



# The Transition Readiness Assessment Questionnaire (TRAQ): Its Factor Structure, Reliability, and Validity

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## ABSTRACT

**OBJECTIVE:** National consensus statements recommend that providers regularly assess the transition readiness skills of adolescent and young adults (AYA). In 2010 we developed a 29-item version of Transition Readiness Assessment Questionnaire (TRAQ). We reevaluated item performance and factor structure, and reassessed the TRAQ's reliability and validity.

**METHODS:** We surveyed youth from 3 academic clinics in Jacksonville, Florida; Chapel Hill, North Carolina; and Boston, Massachusetts. Participants were AYA with special health care needs aged 14 to 21 years. From a convenience sample of 306 patients, we conducted item reduction strategies and exploratory factor analysis (EFA). On a second convenience sample of 221 patients, we conducted confirmatory factor analysis (CFA). Internal reliability was assessed by Cronbach's alpha and criterion validity. Analyses were conducted by the Wilcoxon rank sum test and mixed linear models.

**RESULTS:** The item reduction and EFA resulted in a 20-item scale with 5 identified subscales. The CFA conducted on a sec-

ond sample provided a good fit to the data. The overall scale has high reliability overall (Cronbach's alpha = .94) and good reliability for 4 of the 5 subscales (Cronbach's alpha ranging from .90 to .77 in the pooled sample). Each of the 5 subscale scores were significantly higher for adolescents aged 18 years and older versus those younger than 18 ( $P < .0001$ ) in both univariate and multivariate analyses.

**CONCLUSIONS:** The 20-item, 5-factor structure for the TRAQ is supported by EFA and CFA on independent samples and has good internal reliability and criterion validity. Additional work is needed to expand or revise the TRAQ subscales and test their predictive validity.

**KEYWORDS:** health care transition readiness; self-assessment questionnaire; youth with special health care needs

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## WHAT'S NEW

The Transition Readiness Assessment Questionnaire (TRAQ; <http://hscj.ufl.edu/jaxhats/traq/>) is a validated 20-item, 5-domain patient-reported assessment of health and health care self-management skills that can be used in preparation for transition to adult care.

ACCORDING TO THE 2009–2010 National Survey of Children With Special Health Care Needs, the prevalence of special health care needs (SHCN) among adolescents (ages 12 to 17 years) is 19.8%.<sup>1</sup> Advances in health care have led to improvements in the survival of children with SHCN, enabling over 90% to transition to adulthood.<sup>2,3</sup>

The process of health care transition (HCT) is defined as “purposeful, planned movement of adolescents and young adults with chronic physical and medical conditions from child-centered care to an adult-oriented care system.”<sup>2</sup> The fact that Healthy People 2020 included measurements of successful HCT as one of the national health objectives indicates the growing importance of HCT.<sup>4</sup> In addition, the Maternal Child Health Bureau includes HCT as a key indicator of measures of health.<sup>5</sup> However, for a number of reasons, many adolescents and young adults (AYA) have a difficult time during transition, experiencing lapses in insurance and gaps in care.<sup>6,7</sup> In addition, many AYA struggle to adjust to the increased level of autonomy expected of patients in the adult service system.<sup>8,9</sup> Studies

of AYA with SHCN have demonstrated that many have not developed disease self-management skills, leading to a decline in health outcomes,<sup>10–12</sup> such as worsening of glycemic control in those with diabetes mellitus,<sup>13</sup> graft failure or transplant rejection in transplant recipients,<sup>14</sup> increased morbidity in young adults with congenital heart disease,<sup>15</sup> increased obesity in individuals with spina bifida,<sup>16</sup> and life-threatening complications among cancer survivors.<sup>17</sup> Young adults with SHCN, after transfer to adult care, also do poorly when compared to the general population with respect to educational outcomes, employment, and socioeconomic status.<sup>18,19</sup>

Acquisition of self-management and health care utilization skills are important for successful transition to the adult health care system.<sup>20</sup> However, national surveys show that only 40% of families report that they receive adequate anticipatory guidance about their child's upcoming transition to adulthood.<sup>21</sup> A 2008 American Academy of Pediatrics survey of pediatricians found that only 50% of child-serving practices assess HCT readiness skills.<sup>22</sup> Furthermore, among young adults aged 19 to 23 with SHCN who had transitioned to adult care, although 50% reported having received advice from their pediatric providers regarding how their needs would change with age, how to obtain health insurance, or how to participate in a transition plan in school, only 24% received counseling in all 3 areas.<sup>23</sup>

In 2011 the American Academy of Pediatrics published a clinical report that promotes a developmental model for HCT preparation within the context of the medical home.<sup>24</sup> The report recommends that providers regularly and objectively assess patients' disease self-management and health care utilization skills. Validated measures of transition-related skills can assist the provider, patient, and family to evaluate these skills, set goals, and guide interventions to prepare adolescents for transition.<sup>25,26</sup> Finally, validated transition readiness assessment tools are also needed to help in the development of an evidence base for interventions to support successful HCT.

To address these issues, we developed the Transition Readiness Assessment Questionnaire (TRAQ; <http://hscj.ufl.edu/jaxhats/traq/>), a 29-item patient-report instrument that assesses AYA self-management and health care utilization skills before and during HCT.<sup>27</sup> We found that the 29 TRAQ scale scores were significantly and positively associated with age and a primary diagnosis of an activity-limiting health condition (vs mental illness/cognitive impairment).<sup>27</sup> With continued use of this instrument, we have identified the following concerns about the content and structure of the 29-item scale. First, the 2 subscales contain heterogeneous groups of skills and are difficult to interpret. Next, the original response set was based on 5 levels in the stages of change theoretical framework, with a sixth response option of "not needed for my care"—a response meant to allow individuals to indicate that a particular skill was not relevant to their care. However, we found that many AYA misunderstood this option and selected it for skills that were clearly relevant to their care. Our third concern centered on several items in the

TRAQ that did not apply to all youth with SHCN, and we thought the questionnaire would be more easily understood by youth if these items were removed. Finally, the initial validation study was conducted on just under 200 patients, and we thought that further refinement and validation on larger samples of AYA were needed because of the complexity of the skills measured and the relative heterogeneity of AYA with SHCN.

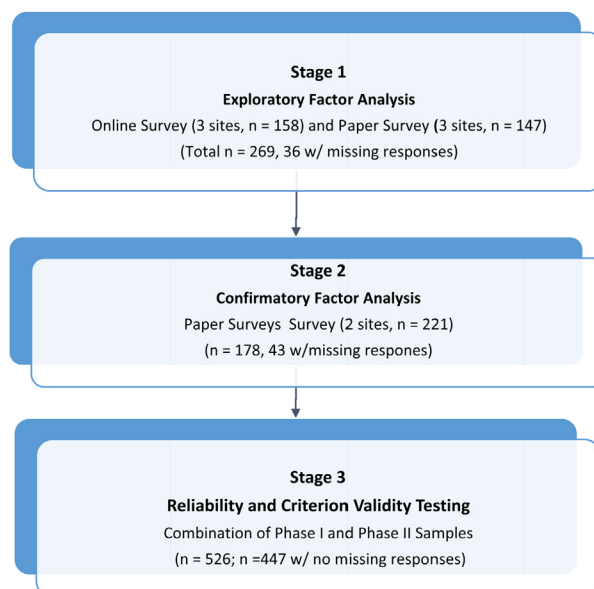
Here we present analyses on 2 separate AYA patient samples from 3 transition clinics. These analyses identify a new scale structure and assess the internal reliability and criterion validity of the overall TRAQ scale and subscales; they also advance our understanding of the constructs inherent in the measurement of HCT-related skills.

## METHODS

### SURVEY ADMINISTRATION

We collected TRAQ responses from 526 adolescent respondents ranging in age from 14 to 26 years; 305 adolescents comprised the first sample, collected in 2011, and 221 adolescents comprised the second sample, collected in 2012 (Figure). The surveys were collected during clinical care from a convenience sample of adolescents attending the University of Florida, JaxHATS in Jacksonville, FL; the Cystic Fibrosis (CF) Center at Boston Children's Hospital and the University of North Carolina (UNC) STARx (Successful Transition to Adulthood with Rx = Treatment) Program. The JaxHATS Clinic provides comprehensive primary care services, care coordination, and intensive transition support for over 400 AYA with a wide variety of conditions. The CF Center at Boston Children's Hospital cares for approximately 560 patients with CF, 150 of whom are between the ages of 16 and 21 years. Since 2006, the UNC-STARx Program has served over 400 AYA with chronic renal disease and other conditions.

The TRAQ questionnaires were collected during the clinical encounter as part of the clinical assessment process



**Figure.** Stage in data collection and analysis.

(Figure). In the first stage, the questionnaires were self-administered, using either a paper-and-pencil questionnaire ( $n = 147$ ) or an online questionnaire ( $n = 158$ ). These responses were used for the exploratory factor analysis (EFA). In the second sample, which occurred 18 months after the first, we collected the data using paper-and-pencil questionnaires from 221 respondents; these responses were used for the confirmatory factor analysis (CFA). We also collected information on age, sex, race, and insurance type. The study was approved by the institutional review boards at all 3 sites.

### ITEM REDUCTION AND EFA

In the first stage of the study, we reduced the number of items using nonresponse analysis and EFA. We analyzed the responses ( $n = 305$ ) to each of the 29 items for nonresponse (missing responses) or responses in the category of “not needed for my care.” We then conducted successive rounds of EFA using maximum likelihood estimation and both orthogonal orthomax and oblique parsimax rotations on all respondents with complete information (ie, no missing data) on all items ( $n = 269$ ). We eliminated items that did not load on at least 1 factor at a level of 0.45 or greater after orthogonal or oblique rotation. After examining the pattern matrix for the orthogonal solution and the oblique solutions, there were no differences in the factor structures. The orthogonal orthomax rotation provided more interpretable and clinically meaningful factor loadings, and therefore only this rotation is included in this report.

### CONFIRMATORY FACTOR ANALYSIS

Using the second sample of data from 221 patients collected 18 months after the first sample, we conducted CFA. The initial step was to fit a structural equation model with the 20 TRAQ items and the hypothesized 5 factors. Lagrange multiplier tests were used to determine whether additional covariance structures between the item residuals were present in the CFA data set. This process continued until no additional covariance structures were useful (defined as changes in Akaike’s information criteria of at least 2.0 when the new covariance was added to the model). This process continued until several goodness-of-fit criteria were met, including root mean square error approximation (RMSEA) and its 90% confidence interval of less than 0.05 with a high probability of a close fit; goodness-of-fit index (GFI) greater than 0.90; and Bentler comparative fit index greater than 0.90. A description of these summaries and values consistent with a good-fitting model are in the SAS documentation. All analyses were run using PROC CALIS in SAS version 9.3 for Windows (SAS, Cary, NC).

### RELIABILITY AND VALIDITY TESTING

In the third step in the analysis, we conducted reliability and criterion validity testing. On the revised scale with 20 items (TRAQ), we conducted reliability testing by calculating the Cronbach’s alpha for the overall scale and for the subscales identified in the EFA and CFA samples and in the pooled or overall sample ( $n = 447$ ). Criterion validity

**Table 1.** Demographics of Participants Eligible for EFA and CFA

Characteristic	EFA (n = 305)	CFA (n = 221)	Total (n = 526)
Age group			
$\geq 18$ y	261 (85.6%)	176 (79.6%)	437 (83.1%)
$< 18$ y	44 (14.4%)	45 (20.3%)	89 (16.9%)
Sex			
Male	80 (26.2%)	103 (46.6%)	183 (34.8%)
Female	91 (29.8%)	117 (52.9%)	208 (39.5%)
Missing	134 (43.9%)	1 (0.4%)	135 (25.7%)
Race			
White	116 (38.0%)	108 (48.8%)	224 (42.6%)
Black	92 (30.2%)	89 (40.3%)	181 (34.4%)
Other	29 (9.5%)	23 (10.4%)	52 (9.9%)
Missing	68 (22.3%)	1 (0.5%)	69 (13.1%)
Insurance			
Private*	61 (20.0%)	76 (34.4%)	137 (26.0%)
Public†	178 (58.4%)	138 (62.4%)	316 (60.1%)
Missing	66 (21.6%)	7 (3.2%)	73 (13.9%)

EFA = exploratory factors analysis; CFA = confirmatory factor analysis.

\*Includes military insurance.

†Includes Medicaid, Medicare, and local indigent insurance program.

was achieved by testing for significant relationships between the overall revised TRAQ scores by age, race, sex, and insurance categories by the Wilcoxon rank sum test individually and in a Kruskal-Wallis multivariable analysis of variance (ANOVA).

## RESULTS

The demographic characteristics of the samples for stage 1 (item reduction and EFA sample) and stage 2 (CFA sample) are summarized in Table 1. A total sample of 305 AYA were available for step 1 of the item reduction analysis; of these, 269 had no missing data and were available for EFA. Overall, 16.9% were under 18 years of age. Of those with race data reported, 49.0% were white, 39.6% were African American, and 11.4% were other. Sex was missing in one-quarter of the surveys; however, of those with sex reported, there were slightly more female than male subjects. A majority of our sample had public insurance.

### ITEM REDUCTION

Four of the 29 items, all related to medical equipment, had a substantial portion (33% to 37%) with the response “not needed for my care,” and thus we removed these 4 questions. Across the remaining 25 questions, only 1 question (“Do you ask questions of the doctor, nurse, or clinic staff?”) had a significant number of missing values, at 28%. It was thought that this question was unclear and often misunderstood by respondents; we therefore eliminated it. Among the remaining 24 items, no item had more than 3.6% missing values.

### EXPLORATORY FACTOR ANALYSIS

EFA was run on the sample of 269 respondents who had no missing data. In this initial EFA, there were 3 questions that did not load on any factor (ie, all factor loadings were less than 0.45). All 3 questions were removed, and the

factor analysis was rerun. In the second round of EFA, 1 question (“Do you pay or arrange payments for your medications?”) did not load on any factor at a level of 0.45 or greater and was removed, leaving a final instrument of 20 questions. The 20 items are listed in the [Appendix](#), compared with the 29 items in the prior version of the TRAQ. For the 20-item analysis, the 5 largest eigenvalues for the final EFA were 21.36, 2.59, 1.24, 1.07, and 0.92. The next largest eigenvalue was 0.47. Using the scree plot, 5 domains seemed justified, while the sixth has a much smaller eigenvalue than the fifth. The 20 items and their rotated factor loadings and standard errors (SE) for the EFA are listed in [Table 2](#), grouped in the 5 subscales.

### CONFIRMATORY FACTOR ANALYSIS

Of the 221 patients in the CFA data set, 43 had 1 or more missing values and were eliminated from the CFA analysis. The initial fit of the EFA model to the new data indicated the addition of 21 residual covariances between items. One item, “Do you fill out the medical history form including a list of your allergies?” loaded high on Tracking Health Issues in the EFA and loaded >0.45 on Managing Medications in the CFA ([Table 2](#)). The path coefficient for item 12 was 0.72 (SE = 0.15) and was almost the same magnitude as the path coefficient for item 3 in this factor (coefficient 0.73, SE = 0.08). The standardized

path coefficients were 0.50 (SE = 0.10) for item 12 in the factor Managing Medications, which was smaller in magnitude than the smallest of the other items that load on this factor; the next smallest is item 3, with an estimate of 0.66 and SE of 0.05. After the additional residual covariances were added to the model, the resulting structural model provided an excellent fit. The addition of more factors based on the residual covariances did not improve fit or lead to substantively interpretable constructs. The *P* value for goodness of fit was .15, the RMSEA (95% confidence interval) was 0.0268 (0, 0.0463), with a probability of close fit *P* value of .098. GFI was 0.92, and the Bentler comparative fit index was 0.992. The factor loadings and SE from the CFA are reported in [Table 2](#).

### RELIABILITY AND VALIDITY TESTING

For the 20-item TRAQ scale, we conducted reliability analyses using the EFA sample and the CFA sample, then pooled them across the 2 samples (*n* = 447) by calculating the Cronbach’s alpha for the overall scale and for the 5 subscales identified in the factor analysis ([Table 3](#)). The overall scale Cronbach’s alpha for the EFA sample was 0.933. For the CFA sample it was 0.944, and for the pooled sample it was 0.937 ([Table 3](#)). Cronbach’s alphas for each of the 5 subscales are reported in [Table 3](#) and are as follows (for pooled sample only): Managing Medications (0.86),

**Table 2.** Factor Loadings for Items in the Transition Readiness Assessment Questionnaire (TRAQ)\*

Domain	Questionnaire Item	EFA		CFA	
		Loading	SE	Loading	SE
Appointment Keeping	Do you call the doctor’s office to make an appointment?	0.577	0.061	0.905	0.017
	Do you follow up on any referral for tests or check-ups or labs?	0.607	0.215	0.849	0.023
	Do you arrange for your ride to medical appointments?	0.481	0.060	0.752	0.034
	Do you call the doctor about unusual changes in your health (ie, allergic reactions)?	0.569	0.063	0.862	0.021
	Do you apply for health insurance if you lose your current coverage?	0.680	0.047	0.783	0.031
	Do you know what your health insurance covers?	0.562	0.054	0.699	0.042
	Do you manage your money and budget household expenses (ie, use checking/debit card)?	0.588	0.052	0.742	0.035
Tracking Health Issues	Do you fill out the medical history form, including a list of your allergies?	0.662	0.053		
	Do you keep a calendar or list of medical and other appointments?	0.571	0.058	0.836	0.036
	Do you make a list of questions before the doctor’s visit?	0.495	0.060	0.648	0.049
Managing Medications	Do you get financial help with school or work	0.529	0.060	0.576	0.059
	Do you fill a prescription if you need to?	0.536	0.069	0.875	0.022
	Do you know what to do if you are having a bad reaction to your medications?	0.574	0.063	0.691	0.043
	Do you take medications correctly and on your own?	0.531	0.071	0.656	0.046
	Do you reorder medications before they run out?	0.629	0.059	0.499	0.099
Talking With Providers	Do you fill out the medical history form, including a list of your allergies?*			0.836	0.027
	Do you tell the doctor or nurse what you are feeling?	0.715	0.046	0.763	0.057
	Do you answer questions that are asked by the doctor, nurse or clinic staff?	0.815	0.046	0.575	0.061
Managing Daily Activities	Do you help plan or prepare meals/food?	0.565	0.064	0.647	0.055
	Do you keep home/room clean or clean up after meals?	0.540	0.064	0.495	0.065
	Do you use neighborhood stores and services (ie, grocery stores and pharmacy stores)?	0.463	0.068	0.731	0.050

EFA = exploratory factors analysis; CFA = confirmatory factor analysis; SE = standard error.

\*Only factor loadings greater than 0.45 are included.

**Table 3.** Cronbach's Alpha for EFA, CFA, and Pooled Samples

Sample	n	Overall TRAQ	Managing Medications	Appointment Keeping	Tracking Health Issues	Talking With Providers	Managing Daily Activities
EFA	269	0.93	0.85	0.89	0.76	0.90	0.67
CFA	178	0.94	0.87	0.93	0.78	0.64	0.67
Pooled	447	0.94	0.86	0.90	0.77	0.80	0.67

EFA = exploratory factors analysis; CFA = confirmatory factor analysis; TRAQ = Transition Readiness Assessment Questionnaire.

Appointment Keeping (0.90), Tracking Health Issues (0.77), Talking With Providers (0.80), and Managing Daily Activities (0.67). These Cronbach's alpha scores indicate that the overall scale and 4 of the 5 scales have good reliability. In sequential order, we removed each of the items of the overall scale and 4 of the 5 scales and recalculated the Cronbach's alpha (results not shown). In each instance, the Cronbach's alpha decreased, indicating that the removed item contributed to the scale's internal reliability.

The individual TRAQ item scores range from 1 to 5. We estimated scale scores by calculating the average score of completed items within the scales, resulting in a scale score also ranging from 1 to 5. We compared TRAQ overall and subscale scores by demographic characteristics and found that the overall TRAQ scores and all 5 subscale scores were significantly higher for adolescents aged 18 years and older versus those younger than 18 (3.99 vs 3.23,  $P < .0001$  for overall;  $P < .001$  to  $P < .01$  for subscales; Table 4). Scores were significantly higher for female subjects, adjusting for the other demographic characteristics, on the overall scale and 2 of the 5 subscales ( $P = .008$  for overall and  $P < .02$  to  $P < .033$  for subscales). There were no significant differences in the overall TRAQ scores or the subscale scores by categories of race or insurance. In a multivariable ANOVA for the overall scale and for each of the 5 subscales that included age, sex, race, and insurance, age was a significant predictor of TRAQ scores in the overall scale and in each of the 5 subscales analyses (data not shown).

## DISCUSSION

This study builds on our initial development of the TRAQ, when we identified candidate items and conducted initial item reduction and validation. In the current analyses, we analyze TRAQ data on over 500 additional respondents from 3 academic clinical centers to further explore and refine the factor structure of the instrument. We eliminated items that either did not apply to all respondents or had high rates of missing values. We used EFA to identify a 20-item scale with 5 subscales. We validated the scale structure using CFA on a second independent sample of patients.

The 5-subscale TRAQ structure was the same in the EFA and CFA, with the exception of 1 item ("Do you fill out the medical history form including a list of your allergies?"), which, in the CFA, loaded on Tracking Health Issues and in the CFA loaded on Managing Medications. This model provided by the CFA, while appearing to provide a mean-

ingful path, may be an artifact of the CFA sample and will be examined in future studies. In the CFA model, there were an additional 21 residual correlations among items included in the CFA path structure to bring the model to a good level of fit. Of the 21 additional covariances, 17 were across factors. This suggests that there is variation not explained by the 5-subscale-factor structure in the data set used for the CFA. This difference is in the form of pairwise residual correlations rather than interpretable constructs. These residual covariances were likely artifacts of these samples and may not be found in future samples.

The Talking With Providers subscale had a lower Cronbach's alpha in the CFA sample than in the EFA sample. This may be because there are only 2 items in the scale. Although a minimum of 3 items is usually recommended for a factor to be included as a subscale, the 2 items for this factor had the highest factor loadings across all items in the EFA, and no other item loaded on this factor in either the EFA or the CFA. Moreover, the items in the factor have high face validity, and the ability to provide a history or ask questions of providers is critical to independent function within the health care system. For these reasons, this factor is included in the TRAQ. However, we recognize that this subscale needs further study, and in future studies, additional items will be tested to determine whether they will be added to the subscale. The overall scale internal reliability is high (Cronbach's alpha = 0.94). In addition, 4 of the 5 subscales have individual internal reliability exceeding 0.70. Only 1 subscale, Managing Daily Activities, had a Cronbach's alpha under 0.70 (0.67). In future studies, we will identify items related to activities of daily living and test them for addition to the Managing Daily Activities subscale.

For criterion validity testing, we assessed scale scores by age, sex, race, and insurance. The TRAQ overall scale and all 5 subscales were in the hypothesized direction in relation to respondent age and were not different, as hypothesized, by race and insurance type. Studies demonstrate that cognitive and emotional development and decision making increases with age, and our finding of increasing scores of reported HCT skills with increasing age are consistent with this.<sup>28</sup> The finding that some of the TRAQ subscale scores were significantly and independently higher for female subjects than for male subjects is interesting and needs further exploration. Further work is needed to determine whether in larger prospective studies health transition-related skills differ by sex.

A number of future studies are planned among larger samples and a wider range of clinics that will collect TRAQs longitudinally every 6 months during transition

**Table 4.** Overall and Subscale TRAQ Scores by Population Demographic Characteristics

Demographic Characteristic	Overall TRAQ Score (Questions 1–20)		Managing Medication (Questions 1, 2, 3, 4, 12)		Appointment Keeping (Questions 5–11)		Tracking Health Issues (Questions 12–15)		Talking With Providers (Questions 16, 17)		Managing Daily Activities (Questions 18–20)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age group†												
<18 y (n = 84)	3.23	0.91	3.30	1.12	2.70	1.21	2.76	1.24	4.43	0.86	4.07	0.85
≥18 y (n = 363)	3.99***	0.96	4.07***	1.14	3.77***	1.22	3.71***	1.19	4.57**	0.87	4.39***	0.93
Race†												
White (n = 194)	3.85	0.90	4.01	1.04	3.51	1.23	3.55	1.17	4.63	0.73	4.34	0.86
Nonwhite (n = 198)	3.96	0.98	3.95	1.19	3.74	1.26	3.70	1.21	4.56	0.82	4.40	0.90
Insurance†												
Private (n = 127)	3.86	0.95	4.01	1.04	3.47	1.32	3.64	1.23	4.65	0.73	4.33	0.79
Public (n = 263)	3.93	0.93	3.96	1.15	3.70	1.21	3.62	1.18	4.56	0.80	4.38	0.92
Sex†												
Male (n = 146)	3.68	1.01	3.72	1.19	3.38	1.33	3.43	1.17	4.45	0.94	4.19	0.98
Female (n = 180)	3.96**	0.92	4.06**	1.12	3.68	1.25	3.59	1.23	4.66	0.68	4.47**	0.80

TRAQ = Transition Readiness Assessment Questionnaire; SD = standard deviation.

\*\* $P < .01$ .

\*\*\* $P < .001$ .

†Wilcoxon rank sum test.

and other transition outcomes such as health care utilization (appointment keeping, emergency department utilization), quality of life and clinical outcomes (eg, disease activity or control, and morbidity). These studies will allow us to assess the predictive validity of the TRAQ scale and subscales, which we were not able to assess in our current study. Finally, in future studies, it will be important to understand the relationship between the acquisition of transition-related skills, as measured by the TRAQ, and other theoretical constructs such as self-efficacy and motivation, thereby building a theoretical framework for HCT that can be used for future studies. Our understanding of the developmental trajectories of AYA with SHCN through HCT is rudimentary, and longitudinal studies are needed to help us understand factors that positively or negatively affect this trajectory.<sup>29–31</sup> The development of reliable and valid assessment tools will help us advance the science of HCT measurement and will be critical to the development of evidence for interventions that support successful transition.

This study has several limitations. First, all data in this study are self-reported. No external observations were used for validation of the self-reported ratings of transition skills. Self-report is subject to several biases, including social desirability bias. However, although subject to bias, adolescent self-report has been found to be an important and valid perspective on adolescent behaviors.<sup>32</sup> The study is cross-sectional and did not measure other transition outcomes. Therefore, we could not assess the predictive validity or the test–retest reliability of the TRAQ instrument. Last, this study, is limited by being a clinical sample from transition clinics. However, the clinics were geographically dispersed (Florida, North Carolina, and Massachusetts) and have populations that are diverse with respect to demographics and clinical conditions.

The TRAQ is designed to be used regularly (every 6 to 12 months) and thus could be used by pediatricians and other providers as a tool to perform regular transition-readiness screening advocated by the American Academy of Pediatrics. Therefore, the TRAQ can be thought of as a developmental assessment of AYA focused on disease self-management and health care utilization skills. Using TRAQ scale scores can guide providers to identify specific areas in which to help AYA set goals for their own personal development and better prepare them to enter the adult health care system. This type of interactive goal setting has been found to help promote independence in disease self-management skills in adolescents with a wide range of clinical conditions.<sup>31</sup>

In summary, this study provides evidence that the TRAQ subscale structure has good internal reliability and criterion validity. Moreover, the TRAQ scores have good criterion validity with scores associated with increasing age. Future research is needed to test the predictive validity of the TRAQ, to better understand the developmental trajectories of adolescents with SHCN through HCT, and to gain insight on the interventions that have the potential to improve outcomes for AYA throughout and beyond transition to adult health care.

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## APPENDIX

**Appendix Table.** Comparison of 29-Item Versus 20-Item Transition Readiness Assessment Questionnaires (TRAQ)

Domain	29 Item TRAQ	20 Item TRAQ
Managing Medications	Do you fill a prescription if you need to?	Do you fill a prescription if you need to?
	Do you know what to do if you are having a bad reaction to your medications?	Do you know what to do if you are having a bad reaction to your medications?
	Do you take medications correctly and on your own?	Do you take medications correctly and on your own?
	Do you reorder medications before they run out?	Do you reorder medications before they run out?
	Do you pay or arrange payments for your medications?	...
	Do you take care of your medical equipment and supplies?	...
	Do you call the suppliers when there is a problem with the equipment?	...
	Do you order medical equipment before they run out?	...
Appointment Keeping	Do you arrange payment for the medical equipment and supplies?	...
	Do you call the doctor's office to make an appointment?	Do you call the doctor's office to make an appointment?
	Do you follow up on any referral for tests or check-ups or labs?	Do you follow up on any referral for tests or check-ups or labs?
	Do you arrange for your ride to medical appointments?	Do you arrange for your ride to medical appointments?
	Do you call the doctor about unusual changes in your health (eg, allergic reactions)?	Do you call the doctor about unusual changes in your health (eg, allergic reactions)?
	Do you apply for health insurance if you lose your current coverage?	Do you apply for health insurance if you lose your current coverage?
	Do you know what your health insurance covers?	Do you know what your health insurance covers?
	Do you manage your money and budget household expenses (eg, use checking/debit card)?	Do you manage your money and budget household expenses (eg, use checking/debit card)?
Tracking Health Issues	Do you fill out the medical history form, including a list of your allergies?	Do you fill out the medical history form, including a list of your allergies?
	Do you keep a calendar or list of medical and other appointments?	Do you keep a calendar or list of medical and other appointments?
	Do you make a list of questions before the doctor's visit?	Do you make a list of questions before the doctor's visit?
	Do you get financial help with school or work?	Do you get financial help with school or work?
Talking With Providers	Do you tell the doctor or nurse what you are feeling?	Do you tell the doctor or nurse what you are feeling?
	Do you answer questions that are asked by the doctor, nurse or clinic staff?	Do you answer questions that are asked by the doctor, nurse, or clinic staff?
	Do you ask questions of the doctor, nurse or clinic staff (eg, what medications or treatments are best for you)?	...
Managing Daily Activities	Do you help plan or prepare meals/food?	Do you help plan or prepare meals/food?
	Do you keep home/room clean or clean up after meals?	Do you keep home/room clean or clean up after meals?
	Do you use neighborhood stores and services (eg, grocery stores and pharmacy stores)?	Do you use neighborhood stores and services (eg, grocery stores and pharmacy stores)?
	Do you request the accommodations and support you need at school or work?	...
	Do you apply for a job or work or vocational services?	...
	Do you use community support services (eg, after-school programs) or advocacy services (eg, legal services) when you need them?	...