory factor analysis models were used to test the hypothesized internal structure of the PedsQL$^{TM}$ 4.0 Teen Report.
*Results* Models A, B, and C had acceptable CFI ($\geq$.90), TLI ($\geq$.90), and RMSEA ($\leq$.08) fit indicators. However, factor loadings for items 5 and 6 were problematic. After removing the two problematic items, Model D was fit to the data and proved to be the superior of the four models. This model included two first-order factors (physical health problems; school attendance problems) and one second-order factor (psychological health problems).
*Conclusions* The findings suggest that researchers and practitioners studying youth in residential settings can reliably use the PedsQL$^{TM}$ to assess their HRQoL.

**Keywords** Quality of life · Health · Adolescent · Residential treatment

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## Introduction

Adolescent health-related quality of life (HRQoL) can be defined as the subjective perception of health status on psychological, physical, and social functioning [1]. Much research on HRQoL has been conducted during the past 25 years, including studies looking at its connection to various physical and mental health problems among a variety of populations and subgroups [2–4]. According to the Institute of Medicine, assessing and improving HRQoL is crucial to helping individuals with serious health issues live well [5].

HRQoL is a particularly relevant construct for adolescents in residential care settings. These youths often struggle with a variety of unique challenges (e.g., history of maltreatment, high residential mobility, legal concerns, etc.) that distinguish them from adolescents in typical community settings [6, 7]. Furthermore, they have increased physical and mental health risks that could undermine QoL. Specifically, upon entry to care these youths demonstrate high rates of physical health needs,

high rates of chronic illnesses, and high rates of psychotropic medication use [8]. As residential care organizations often seek to improve youth functioning across domains (e.g., psychological, behavioral, medical, etc.), assessing HRQoL could be an important component of more comprehensive assessments of youth functioning in these settings.

The Pediatric Quality of Life assessment (PedsQL$^{TM}$) 4.0 Teen Report is the most well-known, established, and widely used measure of pediatric HRQoL, making it an ideal instrument for psychometric evaluation among youth in residential care. It has been well received by the academic community as a measure of adolescent HRQoL and has been cited in over 600 published research articles [9]. In numerous studies among various populations, it has been found to be a reliable and valid measure of HRQOL [9–11]; however, its factor structure has never been empirically evaluated among youth living in residential care. The purpose of this study was to assess the factor structure of the PedsQL$^{TM}$ among youth in a residential treatment setting. Based on its performance among other medically vulnerable and at-risk populations [12, 13], we hypothesized that the factor structure of the PedsQL$^{TM}$ would be adequate when used among youth in residential care. Such a finding would give clinicians and researchers confidence that the PedsQL$^{TM}$ can be validly and reliably used with this uniquely vulnerable population.

## Methods

### Participants and procedures

The Institutional Review Boards of the University of Nebraska-Lincoln and the participating residential treatment organization approved this project and all its procedures. High school–aged youths living at a large residential treatment facility in Omaha, NE, were recruited for one-time data collection that would take place during a school day. Of the 333 youth (ages 14–19) who were contacted, 240 expressed interest in participating. Permission for the students to participate in the study was then solicited and received from each student's family teachers (i.e., a married couple who lives with youth during their time in treatment). Trained data collectors worked with school staff to remove students from a non-core class during the school day. Youths were then read an assent form, a HIPPA form, and given an opportunity to ask questions. Assenting youth then completed the study packet that included the PedsQL$^{TM}$ 4.0 Teen Report HRQoL assessment. Since 11 interested youths were discharged before data collection, the final sample consisted of 229 youth.

### Analysis plan

Mplus v6 [14] was used to test the internal structure of the PedsQL$^{TM}$ version 4.0 Teen Report by estimating four competing confirmatory factor analysis (CFA) models that have been previously established for different populations of youth [15–18]. Model A (Fig. 1) was specified with four first-order latent factors (physical health problems, emotional problems, social problems, and school problems) [15]. Model B (Fig. 2) was specified with five first-order factors [16, 17]. For this model, the school problems' factor was divided into two factors: school problems (three items) and school absences due to health issues (2 items). Model C (Fig. 3) was specified with five first-order factors and one second-order factor (psychological health problems) measured by the emotional, social, and school problems latent factors [18]. Model D (Fig. 4) was a modified version of Model C with the lowest loading factors, items 5 and 6, omitted from the model.

The effects-coding method [19] was used to identify the CFA model and scale the latent variables (i.e., unstandardized factor loadings were constrained to average one). Weighted least squares (WLSMV) were used to estimate the CFA models. Missing data were minimal (covariance coverage exceeded 99 % for all bivariate covariances) and were treated as *missing at random*. The fit of the CFA models was evaluated using the comparative fit index (CFI) [20], Tucker–Lewis Index (TLI) [21], and the root mean square error of approximation (RMSEA) [22]. Acceptable fitting models have CFI and TLI values $\geq$.90 and RMSEA values between .06 and .08 [23, 24]. Since traditional approaches to evaluating non-nested models such as the Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC) are based on the maximum likelihood function, we relied upon an examination of the fit indicators and the factor loadings of the items to inform model evaluation.

## Results

PedsQL$^{TM}$ items-level data were positive-skewed (.139–8.61) and tended to be kurtotic (−.537 to 72.956; i.e., almost all youth rated the items with the same low-response categories). The most extreme case of restricted range in response usage was for item 5 for which 98.7 % of youth rated the items using the *Never* category; the other 1.3 % of youth rated the item using the *Almost Never* category. Item means were also quite low ranging from .01 to 1.50 (on a scale from 0 to 4). Low item means may represent a possible floor effect where most youth report few QoL health problems.

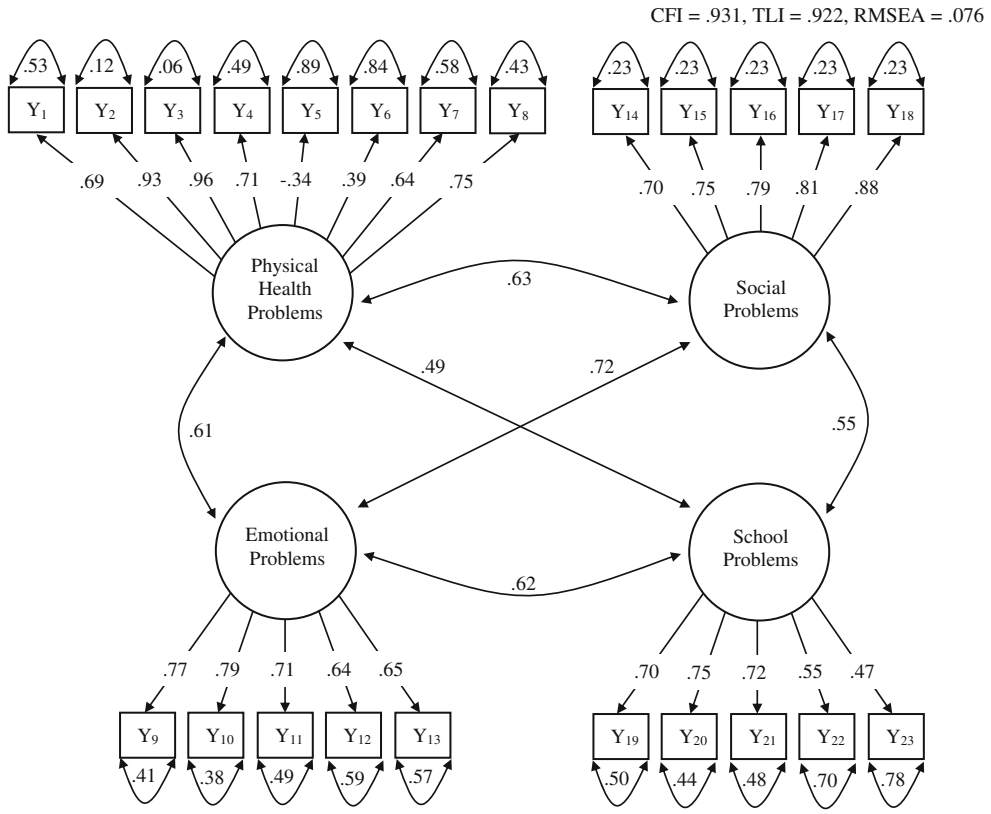


**Fig. 1** Model A (four-factor model)

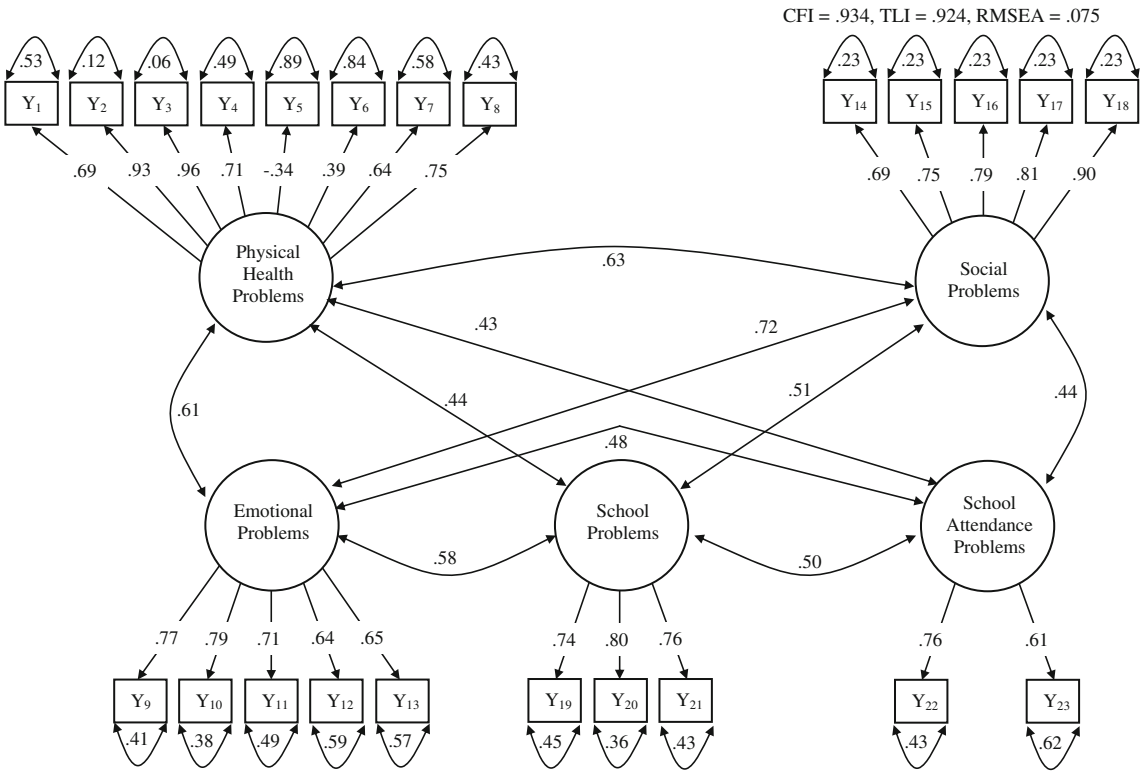


**Fig. 2** Model B (5-factor model)

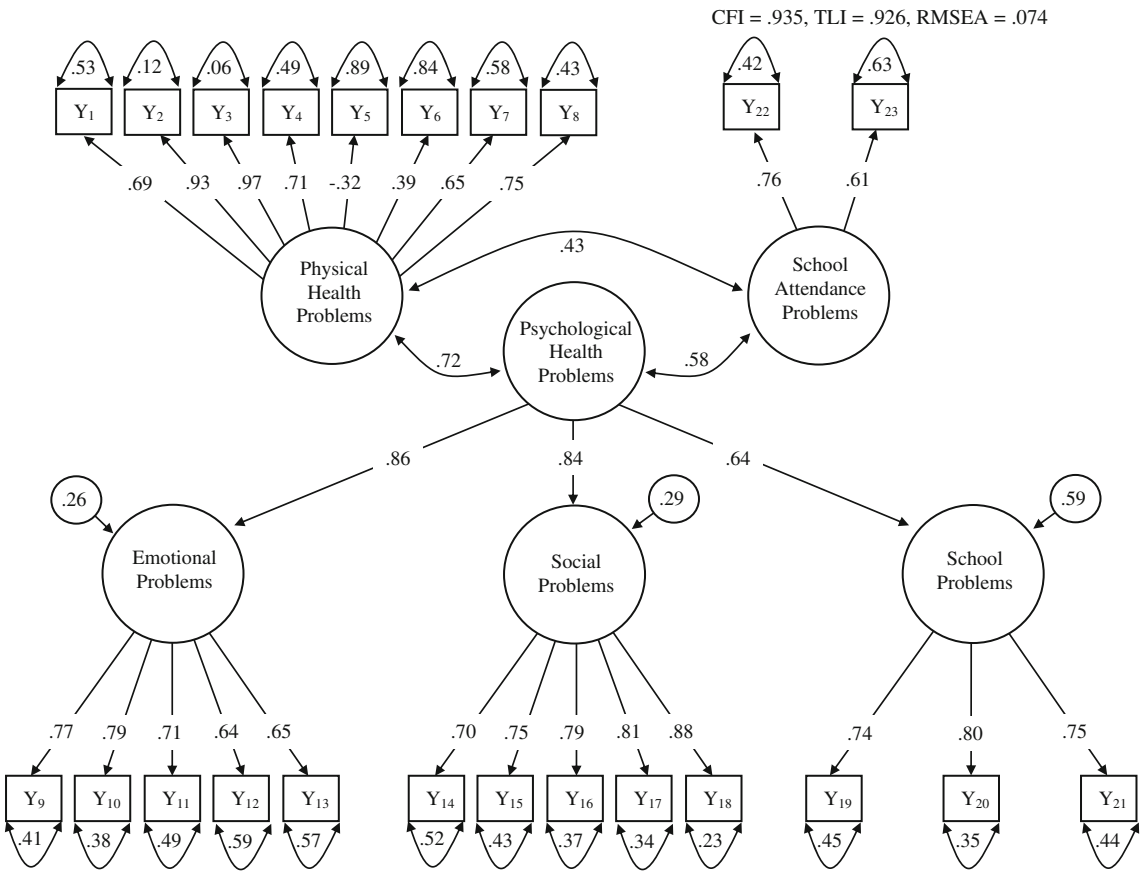


**Fig. 3** Model C (five-factor second-order)

## CFA

Table 1 contains the standardized factor loadings and model fit indicators for all four models. Models A, B, and C had acceptable CFI (≥.90), TLI (≥.90), and RMSEA (≤.08) fit indicators as determined by standard fit criteria [23, 24]. However, factor loadings for items 5 and 6 were problematic. Item 5 had a negative factor loading indicating that higher scores on this item were associated with lower standing on the health problem latent factor. As items on the PedsQL™ are worded so that high scores on items represent greater problems, item 5 clearly did not function as it was intended. Item 6 had a low loading (≤.40) indicating a very weak relationship to the latent factor; the latent physical health factor only explained 15.6 % of the variance for item 6.

After removing the two problematic items, Model D was fit to the data. Model D had excellent CFI and TLI indicators, .961 and .956, respectively, and an acceptable RMSEA value (.063). The significant change in RMSEA is a good indication that Model D is a superior fitting model compared with the other three models. RMSEA is expressed in terms of misfit per degree of freedom [24], so models with fewer degrees of freedom (*df*), such as Model D, tend to exhibit higher RMSEA values. In this case, Model D has fewer *df* and a smaller RMSEA than the other models.

## Discussion

As the HRQoL of youth in residential care is unknown, the purpose of this study was to assess the factor structure of a widely used HRQoL measure to determine whether it could reliably be used among youth living in a residential treatment center. The results supported our hypothesis that the factor structure of the PedsQL™ would be adequate. Although the PedsQL™ was only tested among youth at one residential care center, these findings suggest that researchers and practitioners studying youth in residential settings can reliably use the four-factor model (Model A), five-factor model (Model B), or higher-order five-factor model (Model C) to analyze data. Interestingly, while each model demonstrated adequate fit, the best fitting model was the modified higher-order five-factor model (Model D) in which we dropped items 5 and 6. The findings across all the CFA models suggest that these items contribute little to our understanding of the physical health construct and could

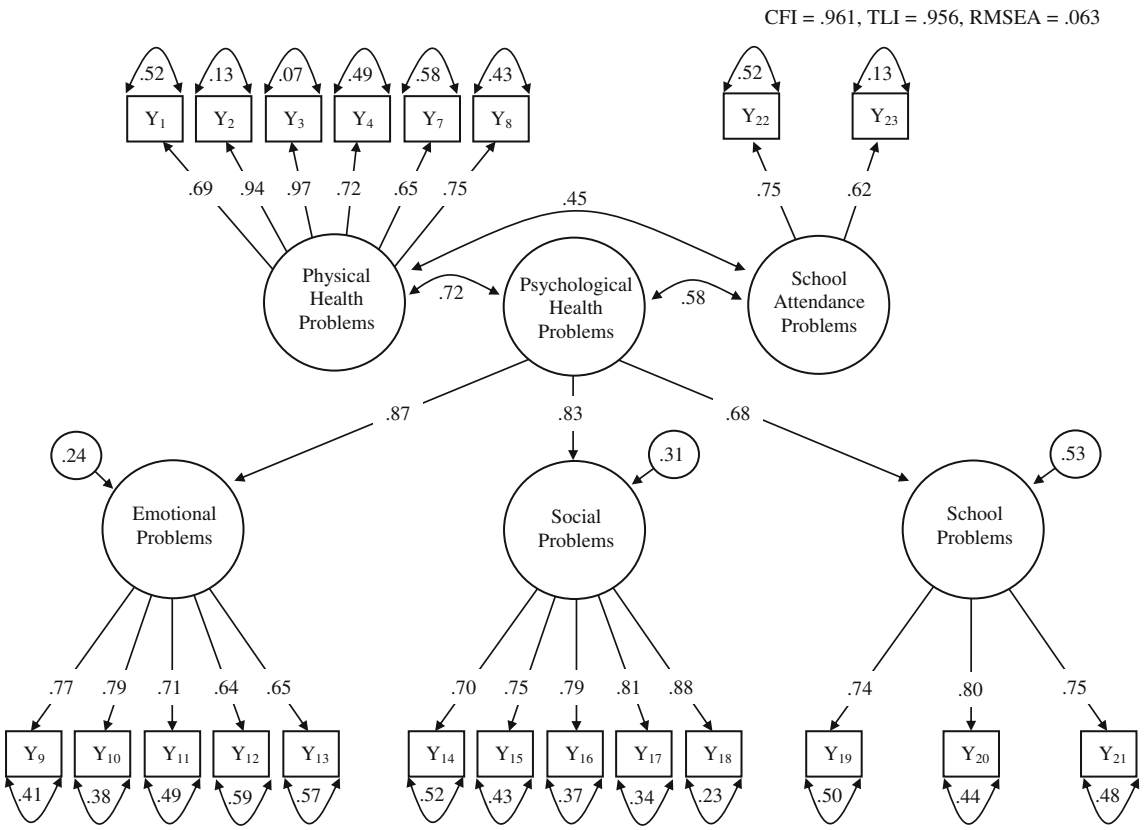


**Fig. 4** Model D (five-factor second-order with items 5 and 6 removed)

**Table 1** CFA factor loadings and fit indicators

| Item[a] | Model A four-factor | Model B[b] five-factor | Model C[b] second order | Model D[b] modified |
|---|---|---|---|---|
| *Physical problems* | | | | |
| 1. Hard to walk | .68 | .68 | .68 | .69 |
| 2. Hard to run | .93 | .93 | .93 | .93 |
| 3. Hard to exercise | .96 | .96 | .96 | .96 |
| 4. Hard to lift things | .71 | .71 | .71 | .71 |
| 5. Hard to bath or shower | −.34 | −.34 | −.31 | – |
| 6. Hard to do chores | .39 | .39 | .39 | – |
| 7. I hurt or ache | .64 | .64 | .64 | .65 |
| 8. I have low energy | .75 | .75 | .75 | .75 |
| *Emotional problems* | | | | |
| 9. I feel afraid or scared | .77 | .77 | .76 | .77 |
| 10. I feel sad or blue | .78 | .78 | .78 | .78 |
| 11. I feel angry | .71 | .71 | .71 | .71 |
| 12. I have trouble sleeping | .63 | .63 | .63 | .63 |
| 13. Worry what will happen to me | .65 | .65 | .65 | .65 |
| *Social problems* | | | | |
| 14. Trouble getting along with teens | .69 | .69 | .69 | .69 |
| 15. Peers do not want to be my friend | .74 | .75 | .74 | .75 |
| 16. Other teens tease me | .78 | .78 | .78 | .79 |
| 17. I cannot do what others do | .80 | .80 | .80 | .81 |
| 18. It is hard to keep up with peers | .89 | .89 | .89 | .87 |

**Table 1** continued

| Item[a] | Model A four-factor | Model B[b] five-factor | Model C[b] second order | Model D[b] modified |
|---|---|---|---|---|
| *School problems* | | | | |
| 19. Hard to pay attention in class | .70 | .73 | .74 | .74 |
| 20. I forget things | .75 | .80 | .80 | .80 |
| 21. Trouble with schoolwork | .72 | .75 | .75 | .75 |
| 22. Miss school because I feel ill | .54 | – | – | – |
| 23. Miss school to go to the doctor | .46 | – | – | – |
| *School illness problems* | | | | |
| 22. Miss school because I feel ill | – | .75 | .76 | .75 |
| 23. Miss school to go to the doctor | – | .61 | .60 | .61 |
| *Psychological problems* | | | | |
| Emotional | – | – | .85 | .86 |
| Social | – | – | .84 | .82 |
| School | – | – | .64 | .64 |
| *Model fit* | | | | |
| *df* | 253 | 220 | 224 | 183 |
| CFI | .931 | .934 | .935 | .961 |
| TLI | .922 | .925 | .926 | .956 |
| RMSEA | .076 | .075 | .074 | .063 |

[a] Statements are summarized (i.e., exact wording of items is not presented due to space limitations)

[b] Items 22 and 23 loaded on the school attendance factor and not on the school problems factor

potentially obfuscate the meaning of the physical health construct. The problematic items (5 and 6) ask how difficult it is to take a shower or do chores. While youth in residential care tend to have higher rates of physical and mental health problems [8], the types of health challenges facing participants in this sample were apparently not so severe that they prohibited them from completing these basic tasks.

Two study limitations should be mentioned. As previously stated, all participants came from the same residential treatment center, thus limiting the generalizability of these findings. Also, our sample was comprised exclusively of youth in residential care, thus not allowing for cross-group invariance testing with non-residential youth. Future researchers may consider addressing these limitations by broadening the target sample to include youth from various treatment facilities and youth not receiving residential treatment services. However, despite these limitations, the results from this study indicate that the PedsQL™ version 4.0 Teen Report can be recommended for use in residential treatment settings.

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## References

1. Matza, L. S., Swensen, A. R., Flood, E. M., Secnik, K., & Leidy, N. K. (2004). Assessment of health-related quality of life in children: A review of conceptual, methodological, and regulatory issues. *Value in Health, 7*, 79–92.
2. Dalmida, S. G. (2006). Spirituality, mental health, physical health, and health-related quality of life among women with HIV/AIDS: Integrating spirituality into mental health care. *Issues in Mental Health Nursing, 27*, 185–198.
3. Eton, D. T., & Lepore, S. J. (2002). Prostate cancer and health-related quality of life: A review of the literature. *Psychooncology, 11*, 307–326.
4. Eisenman, D. P., Gelberg, L., Liu, H., & Shapiro, M. F. (2003). Mental health and health-related quality of life among adult Latino primary care patients living in the United States with previous exposure to political violence. *The Journal of the American Medical Association, 290*, 627–634.
5. Institute of Medicine. (2012). *Living well with chronic illness: A call for public health action*. Washington, DC: The National Academics Press.
6. Asarnow, J. R., Aoki, W., & Elson, S. (1996). Children in residential treatment: A follow-up study. *Journal of Clinical Child Psychology, 25*, 209–214.
7. Drais-Parrillo, A. A., Baker, A., Fojaz, S., Gunn, S., Kurland, D., & Schnur, E. (2005). *The Odyssey project: A descriptive and prospective study of children and youth in residential group care and therapeutic foster care*. Washington, DC: Child Welfare League of America.
8. Nelson, T. D., Smith, T. R., Thompson, R. W., Epstein, M. H., Griffith, A. K., Duppong Hurley, K., et al. (2011). Prevalence of

physical health problems among youth entering residential treatment. *Pediatrics, 128*, e1226–e1232.
9. Varni, J. W. (2012). About the model. *The PedsQL™ Measurement Model for the Pediatric Quality of Life Inventory.* http://www.pedsql.org/about_pedsql.html. Accessed June 28, 2012.
10. Hao, Y., Tian, Q., Lu, Y., Chai, Y., & Rao, S. (2010). Psychometric properties of the Chinese version of the Pediatric Quality of Life Inventory 4.0 generic core scales. *Quality of Life Research, 19*, 1229–1233.
11. Lin, C. Y., Luh, W. M., Yang, A. L., Su, C. T., Wang, J. D., & Ma, J. I. (2012). Psychometric properties and gender invariance of the Chinese version of the self-report Pediatric Quality of Life Inventory version 4.0: Short form is acceptable. *Quality of Life Research, 21*, 177–182.
12. Panepinto, J. A., Hoffmann, R. G., & Pajewski, N. M. (2009). A psychometric evaluation of the PedsQL™ family impact module in parents of children with sickle cell disease. *Health and Quality of Life Outcomes, 7*, 1–11.
13. Perrin, J. M., Kuhlthau, K., Chughtai, A., Romm, D., Kirschener, B. S., Ferry, G. D., et al. (2008). Measuring quality of life in pediatric patients with inflammatory bowel disease: Psychometric and clinical characteristics. *Journal of Pediatric Gastroenterology and Nutrition, 46*, 164–171.
14. Muthén, L. K., & Muthén, B. O. (1998–2009). *Mplus user's guide* (6th ed.). Los Angeles, CA: Muthén & Muthén.
15. Limbers, C. A., Newman, D. A., & Varni, J. W. (2008). Factorial invariance of child self-report across healthy and chronic health condition groups: A confirmatory factor analysis utilizing the PedsQL 4.0 Generic Core Scales. *Journal of Pediatric Psychology, 33*, 630–639.
16. Varni, J. W., Seid, M., & Kurtin, P. S. (2001). PedsQL 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.
17. Varni, J. W., Seid, M., & Rode, C. A. (1999). The PedsQL: Measurement model for the Pediatric Quality of Life Inventory. *Medical Care, 37*, 126–139.
18. Varni, J. W. (2010). *Scaling and scoring of the Pediatric Quality of Life Inventory™ (PedsQL™).* France: Mapi Research Trust.
19. Little, T. D., Slegers, D. W., & Card, N. A. (2006). A non-arbitrary method of identifying and scaling latent variables in SEM and MACS models. *Structural Equation Modeling, 13*(1), 59–72.
20. Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246.
21. Tucker, L., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika, 38*(1), 1–10.
22. Steiger, J. H., & Lind, J. C. (1980, May). *Statistically based tests for the number of common factors*. Paper presented at the annual meeting of the Psychometric Society, Iowa City, IA.
23. Browne, M. W., & Cudeck, R. (1993). Alternative ways of accessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
24. Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55.