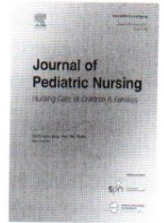




Contents lists available at ScienceDirect

Journal of Pediatric Nursing

journal homepage: www.pediatricnursing.org

Association between transition readiness and mental health comorbidity in youth with chronic health conditions

Brooke Allemang^{a,*}, Gina Dimitropoulos^{a,b}, Scott B. Patten^{b,c,d}, Kathleen C. Sitter^a, Anita Brobbey^e, Andrew S. Mackie^f, Susan Samuel^g

^a Faculty of Social Work, University of Calgary, Calgary, Alberta, Canada

^b Mathison Centre for Mental Health Research & Education, Calgary, Alberta, Canada

^c Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada

^d Department of Psychiatry, University of Calgary, Calgary, Alberta, Canada

^e Cumming School of Medicine, University of Calgary, Calgary, Alberta, Canada

^f Division of Cardiology, Department of Pediatrics, University of Alberta, Edmonton, Alberta, Canada

^g Section of Nephrology, Department of Pediatrics, University of Calgary, Calgary, Alberta, Canada

ARTICLE INFO

Article history:

Received 14 June 2022

Revised 7 September 2022

Accepted 11 September 2022

Keywords:

Transition to adult care

Transition readiness

Chronic health condition

Mental health

Comorbidity

Youth

ABSTRACT

Purpose: Between 33 and 59% of youth with chronic health conditions experience mental health conditions. Transition readiness, or the acquisition of knowledge and self-management skills, facilitates successful transition to adult care. Transition readiness among youth with co-occurring chronic health and mental health conditions has not been explored.

Design and methods: This study used a sample of 201 patients (aged 16–21) with chronic conditions. All patients completed the Transition Readiness Assessment Questionnaire (TRAQ) and were grouped into Cohort A: chronic health conditions only ($n = 140$), and Cohort B: co-occurring chronic health and mental health conditions ($n = 61$). A quantile regression at the 50th percentile was conducted to examine associations between TRAQ score and mental health comorbidity, age, gender and immigration status.

Results: The median TRAQ score for Cohort A was 3.87 (IQR 0.84) versus 4.00 (IQR 0.87) for Cohort B. Our analysis revealed that having a mental health comorbidity ($b = 0.402$, $p = 0.034$), being older in age ($b = 0.540$, $p = 0.004$) and being female ($b = 0.388$, $p = 0.001$) were associated with higher overall TRAQ score.

Conclusions: The presence of a mental health comorbidity was associated with greater transition readiness as measured by the TRAQ in our sample. Future research should explore why youth with co-occurring chronic health and mental health conditions exhibit greater transition readiness.

Practice implications: Youth with co-occurring chronic health and mental health conditions may develop transition readiness as a result of coping with mental health challenges. Practitioners could invite them to reflect on how their physical and mental health are related and affect their level of preparedness for adult care.

Crown Copyright © 2022 Published by Elsevier Inc. All rights reserved.

Introduction

Background

Transition from the pediatric to the adult system is a complex process for youth with chronic health conditions, leaving many at risk for poor health outcomes (Heery et al., 2015). A high proportion (33–59%) of youth with chronic health conditions also experience

mental health conditions including depression or anxiety (Caplan et al., 2005; Chang et al., 2021; Engel et al., 2021; Guilfoyle et al., 2017; Reid et al., 2021). The presence of mental health comorbidities in youth with chronic health conditions contributes to decreased quality of life, increased severity of disability, decreased adherence to medications, prolonged hospitalizations and higher health care costs (Belgrave & Molock, 1991; Chang et al., 2021; Engel et al., 2021; McKay et al., 2018; Patten et al., 2017; Richardson et al., 2008). Youth with co-occurring chronic health and mental health conditions may be transitioning out of multiple pediatric services concurrently, further complicating this period. Given these complexities and unique considerations, it is important to identify strategies for supporting this population during pediatric-adult transitions.

* Corresponding author at: Faculty of Social Work, University of Calgary, MacKimmie Tower, 400-B3, 2500 University Drive, NW, Calgary, Alberta T2N 1N4, Canada.

E-mail address: brooke.allemang1@ucalgary.ca (B. Allemang).

Transition readiness refers to youths' level of preparedness for adult-oriented care (Straus, 2019). It is comprised of a variety of skills, competencies and tasks including health-related knowledge, effective communication, and self-management skills (Canadian Association of Paediatric Health Centres, 2016; Straus, 2019) and has been conceptualized as a predictor of transition success for youth (McPherson et al., 2009; Prestidge et al., 2012; Traino et al., 2021; Uzark et al., 2019; van Staa et al., 2011). Assessing and tracking the acquisition of health-related knowledge and self-management skills using a transition readiness questionnaire is a key component of transition planning (Cleverley et al., 2020; Toulany et al., 2022). The Transition Readiness Assessment Questionnaire (TRAQ; Sawicki et al., 2011; Wood et al., 2014) is the best available tool for doing so given its comprehensive nature, content validity, construct validity and internal consistency (Zhang et al., 2014). The TRAQ is a 20-item self-report questionnaire with five subscales measuring health-related knowledge and self-management skills in youth transitioning to adult care (Wood et al., 2014). Known factors associated with transition readiness as measured by the TRAQ include older age and being female (Beal et al., 2016; Chisolm et al., 2021; Mackie et al., 2016).

Despite the high prevalence of mental health conditions in youth with chronic health conditions, the transition readiness of this group has not been explored. To date, studies have investigated transition readiness in singular patient populations, without reporting on the application of these tools for those with co-occurring conditions. For instance, the TRAQ has been validated in physical (e.g., cystic fibrosis), developmental (e.g., autism spectrum disorder), and mental health populations (e.g., attention deficit hyperactivity disorder; Sawicki et al., 2011) and readiness scores have been compared across individuals within different diagnostic categories (Beal et al., 2016). However, there is a paucity of literature examining the transition readiness of youth with co-occurring chronic health and mental health conditions. Research is needed to understand whether the presence of a mental health comorbidity is associated with transition readiness in youth with chronic health conditions in order to inform the refinement of clinical care for this group.

Objectives

The objectives of this study were: i) to describe the transition readiness scores of youth with chronic health conditions with and without mental health comorbidity, and ii) to examine the association between mental health comorbidity and transition readiness, controlling for age, gender and immigration status, in a sample of youth with chronic health conditions.

Methods

Study design

Ethical approval for this study was obtained from the University of Calgary Conjoint Health Research Ethics Board (REB #20–1928). A secondary analysis of data collected for the Transition Navigator Trial (TNT), a pragmatic randomized controlled trial evaluating the effectiveness of a patient navigator compared to a control group receiving usual care (Samuel et al., 2019), was conducted. Using data gathered for the TNT, we established two cohorts of youth participants for this study. Cohort A included youth with chronic health conditions only, and Cohort B included youth with co-occurring chronic health and mental health conditions. A quantile regression approach was used to examine the associations between transition readiness and mental health comorbidity, age, gender and immigration status in youth with chronic health conditions. Reporting of this study adheres to the STROBE guidelines (von Elm et al., 2008).

Setting

Participants in Cohorts A and B were all enrolled in the TNT, and were recruited from three pediatric tertiary care hospitals (Alberta

Children's Hospital, Stollery Children's Hospital, and Glenrose Rehabilitation Hospital) in the province of Alberta, Canada. While the TNT will continue operating until September 2023, recruitment for the trial ended in September 2021, with 339 patients enrolled.

Data source and participants

A secondary analysis of demographic, clinical and transition readiness data collected for the TNT was conducted. Youth eligible to participate in the TNT: (i) were followed within a chronic disease clinic at Alberta Children's Hospital, Stollery Children's Hospital, or Glenrose Rehabilitation Hospital, (ii) were between the ages of 16–21, (iii) lived in Alberta, and (iv) were expected to transfer to adult specialty care within 12 months of study enrollment (Samuel et al., 2019). While youth aged 16–21 were eligible for the TNT, all participants included in this secondary analysis were between 16 and 18 years old at the time of enrollment. All TNT participants completed a series of surveys at enrollment including medical report forms, a demographic survey, the TRAQ and the Short Form Health Survey (SF-12; Ware et al., 1996). Data was collected electronically and stored using REDCap, an online data management and storage platform (Research Electronic Data Capture; Harris et al., 2019). The following data from the TNT was used for the purposes of this secondary analysis: (1) demographic data (e.g., age, gender, ethnicity, immigration status) for descriptive purposes, (2) clinical data (e.g., primary diagnosis, mental health comorbidity) to identify the primary exposure and (3) transition readiness data (i.e., baseline TRAQ scores), the primary outcome of interest. TNT participants who did not complete the medical report form, demographic survey, or answered <15 items on the baseline TRAQ were excluded from this study. In addition, TNT participants who identified as having developmental/intellectual disabilities (e.g., autism spectrum disorder, fetal alcohol spectrum disorders, learning/intellectual disabilities) were excluded, as our focus was youth with chronic physical health and mental health conditions only in this investigation.

Variables

Outcome. Transition readiness, as measured by the overall TRAQ score, was our outcome of interest. The TRAQ is a 20-item validated tool with five subscales for measuring health-related knowledge and self-management skills (Wood et al., 2014). Each of the five subscales contains between two and seven questions, specific to that domain. The subscales include: medication management (e.g., Do you fill a prescription if you need to?), appointment keeping (e.g., Do you call the doctor's office to make an appointment?), tracking health issues (e.g., Do you fill out the medical history form, including a list of your allergies?), talking with providers (e.g., Do you answer questions that are asked by the doctor, nurse, or clinic staff?), and managing daily activities (e.g., Do you help plan or prepare meals/food?) (Wood et al., 2014). Item responses are scored from 1 to 5 on a Likert-type scale (1= "No, I do not know how"; 2= "No, but I want to learn"; 3= "No, but I am learning to do this"; 4= "Yes, I have started doing this"; 5= "Yes, I always do this when I need to") (Wood et al., 2014). The overall TRAQ score is calculated by taking the average of the scores from the 20 items, resulting in possible scores between 1 and 5. Scores for each domain associated with the five subscales can also be calculated by averaging the scores from each question within the subscales (Wood et al., 2014). Possible scores for each domain associated with the five subscales range from 1 to 5. For both the overall TRAQ and the five subscales, higher scores indicate greater readiness for transition.

Exposure. Presence of a mental health comorbidity, as indicated on the TNT baseline medical report form, was our exposure variable of interest. We grouped eligible TNT participants with chronic health conditions into two cohorts based on the presence or absence of a mental health comorbidity. Cohort A included youth with physical health conditions only and Cohort B included youth with physical health conditions and

one or more mental health comorbidities. Fig. 1 provides an overview of exclusion reasons for both cohorts. Detailed information as to the formation of these two cohorts is available elsewhere (Allemang et al., 2022). Briefly, on the baseline medical report form, TNT participants were asked to identify their diagnoses by selecting from a list of possible options, or manually inputting a diagnosis. TNT participants who identified as having one or more physical health conditions on this form, but no mental health conditions, were included in Cohort A. TNT participants who identified as having one or more mental health diagnoses in addition to at least one physical health condition were included in Cohort B. The list of possible mental health diagnoses to select from on the baseline medical report form included: depression, anxiety, obsessive compulsive disorder, eating disorder, schizophrenia, post-traumatic stress disorder/trauma, bipolar disorder, attention deficit disorders (including hyperactivity), or other. Participants who identified as having only a mental health diagnosis (and no physical health condition) were excluded from this study.

Potential confounders. Potential variables confounding the relationship between TRAQ score and presence of a mental health comorbidity included age (16 years old, 17 years old, 18 years old), gender (male, female) and immigration status (yes, no).

Bias

There were two potential sources of bias within this study which we took efforts to mitigate. Given we were reliant upon participants' reporting of their own mental health diagnoses on the TNT baseline medical report form, self-reporting bias was a conceivable concern (Althubaiti, 2016). It is possible our sample may either underestimate or overestimate the number of youth living with mental health conditions (Althubaiti, 2016). To mitigate this form of bias, we reviewed the

medical charts of a random sample of 25 TNT participants to verify the presence (or absence) of mental health diagnoses. We found agreement between the baseline medical report form and the patient navigator's initial assessment notes in all 25 cases.

This study used survey data (i.e., TRAQ, demographics survey, baseline medical report form), thus the data is subject to social desirability bias. This form of bias arises when survey responses may be affected by external biases like the desire for approval by the research team (Althubaiti, 2016). To address this potential source of bias, TNT participants were made aware their names would not be connected to their survey responses and that their information would be kept confidential during the informed consent process. Given the TNT was conducted during the COVID-19 pandemic, most participants completed their surveys electronically (i.e., not in the physical presence of the research team) which may have reduced the likelihood of social desirability bias influencing their responses.

Statistical methods

We used frequency counts and proportions, as appropriate, to describe our two cohorts according to baseline demographic (i.e., age, gender, ethnicity, immigration status, income, educational status, vocational status, post-secondary aspirations) and clinical variables (i.e., primary diagnosis category, mental health diagnoses). We described the TRAQ score data distribution using medians and interquartile ranges (IQRs) for Cohorts A and B. To assess the association between overall TRAQ score and mental health comorbidity, we used quantile regression at the 50th percentile with assessment of effect modifiers (through interaction terms) and adjustment for potential confounding effects (i.e., of age, gender, immigration status). Quantile regression using medians (50th percentile) was used given the data was not normally distributed. The variables selected for the model

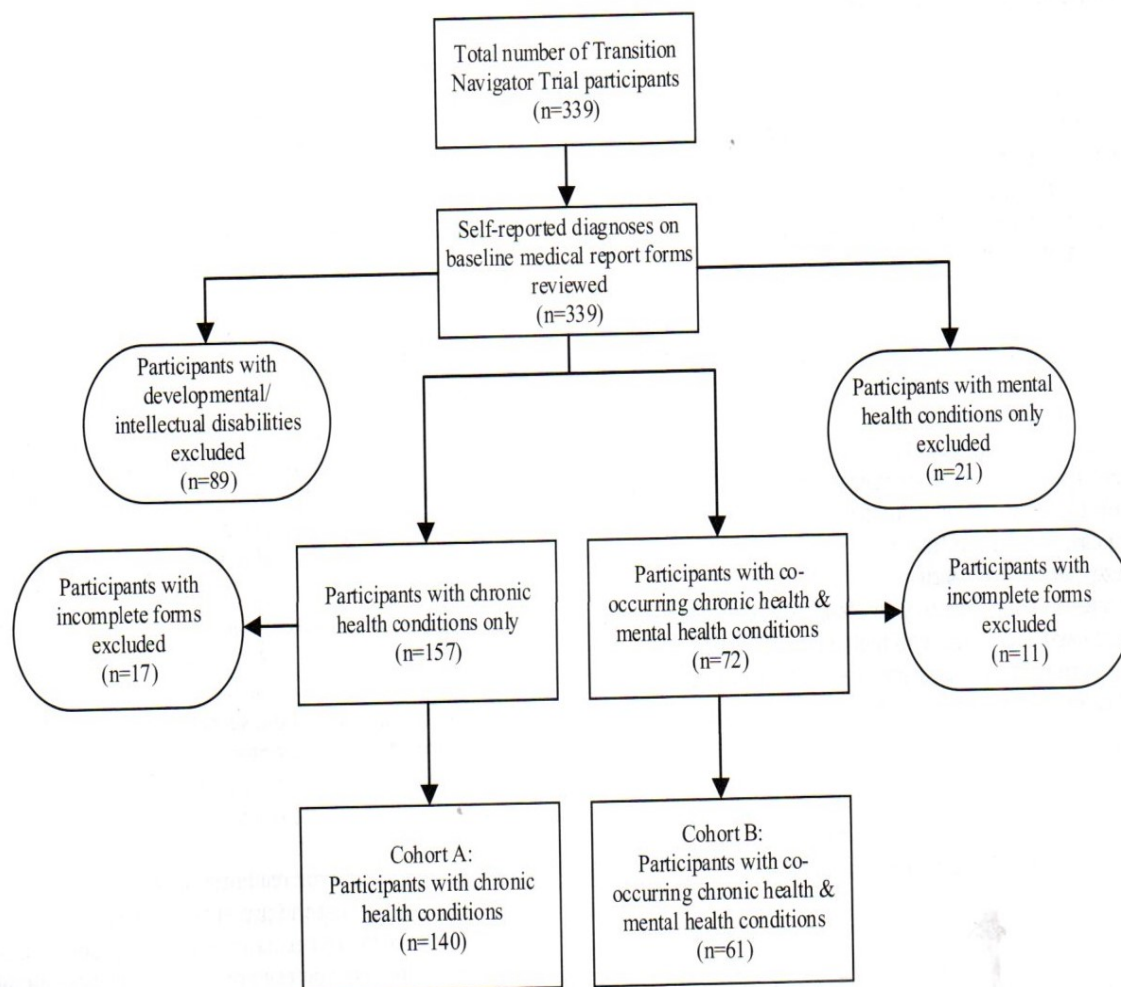


Fig. 1. Flow diagram of eligible participants.

were clinically significant, used in previous literature (e.g., Beal et al., 2016; Chisolm et al., 2021; Mackie et al., 2016) and available to us in the data set. The effect modification was evaluated using interaction terms (mental health comorbidity \times gender) to determine whether the association between TRAQ score and mental health comorbidity differed by gender. If the interaction term was significant, it was retained in the model, if not, it was removed from the model. Adjustment for age was made by including age as a categorical variable (i.e., age 16, age 17, age 18) since age is significantly associated with transition readiness in the literature (Beal et al., 2016; Chisolm et al., 2021; Jensen et al., 2017; Mackie et al., 2016). A significance level of $\alpha \leq 0.05$ was used for all statistical tests. Statistical analyses were conducted using SPSS V.25 (IBM, 2017).

Results

A total of 201 participants were included in this study. One hundred and forty (70%) participants had physical health conditions only (Cohort A), and 61 (30%) participants had co-occurring physical health and mental health conditions (Cohort B). The demographic and clinical characteristics of both cohorts are outlined in Table 1. In Cohort A, the majority of participants were aged 17 years at study enrollment (71%), female (59%), White (67%) and were born in Canada (83%). The most commonly reported primary diagnostic categories in Cohort A were rheumatology (22%), cardiovascular (18%) and neurological (14%). In Cohort B, the majority of participants were aged 17 years at study enrollment (74%), female (68%), White (72%) and were born in Canada (72%). The most commonly reported primary diagnostic categories in Cohort B were rheumatology (36%), neurological (16%), endocrine (13%) and gastrointestinal/liver (13%). Because several variables distinguished the two cohorts at baseline, see Table 1, these variables were added to the regression models in an exploratory analysis. Their inclusion did not alter the results of the study.

The self-reported mental health diagnoses of participants in Cohort B are outlined in Table 2. Anxiety (82%), depression (57%), and attention deficit hyperactivity disorder (26%) were the most commonly reported mental health diagnoses in our sample. The majority of participants in Cohort B ($n = 39$, 64%) reported having more than one mental health diagnosis (i.e., 2–4 diagnoses).

The median TRAQ scores (overall and across each of the five subscales) with IQRs of Cohorts A and B are presented in Table 3. The median overall TRAQ score was 3.87 (IQR 0.84) for Cohort A and 4.00 (IQR 0.87) for Cohort B. The lowest scores were on the appointment keeping subscale; median score 3.14 (IQR 1.28) and 2.86 (IQR 1.42) for Cohorts A and B respectively, and the tracking health issues subscale; median score 3.50 (IQR 1.25) and 3.75 (IQR 0.87) for Cohorts A and B respectively.

The two-way interaction between mental health comorbidity and gender was not significant, hence it was removed from the quantile regression model results presented in Table 4. After adjustment for confounders, our analysis revealed that having a mental health comorbidity was associated with higher overall TRAQ score ($b = 0.402$, $p = 0.034$). Compared to 16 year olds, being 18 years old ($b = 0.540$, $p = 0.004$) was associated with higher overall TRAQ score. Compared to males, being female was associated with higher overall TRAQ score ($b = 0.388$, $p = 0.001$).

Discussion

This study sought to describe transition readiness scores, as measured by the TRAQ, of youth with chronic health conditions, with and without mental health comorbidity. We found that having a mental health comorbidity was associated with greater transition readiness as measured by overall TRAQ score in youth with chronic health conditions. Being female and older were also associated with higher overall TRAQ score in youth with chronic health conditions in this study.

Table 1

Demographic and clinical characteristics of participants.

Characteristics	Cohort A	Cohort B	p value*
	(n = 140)	(n = 61)	
	n (%)	n (%)	
Age at study enrolment (years)			0.438
16	21 (15)	9 (15)	
17	100 (71)	45 (74)	
18	18 (13)	5 (8)	
Not reported	1 (1)	2 (3)	
Self-identified gender			0.147
Male	58 (41)	17 (28)	
Female	82 (59)	42 (68)	
Other	0 (0)	1 (2)	
Not reported	0 (0)	2 (3)	
Primary diagnosis category			0.002
Cardiovascular	25 (18)	3 (5)	
Endocrine	16 (11)	8 (13)	
Gastrointestinal/liver	10 (7)	8 (13)	
Genetic/metabolic	4 (3)	1 (2)	
Hematology/immunodeficiency	15 (11)	0 (0)	
Mental health	0 (0)	3 (5)	
Neurological	19 (14)	10 (16)	
Renal/urinary tract	12 (9)	3 (5)	
Respiratory	6 (4)	2 (3)	
Rheumatology	31 (22)	22 (36)	
Sensory	1 (1)	1 (2)	
Other	1 (1)	0 (0)	
Race			0.983
White/Caucasian	94 (67)	44 (72)	
Not White/Caucasian	31 (22)	9 (15)	
Indigenous/First Nation	7 (5)	4 (7)	
Other (incl. Mixed race)	8 (6)	4 (7)	
Immigrant			0.019
No	116 (83)	58 (95)	
Yes	24 (17)	3 (5)	
Age diagnosed with chronic condition (years)			0.022
Birth – age 10	76 (54)	22 (36)	
Age 11–14	32 (23)	17 (28)	
Age 15–18	32 (23)	20 (33)	
Not reported	0 (0)	2 (3)	
Annual household income			0.311
<\$25,000	1 (1)	2 (3)	
\$25,000–74,999	20 (14)	8 (13)	
>\$75,000	32 (23)	9 (15)	
Not reported	87 (62)	42 (69)	
Educational status			0.470
Enrolled in high school	129 (92)	53 (87)	
Enrolled in post-secondary	5 (4)	3 (5)	
Not enrolled in school	6 (4)	5 (8)	
Vocational status			0.283
Currently working	42 (30)	23 (38)	
Not currently working	98 (70)	38 (62)	
Post-secondary aspirations			0.470
College/university	117 (84)	52 (85)	
Trade school	6 (4)	5 (8)	
Work	9 (6)	1 (2)	
Other	1 (1)	0 (0)	
Not reported	7 (5)	3 (5)	
Anticipated living arrangements post-transfer			0.032
Family home	110 (79)	39 (64)	
Renting/dorm/own home	24 (17)	16 (26)	
Don't know	5 (3)	2 (3)	
Not reported	1 (1)	4 (7)	

* Results are from chi-squared or Fisher's exact test between cohort and each characteristic. Chi-squared tests were used when $\leq 20\%$ of cell counts had expected frequencies < 5 . Fisher's exact tests were used when $> 20\%$ of expected cell counts were < 5 .

To our knowledge, this is the first study to examine the effect of mental health on transition readiness in youth with chronic health conditions. Our finding that the presence of a mental health comorbidity was associated with greater transition readiness in youth with chronic health conditions contributes to the growing body of literature focused on intersections between physical and mental health among youth during service transitions (e.g., McManus & White, 2017). One possible

Table 2
Self-reported mental health diagnoses of participants in Cohort B.

	Cohort B (n = 61)
	n (%)
Self-reported mental health diagnoses	
Anxiety	50 (82)
Depression	35 (57)
Attention deficit hyperactivity disorder	16 (26)
Post-traumatic stress disorder/trauma	9 (15)
Obsessive compulsive disorder	4 (7)
Eating disorder	2 (3)
Bipolar disorder	1 (2)
Other	1 (2)

explanation for this finding is that youth with co-occurring chronic health and mental health conditions are involved with multiple service providers, thus experience greater opportunities to discuss and plan for service transitions. Given youth mental health treatment often consists of talk therapy with the goal of increasing interpersonal effectiveness (e.g., interpersonal therapy), it is conceivable that youth with co-occurring physical and mental health conditions exhibit greater comfort in communicating with service providers and voicing their needs (McCarty & Weisz, 2007; Mufson et al., 2004). It is important to highlight that most participants in our sample of youth with co-occurring conditions (82%) reported having anxiety. Pediatric anxiety has been associated with greater planning time and cognitive flexibility in youth (Murphy et al., 2018), factors which may contribute to enhanced preparedness for adult care. Interestingly, one previous study identified that youth with mental health conditions had lower TRAQ scores than youth with activity limiting physical health conditions (Sawicki et al., 2011). In their development of the TRAQ, Sawicki et al. (2011) compared the TRAQ scores of a sample of youth with mental health conditions (e.g., attention-deficit hyperactivity disorder, bipolar disorder) to those of youth with cognitive impairment and physical health conditions. Of note, youth participants with mental health conditions comprised only 11% of the total sample (21 participants) in Sawicki et al.'s (2011) study, and individuals with co-occurring diagnoses were not included in their research. The current study, however, focuses on the transition readiness of youth with co-occurring chronic health and mental health conditions and includes a sample of youth with a range of mental health diagnoses and a high proportion of youth with multiple mental health diagnoses. Given our findings, it may be that individuals with co-occurring chronic health and mental health conditions have greater readiness than those with mental health conditions only, though further research is needed in this area.

In alignment with existing research, being older in age was associated with higher TRAQ scores in our study (Chan et al., 2019; González et al., 2017; Sawicki et al., 2011; Wood et al., 2014). This is expected given transition readiness has been known to improve with increasing age given youth have greater opportunities to practice, develop and solidify self-management skills in the context of their health-related appointments over time (Wood et al., 2014). As youth age and approach their transfer out of pediatric services, care providers may more explicitly discuss topics related to health literacy and self-

Table 3
TRAQ scores by presence of mental health comorbidity.

TRAQ scores	Cohort A (n = 140)	Cohort B (n = 61)
	Median IQR	Median IQR
TRAQ overall score (range 1–5)	3.87 0.84	4.00 0.87
TRAQ managing medications subscale	4.00 1.50	4.00 1.75
TRAQ appointment keeping subscale	3.14 1.28	2.86 1.42
TRAQ tracking health issues subscale	3.50 1.25	3.75 0.87
TRAQ talking with providers subscale	5.00 0.50	5.00 0.50
TRAQ managing daily activities subscale	4.33 1.00	4.33 0.83

Table 4
Quantile Regression on Overall TRAQ Score (n = 192).

Variable	Coefficient	t	Sig.	CI
Mental health (ref. yes)	0.402	2.132	0.034	0.030–0.775
Age (ref. 16 years)		1.227		
17 years	0.162	2.886	0.221	–0.098 –0.422
18 years	0.540		0.004	0.171–0.910
Gender (ref. female)	0.388	3.319	0.001	0.157–0.619
Immigrant (ref. yes)	–0.186	–1.292	0.198	–0.469 –0.098

Note. Pseudo R² = 0.070 (N = 192, p < 0.05).

Note. Reference categories appear in parentheses.

advocacy to prepare them for adult-oriented care in a stepwise manner, further contributing to their readiness for transition (Toulany et al., 2022). Our results regarding transition readiness and gender were also shown in previous literature indicating that females demonstrate greater readiness for transition than males as measured by the TRAQ (Chisolm et al., 2021). Maturational factors and gender-based differences in self-management skills during adolescence and emerging adulthood may account for this finding (Burner et al., 2013; Koolschijn & Crone, 2013).

Notably, the results of this study revealed that immigration status was not associated with transition readiness, likely due to the small sample sizes of our cohorts. While immigration status has been examined as a variable in health care utilization studies among transition-age youth with chronic conditions (Cohen et al., 2016), there appears to be limited literature explicating relationships between immigration status and readiness for adult care, specifically. This area warrants further exploration, including how factors like length of time since immigration, country of origin, and first language spoken, influence youths' readiness for transition and self-management skills.

Practice implications

Our findings have implications for clinical practice, including the refinement of readiness practices for youth with co-occurring chronic health and mental health conditions. Health and mental health providers should consider the unique needs of this group as they prepare to exit pediatric services. Our results challenge commonly held assumptions that youth with co-occurring health and mental health conditions transitioning to adult care simply require more support than those without mental health conditions. This research suggests that this group may have developed transition readiness (i.e., self-management, communication and advocacy skills) as a result of coping with mental health challenges throughout adolescence and young adulthood. In line with these findings, youths' capacities, existing self-management skills and strengths could be highlighted in clinical encounters, and providers could invite youth to reflect on how their physical and mental health are related and affect their level of preparedness for adult care. Based on our results, it is possible youth with co-occurring chronic health and mental health conditions may also benefit from specific guidance about tracking and making appointments in preparation for transition given their involvement with multiple care providers. Future research should aim to understand why youth with co-occurring chronic health and mental health conditions exhibit greater transition readiness, given these factors may highlight opportunities to enhance transition readiness for other populations.

Limitations

This study has several limitations. It involved a secondary analysis of data previously collected for the TNT. Therefore, we were reliant upon the completeness of this data set and the data collection measures identified within the TNT. The baseline medical report form did not clearly identify whether mental health diagnoses were needed in order for participants to identify as having a mental health condition. Although

youth may have self-identified mental health needs, they may not have received diagnoses or sought services, thus may not have indicated a mental health condition on the baseline medical report form. Selection bias (Tripepi et al., 2010) may also be of concern in this study, as TNT participants with severe mental health conditions may not have been eligible to participate in the TNT. It is conceivable, therefore, that Cohort B may not provide a representative sample of the range of possible mental health diagnoses and severity, resulting in an underestimation of the influence of a mental health comorbidity on TRAQ score. In addition, our sample sizes were too small to conduct subgroup analyses examining possible differences between TRAQ scores based on mental health diagnosis (e.g., anxiety vs. depression). This area could be explored in future research. Though immigration status was not associated with transition readiness, nuanced information about age at immigration, access to services, and country of origin, for instance was not collected in this study. This data would be important to include in future research to better define this variable. This study was observational, thus we cannot account for residual confounding variables that could have influenced the results. For instance, living in a two-parent household and having high health literacy have been associated with greater transition readiness in prior research (Mackie et al., 2016). Thus, it is possible that these factors may mediate the effect of mental health status on transition readiness in youth with chronic health conditions. Data on family structure and health literacy were not gathered in the TNT, limiting our ability to draw confusions about relationships between these potential confounders and transition readiness in our sample. While the TRAQ has been found to demonstrate good content validity, construct validity and internal consistency, little is known about its predictive validity (Zhang et al., 2014). Longitudinal studies are needed to examine its ability to predict transition outcomes among youth with co-occurring diagnoses (Zhang et al., 2014).

Our sample in this study included youth with a variety of physical and mental health conditions, contributing to the generalizability of its findings. To our knowledge, this is the first study to explore the transition readiness of youth with co-occurring diagnoses, and to specifically examine the effect of mental health comorbidity on transition readiness in youth with chronic health conditions. However, the lack of diversity across other demographic characteristics in our sample, including ethnicity, immigration status, and household income may limit the generalizability of our findings to youth from various backgrounds. Our findings should be interpreted cautiously, given transition readiness may be partly dependent upon system-level factors, including availability of resources, access to developmentally-appropriate services and provider knowledge about transition, thus the results may not be generalizable to countries with different types of health and mental health systems. Further research with more diverse and representative samples is needed to examine how socio-demographic and system-level factors contribute to transition readiness in youth with co-occurring diagnoses.

Conclusions

Our results indicate that the presence of a mental health comorbidity in youth with chronic health conditions was associated with greater transition readiness. We also identified that youth with co-occurring chronic health and mental health conditions scored higher on the TRAQ overall and the tracking health issues subscale, but lower on the appointment keeping subscale when compared to youth with chronic health conditions only. These findings suggest youth with co-occurring chronic health and mental health conditions may be more prepared for adult care, but could benefit from tailored education and support regarding appointment keeping. Future directions should include qualitative research with youth with co-occurring chronic health and mental health conditions to better understand the perspectives of this group and elucidate factors shaping their readiness for transition.

Funding

This work was supported by the Canadian Institutes for Health Research Patient-Oriented Research Transition to Leadership Fellowship and the Alberta Innovates Graduate Studentship held by BA.

CRediT authorship contribution statement

Brooke Allemang: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. **Gina Dimitropoulos:** Methodology, Supervision, Writing – review & editing, Resources. **Scott B. Patten:** Methodology, Writing – review & editing. **Kathleen C. Sitter:** Writing – review & editing. **Anita Brobbey:** Formal analysis, Writing – review & editing. **Andrew S. Mackie:** Writing – review & editing, Resources. **Susan Samuel:** Methodology, Supervision, Writing – review & editing, Resources.

Declaration of Competing Interest

The authors have no conflicts of interest or financial relationships to disclose.

Acknowledgments

The authors gratefully acknowledge the READY2Exit Young Adult Research Partners and all members of the Transition Navigator Trial team (Megan Patton, Marcela Farias, Katelyn Greer, Karina Pintson, Keighley Schofield, Ken Pfister, Zoya Punjwani, Laurel Ryan, Daniella San Martin-Feeney, Deb Thul, Kristin Tinge) for their ongoing involvement in this study, their input on variables and data interpretation, their guidance, and their commitment to the field of health care transitions. SBP receives support from the Cuthbertson & Fischer Chair in Pediatric Mental Health.

References

- Allemang, B., Samuel, S., Sitter, K. C., Patten, S. P., Patton, M., Pintson, K., Greer, K., Schofield, K., Farias, M., Punjwani, Z., Mackie, A. S., & Dimitropoulos, G. (2022). Protocol for READY2Exit: A patient-oriented, mixed methods study examining transition readiness in adolescents with co-occurring physical and mental health conditions. *Journal of Transition Medicine*, 4(1), 20220001. <https://doi.org/10.1515/jtm-2022-0001>.
- Althubaiti, A. (2016). Information bias in health research: Definition, pitfalls, and adjustment methods. *Journal of Multidisciplinary Healthcare*, 9, 211–217. <https://doi.org/10.2147/JMDH.S104807>.
- Beal, S. J., Riddle, I. K., Kichler, J. C., Duncan, A., Houchen, A., Casnellie, L., ... Corathers, S. D. (2016). The associations of chronic condition type and individual characteristics with transition readiness. *Academic Pediatrics*, 16(7), 660–667. <https://doi.org/10.1016/j.acap.2016.06.007>.
- Belgrave, F. Z., & Molock, S. D. (1991). The role of depression in hospital admissions and emergency treatment of patients with sickle cell disease. *Journal of the National Medical Association*, 83, 777–781. <https://pubmed.ncbi.nlm.nih.gov/1942111/>.
- Burner, E., Menchine, M., Taylor, E., & Arora, S. (2013). Gender differences in diabetes self-management: A mixed-methods analysis of a mobile health intervention for inner-city Latino patients. *Journal of Diabetes Science and Technology*, 7(1), 111–118. <https://doi.org/10.1177/193229681300700113>.
- Canadian Association of Paediatric Health Centres (2016). *A guideline for transition from paediatric to adult health care for young people with special health care needs: A national approach*. Canadian Association of Paediatric Health Centres. <https://ken.childrenshealthcarecanada.ca/xwiki/bin/download/Transitioning+from+Paediatric+to+Adult+Care/A+Guideline+for+Transition+from+Paediatric+to+Adult+Care/2017%2005%2010%20CAPHC%20Transition%20to%20Adult%20HC%20Guideline.pdf>.
- Caplan, R., Siddarth, P., Gurbani, S., Hanson, R., Sankar, R., & Shields, W. D. (2005). Depression and anxiety disorders in pediatric epilepsy. *Epilepsia*, 46(5), 720–730. <https://doi.org/10.1111/j.1528-1167.2005.43604.x>.
- Chan, J. T., Soni, J., Sahni, D., Mantis, S., & Boucher-Berry, C. (2019). Measuring the transition readiness of adolescents with type 1 diabetes using the transition readiness assessment questionnaire. *Clinical Diabetes*, 37(4), 347–352. <https://doi.org/10.2337/cd18-0027>.
- Chang, J. C., Davis, A. M., Klein-Gitelman, M. S., Cidav, Z., Mandell, D. S., & Knight, A. M. (2021). Impact of psychiatric diagnosis and treatment on medication adherence in youth with systemic lupus erythematosus. *Arthritis Care & Research*, 73(1), 30–38. <https://doi.org/10.1002/acr.24450>.

- Chisolm, D. J., Keedy, H. E., Hart, L. C., Chavez, L. J., Dolce, M., Morack, J., ... Kelleher, K. (2021). Exploring health literacy, transition readiness, and healthcare utilization in medicaid chronically ill youth. *Journal of Adolescent Health*, 69, 622–628. <https://doi.org/10.1016/j.jadohealth.2021.03.023>.
- Cleverley, K., Rowland, E., Bennett, K., Jeffs, L., & Gore, D. (2020). Identifying core components and indicators of successful transitions from child to adult mental health services: A scoping review. *European Child & Adolescent Psychiatry*, 29, 107–121. <https://doi.org/10.1007/s00787-018-1213-1>.
- Cohen, E., Gandhi, S., Toulany, A., Moore, C., Fu, L., Orkin, J., Levy, D., Stephenson, A. L., & Guttman, A. (2016). Health care use during transfer to adult care among youth with chronic conditions. *Pediatrics*, 137(3) Article ID: e20152734 <https://doi.org/10.1542/peds.2015-2734>.
- von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gotsche, P. C., Vandenbroucke, J. P., & STROBE Initiative (2008). The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Annals of Internal Medicine*, 147(8), 573–577. <https://doi.org/10.1136/bmj.39335.541782.AD>.
- Engel, M. L., Shanley, R., Scal, P. B., & Kunin-Batson, A. (2021). Anxiety and depressive symptoms in adolescents and young adults with epilepsy: The role of illness beliefs and social factors. *Epilepsy & Behavior*, 116, Article 107737. <https://doi.org/10.1016/j.yebeh.2020.107737>.
- González, F., Roizen, M., De Las Mercedes Rodriguez Celin, M., De Cunto, C., Eymann, A., Mato, R., ... Fano, V. (2017). Validation of the argentine Spanish version of transition readiness assessment questionnaire for adolescents with chronic conditions. *Archivos Argentinos de Pediatría*, 115, 18–27. <https://doi.org/10.5546/aap.2017.eng.18>.
- Guilfoyle, S. M., Wagner, J. L., Modi, A. C., Junger, K. F., Barrett, L. E., Riisen, A. C., ... Weyand, C. (2017). Pediatric epilepsy and behavioral health: The state of the literature and directions for evidence-based interprofessional care, training, and research. *Clinical Practice in Pediatric Psychology*, 5(1), 79–90. <https://doi.org/10.1037/cpp0000169>.
- Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., ... REDCap Consortium (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, 95, Article 103208. <https://doi.org/10.1016/j.jbi.2019.103208>.
- Heery, E., Sheenan, A. M., While, A. E., & Coyne, I. (2015). Experiences and outcomes of transition from pediatric to adult health care services for young people with congenital heart disease: A systematic review. *Congenital Heart Disease*, 10, 413–427. <https://doi.org/10.1111/chd.12251>.
- IBM (2017). *SPSS statistics for mac. Version 25.0*. Armonk, NY: IBM.
- Jensen, P. T., Paul, G. V., LaCount, S., Peng, J., Spencer, C. H., Higgins, G. C., ... Ardoin, S. P. (2017). Assessment of transition readiness in adolescents and young adults with chronic health conditions. *Pediatric Rheumatology Online Journal*, 15, 70. <https://doi.org/10.1186/s12969-017-0197-6>.
- Koolschijn, C. M. P., & Crone, E. A. (2013). Sex differences and structural brain maturation from childhood to early adulthood. *Developmental Cognitive Neuroscience*, 5, 106–118. <https://doi.org/10.1016/j.dcn.2013.02.003>.
- Mackie, A. S., Rempel, G. R., Islam, S., Rankin, K., McCurdy, C., Vonder Muhll, I., ... Kovacs, A. H. (2016). Psychosocial maturity, autonomy, and transition readiness among young adults with congenital heart disease or a heart transplant: Maturity in young adults with CHD or HTx. *Congenital Heart Disease*, 11(2), 136–143. <https://doi.org/10.1111/chd.12300>.
- McCarty, C. A., & Weisz, J. R. (2007). Effects of psychotherapy for depression in children and adolescents: What we can (and can't) learn from meta-analysis and component profiling. *Journal of the American Academy of Child & Adolescent Psychiatry*, 46(7), 879–886. <https://doi.org/10.1097/chi.0b013e31805467b3>.
- McKay, K. A., Tremlett, H., Fisk, J. D., Zhang, T., Patten, S. B., Kastrukoff, L., ... CIHR Team in the Epidemiology and Impact of Comorbidity on Multiple Sclerosis (2018). Psychiatric comorbidity is associated with disability progression in multiple sclerosis. *Neurology*, 90, e1316–e1323. <https://doi.org/10.1212/WNL.0000000000005302>.
- McManus, M., & White, P. (2017). Transition to adult health care services for young adults with chronic medical illness and psychiatric comorbidity. *Child and Adolescent Psychiatric Clinics of North America*, 26(2), 367–380. <https://doi.org/10.1016/j.chc.2016.12.010>.
- McPherson, M., Thaniel, L., & Minniti, C. P. (2009). Transition of patients with sickle cell disease from pediatric to adult care: Assessing patient readiness. *Pediatric Blood & Cancer*, 52, 838–841. <https://doi.org/10.1002/pbc.21974>.
- Mufson, L., Dorta, K. P., Moreau, D., & Weissman, M. M. (2004). *Interpersonal psychotherapy for depressed adolescents* (2nd). New York: Guilford.
- Murphy, Y. E., Luke, A., Brennan, E., Francazio, S., Christopher, I., & Flessner, C. A. (2018). An investigation of executive functioning in pediatric anxiety. *Behavior Modification*, 42, 885–913. <https://doi.org/10.1177/0145445517749448>.
- Patten, S. B., Marrie, R. A., & Carta, M. G. (2017). Depression in multiple sclerosis. *International Review of Psychiatry*, 29, 463–472. <https://doi.org/10.1080/09540261.2017.1322555>.
- Prestidge, C., Romann, A., Djurdjev, O., & Matsuda-Abedini, M. (2012). Utility and cost of a renal transplant transition clinic. *Pediatric Nephrology*, 27(2), 295–302. <https://doi.org/10.1007/s00467-011-1980-0>.
- Reid, M., Fabricius, J., Danguécan, A., Ardalán, K., Knight, A., & Cunningham, N. (2021). Anxiety and depression in childhood rheumatologic conditions: A topical review. *Indian Journal of Rheumatology*, 16(3), 304–310. https://doi.org/10.4103/injr.injr_127_20.
- Richardson, L. P., Russo, J. E., Lozano, P., McCauley, E., & Katon, W. (2008). The effect of comorbid anxiety and depressive disorders on health care utilization and costs among adolescents with asthma. *General Hospital Psychiatry*, 30, 398–406. <https://doi.org/10.1016/j.genhosppsych.2008.06.004>.
- Samuel, S., Dimitropoulos, G., Schraeder, K., Klarenbach, S., Nettel-Aguirre, A., Guilcher, G., Pacaud, D., Pinzon, J., Lang, E., Andrew, G., Zwaigenbaum, L., Scott, S., McBrien, K., Haniwka, L., & Mackie, A. (2019). Pragmatic trial evaluating the effectiveness of a patient navigator to decrease emergency room utilisation in transition age youth with chronic conditions: The Transition Navigator Trial protocol. *BMJ Open*, 9(12), Article e034309. <https://doi.org/10.1136/bmjopen-2019-034309>.
- Sawicki, G. S., Lukens-Bull, K., Yin, X., Demars, N., Huang, I. -C., Livingood, W., ... Wood, D. (2011). Measuring the transition readiness of youth with special healthcare needs: Validation of the TRAQ—Transition readiness assessment questionnaire. *Journal of Pediatric Psychology*, 36(2), 160–171. <https://doi.org/10.1093/jpepsy/jsp128>.
- van Staa, A. L., Jedeloo, S., van Meeteren, J., & Latour, J. M. (2011). Crossing the transition chasm: Experiences and recommendations for improving transitional care of young adults, parents and providers. *Child: Care, Health and Development*, 37(6), 821–832. <https://doi.org/10.1111/j.1365-2214.2011.01261.x>.
- Straus, E. J. (2019). Challenges in measuring healthcare transition readiness: Taking stock and looking forward. *Journal of Pediatric Nursing*, 46, 109–117. <https://doi.org/10.1016/j.pedn.2019.03.016>.
- Toulany, A., Gorter, J. W., Harrison, M. E., & Canadian Paediatric Society, Adolescent Health Committee (2022). A call for action: Recommendations to improve transition to adult care for youth with complex health care needs. [Accessed April 22, 2022] <https://cps.ca/en/documents/position/transition-to-adult-care-for-youth>.
- Traino, K. A., Sharkey, C. M., Perez, M. N., Bakula, D. M., Roberts, C. M., Chaney, J. M., & Mullins, L. L. (2021). Health care utilization, transition readiness, and quality of life: A latent class analysis. *Journal of Pediatric Psychology*, 46(2), 197–207. <https://doi.org/10.1093/jpepsy/jsaa099>.
- Tripepi, G., Jager, K. J., Dekker, F. W., & Zoccalo, C. (2010). Selection bias and information bias in clinical research. *Kidney Disease and Population Health*, 115, c94–c99. <https://doi.org/10.1159/000312871>.
- Uzark, K., Afton, K., Uy, S., Lowery, R., Smith, C., & Norris, M. D. (2019). Transition readiness in adolescents and young adults with heart disease: Can we improve quality of life? *The Journal of Pediatrics*, 212, 73–78. <https://doi.org/10.1016/j.jpeds.2019.04.060>.
- Ware, J., Kosinski, M., & Keller, S. D. (1996). A 12-item short-form health survey: Construction of scales and preliminary tests of reliability. *Medical Care*, 34(3), 220–233. <https://doi.org/10.1097/00005650-199603000-00003>.
- Wood, D. L., Sawicki, G. S., Miller, M. D., Smotherman, C., Lukens-Bull, K., Livingood, W. C., ... Kraemer, D. F. (2014). The transition readiness assessment questionnaire (TRAQ): Its factor structure, reliability, and validity. *Academic Pediatrics*, 14(4), 415–422. <https://doi.org/10.1016/j.acap.2014.03.008>.
- Zhang, L. F., Ho, J. S., & Kennedy, S. E. (2014). A systematic review of the psychometric properties of transition readiness assessment tools in adolescents with chronic disease. *BMC Pediatrics*, 14(1), 4. <https://doi.org/10.1186/1471-2431-14-4>.