



# Opportunities for Enhanced Transition of Care Preparation for Adolescents and Emerging Adults With Type 1 Diabetes: Use of the READDY Transition Tool

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There is an ongoing need to determine best practices for effective transition from pediatric to adult care for adolescents and emerging adults (EAs) with type 1 diabetes given the potential for poor health outcomes post-transfer. This study evaluated self-reported confidence ratings as measured by the Readiness of Emerging Adults with Diabetes Diagnosed in Youth (READDY) tool among adolescents and EAs with type 1 diabetes and the association of the confidence ratings with clinical and demographic characteristics, as well as provider documentation of relevant anticipatory guidance topics. The READDY is a diabetes-specific tool used to collect patient-reported confidence in transition preparation topics to target educational interventions. These interventions are divided into four domains: Diabetes Knowledge, Health System Navigation, Insulin Self-Management, and Health Behaviors. A retrospective chart review was conducted of patients 15–24 years of age with type 1 diabetes who completed the READDY survey between January 2017 and January 2018 at a single center. Overall patient-reported confidence levels were high. However, adolescents and EAs endorsed their lowest levels of confidence on items assessing knowledge of alcohol, tobacco, sexual health, and the impact of diabetes on pregnancy (females only), with the percentages of low scores of 20.7, 25.9, 35.9, and 42.9%, respectively. Documentation of provider counseling about screening and prevention of diabetes comorbidities, alcohol use, and tobacco use was associated with scores in the higher range for the corresponding item in the READDY survey. These findings highlight an opportunity to create interventions related to developmentally important topics for adolescents and EAs with type 1 diabetes to enhance successful transition preparation.

Optimizing health care transition from pediatric to adult medical providers is crucial for sustained long-term good health for adolescents and emerging adults (EAs) with type 1 diabetes, particularly given reported risk for poor health outcomes after transfer (1–3). The SEARCH for Diabetes in Youth Study Group reported a 2.5-fold increase in the odds of having poor glycemic control after transition of care from pediatric to adult providers (2). Transition has also been associated with higher rates of acute and chronic complications, as well as psychological and behavioral comorbidities (3). The American Diabetes Association (ADA) has recommended an increased focus on preparation for transition of adolescents and EAs, noting that more evidence-based research is required to determine best practices (3). Transition preparation is especially important for adolescents and EAs with type 1 diabetes, given the signifi-

cant responsibility required for daily self-management and self-care skills (4).

Patient experiences and challenges related to transition have been explored (4,5). In a nationwide survey conducted in the United States of individuals 18–30 years of age with type 1 diabetes, of those being seen by an adult provider, only 66% reported feeling “mostly or completely prepared for transition” (4). Youths with type 1 diabetes and their families have expressed a desire for transition planning support to help with difficult transition experiences such as adapting to new providers and the adult care environment (5).

Based on available evidence, level of confidence in diabetes self-management knowledge and skills among adolescents and EAs are theorized to be important for successful transition,

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alongside the increased acquisition of knowledge and skills associated with increasing age and diabetes duration (5–7). However, data on adolescents' and AEs' confidence in diabetes self-management knowledge and skills are still limited. A lack of diabetes-specific tools to measure transition readiness has contributed to this gap in knowledge (8).

General questionnaires such as the TRAQ (Transition Readiness Assessment Questionnaire) (9,10), the STARx (Self-Management and Transition to Adulthood with Rx = Treatment) questionnaire (11), and the TRxANSITION Index (12) have been validated and subsequently used to assess transition readiness for youths with chronic conditions, including type 1 diabetes, but do not capture diabetes-specific tasks. Transition readiness varies depending on the self-care skills specific to different chronic conditions (13).

A questionnaire specially designed to assess independent self-care readiness among adolescents with type 1 diabetes was recently developed with a focus on self-care as an early stage of transition readiness (14). The READDY (Readiness of Emerging Adults with Diabetes Diagnosed in Youth) survey, a diabetes-specific tool used to collect patient-reported confidence in topics related to transition of care, was devised to enable direction of longitudinal diabetes education and skill development toward patient-centered priorities (8). A better understanding of perceived diabetes knowledge and management abilities among adolescents and EAs can assist in identifying opportunities for intervention and establishing evidence-based guidance for effective transition preparation (e.g., informing health care providers of relevant anticipatory guidance topics for patients based on READDY scores).

The purpose of this article is to describe the results of the READDY survey in a large cohort of adolescents and EAs to determine 1) self-reported confidence in transition-related skills and knowledge among adolescents and EAs with type 1 diabetes and its association with glycemic control, age, sex, duration of diabetes, insulin regimen, and insurance and 2) the association between self-reported confidence levels on anticipatory guidance topics and provider documentation of discussion of these topics. Based on literature review and clinical experience, it was hypothesized that 1) a higher self-confidence rating would be associated with increased age (11,13), longer duration of diabetes (15), and male sex (15) and 2) documentation of anticipatory guidance topics would be positively associated with higher self-reported confidence in the corresponding topics (5,7). This study is the first to report on results of READDY survey use in clinical practice and aims to provide guidance for both further research and pragmatic application in clinical transition preparation programs.

## Research Design and Methods

### Setting and Subjects

The Cincinnati Children's Hospital Medical Center (CCHMC) Diabetes Center is part of an urban, tertiary care pediatric center that cares for ~2,000 youths with type 1 diabetes. As part of a transition to adult care preparation program, adolescents and EAs  $\geq 15$  years of age are screened annually using the READDY survey (8). This study is a retrospective chart review in which all charts from patients aged 15–24 years with type 1 diabetes who completed the READDY survey at the CCHMC Diabetes Center between January 2017 and January 2018 were included ( $n = 805$ ). This age-group was chosen because it represents the target population for longitudinal transition of care preparation at the clinic where the study took place. Patients who completed the READDY survey were required to be fluent in English and be able to independently complete the measure. Exclusion criteria for completion of the READDY survey were profound to moderate developmental disability per parent or clinician report or patient refusal to complete the survey.

### Measurements

The READDY survey consists of 44 items divided into four domains: Diabetes Knowledge, Health System Navigation, Insulin Self-Management, and Health Behaviors (8). The stem for each item is phrased as "I am able to . . ." Example items include "Explain what hemoglobin A1c (HbA1c) measures" or "Tell someone how alcohol affects blood glucose." Response options for each item consist of a five-point Likert scale: 1 = Haven't thought about it; 2 = I plan to start; 3 = No, I still need lots of practice; 4 = Somewhat, but I need a little practice; and 5 = Yes, I can do this. In clinical settings, the mean score in each domain is calculated to guide target areas for intervention, with priority for areas of lowest patient-reported confidence (8).

Patients who are  $\geq 15$  years of age are offered the assessment annually as part of their longitudinal transition preparation and routine clinical care at CCHMC. Additionally, a flowsheet in each patient's electronic medical record (EMR; Epic) provides a system for recording discrete data elements of provider documentation of anticipatory guidance topics, some of which directly overlap with READDY topics. Average blood glucose levels for the prior 3 months, as measured by A1c, were obtained using a Siemens DCA Vantage Analyzer with a point-of-care fingerstick blood sample as part of routine care during each clinic encounter. Time in range (the percentage of time blood glucose levels were 70–180 mg/dL) for the 14 days before each visit was reported for a subset of the cohort who had available continuous glucose monitoring data.

## Data Collection

READDY measure results were extracted from the EMR for the first available visit that the measure was completed within the study inclusion time frame (such that each subject only contributed one READDY result). The following demographic and diabetes disease characteristics of interest were also obtained: age, sex, insurance (private versus Medicaid), duration of diabetes, A1C, time in range, and insulin regimen (pump versus injections). Provider documentation, in a dedicated EMR flowsheet, of discussion of predetermined anticipatory guidance topics was collected; these data were extracted for the clinic visits in the 18 months leading up to the encounter at which the READDY was completed. Institutional review board approval was obtained before study initiation.

## Data Analysis

Mean scores of the individual items specific for the domains Diabetes Knowledge, Health System Navigation, Insulin Self-Management, and Health Behaviors were calculated per protocol for the READDY survey. This study is the first reporting results for a large sample using this clinical tool.

Based on the skew of observed scores and the potential benefit of targeting screened youths at increased risk with enhanced anticipatory guidance during the clinical visit, it was determined for the purpose of analysis that high levels of confidence should be defined as READDY scores of 4 or 5, whereas low levels of confidence should be defined as scores of 1–3. This categorization was based on the level of confidence described by the labels associated with the Likert scales (1 = Haven't thought about it, 2 = I plan to start, and 3 = No, I still need lots of practice, versus 4 = Somewhat, but I need a little practice, and 5 = Yes, I can do this).

Descriptive statistics were used to report the results of individual items and domain subscores of the READDY survey, as well as the demographic and clinical variables and documentation of counseling. Means and SDs were used for reporting continuous variables and frequency and associated percentages were used for categorical variables.

Exploratory analysis was conducted to identify those items for which  $\geq 20\%$  of responses were 1, 2, or 3, and the percentage of responses is reported. Of note, this hypothesis-generating descriptive analysis codes responses in a way that differs from the recommended coding scheme for the READDY survey in clinical use (8). A general linear model was used to assess scores of individual items in relation to documentation of anticipatory guidance counseling related to these items. The initial full models contained all of the predefined variables

and was reduced using a combination of *P* value and change in the coefficient for the independent variable of interest.

Statistical analysis was performed using SAS, version 9.4 (SAS Institute, Cary, NC). A *P* value  $< 0.05$  was considered statistically significant.

## Results

The READDY survey completion rate from January 2017 through January 2018 was 71% for all adolescents and EAs who were 15–24 years of age and presenting for routine diabetes care visits. A total of 805 patient charts were included for analysis in this study (Table 1), reflecting all individuals who completed a READDY assessment during the study time frame. Participants were evenly split between male and female sex, but a greater percentage (76.0%) had private versus public insurance and were of adolescent age (defined as 15–18 years of age) versus EA age (defined as 19–24 years of age) (71.2%). The mean duration of diabetes was  $7.2 \pm 4.8$  years. Mean A1C was  $8.8 \pm 2.0\%$  ( $73 \pm 22$  mmol/mol), and mean time in range was  $41.1 \pm 22.1\%$  for individuals using CGM ( $n = 551$ ).

READDY respondents reported high levels of confidence overall, with 60% answering  $> 4$  for all items (Supplementary Table S1). Mean scores for the domains Diabetes Knowledge, Health System Navigation, Insulin Self-Management, and Health Behaviors were  $4.40 \pm 0.70$ ,  $4.41 \pm 0.74$ ,  $4.76 \pm 0.59$ , and  $4.19 \pm 0.47$ , respectively. To better understand the subset of the total population at greatest need for enhanced anticipatory guidance, the group of participants with scores  $\leq 3$  in any READDY domain ( $n = 91$  [11.3%]) are reported separately from the group with scores  $> 3$  in all domains ( $n = 714$  [88.7%]) (Table 1). Participants with lower scores were younger, had shorter duration of diabetes, and were more likely to have public insurance and to use an injection (versus pump) insulin regimen than participants with higher scores (Table 1). The distribution by sex was similar in both groups, as was glycemic control, as measured by both A1C and time in range (Table 1).

Overall, the prevalence of provider-documented transition counseling in the year before completion of the READDY survey was low. The anticipatory guidance topic prompts from the discrete EMR flowsheet that overlap with READDY topics are shown in Table 2. Screening and prevention topics of diabetes comorbidities had the highest percentage of participants with documentation of counseling (56.4%), followed by seeking emotional support (30.2%) and driving (32.1%). The lowest occurrences of documented counseling were for counseling about alcohol (14.2%), tobacco (5.6%), and pregnancy (12.0%).

**TABLE 1** Demographic and Clinical Variables Overall and by High- Versus Low-Scoring READDY Respondents

|                                 | Total Sample<br>(n = 805) | Those With Any<br>Domain Scores ≤3.0<br>(n = 91) | Those With All<br>Domain Scores >3.0<br>(n = 714) |
|---------------------------------|---------------------------|--|---|
| Age at survey, years            | 17.5 ± 2.1                | 16.5 ± 1.81                                      | 17.6 ± 2.08                                       |
| Diabetes duration, years        | 7.2 ± 4.8                 | 4.66 ± 3.90                                      | 7.54 ± 4.81                                       |
| Time in range, %*               | 41.1 ± 22.1<br>(n = 551)  | 42.0 ± 23.4<br>(n = 58)                          | 41.0 ± 21.0<br>(n = 493)                          |
| A1C, % (mmol/mol)               | 8.8 ± 2.0 (73 ± 22)       | 8.76 ± 2.43 (72 ± 27)                            | 8.81 ± 1.96 (73 ± 21)                             |
| Female sex                      | 400 (49.7)                | 43 (47.2)  | 357 (50.0)  |
| Adolescent age<br>(15-18 years) | 573 (71.2)                | 79 (86.8)  | 494 (69.2)  |
| Private insurance               | 612 (76.0)                | 55 (60.4)  | 557 (78.0)  |
| Pump insulin regimen            | 449 (56.7)                | 37/84 (44.0)†                                    | 412/708 (58.2)†                                   |

Data are mean ± SD or n (%). \*Time in range was only assessed among the subset of patients using CGM. †Different n because the insulin regimen of some respondents was unknown.

When present, documentation of provider counseling on alcohol use, tobacco use, and screening and prevention topics was associated with higher READDY scores for the corresponding item, even after adjusting for relevant covariates (Table 3). Demographic and clinical variables remaining in the models examining the association between provider documentation and scores for these items are as follows: years since diagnosis was significant for all topics, with increasing time since diagnosis associated with higher confidence scores; adolescent versus EA age was significant for all except seeking emotional support, with older age associated with higher confidence scores; glycemic control as measured by A1C was significant for seeking emotional support and knowledge of tests, with decreasing A1C associated with higher confidence

scores; and sex and insurance were significant only for seeking emotional support, with female sex and private insurance associated with higher confidence scores (Table 3).

Given the high scores overall and the desire to highlight opportunities for enhanced anticipatory guidance and other clinical interventions using the READDY survey, items for which ≥20% of respondents had a score ≤3 were examined as items with the lowest levels of self-reported confidence based on the distribution of scores among items. This exploratory analysis, which was conducted to generate areas for future research, revealed that items assessing knowledge of alcohol, tobacco, sexual health, and the impact of diabetes on

**TABLE 2** EMR Anticipatory Guidance Topics that Overlap With READDY Topics

| READDY Item [Domain]   | Anticipatory Guidance Topic in EMR Flowsheet   |
|--|--|
| Tell someone how alcohol affects blood glucose [Knowledge]   | Effect of alcohol and/or drugs on diabetes   |
| Explain long-term impact of tobacco on heart health in people with diabetes [Knowledge]  | Tobacco avoidance  |
| Explain the impact of glucose control before and during pregnancy (female patients) [Knowledge]  | Contraception/glucose control in pregnancy   |
| List examples of tests done in routine visits to identify or prevent complications of diabetes [Knowledge]   | Screening and prevention topics: annual dilated eye exam (retinopathy screening), autoimmune screening (celiac disease, thyroid-stimulating hormone), blood pressure control (hypertension screening), cholesterol goals (lipid screening), foot care and/or exam (neuropathy screening), microalbumin screening (nephropathy screening) |
| Seek emotional support as needed (family, friends, online community, religious services, social worker, support group, therapist, etc.) [Navigation] | Social supports who know about diabetes  |
| Manage my diabetes safely when driving (e.g., check blood glucose before driving, treat high or low blood glucose values) [Health Behaviors]         | Driving safety   |

**TABLE 3** Association of counseling and READDY scores, both unadjusted and adjusted

| READDY Item  | Counseling Documented | n (%)      | Raw Mean Score (SD) | P for Raw Mean | Adjusted Mean Score (SE) | P for Adjusted Mean |
|--|-----------------------|------------|---------------------|----------------|--------------------------|---------------------|
| Emotional support  | Yes                   | 243 (30.2) | 4.59 (0.99)         | 0.11           | 4.54 (0.04)              | 0.23*               |
|  | No                    | 562 (69.8) | 4.68 (0.90)         |                | 4.63 (0.06)              |                     |
| Effect of alcohol on glucose   | Yes                   | 114 (14.2) | <b>4.61 (0.86)</b>  | <0.0001        | <b>4.58 (0.11)</b>       | <b>0.006†</b>       |
|  | No                    | 691 (85.8) | 4.13 (1.31)         |                | 4.24 (0.05)              |                     |
| Impact of tobacco use on heart   | Yes                   | 45 (5.6)   | <b>4.56 (0.69)</b>  | 0.02           | <b>4.54 (0.20)</b>       | <b>0.02†</b>        |
|  | No                    | 760 (94.4) | 3.96 (1.41)         |                | 4.04 (0.06)              |                     |
| Impact of glucose control on pregnancy (females only, n = 400)                                 | Yes                   | 48 (12.0)  | 3.90 (1.29)         | 0.07           | 3.82 (0.21)              | 0.30†               |
|  | No                    | 352 (88.0) | 3.46 (1.51)         |                | 3.59 (0.09)              |                     |
| Manage diabetes while driving (participants ≥16 years of age, n = 661)                         | Yes                   | 213 (32.1) | 4.70 (0.89)         | 0.17           | 4.74 (0.08)              | 0.11†               |
|  | No                    | 448 (67.8) | 4.57 (1.07)         |                | 4.58 (0.06)              |                     |
| List examples of tests done in routine visits to identify or prevent complications of diabetes | Yes                   | 454 (56.4) | <b>4.46 (1.51)</b>  | 0.01           | <b>4.50 (0.03)</b>       | <b>0.02‡</b>        |
|  | No                    | 351 (43.6) | 4.31 (0.78)         |                | 4.38 (0.04)              |                     |

Bold type indicates statistical significance. \*Adjusted for sex, years since diagnosis of diabetes, and A1C. †Adjusted for age and years since diagnosis of diabetes. ‡Adjusted for age, years since diagnosis of diabetes, and A1C.

pregnancy (females only) stood out among items associated with low levels of confidence, with percentage of low scores of 20.7, 25.9, 35.9, and 42.9%, respectively.

## Discussion

Overall self-reported confidence levels in a single-center cohort of adolescents and EAs were high. Notably, items on which participants expressed the lowest confidence included developmentally important topics for people in these age-groups (i.e., risks of alcohol and tobacco use, sexual health, and, for females, the impact of diabetes on pregnancy). Provider documentation of anticipatory guidance counseling for these topics was low. However, when present, documented counseling was associated with higher confidence for items related to alcohol and tobacco use. These results point toward several opportunities to enhance transition of care preparation for adolescents and EAs with type 1 diabetes.

In this cross-sectional study, higher self-confidence in diabetes self-management skills and knowledge was not associated with differences in glycemic control as measured by A1C. A study of perceived readiness for self-care among youths with type 1 diabetes similarly found no association between A1C and perceived self-care readiness (16). It should be recognized that many factors affect glycemic management over time. At any given snapshot along the trajectory of a lifelong condition, self-confidence in diabetes knowledge and skills may not correlate with recent health behaviors.

It is possible that adolescents and EAs perceive themselves as competent in managing diabetes-related health behaviors while they are discussing them in the abstract with providers but do not consistently engage in those behaviors in real-world contexts, particularly when immediate rewards (e.g., social acceptance with peers) are perceived to be greater than potential long-term consequences. This scenario is consistent with patterns of decision-making around risk and reward documented in the literature on adolescents and EAs without chronic conditions. Prioritizing potential immediate rewards over future risks, particularly in the context of seeking peer approval, is a well-documented phenomenon among people in these age-groups (17). Adolescents and EAs with type 1 diabetes may engage in increased illness-specific risk-taking behaviors when presented with immediate rewards. For example, in exchange for immediate satisfaction or social acceptance, which may be gained by drinking or smoking tobacco, adolescents may not prioritize monitoring their blood glucose or pausing a social interaction to dose insulin (18).

When considered in this context, one could expect adolescents and EAs to rate competency in managing health behaviors as high after years of lived experience and formal diabetes education, but those ratings may not translate to behavior outside of clinical settings. A study of adolescents with type 1 diabetes found a mismatch between alcohol and illicit substance-related knowledge and application of that knowledge among those who reported alcohol and illicit substance use, which may be reflective of this type of behavior (19).

It is worth noting that participants' self-reported lowest levels of confidence were in topic areas associated with risk-taking, including alcohol, tobacco, sexual health, and the impact of diabetes on pregnancy. Literature supports that adolescents and EAs with type 1 diabetes engage in sexual activity, alcohol consumption, and tobacco use at rates comparable to peers without diabetes, despite being vulnerable to diabetes-associated complications that accompany these behaviors (3,20–28). Yet, these topics were inadequately addressed by provider-documented anticipatory guidance in our study and without evidence of improvement when compared with earlier studies (29–33). Patient-reported prevalence rates of counseling on reproductive health and alcohol in the most recent study of a national sample of U.S. young adults with type 1 diabetes (data collected in 2014–2015) were 43 and 68% for each topic, respectively, compared with 99% for discussion on managing diabetes and 90% for discussion of screening tests (34). In the SEARCH for Diabetes in Youth Study cohort (data collected in 2008–2009), prevalence of reported counseling on glucose control during pregnancy was 34% (35). Rates of patient-reported tobacco counseling by health care providers reported in 2011 were similarly low, ranging from <50% for youths with diabetes aged 10–14 years to 57% for those  $\geq 20$  years of age (36). In a more recent single-center study, only 5 of 64 adolescents and EAs were found to have discussed substance use during their most recent diabetes visit (22).

According to ADA recommendations, health care transition should include counseling on “birth control, pregnancy planning and risks, prevention of sexually transmitted illnesses, use of alcohol and drugs, [and] smoking” (3). Alcohol and substance use has been associated with increased mortality for people with type 1 diabetes (21). The current study's findings highlight a persistent gap in translating guidelines into clinical practice, which offers an opportunity for enhancing developmentally relevant anticipatory guidance to adolescents and EAs with type 1 diabetes. Studies have demonstrated the efficacy and desirability of counseling about sexual activity, alcohol, and tobacco (7,37–40). The association between higher confidence scores and documented counseling for diabetes-related comorbidities and risk-taking behaviors in this study likewise points toward a possible positive effect of counseling. Additionally, the results demonstrate the relevance of documenting counseling to assist interdisciplinary care teams in tracking whether adolescents and EAs are receiving appropriate preparation for care transition. Future study to assess whether documentation of anticipatory guidance in individuals with low READDY scores improves subsequent READDY scores could help strengthen evidence for this association.

The characteristics of participants with lower READDY scores in this study provide guidance on which adolescents and EAs may need enhanced transition care support. The findings corroborate the expectation that younger patients and patients with a shorter duration of diabetes would self-report lower confidence levels given that transition readiness is a longitudinal process. Having public insurance and an insulin injection regimen were also associated with lower scores, which may have been the result of confounding factors that were not assessed in this study. For example, public insurance may be a proxy for social stressors, barriers to care, or other social determinants of health affiliated with systemic inequity in health care delivery that translate to lower self-perceived confidence in diabetes knowledge and skills (41). Disparities in diabetes technology use have previously been demonstrated (42,43). Additional study is needed to explore these associations, further refine which patients would benefit from enhanced transition preparation, and better understand disparities in transition preparation support.

The study findings may be limited in generalizability in that they reflect the status of adolescent and EA patients and providers in one center and are based on retrospective data. However, this center covers a large catchment area that includes a diverse patient population coming from urban and rural areas such that the results still represent a broad and diverse sample, particularly given the sample's large size (a strength of the study).

The retrospective nature of the study did not allow for prospective capture of relevant outcomes beyond A1C such as reduction of severe hypoglycemia and improvement in quality of life or longer-term outcomes after transfer to adult care (44).

The current study constituted an exploratory analysis from a single center to help inform the development of a clinical transition readiness program. The data were collected after the center was already engaged in a formal transition preparation program; therefore, responses may have been skewed toward higher scores than what may be seen in other populations. In addition, it is not possible to know whether respondents were answering the READDY survey based on topics they wished to discuss or based on what they think providers expected from them. The latter could also explain the skew toward higher confidence levels.

The frequency of anticipatory guidance may have been underestimated because of the reliance on provider documentation to measure whether verbal anticipatory guidance was provided. This reliance on documentation in a discrete flowsheet within the EMR before the READDY was completed did not capture free text in notes, verbal guidance, or counseling provided by other disciplines. In clinical practice,

READDY responses direct subsequent educational interventions by providers, certified diabetes education and care specialists, and social workers over time. The reliance on discrete documentation for data analysis limited the ability to fully capture the potential association between counseling and confidence levels.

Finally, there may have been bias resulting from missing data from the subset of eligible patients who did not fill out the survey (although the response rate was high, with 71% of eligible adolescents and EAs completing a READDY assessment during the study time frame). A prospective longitudinal study design would allow for better measurement and capture of potential effects of confounders and covariates.

Despite these limitations, the findings that lower confidence is grouped in areas of risk behaviors suggest opportunities for further enhancement of formal transition preparation around these topics. This finding is particularly relevant given prior findings of increased odds of poor glycemic control after transfer (2) and risk for lapse in care between pediatric graduation and adult receivership that put adolescents and EAs at increased risk for acute complications such as diabetic ketoacidosis (3,4).

Future validation work is planned for the READDY measure with a larger, multisite, longitudinal sample to allow for future continued study of the transition of care needs of adolescents and EAs. Longitudinal multisite studies will be valuable in determining whether confidence levels in diabetes management knowledge and skills correlate with positive health outcomes after transfer, as hypothesized by existing conceptual models of the transition preparation process (7,8).

Given that the ADA has already provided guidelines for counseling related to alcohol, tobacco, sexual health, and the impact of diabetes on pregnancy in adolescents and EAs with type 1 diabetes (3), studies to understand barriers to effective counseling on these topics are also needed. Prior research has already established best practices for screening and anticipatory guidance. SBIRT (Screening, Brief Intervention, and Referral to Treatment) is a widely accepted evidence-based approach for substance use screening and anticipatory guidance that has been validated in adolescents with type 1 diabetes (45).

In summary, based on responses of the study cohort, even in a clinic with an established transition program, preparation could be strengthened by more focused counseling on the topics of alcohol, tobacco, sexual health, and the impact of diabetes on pregnancy in keeping with ADA guidelines. Simultaneously, ongoing research to develop a

better understanding of the interactions between counseling, behavior, glycemic control, and health and quality-of-life outcomes will further add to the impact of transition preparation interventions. Strategies within existing EMRs to facilitate consistent documentation of counseling will assist interdisciplinary teams in tracking longitudinal transition preparation. Best practices for using self-confidence assessment tools to improve transition readiness remain unclear and require more research. For programs using the READDY survey to guide transition readiness, the authors suggest attention to areas of lowest patient-reported confidence as priority topics for interventions.

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#### DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

#### AUTHOR CONTRIBUTIONS

C.K., J.C.K., N.C., and S.D.C. designed the study. C.K. performed the research (retrospective chart review). J.C.K. performed the statistical analysis. All authors analyzed the data, wrote the manuscript, and approved the final manuscript for submission. S.D.C. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

#### PRIOR PRESENTATION

The results of this study were first presented as a poster abstract at the 2019 Pediatric Endocrine Society Annual Meeting, Baltimore, MD, 24 April to 1 May 2019.

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