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Examination of the Pediatric Diabetes Routines Questionnaire in Adolescents: Development of an Adolescent Self-Report Version and Confirmatory Factor Analysis

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The University of Southern Mississippi

EXAMINATION OF THE PEDIATRIC DIABETES ROUTINES QUESTIONNAIRE IN ADOLESCENTS: DEVELOPMENT OF AN ADOLESCENT SELF-REPORT VERSION AND CONFIRMATORY FACTOR ANALYSIS

by

Jessica Sima Pierce

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

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ABSTRACT

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Previous literature suggests a positive relationship between general child routines and diabetes treatment adherence. However, research examining routines specific to the diabetes regimen is lacking. Recently, the Pediatric Diabetes Routines Questionnaire (PDRQ) was developed as a parent-report measure of diabetes-specific routines for children and adolescents with type 1 diabetes. Though the PDRQ has provided a means to measure routines specific to the diabetes regimen, limitations exist in regard to its use with adolescents. Thus, the goals of this study were to develop and evaluate a parallel adolescent self-report version (PDRQ: Adolescent; PDRQ:A) of the PDRQ and to examine the psychometric properties of the PDRQ (now PDRQ: Parent, PDRQ:P) and PDRQ:A in a large sample of adolescents. Confirmatory factor analysis was also conducted to evaluate factorial validity. Participants included 120 parent-adolescent dyads (ages 12 to 17) and an additional 24 parents only. Participants completed the PDRQ:P/A, as well as a series of questionnaires on general adolescent routines, diabetes treatment adherence, diabetes-specific family support, and diabetes-specific family conflict to evaluate the reliability and validity of the PDRQ:P/A. The predicted factor solutions were not confirmed; however, a solid one-factor model (PDRQ:P/A Total Routines score) was supported and included three new items. Additionally, the

PDRQ:P/A demonstrated good internal consistency, test-retest reliability, and inter-rater reliability, and adequate validity coefficients. Overall, promising results for the PDRQ:P/A were found. Recommendations for scoring and use of the PDRQ:P/A are discussed.

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TABLE OF CONTENTS

LIST OF TABLES

Table

CHAPTER I

INTRODUCTION

Poor control of type 1 diabetes (T1D) can result in long-term (e.g., retinopathy, neuropathy, heart and kidney disease, blindness) and acute (e.g., diabetic ketoacidosis) medical, as well as psychosocial (e.g., psychopathology, stress) consequences (Dantzer, Swendsen, Maurice-Tison, & Salamon, 2003; Diabetes Control and Complications Trial Research Group, 1994; Wysocki, Greco, & Buckloh, 2003). Treatment of T1D to manage diabetes and prevent the development of such complications requires a tedious regimen, including self monitoring of blood glucose, insulin administration, and dietary and exercise management (Silverstein et al., 2005). Thus, daily and regular management of T1D is crucial for adequate care. Many of these recommendations can be incorporated into the child's or adolescent's daily or weekly routines such as eating regular meals, getting ready for school and bed, and daily activities. Consequently, those children who are more capable of integrating their regimen into the organization of daily routines are expected to have more effective management strategies and better adherence to treatment regimens.

Family routines and rituals have been examined in relation to pediatric chronic illness (Keltner, 1992; Markson & Fiese, 2000; Mellin, Neumark-Sztainer, Patterson, & Sockalosky, 2004; Murphy, Marelich, Herbeck, & Payne, 2009; Schreier & Chen, 2010), and general child routines have been examined in relation to diabetes treatment adherence (Greening, Stoppelbein, Konishi, Jordan, & Moll, 2007). However, examination of routines that are specific to the T1D regimen is limited due to a lack of an adequate measure. Recent development of the Pediatric Diabetes Routines Questionnaire (PDRQ;

Pierce & Jordan, 2012) has provided a psychometrically sound mechanism for studying diabetes-specific routines in children and adolescents with T1D.

Though the PDRQ has aided in the study of routines specific to the diabetes regimen, limitations still exist, particularly regarding its use to assess diabetes-specific routines in adolescents. First, the PDRQ was designed to obtain data only through parent report, despite the age of the child/adolescent. However, it is well known that adolescents are more independent from their families than are children and, therefore, may be more accurate reporters of their routines than are their parents (Fiese, Wamboldt, & Anbar, 2005). Development of an adolescent self-report version of the PDRQ provides a means to obtain information about adolescents' own diabetes routines directly from the adolescents. Moreover, development of an adolescent self-report version of the PDRQ allows for the study of diabetes-specific routines with multiple informants, providing greater confidence that diabetes-specific routines data are being accurately reported. Researchers in the field of child development suggest the use of multiple informants for research and assessment to increase reliability and validity of informant reports (Reynolds & Kamphaus, 2004).

Second, findings from the initial development study differed with respect to the expected factor structure of the PDRQ. Although a three-factor structure (Medical Routines, Diet and Exercise Routines, and Daily Living Routines) was hypothesized based on theory, exploratory factor analysis of the measure revealed a two-factor solution (Daily Regimen Routines and Technical/Situational Routines). Therefore, there is a need for further evaluation of the factorial validity of the PDRQ. Specifically, the factor structure needs to be confirmed to determine that the two-factor structure was accurate in

the development study and was not idiosyncratic to the development sample (Pierce & Jordan, 2012).

Finally, in its initial study (Pierce & Jordan, 2012), the adolescent portion of the sample was too small to determine whether the PDRQ is valid for use in adolescents. Initial examination of the PDRQ revealed that parents of adolescents reported fewer diabetes-specific routines than those of school-aged children (i.e., child age was negatively correlated with the PDRQ Total score). Thus, it is questionable as to whether there is an actual decrease in routines during adolescence or whether parents are simply less aware of their adolescent's routines due to increased independence both in diabetes care and in everyday life. Indeed, research has suggested that as children approach adolescence, responsibility for their diabetes management increases, while regimen adherence and conscientious disease management decreases (Duke et al., 2008; Greening et al., 2007; Harris et al., 2000). Therefore, further examination of the reliability and validity of the PDRQ in a larger adolescent sample is necessary and warranted.

Given the need for adolescents to report on their own diabetes-specific routines, this study aimed to develop an adolescent self-report instrument. A second goal of this study was to further examine the factor structure of the original parent-report and new adolescent self-report forms of the PDRQ. Additionally, because of the small portion of adolescents in the initial PDRQ study, a third goal was to examine the reliability and validity of both the original parent-report and new adolescent self-report form of the PDRQ in a large sample of adolescents.

Family Routines, Rituals, and Adolescent Health

Substantial research has focused on the importance that family routines and rituals have on health and well-being in children and adults. For example, family routines are positively correlated with children's health (Keltner, 1992) and aid in adults' coping with chronic pain (Bush & Pargament, 1997). Family rituals were also found to be a protective factor against anxiety in children with asthma (Markson & Fiese, 2000). This research has also been extended to adolescents and may be particularly important in this age group. Despite adolescents' growing autonomy and independence from their families, their need for a sense of stability and security remains. Keltner, Keltner, and Farren (1990) suggest that family routines and rituals provide that type of predictability and stability.

Specifically, Fiese (1993) examined the protective function of family rituals against health-related anxiety symptoms (e.g., headaches, back pain, and stomach aches) in adolescents being raised by an alcoholic parent. Results indicated that adolescents with an alcoholic parent and high family rituals reported significantly fewer health-related anxiety problems than adolescents with an alcoholic parent and low family rituals (Fiese, 1993). This study provides evidence that family rituals may protect adolescents against the damaging psychological and emotional effects of being raised in an alcoholic family.

In addition to family rituals, recent research has emphasized the importance of family routines for adolescents' behavioral and emotional functioning. Kiser, Bennett, and Paavola (2005) evaluated family rituals and routines in adolescents using a semi-structured interview. The researchers found that compared to non-clinical adolescents, clinical adolescents (i.e., those receiving psychiatric services for a diagnosed psychiatric

disorder) had fewer family rituals and routines. Similarly, family routines may protect against the effects of risk factors (e.g., poverty and community violence) associated with growing up in a low-income household (Loukas & Prelow, 2004). Specifically, Loukas and Prelow (2004) found that family routines were moderately associated with fewer externalizing and internalizing problems in a sample of low-income Latino, female adolescents.

Family rituals and routines have also been examined in the context of a variety of medical conditions. Mellin and colleagues (2004) examined family meal routines as a protective function against unhealthy weight management behavior among adolescent girls with T1D. Results suggested that adolescent girls with T1D who engaged in disordered eating behaviors (e.g., bingeing and purging, use of laxatives and diet pills, skipping insulin dose) were three times more likely to have a *Low* level of family meal structure than girls with T1D who did not engage in disordered eating behavior (67% vs. 20%, respectively). Families classified as having a *Low* level of family meal structure had few routines structured around family dinners (e.g., not sitting down at the table together). Thus, maintaining structure and routine around family meals is related to better health in adolescent girls with T1D such that high family meal structure was considerably more prevalent among those without disordered eating behaviors (Mellin et al., 2004).

More recently, Murphy and colleagues (2009) examined the influence of family routines on outcomes among adolescents affected by mothers with HIV/AIDS. Among families with more frequent family routines, adolescents showed lower rates of aggressive behavior, physiological anxiety, worry, depressive symptoms, conduct disorder behaviors, and binge drinking over time. Moreover, these adolescents also

showed increased self-concept scores, compared to adolescents in families where there was a lower frequency of family routines. These results suggest the importance of maintaining family routines even when mothers are experiencing physical illness (Murphy et al., 2009).

In a recent longitudinal study, Schreier and Chen (2010) examined whether trajectories of inflammatory markers of asthma can be predicted by levels of family routines in older youth and adolescents (ages 9 to 16) with asthma. Increased release of inflammatory markers results in inflammation, airway constriction, and mucus production, which are negative health indicators in people with asthma (Schreier & Chen, 2010). Results indicated that routines significantly predicted changes in youth's stimulated inflammatory production over time after controlling for asthma severity, indicating that as levels of family routines increased, youth showed decreased stimulated inflammatory markers over time. These results suggest that family routines predict decreases in inflammatory profiles in youth with asthma, thereby reducing asthma morbidity in the long-term. Taken together, the previous studies suggest that family rituals and routines may be associated with fewer stressors among adolescents affected by chronic illness.

Child Routines and Chronic Illness Management

Child routines have been defined as "observable, repetitive behaviors which directly involve the same child and at least one adult acting in an interactive or supervisory role, and which occur with predictable regularity in the daily and/or weekly life of the child" (Sytsma, Kelley, & Wymer, 2001, p. 29). Both family routines and child routines are observable, repetitive, and important in structuring family life (Keltner et al.,

1990); however, while family routines are activities and events that involve the entire family unit, individual family members may also have unique individual routines (e.g., exercise routine, homework routine). Thus, researchers have argued that routines of individual children in families may differ just as child adjustment may differ across children within a family (Jordan, 2003). Assessment of child routines allows for the evaluation of routines specific to the individual child or adolescent.

Like family routines and rituals, routines of the individual child or adolescent are important in examining the relationships between routines and chronic illness. However, research on child routines and health is in its infancy. Nevertheless, researchers have recently begun to examine relations between child routines and adherence in pediatric chronic illness. Examining child routines in the context of chronic illnesses is useful because the individual child or adolescent with the chronic illness may have routines that differ from those of his/her entire family unit, which may uniquely impact his/her disease/health status (Denham, 2003). However, despite their increasing independence from the family unit, no studies to date have examined these relationships uniquely in adolescent samples, although most studies have combined child/adolescent samples.

DeMore, Adams, Wilson, and Hogan (2005) were the first to examine the relationship between general child routines and adherence to a chronic illness. Specifically, they evaluated the roles of child routines, child behavior problems, and parenting distress in relation to children's daily medication adherence in pediatric asthma. The researchers predicted that families with higher levels of routines would more easily incorporate asthma care into their daily lives and, therefore, would have children with better adherence. In contrast to the researchers' prediction, child routines did not

significantly predict unique variance in medication adherence when parenting stress was also entered in the model. Additionally, the zero-order correlation between child routines and medication adherence failed to reach statistical significance (r = -.25, *ns*). However, it is important to note the small sample size (N = 45) and consequential reduced statistical power for regression analyses. Additionally, the age range of the sample was limited to school-age children (ages 6 to 12). Thus, adolescents were not included in the sample. DeMore and colleagues' (2005) unexpected findings prompted further research in examining relations between child routines and treatment adherence in children and adolescents with chronic illnesses.

Following DeMore and colleagues (2005), Greening and colleagues (2007) examined relationships between child routines, behavior problems, and adherence in a large sample of children and adolescents with T1D (N = 111). It was hypothesized that youth with T1D and externalizing behavior problems who engage in more routine behaviors would have better treatment adherence. Routines were examined as a protective factor (moderator) and as a mediator of the relationship between childhood behavior problems and poor treatment adherence, with results supporting a full mediation hypothesis. Thus, failure to engage in child routines explains why children and adolescents with behavior problems have poor treatment adherence. These results suggest that routines may be a mode of intervention for improving adherence among diabetic youth with behavioral problems (Greening et al., 2007).

As an attempt to further examine relationships between child routines and adherence to chronic illness treatment regimens, Jordan, Stoppelbein, Hilker, Jensen, and Elkin (2006) examined the relationship between child routines and treatment adherence

in children and adolescents with sickle cell disease (SCD). Results indicated a moderate positive relationship between child routines and self report of SCD treatment adherence, suggesting that children with more frequent routines have better adherence to their SCD self-care regimen. Additionally, child routines independently predicted 13% of the variance of SCD treatment adherence after controlling for child age, maternal education, and parents' knowledge of sickle cell disease. This study along with Greening and colleagues' (2007) results, suggests that establishing routines in children and adolescents with chronic illnesses may improve treatment adherence. However, these results are inconsistent with the findings by DeMore and colleagues (2005), suggesting that relationships between routines and regimen adherence may be unique to specific diseases. Thus, further research on routines and adherence to chronic illness regimens is warranted, and disease-specific routines are a potential mechanism that may contribute to the understanding of these relationships.

Disease-Specific Routines Defined and Related Constructs

Disease-specific routines are "observable, repetitive behaviors, in relation to self-care behaviors of disease management, which occur with predictable regularity in the daily and/or weekly life of the individual with the illness" (Pierce & Jordan, 2012, p. 58). Disease-specific routines consist of modifications in existing general daily routines (e.g., mealtime routines) as well as additional routines that cannot be determined by a measure of general child routines (e.g., medical regimen routines). Success in managing a chronic illness regimen often involves patterned or habitual behaviors (routine behaviors) of the individual with the chronic illness and the individual's household members who interact to support the member with the disease (Denham, 2003). Therefore, implementation of

disease-specific routines is expected to help individuals adhere to their treatment regimens. Whereas adherence is defined as the "daily regimen tasks that the individual performs to manage their disease" (Weigner, Butler, Welch, & La Greca, 2005, p. 1), disease-specific routines occur when specific routines are formed around these self-care tasks. For example, *When blood sugar is low, parent or child treats it,* is an example of treatment adherence, and *When blood sugar is low, parent or child has a set routine for treating it (e.g. test blood glucose, eat glucose tablets, wait 15 minutes, test again),* is an example of a diabetes-specific routine. Another example of treatment adherence is *Parent or child manages diabetes during exercise*, and *My child routinely prepares for possible low blood sugar before exercise (e.g., eats snack before exercising, carries supplies to treat, decreases insulin dose)*, is an example of a diabetes-specific routine.

Disease-specific routines are also related to measures of parental involvement and support in diabetes care. Boland, Grey, Mezger, and Tamborlane (1999) found that adolescents with more consistent diabetes care had greater parental involvement in their diabetes care. Additionally, Pierce and Jordan (2012) found that children and adolescents with more frequent diabetes-specific routines had a greater level of diabetes-specific supportive family behaviors and a lower level of diabetes-specific nonsupportive family behaviors. As disease-specific routines often involve members of the child's or adolescent's family, they also relate to parental behaviors specific to diabetes management (Pierce & Jordan, 2012). These relationships are particularly important in adolescence because, despite adolescents' increased independence from the family unit, adolescents whose parents maintain some guidance and control in their diabetes management have better outcomes (Boland et al., 1999).

Disease-Specific Routine Measures

Although a number of standardized instruments are available to study general child and family routines, these measures were not designed to measure specific variables associated with health or chronic illness routines. According to Denham (2003), more information is needed about specific routine factors, including "timing of events, rhythmicity of behaviors, rigidity, flexibility, and resiliency of patterns" (p. 322) and how they relate to chronic illness management. Development of disease-specific routine measures offers a means of assessing how routines influence adherence to chronic illness regimens, as well as general health over time (Denham, 2003). Consequently, researchers have begun to develop measures of child and adolescent routines specific to chronic illness regimens.

The Asthma Routines Questionnaire (Fiese et al., 2005) is a brief, parent-report questionnaire that assesses asthma management routines in children and adolescents with asthma between the ages of 5 and 18. It includes eight items with topics ranging from specific characteristics of medication routines, such as remembering to fill prescriptions, to more global routines, such as the family's emotional commitment to care. Factor analysis of 153 caregiver responses to the Asthma Routines Questionnaire revealed two factors. The Medication Routines factor included items pertaining to practices associated with taking medication and reminding the patient to take medication. The Routine Burden factor included items pertaining to the caregiver's emotional burden of performing the routines (e.g., "housecleaning is a chore").

The researchers hypothesized that asthma-specific routines would be associated with greater medication adherence and more positive quality of life. However, outcomes differed by factor, such that medication routines were positively correlated with adherence to medication regimens, while routine burden was negatively correlated with quality of life. The researchers concluded that distinguishing the routines that families actually use from how burdened they feel by their child's asthma may help clinicians in developing more effective methods for implementing routines (Fiese et al., 2005).

Furthermore, the medication routines factor was negatively related to child age, such that parents of adolescents reported fewer asthma-specific routines than parents of children. Fiese and colleagues (2005) suggested that there is a decrease in routines as children approach adolescence because the behavioral practices of adolescents are often more strongly influenced by outside influences, such as peers, than by the family members. The authors, therefore, advised that during adolescence, it may be important to consider routines that are initiated by the adolescent, rather than the parent (Fiese et al., 2005), providing further support for the need for adolescent self-report measures of routines.

The Consistency in Diabetes Scale (Boland et al., 1999) was developed to compare diabetes routines during school months to routines during summer months. It is 13-item, adolescent self-report questionnaire that was developed to determine whether diabetes care routines varied between the summer and school months. The frequency of performing diabetes regimen behaviors is rated on a Likert-scale with responses ranging from "Always" to "Never." The Consistency in Diabetes Care instrument was piloted and rewritten based on feedback from adolescents. Items all had the same stem, "Compared

with the summer, would you say that you…" and ended with a question such as, "Take your morning insulin later in the day?" The measure demonstrated moderate internal consistency, $\alpha = .69$. The Consistency in Diabetes Scale was then distributed to 40 adolescents with T1D, and metabolic control was also measured. Results indicated that metabolic control was worse during the summer when adolescents had less consistent daily routines (Boland et al., 1999). Despite its relative usefulness, the Consistency in Diabetes Scale has not been validated in subsequent studies. Furthermore, although the scale is an adolescent self-report measure of diabetes-specific routines, it is limited in that it functions in simply differentiating between routines during summer and school months. Consequently, an everyday measure of diabetes-specific routines was needed.

More recently, the Pediatric Diabetes Routines Questionnaire (PDRQ; see Appendix A) was developed as a parent-report measure of everyday routines specific to the diabetes regimen in children and adolescents with T1D between the ages of 5 and 17. Development of the PDRQ involved defining a pool of diabetes-specific routines common to children and adolescents with diabetes (DeVellis, 2003). Ten professionals evaluated 32 initial items, resulting in an initial item pool of 29 items. After data collection, factor analysis was conducted on 198 parent responses to the 29-item PDRQ. Specifically, a principal components analysis with promax oblique rotation was utilized, and items were removed one by one until only items loading > 0.3 on one factor and < 0.3 on the other factor were retained.

The researchers hypothesized that the PDRQ would reveal three factors based on the diabetes regimen: 1) medication routines, 2) diet and exercise routines, and 3) daily living routines (Silverstein et al., 2005). Although the three-factor solution was not

confirmed, a solid two-factor solution was revealed and comprised of Daily Regimen Routines and Technical/Situational Routines, which sum to form a Total Routines score. The Daily Regimen Routines factor is comprised of daily components of the diabetes regimen that are routine in nature. Items on this component assess the extent to which daily regimen tasks are completed in a routine manner (i.e., occur at about the same time, in the same order, or in the same way every time). The Technical/Situational Routines factor is comprised of components of the diabetes regimen that occur less frequently but still may occur routinely. These behaviors are those that occur in emergency situations (e.g., treating high and low blood sugars), as well as technical aspects of the regimen (e.g., rotating sites and calculating doses). Thus, they are more specific to the individual child/adolescent than items comprising the Daily Regimen Routine factor. Although the two-factor solution was theoretically and statistically sound, the development of the PDRQ would benefit from further examination of the factor structure to determine whether the current two-factor or the originally predicted three-factor solution has better fit.

After factor analysis, the psychometric properties of the PDRQ were examined. Findings revealed good to very good reliability, including internal consistency and test-retest reliability. Internal consistency estimates were higher than those reported for the Diabetes Family Behavior Checklist (DFBC; Lewin et al., 2005) and the Self-Care Inventory (SCI; Lewin et al., 2009) and similar to those reported for the Child Routines Questionnaire (CRQ; Jordan, 2003; Sytsma et al., 2001; see Appendix B). Two-week temporal reliability estimates were good for the PDRQ Total scale and both subscales (see Appendix C). Construct validity of the PDRQ was supported by significant positive

relationships between the frequency of diabetes-specific routines and general child routines, family rituals, diabetes treatment adherence, and diabetes-specific supportive family behaviors and by a negative relationship between the frequency of diabetes specific routines and nonsupportive diabetes-specific family behaviors (see Appendix D).

Like the Asthma Routines Questionnaire, analysis of the PDRQ revealed that child age was negatively correlated with the PDRQ, such that parents of adolescents endorsed significantly fewer diabetes-specific routines than parents of school-aged children. It is important to note, however, that illness duration was also negatively related to frequency of diabetes-related routines. However, age and duration of illness are confounded, such that adolescents generally have been diagnosed with diabetes longer than children. The strength of the relationship between these two variables was moderate, so further regression analyses were conducted to determine the nature of this relationship. When age was controlled for, the amount of incremental variance added by illness duration beyond that accounted for by age was small and only approached significance (p = .05). However, age added significant and sizeable incremental variance beyond that accounted for by illness duration. The fact that age and illness duration are confounded makes findings difficult to interpret; however, results suggested that age has a larger influence on diabetes-specific routines than illness duration, with adolescents having fewer diabetes-specific routines than school-aged children.

The results of the original PDRQ study are consistent with several studies indicating that there are developmental changes in diabetes management as children approach adolescence. Significant age differences between children and adolescents have been found on other measures of diabetes-specific constructs. For example, older youth

reported less conscientious diabetes self-management than younger youth (Harris et al., 2000) and age has been consistently inversely related to diabetes treatment adherence (e.g., Duke et al., 2008; Greening et al., 2007). Furthermore, as previously mentioned, asthma medication routines were negatively related to child age, suggesting that this finding generalizes across chronic illnesses (Fiese et al., 2005). Due to these age-related changes in disease responsibility, reduced parental monitoring, and increasing amounts of time spent with peers, adolescents may be more accurate informants regarding their routines than are their parents.

Moreover, the PDRQ was designed with a parent-report format regardless of the child/adolescent's age. However, the parent-report style may affect conclusions about the validity of the PDRQ because some adolescents with diabetes are more familiar with their diabetes regimen and how routinely they follow their specific regimen than are their parents (Duke et al., 2008). As previously discussed, parents of adolescents reported significantly fewer diabetes-specific routines than parents of school-aged children. It is questionable as to whether this is because adolescents truly have fewer routines than school-aged children or whether their parents are simply less aware of their adolescents' routines due to the developmental shift in responsibility of diabetes management. An adolescent self-report version of the PDRQ would help determine the nature of this discrepancy by providing a means of obtaining information directly from the adolescent and allowing for comparison of frequency of diabetes-specific routines among informants.

Furthermore, it is important to note that in the initial PDRQ study the adolescent portion of the sample was small (n = 66), compared to the overall sample, which limits

conclusions about the validity of the PDRQ in adolescents (Pierce & Jordan, 2012). Specifically, there was not enough power to examine the PDRQ in children and adolescents separately. Although age differences were demonstrated between children and adolescents, it is not clear the extent to which lower scores on the PDRQ correspond to fewer routines and true declines in adherence or if there are developmental factors that cause fewer routines to be normative despite adequate adherence in adolescence. Furthermore, although there was strong initial evidence for construct validity of the PDRQ, the small portion of adolescents in the sample did not permit enough power to examine validity coefficients separately in adolescents. Therefore, there is a need to examine the psychometric properties of the PDRQ parent-report and adolescent self-report forms, particularly validity, in larger samples of adolescents.

Summary and Rationale for Current Study

For the proposed study, the PDRQ was extended by the development of a self-report measure, the PDRQ: Adolescent (PDRQ:A), as well as through further validation of the parent-report version (PDRQ: Parent; PDRQ:P). The validity of the PDRQ was limited because the adolescent portion of the initial PDRQ sample was too smallto adequately assess its use in adolescents and because the measure was designed to be parent-report regardless of the child's/adolescent's age. However, most adolescents with diabetes are more familiar with their diabetes regimen and how routinely they follow their specific regimen than are their parents (Duke et al., 2008).

Therefore, the first goal of the current study was to develop the PDRQ:A as a parallel adolescent self-report version of the PDRQ:P. During the development phase, five new developmentally relevant items (i.e., "I/My adolescent follow/s a routine for

adhering to his/her/my diabetes regimen while on a date," "I/My adolescent follow/s a routine for adhering to his/her/my diabetes regimen while engaging in extracurricular activities (e.g., sports, clubs, etc.)," and "I/My adolescent follow/s a routine for adhering to his/her/my diabetes regimen while spending time with friends at my house," "I/My adolescent follow/s a routine for adhering to his/her/my diabetes regimen while spending time with friends away from home," "I/My adolescent follow/s a routine for adhering to his/her/my diabetes regimen while at work") were included in both versions of the PDRQ to assure that all aspects of adolescent diabetes routines were being assessed. These new items were evaluated to determine their adequacy for being included in the PDRQ. The second goal of the current study was to extend the factorial validity of the PDRQ:P and to examine the factorial validity of the PDRQ:A through confirmatory factor analysis. Because both a two- or three-factor structure was potentially adequate, both models were examined to determine the best fit for each version of the PDRQ.

Finally, a third goal of the current study was to examine the reliability and construct validity of the PDRQ:A and to determine whether the psychometric properties of the PDRQ:P were upheld in a larger sample of adolescents. It was expected that the PDRQ:A would exhibit at least moderate internal consistency and temporal stability and that the internal consistency of the PDRQ:P would be upheld in the current adolescent sample. Additionally, it was expected that the PDRQ:P and PDRQ:A would exhibit at least moderate inter-rater reliability. As evidence for initial construct validity of the PDRQ:A and further validation of the PDRQ:P in an adolescent sample, it was expected that frequency of diabetes-specific routines as measured by the PDRQ:P/A would be positively related to parent- and adolescent self-report, respectively, measures of general

adolescent routines, diabetes-specific supportive family behaviors, and diabetes treatment adherence. It was also expected that the PDRQ:P/A would be negatively correlated with parent- and adolescent self-report, respectively, measures of diabetes-specific nonsupportive family behaviors and diabetes-specific family conflict.

CHAPTER II

METHOD

Participants

The PDRQ:P/A was administered to 120 adolescents with type 1 diabetes between the ages of 12 and 17 (M = 13.86, SD = 1.61) and their parent or caretaker. Twenty-four additional parents completed the PDRQ:P, without the completion of the PDRQ:A by their adolescent. These additional PDRQ:Ps were included in analyses in which the PDRQ:P and PDRQ:A were analyzed independently (i.e., confirmatory factor analysis, internal consistency, construct validity). Participants were recruited through the mailing lists of several diabetes organizations across the U.S., as well as through the upcoming patient appointment list at a children's hospital. Exclusion criteria included adolescents diagnosed with (a) diabetes ≤ 6 months ago, (b) type 2 diabetes, (c) a comorbid chronic illness, and (d) mental retardation or a pervasive developmental disorder. A total of 19 participants were not included in the study because they did not fall in the age range specified or they met exclusion criteria.

Of the adolescents reported on, 45.0% were male and 85.0% were Caucasian. All parents were over the age of 18 at the time of participation (M = 44.69, SD = 6.52). Most parents were female (88.9%) and married (79.9%). The mean length of time since adolescents were diagnosed with T1D was approximately five years (M = 5.42, SD = 3.98). Additionally, more than half (58.3%) of the sample used the insulin pump as opposed to injections to administer insulin.

Based on information provided by the parents, socioeconomic status (SES) was computed using Hollingshead's (1975) four-factor index of social position. This score

takes into account education, occupation, sex, and marital status in estimating SES. Using this index, a value ranging from 8 to 66 is calculated, which can be further subdivided into five levels, with lower levels indicating lower SES (M = 52.63, SD = 10.17; see Table 1). The median SES value fell in level IV, corresponding to major business and professionals. A detailed breakdown of demographic information is provided in Table 1.

Table 1

Adolescent Demographic Characteristics of Item Development Sample

	Initial *n* (%)	Retest *n* (%)
Adolescent's Gender		
Male	54 (45.0%)	25 (58.1%)
Female	63 (52.5%)	18 (41.9%)
Not reported	3 (2.5%)	0 (0%)
Adolescent's Age		
12	33 (27.5%)	15 (34.9%)
13	24 (20.0%)	7 (16.3%)
14	22 (18.3%)	7 (16.3%)
15	17 (14.2%)	5 (11.6%)
16	16 (13.3%)	5 (11.6%)
17	8 (6.7%)	4 (9.3%)
Adolescent's Race		
Caucasian	102 (85.0%)	40 (93.0%)
African American	10 (8.3%)	1 (2.3%)
Hispanic	3 (2.5%)	1 (2.3%)
Asian	1 (0.8%)	1 (2.3%)
Other	2 (1.7%)	0 (0%)
Not reported	2 (1.7%)	0 (0%)
Parent's Gender		
Male	15 (10.4%)	6 (14.0%)
Female	128 (88.9%)	36 (83.7%)
Not reported	1 (0.7%)	1 (2.3%)

Table 1 (continued).

	Initial *n* (%)	Retest *n* (%)
Parent's Race		
Caucasian	126 (87.5%)	41 (95.3%)
African American	13 (9.0%)	1 (2.3%)
Asian	1 (0.7%)	1 (2.3%)
Hispanic	3 (2.1%)	0 (0%)
Other	1 (0.7%)	0 (0%)
Not reported	0 (0.0%)	0 (0%)
Marital Status		
Married	115 (79.9%)	39 (90.7%)
Separated	4 (2.8%)	2 (4.7%)
Divorced	17 (11.8%)	1 (2.3%)
Widowed	3 (2.1%)	1 (2.3%)
Single/Living with significant other	3 (2.1%)	0 (0%)
Single/Not living with significant other	2 (1.4%)	0 (0%)
Not reported	0 (0.0%)	0 (0%)
SES Level		
I	0 (0%)	0 (0%)
II	7 (4.9%)	2 (4.7%)
III	7 (4.9%)	1 (2.3%)
IV	46 (31.9%)	15 (34.9%)
V	64 (44.4%)	21 (48.8%)
Not reported	20 (13.9%)	4 (9.3%)

Measures Under Examination

Demographic Form

A demographic form was administered to the parent for the purpose of gathering descriptive information about the adolescent and his/her parent. The demographic form asked for information including the parent's gender, age, race, educational background, occupation, and combined family income. It also asked for demographic information

regarding the child (e.g., age, gender, and race), as well as diabetes variables (e.g., date of diagnosis and insulin regimen).

Pediatric Diabetes Routines Questionnaire: Adolescent (PDRQ:A)

This measure was developed for the current study. It included 21 items that were reworded to first person (i.e., "I" instead of "My child") from the original 21-item PDRQ. Additionally, five new items were included in the PDRQ:A to assure developmental appropriateness: "I follow a routine for managing my diabetes while on a date;" "I follow a routine for adhering to my diabetes regimen while engaging in extracurricular activities (e.g., sports, clubs, etc.);" "I follow a routine for managing diabetes while spending time with friends at my house;" "I follow a routine for managing diabetes while spending time with friends away from home;" and "I follow a routine for managing diabetes while at work.". Although these new items were added, it was expected that all items will fall within the Technical/Situational Routines domain identified in the original PDRQ because they occur in specific situations and are unique to the individual adolescent. The occurrence of these items was measured through the use of a 5-point Likert scale ranging from 0 "never" to 4 "nearly always." A N/A "cannot rate this item/not applicable" response was also available.

Pediatric Diabetes Routines Questionnaire: Parent (PDRQ:P)

The PDRQ:P (originally the PDRQ; Pierce & Jordan, 2012) is a 21-item parent-report measure of diabetes-specific routines in children and adolescents ages 5 to 17 with type 1 diabetes. For this study, the PDRQ:P included the same five new developmentally relevant items that were added to the PDRQ:A to assure that all aspects of adolescent routines were assessed. Item frequency of the PDRQ:P is measured through the use of a

5-point Likert scale ranging from 0 "never" to 4 "everyday." A N/A "cannot rate this item/not applicable" response was also be available.

Factor analysis of the initial PDRQ revealed two subscales: Daily Regimen Routines and Technical/Situational Routines, which sum to form a Total scale. Initial analyses suggested strong reliability coefficients, including internal consistency ($\alpha = .88$; see Appendix B) and test-retest reliability ($r = .81$; see Appendix C). Construct validity was also supported through positive relations with general child routines, family rituals, diabetes treatment adherence, and supportive diabetes-specific family behaviors and through a negative correlation with nonsupportive diabetes-specific family behaviors (Pierce & Jordan, 2012; see Appendix D). The PDRQ:P was used in the current study to compare its factor structure with that of the PDRQ:A and to determine if the two-factor structure was upheld in a larger adolescent sample.

Validation Measures

Adolescent Routines Questionnaire: Parent & Self-Report (ARQ:P/S)

The ARQ (Meyer, 2008) is a 33-item measure of routines in adolescents (12-17) in five domains: Daily Living Routines, School and Discipline Routines, Household Routines, Extracurricular Activities, and Social Routines, which sum to form a Total score. The only difference between the ARQ:P and ARQ:S is the item stem; item content is identical. Specifically, on the ARQ:P, items begin with "My adolescent…" and on the ARQ:S, items begin with "I…" Item frequency of daily and weekly routines is rated on a 5-point Likert-scale ranging from 0 "almost never" to 4 "nearly always." The ARQ:P and ARQ:S both have promising reliability, including internal consistency ($\alpha = .86$ and $\alpha = .85$, respectively), test-retest reliability ($r = .74$ and $r = .67$, respectively), and inter-rater

reliability (r = .65). Construct validity was also supported through positive relations with family routines, adaptive skills, and personal adjustment and through a negative correlation with externalizing behavior problems. The ARQ:P and ARQ:S were used in the present study for the purpose of construct validation of the PDRQ:A and further validation of the PDRQ:P. Coefficient alpha in the present sample was .91 and .86 for the ARQ:P and ARQ:S, respectively.

Diabetes Family Behavior Checklist: Parent- & Child-Rated (DFBC:P/C)

The DFBC (Schafer, Glasgow, McCaul, & Dreher, 1983; Schafer, McCaul, & Russell, 1986) is a 16-item measure of family support specific to the youth's diabetes self-care regimen. It assesses the frequency of behaviors directed toward diabetic persons by family members in children and adolescents ages 8 to 18 in two domains: Supportive Family Behaviors and Non-supportive Family Behaviors. The only difference between the DFBC:P and DFBC:C is the item referent; item content is identical. Specifically, on the DFBC:P, items reference "the patient" and on the DFBC:C items reference "you." Frequencies of non-supportive and supportive behaviors are rated on a 5-point Likert scale from 1 "never" to 5 "at least once a day." Adequate internal consistency was found for the DFBC:P Non-supportive (α = .74) and Supportive (α = .71) scales and for the DFBC:C Non-supportive (α = .79) and Supportive (α = .74) scales (Lewin et al., 2005). Convergent and divergent validity of the DFBC:P and DFBC:C is supported through correlations between the DFBC:P scales and measures of diabetes family support, metabolic control, and adherence (Lewin et al., 2005). The DFBC:P and DFBC:C was used in the present study for the purpose of construct validation of the PDRQ:A and further validation of the PDRQ:P. Coefficient alpha for the DFBC:P and DFBC:C

Supportive scale in the present study was .67 and .76, respectively. Coefficient alpha for the DFBC:P and DFBC:C Nonsupportive scale in the present study was .72 and .69, respectively.

Diabetes Family Conflict Scale: Parent and Child Versions (DFCS:P/C)

The DFCS (Hood, Butler, Anderson, & Laffel, 2007; Rubin, Young-Hyman, & Peyrot, 1989) is a 19-item measure of diabetes-specific family conflict in two domains: Direct Management Tasks and Indirect Management Tasks. Respondents indicate the degree of conflict they experience over a range of diabetes-specific variables. The only difference between the DFCS:P and DFCS:C is the item stem; item content is identical. Specifically, on the DFCS:P, items begin with "In the past month, I have argued with my child about…" and on the DFCS:C, items being with "In the past month, I have argued with my parent(s) about…." Frequencies of conflict are rated on a 3-point Likert scale from 1 "almost never" to 3 "almost always." The DFCS:P and DFCS:C both have good psychometric properties, including strong internal consistency (α = .81 and α =.85, respectively), moderate inter-rater reliability (r = .26), and concurrent validity through correlations with negative affect around blood glucose monitoring, lower quality of life, and greater parental burden, and predictive validity through a correlation with metabolic control (Hood et al., 2007). The DFCS:P and DFCS:C were used in the present study for the purpose of construct validation of the PDRQ:A and further validation of the PDRQ:P. Coefficient alpha for the present study was .95 and .97 for the DFCS:P and DFCS:C, respectively.

Self-Care Inventory: Parent and Adolescent Versions (SCI:P/A)

The SCI (La Greca, Swales, Klemp, & Madigan, 1988) is a 14-item measure of respondents' perceptions of their adherence to diabetes self-care recommendations over the previous 1-2 weeks. The SCI assesses four domains of adherence behaviors (monitoring, insulin, diet, and exercise). Respondents report on adherence behaviors using a 5-point Likert scale from 1 "never do it" to 5 "always do this as recommended without fail," and "non-applicable" is provided as a response option. The only difference between the ARQ:P and ARQ:S is the item stem; item content is identical. Specifically, in the SCI:P, items begin with "In the past month, how well has *your child* followed recommendations for…," and the SCI:A begins with "In the past month, how well have *you* followed recommendations for…." Lewin and colleagues (2009) reported adequate internal consistency for the SCI:P (α = .78) and SCI:A (α = .80). Strong test-retest reliability coefficients were also reported for the SCI:P (*r* = .86) and for the SCI:A (*r* = .91; Lewin et al., 2009). Inter-rater reliability was moderate (*r* = .47; Lewin et al., 2009). Convergent and construct validity of the SCI:P and SCI:A were supported through correlations with a structured interview of adherence, glycemic control, and frequency of blood-glucose monitoring, (Lewin et al., 2009). The SCI:P and SCI:A were used in the present study for the purpose of construct validation of the PDRQ:A and further validation of the PDRQ:P. Coefficient alpha in the present sample was .75 and .77 for the SCI:P and SCI:A, respectively.

Procedures

Three organizations were utilized to recruit participants for this study: Diabetes Foundation of Mississippi (DFM), Juvenile Diabetes Research Foundation (JDRF), and

Children's National Medical Center (CNMC). Three different procedures were used for data collection: 1) Online through DFM and JDRF, 2) online through CNMC, and 3) mail-out through DFM. Initially, the primary investigator contacted DFM and JDRF to explain the goals and importance of the study and to request assistance with recruitment. Following agreement from DFM/JDRF, IRB approval through The University of Southern Mississippi was obtained (Appendix G).

Items from the PDRQ:P were reworded into a first person format to form the PDRQ:A. Additionally, the five new developmentally relevant items (see Measures section) were added to both the PDRQ:P and the PDRQ:A. It was predicted that the five new items would fall on the Technical/Situational Routines factor because they occur in specific situations and are unique to the individual adolescent.

Study measures were administered online using a secure Internet website. Two hyperlinks were created: a parent link and an adolescent link. For recruitment through DFM and JDRF (n = 90, 62.5% of total sample), the parent hyperlink was emailed to a contact person at DFM and JDRF, who then distributed the link to its members along with detailed instructions to complete the consent process and parent questionnaires. Parents were prompted to read and electronically sign a consent form, providing consent for themselves and for their adolescent. Parents were then required to enter a unique six digit code (i.e., first two letters of their child's last name and child's birth month and day). Parents were also required to provide their email address before proceeding with the surveys. Within one week of the parent survey completion, the primary investigator emailed the adolescent hyperlink to the email address the parent provided. All adolescent surveys were completed within one month of parent survey completion. Adolescents

were prompted to provide assent. They were then required to enter the same six digit code that their parent used, for the purpose of pairing parent-adolescent dyads. Additionally, they were required to check a box that endorsed that they were, in fact, adolescents with diabetes and were then warned that their data would be invalidated if they did not check the box. For the purpose of establishing test-retest reliability of the PDRQ:A, two weeks after adolescents submitted their questionnaires an additional email, which included a hyperlink to the PDRQ:A, was sent to parents to invite their adolescent to complete the PDRQ:A a second time. Adolescents were required to provide assent and enter the same six digit code that they previously entered for the purpose of pairing measures.

Following recruitment through DFM/JDRF, IRB approval was obtained through CNMC. All CNMC participants were recruited online (n = 28, 19.4% of total sample); however, the procedure differed slightly. The primary investigator obtained a list of adolescents with upcoming visits through the CNMC diabetes team (n = 300). Parents were mailed a letter, providing them with information about the study and notifying them that the primary investigator would be calling them in approximately two weeks to provide them with additional information and to invite them to participate. In the letter, parents were also provided with the primary investigator's email address and phone number and were given the option to contact the primary investigator immediately if they wished to participate or did not wish to be contacted further. Parents who contacted the primary investigator immediately wishing to participate were emailed the parent survey link and the adolescent survey link, the latter of which they were instructed to forward to their adolescent. For parents who wished to opt out of participating, the letter also

included a self-addressed, stamped postcard that parents were instructed to mail back within two weeks to decline participation in the study prior to them being contacted by phone. Parents who did not contact the primary investigator asking to participate, but who also did not return a postcard to decline participation were contacted by the primary investigator by phone two weeks after the letter was sent. During the phone call, the primary investigator invited the parent and his/her adolescent to participate in the study. If the parent agreed to participate, the primary investigator obtained the parent's email address and sent an email containing the parent survey link and the adolescent survey link, the latter of which parents were instructed to forward to their adolescents with T1D. Survey links for completing the measures were the same for both procedures. The test-retest reliability procedure for CNMC was the same as that for DFM/JDRF. Overall, the PDRQ:A was completed by 43 (35.8% of total sample) adolescents a second time with demographic characteristics similar to the entire sample (Table 1). All PDRQ:A retest surveys were completed between two and five weeks following initial PDRQ:A completion.

Participation time took between 20 and 30 minutes for both the parent and adolescent to complete the online surveys. Parent-adolescent dyads were offered an opportunity to be entered into a drawing for one of three 25 dollar gift certificates to Walmart for the DFM/JDRF group and for one 25 dollar cash card for the CNMC group upon completion of all questionnaires.

Many DFM members did not have email addresses on file with the organization. In an effort to recruit a socioeconomically diverse sample, a mail-out was also conducted. Paper packets including consent and assent forms, demographic forms, and study

measures were provided to the organization contact person, who then mailed packets to parents. Only parents who did not have email addresses on file with DFM and who, therefore, did not receive the online surveys, received the paper packets. Parents and adolescents were instructed to complete their questionnaires independently. Postage and self-addressed envelopes were provided to these participants for ease of returning packets. Mail-out participants consisted of 18.1% of the total sample (n = 26). Mail-out participants did not participate in the test-retest reliability procedure.

Measures were then examined to determine if participants adequately completed them. For CFA, missing items and not applicable responses on the PDRQ:P/A were interpolated using bootstrapping, which occurred for less than 0.05% of PDRQ:P and PDRQ:A responses. For demographic, reliability, and validity analyses, missing items and not applicable responses on the PDRQ:P/A for the initial sample and the retest sample were replaced with the average item score, which occurred for less than 0.03% of PDRQ:P and PDRQ:A responses. Questionnaires with more than four items missing were not included in the analyses. With this criterion, 141 PDRQ:P's and 112 PDRQ:A's were included in demographic, reliability, and validity analyses. The ARQ:P/S was considered complete if no more than one item was missing per subscale. With this criterion, 136 ARQ:P's and 112 ARQ:S's were included in the study. Missing items were replaced with the subscale mean, which occurred for less than 0.002% of ARQ:P responses and less than 0.001% of ARQ:S responses. The SCI:P/A was considered complete if it was missing no more than two items. With this criterion, 142 SCI:Ps and 113 SCI:As were completed and included in the study, and less than 0.002% of SCI:P items and 0% of SCI:A items were replaced with the scale mean. The DFBC:P/C was

considered complete if no more than two items were missing per subscale. With this criterion, 141 DFBC:Ps and 108 DFBC:Cs were included in the study, and less than 0.004% of DFBC:P items and less than 0.002% of DFBC:C items were replaced with the subscale mean. The DFCS:P/C was considered complete if no more than two items were missing per subscale. With this criterion, 140 DFCS:Ps and 106 DFCS:Cs were included in the study, and less than 0.003% of DFCS:P items and less than 0.001% of DFCS:C items were replaced with the subscale mean.

CHAPTER III

RESULTS

Item Evaluation

The first step in examining the factor structures of the PDRQ:P and PDRQ:A was to evaluate the properties of the five new developmentally relevant items that were added to each version to determine whether they should be included in the confirmatory factor analyses. Items were considered for elimination based on the following criteria: a) Item mean of 2.00 or less, indicating the average rating for the routine was "sometimes" (or less); b) Item-total correlation coefficient below .30 with the PDRQ:P/A Total Routines score; and/or c) Item endorsement of greater than 50% "Not Applicable," indicating that the item is not representative of the majority of participants.

All five of the new items had means greater than 2.00 and item-total correlations greater than .30 for the PDRQ:P and PDRQ:A, with the exception of PDRQ:P Item 22 (Item-total correlation = .273; Table 2). Two items had a high percentage of "Not Applicable" (N/A) responses by both parents and adolescents. Item 22 ("I/My child follow/s a routine for adhering to my/his/her diabetes regimen while on a date") and Item 26 ("I/My child follow/s a routine for adhering to my/his/her diabetes regimen while at work") were eliminated from the PDRQ:P/A based on this criterion. Specifically, 68.1% of parents endorsed N/A for Item 22 and 79.9% of parents endorsed N/A for Item 26 on the PDRQ:P. On the PDRQ:A, 51.7% of adolescents endorsed N/A for Item 22 and 69.7% of adolescents endorsed N/A for Item 26. These items were not representative of the majority of participants such that most adolescents in the sample did not go on dates

or work, as reported by themselves and their parents, to the extent that inclusion in the CFA would have prohibitively restricted the sample size.

Table 2

Item Characteristics of PDRQ:P/A Five New Developmentally Relevant Items

	PDRQ:P	Mean (SD)	Item-Total Correlation[a]	Percentage Not Applicable
Item 22	while on a date (*n* = 46)	2.93 (1.16)	.273	68.1
Item 23	extracurricular activities (*n* = 139)	3.29 (0.91)	.758	3.5
Item 24	spending time with friends at home (*n* = 142)	3.42 (0.84)	.758	1.4
Item 25	spending time with friends away from home (*n* = 142)	3.14 (0.96)	.803	1.4
Item 26	while at work (*n* = 29)	3.21 (1.18)	.325	79.9
	PDRQ:A	Mean (SD)	Item-Total Correlation[b]	Percentage Not Applicable
Item 22	while on a date (*n* = 58)	3.17 (0.99)	.728	51.7
Item 23	extracurricular activities (*n* = 113)	3.52 (0.68)	.689	5.8
Item 24	spending time with friends at home (*n* = 116)	3.46 (0.75)	.758	2.5
Item 25	spending time with friends away from home (*n* = 115)	3.39 (0.78)	.729	2.5
Item 26	while at work (*n* = 36)	3.08 (1.25)	.390	69.7

Note. [a]*n* = 16. [b]*n* = 21.

Factorial Validity

A confirmatory factor analysis (CFA) was conducted to determine if the two factors (Daily Regimen Routines and Technical/Situational Routines) that were obtained in the development study were maintained in the current sample, or whether the originally predicted three-factor structure (Medication Routines, Diet/Exercise Routines, and Daily Living Routines) was a better fit. The CFA models were tested using Mplus Version 6.11 (Muthén & Muthén, 2007). Weighted Least Squares Mean and Variance (WLSMV) was specified as the estimator for the CFA. WLSMV is an appropriate estimator for skewed data because it does not assume a particular distributional form (Kline, 2011). To assess fit of the models, two fit indices were evaluated: the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). The CFI examines fit of a specified model relative to a null model, while the RMSEA examines fit of a specified model adjusting for parsimony (Brown, 2006). It was expected that analyses would reveal a RMSEA index value close to or less than .08 and a CFI fit index value greater than or equal to .95 on a scale from 0 to 1.0, which are indicative of a satisfactory fit (Brown 2006; Hu & Bentler, 1999). Although chi square is commonly reported as a test of model fit, research has suggested that this index is easily inflated with large sample sizes (Lawley, 1956). Thus, for the present study, chi square was reported but emphasis was placed on other fit indices to determine goodness of fit (Lawley, 1956).

The specified CFA models consisted of 24 observed variables from the PDRQ:P and PDRQ:A. For the PDRQ:P, the two-factor fit produced the following results: χ^2 (251, N = 119) = 467.91, $p < .001$; CFI = .97; and RMSEA = .08, indicating that the two-factor

model provided a satisfactory fit to the PDRQ:P data. For the PDRQ:A, the two-factor fit produced the following results: χ^2 (251, N = 112) = 362.68, $p < .001$; CFI = .95; and RMSEA = .06, indicating that the two-factor model provided a good fit to the PDRQ:A data. The three-factor model also provided a good fit to the PDRQ:P/A. The following results were produced for the PDRQ:P: χ^2 (249, N = 121) = 425.83, $p < .001$; CFI = .98; and RMSEA = .07 and for the PDRQ:A: χ^2 (249, N = 114) = 346.42, $p < .001$; CFI = .96; and RMSEA = .06. The inter-factor correlation between the two subscales on the PDRQ:P two-factor model was $r = .95$, $p < .001$ and on the PDRQ:A two-factor model was $r = .93$, $p < .001$. The inter-factor correlations between the three subscales on the PDRQ:P three-factor model ranged from .87 to .92, *p's* < .001 and on the PDRQ:A three-factor model ranged from .80 to .89, *p's* < .001.

The high inter-factor correlations between the factors on the two-factor and three-factor models (i.e., above .80) suggest that there was a considerable degree of overlap between and among these scales. Items likely cross-loaded between factors. Therefore, a one-factor model (PDRQ:P/A Total Routines) was tested for the PDRQ:P and PDRQ:A. With the 24 observed variables used previously, the one-factor model provided a good fit to the PDRQ:P/A. The following results were produced for the PDRQ:P: χ^2 (252, N = 118) = 486.16, $p < .001$; CFI = .97; and RMSEA = .08, and for the PDRQ:A: χ^2 (252, N = 111) = 369.85, $p < .001$; CFI = .95; and RMSEA = .06. The factor loadings for each item of the PDRQ:P and PDRQ:A are reported in Table 3. For the PDRQ:A, all items significantly loaded, $p < .01$, onto the expected latent factor for the one-factor model. For the PDRQ:P, Item 4 ("My adolescent is routinely supervised when s/he has a low blood sugar at school.") did not load significantly, $p = .26$, onto the expected latent factor for

the one-factor model. However, given the significant item loading on the PDRQ:A, as well as the item's positive performance in the initial development study, Item 4 was retained on the PDRQ:P to maintain consistency.

Table 3

Standardized PDRQ:P/A Item Loadings for CFA Specified One-Factor Model

	Factor 1: PDRQ:P/A Total Routines	Pattern Coefficients PDRQ:P	Pattern Coefficients PDRQ:A
Item 1	testing for ketones when blood sugar is high	.396	.299
Item 2	refilling prescriptions and diabetes supplies	.560	.485
Item 3	forgets or purposely does not take insulin	.645	.519
Item 4	supervised when low blood sugar at school	.102	.242
Item 5	adhering to regimen when away from home	.873	.798
Item 6	treating high blood sugars	.611	.607
Item 7	follows meal plan	.822	.774
Item 8	calculating insulin dose at each meal and snack	.820	.737
Item 9	treating low blood sugars	.718	.699
Item 10	testing blood sugar	.915	.755
Item 11	planning for meals away from home	.769	.693
Item 12	eats food not supposed to	.592	.423
Item 13	forgets or purposely does not test blood sugar	.607	.595
Item 14	taking insulin	.926	.757
Item 15	selecting or rotating injection or pump site	.598	.462
Item 16	prepares for low blood sugar before exercise	.806	.624
Item 17	eating snacks	.734	.622
Item 18	special events	.806	.786
Item 19	follows regimen while at school	.867	.820
Item 20	equipment/emergency supplies at school	.713	.543
Item 21	emergency supplies for treating low blood sugar	.803	.582
Item 23	extracurricular activities	.911	.782
Item 24	spending time with friends at home	.919	.811
Item 25	spending time with friends away from home	.917	.847

Reliability

Item-Total Correlations and Internal Consistency

The 24-item PDRQ:P Total Routines score demonstrated a coefficient alpha of .939 with item-total correlations ranging from .104 (Item 4) to .817 (Item 25; see Table 4). The 24-item PDRQ:A Total Routines score demonstrated a coefficient alpha of .901 with item-total correlations ranging from .229 (Item 4) to .698 (Item 25; Table 4).

Table 4

PDRQ:P/A Item-Total Correlation Coefficients

PDRQ:P/A Total Routines		PDRQ:P Item-Total Correlations	PDRQ:A Item-Total Correlations
Item 1	testing for ketones when blood sugar is high	.363	.282
Item 2	refilling prescriptions and diabetes supplies	.359	.297
Item 3	forgets or purposely does not take insulin	.561	.369
Item 4	supervised when low blood sugar at school	.104	.229
Item 5	adhering to regimen when away from home	.798	.695
Item 6	treating high blood sugars	.534	.477
Item 7	follows meal plan	.740	.687
Item 8	calculating insulin dose at each meal and snack	.689	.611
Item 9	treating low blood sugars	.627	.600
Item 10	testing blood sugar	.808	.665
Item 11	planning for meals away from home	.671	.566
Item 12	eats food not supposed to	.518	.410
Item 13	forgets or purposely does not test blood sugar	.514	.536
Item 14	taking insulin	.794	.544
Item 15	selecting or rotating injection or pump site	.507	.329
Item 16	prepares for low blood sugar before exercise	.703	.483
Item 17	eating snacks	.654	.542
Item 18	special events	.724	.676
Item 19	follows regimen while at school	.733	.689
Item 20	equipment/emergency supplies at school	.554	.395
Item 21	emergency supplies for treating low blood sugar	.731	.494
Item 23	extracurricular activities	.795	.659
Item 24	spending time with friends at home	.795	.658
Item 25	spending time with friends away from home	.817	.698

PDRQ:A Temporal Reliability

A two-week test-retest reliability study was conducted with a subsample of 43 adolescents (38%) to examine the temporal reliability of the PDRQ:A.

Sample characteristics are shown in Table 1. Item level correlations between the initial test and retest of the PDRQ:A ranged from .172 to .777 (Appendix E). The bivariate correlation between the PDRQ:A Total Routines score initial test and retest demonstrated good temporal reliability, r (38) = .761, $p < .001$.

Paired samples *t*-tests were conducted to examine the means of the subscale and the total scores on the PDRQ:A between the initial test and retest samples. The means between administrations were not significantly different, t (38) = -1.56 p = .13 for the PDRQ:A Total Routines score, indicating that routine scores from time one administration were consistent with time two administration (Table 5).

Table 5

Means and Standard Deviations for PDRQ:A Time 1 and PDRQ:A Time 2 Retest

	Time 1 *M (SD)*	Time 2 *M (SD)*
PDRQ:A Total Score:	77.66 (12.38)	79.73 (11.67)

Note. n = 39.

Inter-Rater Reliability

To examine consistency between parent and adolescent report of the adolescent's diabetes-specific routines, the bivariate correlation was calculated between the PDRQ:P Total Routines scale and the PDRQ:A Total Routines scale, r (109) = .611, $p < .001$. Item level correlations between each version of the PDRQ ranged from .120 to .518 (Appendix F). Paired samples *t*-tests were conducted to examine the means of the total scores on the

PDRQ:P and PDRQ:A. The means between versions of the PDRQ Total Routines scale were not significantly different, t (109) = -.635, p = .53, indicating that routine scores were consistent across versions (Table 6).

Table 6

Means and Standard Deviations for PDRQ:P and PDRQ:A at Time 1

	PDRQ:P M (SD)	PDRQ:A M (SD)
PDRQ Total Score:	76.31 (14.89)	77.06 (12.54)

Note. n = 101.

Validity

Construct Validity

A correlation matrix was calculated to evaluate bivariate relationships between the PDRQ:P/A Total Routines score and various scores of measures theoretically thought to be related to diabetes-specific routines, including measures of general adolescent routines, diabetes adherence, diabetes-specific family behaviors, and diabetes-specific family conflict to examine construct validity (Tables 7 and 8).

It was expected that individuals would be consistent across domains of routines. As expected, a moderate positive relation between parent- and adolescent-report of frequency of diabetes-specific routines and general adolescent routines, as measured by the ARQ:P/S was found; PDRQ:P Total Routines r (132) = .49, $p < .001$, and PDRQ:A Total Routines r (104) = .35, $p < .001$.

As expected, results indicated a moderate relationship between parent- and adolescent-report of frequency of diabetes-specific routines and diabetes treatment adherence, as measured by the SCI:P/A; PDRQ:P Total Routines r (138) = .69, $p < .001$, and PDRQ:A Total Routines r (105) = .67, $p < .001$.

Table 7

Correlation Matrix of PDRQ:P and Other Parent Report Measures

	PDRQ:P[a]	ARQ:P[b]	SCI:P[c]	DFBC:P-S[d]	DFBC:P-N[d]
ARQ:P	.488***				
SCI:P	.691***	.395***			
DFBC:P-S	.004	.092	.133		
DFBC:P-N	-.556***	-.320***	-.411***	.305***	
DFCS:P[e]	-.483***	-.290**	-.315***	.115	.601***

Note. PDRQ:P = Pediatric Diabetes Routines Questionnaire: Parent; ARQ:P = Adolescent Routines Questionnaire: Parent; SCI:P = Self-Care Inventory: Parent; DFBC:P-S = Diabetes Family Behavior Checklist: Parent Supportive Scale; DFBC:P-N = Diabetes Family Behavior Checklist: Parent Nonsupportive Scale; DFCS:P = Diabetes Family Conflict Scale: Parent.

[a]$n = 141$. [b]$n = 136$. [c]$n = 142$. [d]$n = 141$. [e]$n = 140$.

*$p < .05$, **$p < .01$, *** $p < .001$

Individuals were expected to have consistent scores across domains of diabetes specific functioning. As expected, a moderate positive relation between parent- and adolescent-report of frequency of diabetes-specific routines and diabetes-specific supportive family behaviors as measured by the DFBC:P/S Supportive Scale was found in the PDRQ:A: PDRQ:A Total Routines r (99) = .39, $p < .001$. However, a significant relationship was not found between the PDRQ:P Total Routines scale and the DFBC:P Supportive Scale (Table 7).

As expected, a moderate negative relationship was found between parent- and adolescent-report of frequency of diabetes-specific routines and diabetes-specific nonsupportive family behaviors as measured by the DFBC:P/S Nonsupportive Scale;

PDRQ:P Total Routines r (137) = -.56, $p < .001$ and PDRQ:A Total Routines r (101) = -.33, $p = .001$.

As expected, a moderate negative relation between parent- and adolescent-report of frequency of diabetes-specific routines and diabetes-specific family conflict as measured by the DFCS:P/S was supported in the PDRQ:P: PDRQ:P Total Routines r (136) = -.48, $p < .001$. However, a significant relationship was not found between the PDRQ:A Total Routines scale and the DFCS:C, although the relationship approached significance, r (99) = -.19, $p = .057$ (Table 8).

Table 8

Correlation Matrix of PDRQ:A and Other Self-Report Measures

	PDRQ:A[a]	ARQ:S[a]	SCI:A[b]	DFBC:C-S[c]	DFBC:C-N[d]
ARQ:S	.350***				
SCI:A	.667***	.411***			
DFBC:C-S	.385***	.327***	.447***		
DFBC:C-N	-.327**	-.097	-.255**	.196*	
DFCS:A[c]	-.191	-.069	-.083	-.043	.470***

Note. PDRQ:A = Pediatric Diabetes Routines Questionnaire: Adolescent; ARQ:S = Adolescent Routines Questionnaire: Self-Report; SCI:A = Self-Care Inventory: Adolescent; DFBC:C-S = Diabetes Family Behavior Checklist: Child Supportive Scale; DFBC:C-N = Diabetes Family Behavior Checklist: Child Nonsupportive Scale; DFCS:A = Diabetes Family Conflict Scale: Adolescent.

[a]$n = 112$. [b]$n = 113$. [c]$n = 106$. [d]$n = 108$.

*$p < .05$, **$p < .01$, *** $p < .001$

Preliminary Demographic Analyses

As mentioned in Chapter II, chi-square tests and *t*-tests were also examined to determine if demographic variables differed between participants who completed surveys online compared to those who completed them via mail, as well as between participants in the DFM/JDRF online group and the CNMC online group. Group differences were found between the online and mail-out groups on Hollingshead's (1975) index of SES, with the online group reporting a significantly higher SES level than the mail-out group. An independent sample *t*-test revealed that the online group had a significantly higher Hollingshead SES level ($M = 53.69$, $SD = 9.32$) than the mail-out group ($M = 47.43$, $SD = 12.59$), $t\ (128) = 2.21$, $p < .05$. Given the vastly different sample sizes (Online $n = 108$ and Mailout $n = 22$), equal variances were not assumed for this analysis. Additionally, a chi-square test indicated that the percentage of pump users significantly differed by online group, $\chi^2\ (1, N = 115) = 9.32$, $p < .01$, indicating that there was a significantly higher percentage of pump users in the DFM/JDRF online group than the CNMC online group.

Correlations were examined between the PDRQ:P/A and demographic variables including the adolescent's age, gender, and race; Hollingshead calculation of SES; parental marital status; survey completion method (i.e., mail-out vs. online, DFM/JDRF vs. CNMC); insulin administration method (i.e., injections vs. pump); and duration of diabetes to determine if any factors may be related to diabetes-specific routines (Table 9). Race was dichotomized as Caucasian and non-Caucasian to analyze the correlations due to the small number of participants within minority racial categories (13.4%). Marital status was dichotomized as single parenting (single living alone, divorced, widowed, or separated) or coparenting (married or single but living with someone).

Table 9

Correlation of PDRQ:P/A and Demographic Variables

	PDRQ:P Total Routines	PDRQ:A Total Routines
Child Age (*n* = 140)	-.226**	-.230*
Child Gender[a] (*n* = 141)	-.073	.081
Child Race[b] (*n* = 142)	-.199*	-.008
SES (*n* = 130)	.173	.157
Marital status[c] (*n* = 144)	-.211*	-.082
Online vs. Mail-Out (*n* = 144)	.059	.042
DFM/JDRF vs. CNMC (*n* = 118)	.160	.097
Insulin Administration Method (*n* = 141)	-.055	.037
Duration of Diabetes (*n* = 143)	-.036	-.192*

Note: PDRQ:P = Pediatric Diabetes Routines Questionnaire: Parent; PDRQ:A = Pediatric Diabetes Routines Questionnaire: Adolescent; SES = Hollingshead (1975) four factor index of social position

[a]Male = 1 and Female = 2; [b]White = 1 and Nonwhite = 2, [c]Co-parenting = 1 and Single = 2.

*p <.05, ** p <.01

Results indicated that adolescent age was significantly correlated with the PDRQ:P/A Total Routines score (Table 9) with parents of younger adolescents and younger adolescents themselves reporting significantly more routines than parents of older adolescents and older adolescents themselves. Additionally, there was a decline in PDRQ:P/A means between younger adolescents (age 12 to 14) and older adolescents (age 15 to 17; Table 10). Thus, age was then dichotomized as younger adolescents (age 12 to 14 years) and older adolescents (age 15 to 17 years). An independent-samples *t*-test

revealed that on the PDRQ Total Routines score, parents of younger adolescents (M = 78.63, SD = 13.62; n = 90) and younger adolescents themselves (M = 79.36, SD = 11.15; n = 73) differed from parents of older adolescents (M = 69.79, SD = 16.93; n = 51) and older adolescents themselves (M = 72.14, SD = 14.07; n = 39), indicating that greater frequency of diabetes-specific routines was reported by parents of younger adolescents, t (139) = 3.39, p = .001, and younger adolescents themselves, t (110) = 2.98, p =.004.

Table 10

Means of PDRQ:P/A and SCI:P/A by Age

Child Age	PDRQ:P Total Routines Score *M* (*SD*)	SCI:P Score *M* (*SD*)	PDRQ:A Total Routines Score *M* (*SD*)	SCI:C Score *M* (*SD*)
12	77.52 (12.43) *n* = 36	54.53 (6.67) *n* = 36	78.66 (9.64) *n* = 30	54.11 (8.48) *n* = 27
13	79.60 (16.53) *n* = 26	54.98 (10.36) *n* = 26	79.55 (12.92) *n* = 23	56.21 (9.39) *n* = 24
14	79.15 (12.46) *n* = 28	53.08 (7.80) *n* = 28	80.18 (11.60) *n* = 20	55.23 (7.32) *n* = 22
15	70.36 (17.65) *n* = 22	50.86 (9.10) *n* = 22	74.26 (11.97) *n* = 15	53.18 (7.38) *n* = 17
16	69.21 (16.83) *n* = 19	48.58 (10.03) *n* = 19	69.32 (16.57) *n* = 16	47.50 (9.03) *n* = 16
17	69.63 (17.27) *n* = 10	51.28 (9.32) *n* = 11	73.80 (12.97) *n* = 8	53.86 (10.64) *n* = 7
Total	75.43 (15.44) *N* = 141	52.71 (8.82) *N* = 142	76.84 (12.66) *N* = 112	53.68 (8.78) *N* = 113

However, results also revealed that duration of diabetes negatively correlated to the PDRQ:A Total Routines score, but not the PDRQ:P Total Routines score (Table 9). This indicates that adolescents who have had diabetes for a shorter duration report more

frequent diabetes-specific routines than adolescents who have had diabetes for a longer duration. However, since age and duration of illness are confounded, such that younger adolescents generally have shorter illness durations than older adolescents, age and illness duration were correlated to examine the strength of that relationship, $r = .196$, $p = .02$.

To further explore the relation between child age, illness duration, and PDRQ:A scores, two multiple regression analyses were conducted, using PDRQ:A Total Routines score as the criterion. The first analysis examined incremental variance accounted for by illness duration controlling for child age and the second analysis examined incremental variance accounted for by child age controlling for illness duration. Results indicated that illness duration alone did not significantly predict frequency of diabetes-specific routines, F (1, 138) = .18, $p = .68$; although together age and illness duration significantly predicted frequency of diabetes-specific routines, F (2, 137) = 3.67, $p = .03$. When child age was controlled for, illness duration did not explain additional variance in the PDRQ Total score, $F\Delta = .001$, $p = .97$. However, when illness duration was controlled for, age did explain additional variance, $F\Delta = 7.15$, $p = .01$, and accounted for an additional 5.1% of the variance above that explained by illness duration. Table 11 displays the R^2 and change in R^2 for each analysis and the unstandardized regression coefficients (*B*), standard error (*SEB*), and standardized regression coefficients (ß) for each predictor.

Additionally, the relationships between the PDRQ:P/A and the SCI:P/C, respectively, were further examined to determine if adherence shows a similar age-related decline as frequency of diabetes-specific routines. Indeed, parent- and self-report of diabetes regimen adherence were also significantly related to child age, $r_{SCI:P}$ (141) = -

.22, $p = .01$, $r_{SCI:A}$ (112) = -.19, $p = .05$. Additionally, there was a similar decline in SCI:P/C means between younger adolescents (ages 12 to 14) and older adolescents (ages 15 to 17; Table 10). An independent-samples *t*-test revealed that on the SCI, parents of younger adolescents ($M = 54.21$, $SD = 8.17$; $n = 90$) and younger adolescents themselves ($M = 55.14$, $SD = 8.40$; $n = 73$) differed from parents of older adolescents ($M = 50.12$, $SD = 9.38$; $n = 52$) and older adolescents themselves ($M = 51.03$, $SD = 8.92$; $n = 40$), indicating that better regimen adherence was reported by parents of younger adolescents, t (140) = 2.72, $p < .01$, and younger adolescents themselves, t (111) = 2.44, $p = .02$.

Table 11

Regression Analysis Summary for Adolescent Age and Illness Duration Predicting PDRQ:A Total Score

			Results at Each Step		
Variable	R^2	ΔR^2	B	SEB	ß
Model 1					
Step 1	.051				
Adolescent age			-2.181	.803	-.225**
Step 2	.051	.000			
Adolescent age			-2.186	.817	-.226**
Illness duration			.011	.327	.003
Model 2					
Step 1	.001				
Illness duration			-.139	.330	-.036
Step 2	.051	.050			
Illness duration			.011	.327	.003
Adolescent age			-2.186	.817	-.226**

Note. ** $p < .01$

To further explore the relation between child age, diabetes routines, and diabetes adherence, and specifically, to understand if the relation between age and routines is fully accounted for by adherence or vice versa, two partial correlation analyses were conducted. The first analysis examined the relationship between the PDRQ:P/A and child age controlling for adherence and the second analysis examined the relationship between the SCI:P/C and child age controlling for frequency of diabetes-specific routines. In the first analysis, partial correlations between the PDRQ:P/A and child age were no longer significant after controlling for adherence, $r_{PDRQ;P}$ (136) = -.16, p = .06 and $r_{PDRQ;A}$ (103) = -.12 p = .21. In the second analysis, partial correlations between the SCI:A/C and child age were also nonsignificant, after controlling for diabetes-specific routines, $r_{SCI:P}$ (136) = -.05, p = .59 and $r_{SCI:A}$ (103) = -.11, p = .28. These findings indicate that there is a significant degree of overlap between frequency of diabetes-specific routines and diabetes regimen adherence and that changes in one may be attributable to changes in the other.

Results also revealed two additional significant relationships between the PDRQ:P Total Routines score and other demographic variables. Adolescent race was significantly correlated with the PDRQ:P Total Routines score (Table 9). An independent-samples *t*-test confirmed that on the PDRQ:P Total Routines score, Caucasian adolescents (M = 76.61, SD = 14.65; n = 120) significantly differed from Non-Caucasian adolescents (M = 67.66, SD = 18.92; n = 19), with greater frequency of diabetes-specific routines being reported by parents of Caucasian adolescents, t (137) = 2.37, p = .02. However, adolescent race was not significantly correlated with the PDRQ:A Total Routines score.

Parental marital status was also significantly correlated with the PDRQ:P Total Routine score (Table 9). An independent-samples *t*-test confirmed that on the PDRQ:P Total Routines score, adolescents of coparenting households ($M = 76.97$, $SD = 14.16$; $n = 115$) significantly differed from adolescents of single parenting households ($M = 68.62$, $SD = 19.01$; $n = 26$). Equal variances were not assumed for this analysis as Levene's test for homogeneity of variance was significant, $F = 6.25$, $p = .014$. Greater frequency of diabetes-specific routines was reported by parents of adolescents from coparenting households, $t\ (31.56) = 2.11$, $p = .04$. However, parental marital status was not significantly correlated with the PDRQ:A Total Routines score.

CHAPTER IV

DISCUSSION

Pediatric diabetes management requires a tedious regimen which emphasizes the importance of daily and regular management, including self-monitoring of blood glucose, insulin administration, and dietary and exercise management (Silverstein et al., 2005). Many of these recommendations are framed as part of the child's daily or weekly routines such as eating regular meals, getting ready for school and bed, and daily activities. Accordingly, diabetes management becomes a part of the child's daily life and those children who are more capable of integrating their regimen into the organization of daily routines are expected to have more effective management strategies and better adherence to treatment regimens. General child routines have been shown to relate to diabetes treatment adherence (Greening et al., 2007), and more recently the Pediatric Diabetes Routines Questionnaire (PDRQ) was developed as a parent-report measure of daily routines that are specific to the diabetes regimen (Pierce & Jordan, 2012). Though the PDRQ has aided in the study of routines specific to the diabetes regimen, limitations still exist, particularly regarding its use to assess diabetes-specific routines in adolescents.

The present study aimed to resolve these limitations through the development of an adolescent self-report version of the PDRQ and through further examination of the factorial validity and psychometric properties of both versions of the PDRQ in a larger adolescent sample. The adolescent version of the PDRQ, the PDRQ: Adolescent (PDRQ:A) was developed as a parallel self-report version of the parent version, which was renamed PDRQ: Parent (PDRQ:P) for the purpose of providing a means to obtain information about adolescents' own diabetes routines directly from the adolescents.

During the measure development phase, five new developmentally relevant items were added to both versions of the PDRQ to assure that all aspects of adolescent diabetes routines were being assessed. Two of these items (Item 22, "I/My adolescent follow/s a routine while adhering to my/his/her diabetes regimen while on a date," and Item 26, "I/My adolescent follow/s a routine while adhering to my/her/her diabetes regimen while at work") were eliminated prior to analyses due to low item means, poor item-total correlations, and a large portion of the sample (i.e., over 50%) endorsing the item as "Not Applicable." Because the sample included adolescents between the ages of 12 and 17, the "work" item was probably not appropriate for the younger portion of the sample (i.e., adolescents between the ages of 12 and 15). Indeed, the U.S. Department of Labor does not even report employment statistics for youth below the age of 16 (Bureau of Labor Statistics, U.S. Department of Labor, 2012). The same explanation is likely for the "dating" item as well.

Another item, (Item 4, "I/My adolescent is routinely supervised when I/he/she has a low blood sugar at school") did not load significantly onto the expected latent factor solution for the PDRQ:P, although it did load significantly onto the expected latent factor for the PDRQ:A. There are several potential explanations for this discrepant finding. First, the pattern coefficients and item-total correlations were low for both informants, suggesting the item is measuring something different than other items on the scale. Given that the sample was a relatively adherent one based on item means on the SCI, it is likely that there is a low base rate of low blood sugar altogether. Further, in adolescents with T1D, low blood sugar treatment usually requires a blood glucose check, consumption of 15 to 30 fast acting carbohydrates, and a re-check 15 minutes later. This is something that

can be done relatively easily and independently while sitting in class rather than leaving class to go to the nurse's office for supervision. Thus, supervision is likely something that is not relevant to adolescents with T1D and differentiates Item 4 from the other school-related items, which measured routine adherence to the diabetes regimen at school (Item 19) and routine for accessing emergency supplies at school (Item 20), both of which had moderate to high pattern coefficients and item-total coefficients.

Despite this discrepant finding, Item 4 was retained on the PDRQ:P for two reasons. First, in the PDRQ development study, Principal Components Analysis revealed that Item 4 had a good pattern coefficient for the Daily Regimen Routines component, as well as a good item-total correlation. Second, one of the goals of the study was to create a parallel adolescent form of the PDRQ:A. Thus, Item 4 was retained to maintain consistency between versions of the PDRQ and across studies. However, future PDRQ development studies should continue to monitor and evaluate the properties of Item 4, particularly on the adolescent version.

Confirmatory factor analysis was conducted to extend the factorial validity of the PDRQ:P and to examine the factorial validity of the PDRQ:A. Because both a two- or three-factor structure was potentially adequate, both models were examined to determine the best fit for each version of the PDRQ. The two- and three-factor models resulted in almost equally good fit for the PDRQ:P/A. However, the high inter-factor correlations between the factors on the two-factor model and among the factors on the three-factor model (i.e., above .80) suggests that there was a considerable degree of overlap between and among these scales. Items cross-loaded between factors suggesting they were not measuring distinct types of routines. Thus, a one-factor model was tested and provided a

good fit for the PDRQ:P/A, offering a more parsimonious fit to the data. Although diabetes-specific routines can theoretically be understood in terms of two or three factors, there is no presumption that the underlying component constructs are necessarily distinct, orthogonal, or differentially predictive. Thus, use of a single factor is not conceptually problematic for measurement of the diabetes-specific routine construct.

In examining psychometric properties of the PDRQ:P/A, findings revealed good to very good reliability. Internal consistency estimates for the PDRQ:P were higher than those reported in the PDRQ development study, while the internal consistency estimates for the PDRQ:A were similar to or slightly lower than the PDRQ:P. This is not surprising as many parent report measures demonstrate higher internal consistency compared to the parallel child or adolescent self-report measures (e.g., Behavior Assessment System for Children, Second Edition; BASC-2; Reynolds & Kamphaus, 2004).

Temporal reliability for the PDRQ:A was assessed through re-administration of the PDRQ:A two to five weeks after the initial administration. Temporal reliability examines the stability of an instrument across time, as well as the consistency of respondents across administrations. Although diabetes-specific routines may change for an individual, the overall sample should maintain a similar mean from time one to time two and not change in a similar pattern across all individuals in the sample. Although slightly lower than the temporal reliability estimates found for the parent-report version in the PDRQ development study, the PDRQ:A Total Routines scale yielded a good temporal reliability estimate.

Additionally, the PDRQ demonstrated good inter-rater reliability between the PDRQ:P and PDRQ:A. Inter-rater reliability examines the stability of an instrument

across raters, as well as the consistency between versions of an instrument. These results were very promising considering the literature generally reflects much lower agreement between self-ratings and other informants (e.g., Achenbach, McConaughy, & Howell, 1987). At the item level, bivariate correlations among test-retest ratings of adolescents themselves were of slightly higher magnitude than inter-rater bivariate correlations. This does suggests that adolescents and parents are providing unique information, with some items being rated more similarly than others. However, lack of total mean differences across informants indicate that parents and adolescents report a similar frequency of routines overall. Thus, despite the expected developmental shift in responsibility of diabetes management, parents are generally aware of their adolescents' routines.

Construct validity of the PDRQ:P/A was supported by significant relationships between the frequency of diabetes-specific routines and most of the other measures examined in the sample. Specifically, a significant positive relation was found between parent- and adolescent-report of diabetes-specific routines and parent- and adolescent-report of adolescent routines, respectively. This indicates diabetes-specific routines are related to more general adolescent routines. As diabetes-specific routines are formed and incorporated into adolescents' lives, they become integrated with their general routines. Therefore, diabetes-specific routines were expected to be related to general routines.

Additionally, as Greening and colleagues (2007) demonstrated a positive relationship between general child routines and diabetes treatment adherence, a significant positive relationship was observed between parent- and adolescent-report of diabetes-specific routines and parent- and adolescent-report of diabetes treatment adherence, respectively. Those adolescents who are more capable of integrating their

regimen into the organization of daily routines were expected to have better adherence to treatment regimens.

Furthermore, adolescents were expected to have similar scores across domains of diabetes-specific family functioning, as diabetes management often involves members of the adolescent's family. As predicted, a significant negative relationship was found between parent- and adolescent-report of diabetes-specific routines and parent- and adolescent-report of nonsupportive diabetes-specific family behaviors, respectively. However, only adolescents revealed a positive relationship between adolescent-report of diabetes-specific routines and adolescent-report of supportive diabetes-specific family behaviors. The nonsignificant relationship between parent report of diabetes-specific routines and supportive diabetes-specific family behaviors was surprising given the positive correlations found between the same variables in the PDRQ development study (Pierce & Jordan, 2012).

The PDRQ:P was also correlated with another domain of family behavior related to diabetes management; diabetes-specific family conflict. It was expected that higher family conflict surrounding diabetes tasks would be related to a lower frequency of diabetes-specific routines. This relationship was supported in the parent-report version of the PDRQ; a significant negative relationship was found between parent-report of diabetes-specific routines and parent-report of diabetes-specific family conflict. However, a significant relationship was not found between the PDRQ:A and adolescent-report of diabetes-specific family conflict. Nevertheless, the relationship approached significance ($p = .057$), indicating that with more power (e.g., a larger sample size) the relationship may have reached significance.

Due to differences in sampling methods, chi-square tests and *t*-tests were examined to determine if demographic variables differed between participants who completed surveys online compared to those who completed them by mail, as well as between participants who completed them online from DRF/JDRF versus CNMC. Group differences were found between the online and mail-out groups on Hollingshead's (1975) calculation of SES, with the online group reporting a significantly higher SES level than the mail-out group. Although this difference was not found in the PDRQ development study, it is not surprising that participants in the mail-out group, who likely did not have access to a computer, had a lower SES level. This underscores the critical importance of including broad mechanisms to reach a broad range of SES in order to obtain representative samples of adolescents with diabetes and their parents. Additionally, there was a significantly higher percentage of pump users in the DFM/JDRF online group than the CNMC online group. The CNMC online group (n = 28) was substantially smaller than the DFM/JDRF online group (n = 90), and drawn from a single outpatient endocrinology setting, so likely less representative of the underlying population of adolescents with diabetes than the DFM/JDRF group, which was larger and recruited nationally. Thus, this finding may be an artifact of these sampling differences.

Relationships between Demographic Variables, Diabetes-Specific Routines, and Adherence

In examining demographic differences in the PDRQ:P/A, adolescent age was negatively correlated with the PDRQ:P and PDRQ:A Total Routines scores, indicating that the frequency of routines continues to decline throughout adolescence. These results are consistent with the PDRQ development study, which demonstrated a decline in

frequency of routines from childhood to adolescence (Pierce & Jordan, 2012). Likewise, adolescent age was also negatively correlated with the SCI:P/S, indicating that diabetes regimen adherence also declines throughout adolescence. When dichotomized, older adolescents reported both lower frequency of diabetes-specific routines and adherence than younger adolescents.

However, the correlations between the PDRQ:P/A and age became nonsignificant when controlling for parent- and self-report of adherence, respectively, and the correlations between the SCI:A/C and age became nonsignificant when controlling for parent- and self-report of diabetes-specific routines, respectively. This provides further evidence that the decline in frequency of routines and adherence across adolescence are systematically related. While the cross-sectional nature of this study precluded conclusions regarding directionality or cause of these relations, the fact that both adherence and routines declined with age is consistent with prior literature suggesting age-related declines in adherence (e.g., Duke et al., 2008, Greening et al., 2007) and changes in diabetes management responsibility throughout adolescence (e.g., the shift of responsibilities from the parent to the adolescent; Anderson & Laffel, 1997).

Moreover, these results have implications regarding the scoring of the PDRQ:P/A. The fact that both diabetes-specific routines and adherence decrease with increasing age suggests that lower PDRQ scores are not normative in adolescence. Rather, decreasing PDRQ:P/A scores with increasing age corresponds to true declines in adherence, implying that a lower PDRQ:P/A score is reflective of adolescents' increasingly worse disease management . Thus, the development of age-based norms for the PDRQ:P/A is not indicated at this time.

Duration of diabetes was the only demographic variable that was significantly related to the PDRQ:A Total Routines score, with adolescents who have had diabetes for a shorter duration reporting more frequent diabetes-specific routines than adolescents who have had diabetes for a longer duration. Although age and illness duration are confounded, such that younger adolescents have shorter illness durations than older adolescents, the strength of this relationship was moderate and weaker than that observed in the development study (Pierce & Jordan, 2012). Although this confound complicates interpretation, it is largely unavoidable in a pediatric sample (as age and duration of illness covary in childhood). However, age clearly added significant and sizeable incremental variance beyond illness duration in both studies, which seems to suggest that age has a larger influence on diabetes-specific routines than illness duration.

Further examination of demographic differences in the PDRQ:P revealed several significant correlations, which was surprising given that the only relationships found in the PDRQ development study were those between frequency of diabetes-specific routines and child age and duration of diabetes. In the present study, racial differences were observed in the PDRQ:P Total Routines score, with parents of Caucasian adolescents reporting significantly more frequent routines than parents of minority adolescents. Although Greening and colleagues (2007) did not find a significant relationship between general child routines and child race, a significant difference was found in glycemic control with African American youths showing poorer glycemic control than Caucasian youths. The researchers suggest that this finding underscores the importance of biopsychosocial research investigating the processes underlying this health disparity (Greening et al., 2007). Furthermore, in a review of the child routines and rituals

literature, Fiese and colleagues (2002) suggest that culture plays an important role in the expression of routines and rituals and that clinicians should be aware of cultural practices that could influence the expression of child routines.

Additionally, parental marital status was correlated with the PDRQ:P Total Routines score with parents who coparent reporting significantly more frequent routines than single parents. Although these relationships were not found in the PDRQ development study, it was not unexpected that single parents reported less frequent routines. Single parents likely have greater demands placed on them to support their child/ren because of a lack of spousal support, as well as potentially less parental supervision and involvement with the diabetes regimen given additional responsibilities placed on single parents. Indeed, Streisand, Swift, Wickmack, Chen, & Holmes (2005) found that single parents of children with diabetes have more parenting stress than coparenting parents. Further, single-parent family composition (Hanson, Henggeler, Rodriguez, Burghen, & Murphy, 1988; Harris, Greco, Wysocki, Elder-Danda, & White, 1999, as cited in Wysocki, 2006) has been consistently identified as a demographic factor that increases risk for nonadherence to the diabetes treatment regimen (Wysocki, 2006).

Recommendations for Scoring the PDRQ:P/A

Missing Data

Missing values may be prorated up to four items per the PDRQ:P/A Total Routines scale. Sum the values of total items completed and divide by the number of items completed. Use the obtained value to estimate the value of the missing item.

Reverse Scored Items

Item 3 (PDRQ:P – "My adolescent forgets or purposely does not take his/her insulin;" PDRQ:A – "I forget or purposely do not take my insulin"), Item 12 (PDRQ:P "My adolescent routinely eats food that s/he is not supposed to;" PDRQ:A – "I routinely eat food that I am not supposed to"), and Item 13 (PDRQ:P – "My adolescent forgets or purposely does not test his/her blood sugar;" PDRQ:A – "I forget or purposely do not test my blood sugar") are reverse scored, such that 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0.

Calculating the PDRQ:P/A Total Routines Score

Sum scores for the 24 items to obtain the PDRQ:P/A Total Routines score. Because Items 22 and 26 were eliminated from the measure, items will need to be resequenced. As such, Item 1 through Item 21 will remain in the same sequence. Item 23 through Item 25 will become Item 22 through Item 24, respectively.

Item 4

At this point, Item 4 (PDRQ:P – "My adolescent is routinely supervised when s/he has a low blood sugar at school;" PDRQ:A – "I am routinely supervised when I have a low blood sugar at school") is included in the PDRQ:P/A Total Routines score, despite its inconsistent findings with regard to factor loadings and item-total correlations. As mentioned, future PDRQ development studies should continue to monitor and evaluate the properties of this item.

Limitations

Findings of the present study should be considered in light of certain limitations. The first limitation involved sample size. The initial sample size that was proposed was 260, based on the guideline that the sample size should be five to 10 cases per each freed

parameter for adequate power in a confirmatory factor analysis. Although the reported sample size of 120 adolescents and 144 parents meets the minimum criteria, it is on the lower end of the spectrum. Additionally, general guidelines for determining sample size in CFA studies have been criticized due to their poor generalizability to any given research data set (Brown, 2006). Brown (2006) suggests evaluating sample size requirements in the context of the particular data set and model, using the Satorra-Saris Method or the Monte Carlo Approach. Moreover, because the correlation between the PDRQ:A and DFCS was in the expected direction, more power (i.e., a larger sample size) may have resulted in a significant relationship.

Another limitation involves the validity of the PDRQ:P/A being limited to construct validity and more specifically, convergent validity. Although the convergent validity of the sample was well established, divergent validity was not assessed. External validity is also limited in that the PDRQ:P/A does not generalize to adolescents with T2D. Given the increasing rate of T2D in youth (Wysocki et al., 2003), evaluation of diabetes-specific routines in this population is necessary and warranted. Additionally, the majority of participants in the current sample were Caucasian (85%), and had parents who were married (80%) and of middle-upper to upper SES (Level IV or V; 77%), limiting the ability to generalize findings to other demographic groups that may be more representative of adolescents with diabetes. Further, approximately two-thirds of the present sample was comprised of younger adolescents (ages 12 to 14; see Table 1), indicating greater representation of younger relative to older adolescents.

A final limitation involves the time frame between completion of parent and adolescent questionnaires. Parents were instructed to email their adolescent with diabetes

the adolescent questionnaires within a week of parent questionnaire completion. However, in order to maximize the number of adolescents recruited, the time frame in which the adolescents had to complete their questionnaires was left open ended. Although all adolescents completed their surveys within a month of their parents, the over-one-week time lag between raters may have limited inter-rater reliability. As mentioned, the PDRQ:P/A demonstrated good inter-rater reliability (r = .611). However, on validation measures, inter-rater reliability was somewhat lower with the DFBC-S:P/A being the lowest (r = .265).

Future Directions

Overall, the present study found promising results for use of the PDRQ:P/A in adolescents (ages 12 to 17) with T1D and their parents. However, given the difference in factor structures between the initial PDRQ (Pierce & Jordan, 2012) and the PDRQ:P/A (i.e., two-factor structure and one-factor structure, respectively), future comparisons should focus on further examination of the PDRQ and PDRQ:P/A factor structure. Specifically, it is unclear whether a one- or two-factor structure is appropriate, or whether the factor structures differ by form (i.e., two-factor for parent school-age PDRQ and one-factor for parent adolescent PDRQ and adolescent self-report PDRQ). On a related note, given the wide age range in the initial PDRQ study (i.e., ages five to 17; Pierce & Jordan, 2012), future studies should focus on examining the psychometric properties of the initial PDRQ in another sample of school-age children (ages five to 12) and establishing the initial PDRQ as the PDRQ: Child Parent Report (PDRQ: CPR). For consistency, the PDRQ:P should be renamed the PDRQ: Adolescent Parent Report (PDRQ: APR) and the PDRQ:A should be re-named the PDRQ: Adolescent Self Report (PDRQ:ASR).

Additionally, given the dichotomy between younger adolescents (ages 12 to 14) and older adolescents (ages 15 to 17), future research should examine whether younger adolescents perform more in line with school-age children on the PDRQ and SCI, or whether there are three levels or age groups for routines and adherence (i.e., ages five to 11, ages 12 to 14, and ages 15 to 17). Likewise, 12 year olds were included in the present study as "younger adolescents;" however, in the initial PDRQ study, 12 year olds fell into the "school-age" group when school-age children and adolescents were dichotomized. Future research should focus on determining which measure (i.e., the initial PDRQ [PDRQ – Child Parent Report] or the PDRQ:P) is a better fit for 12 year olds. Further, given that routines continue to decline throughout adolescence, future research should examine the PDRQ in a sample of young adults with T1D (i.e., ages 18 to 25) to determine whether frequency of diabetes-specific routines increases following adolescence, and to explore relations with adherence among this age group.

Given the discrepancy in the frequency of routines reported between parents of Caucasian and minority adolescents, as well as between coparenting and single parents, future studies should focus on examination of the psychometric properties (i.e., reliability, validity, and factor structure) of the PDRQ:P/A in a larger, more demographically representative sample. Further, given that variables such as family composition, parenting stress, and child race have consistently been found to be related to diabetes treatment adherence, these variables should be examined as mediators or moderators in the relationship between diabetes-specific routines and adherence.

Future research should also focus on further exploring the construct validity of the PDRQ. Specifically, relationships between the PDRQ:P/A and diabetes-specific family

variables should be further examined, as mixed results have been found. Additionally, validation studies should aim to examine correlations between the PDRQ and constructs that are theoretically unrelated to diabetes-specific routines (e.g., anxiety, withdrawal; see Jordan, 2003) for the purpose of establishing divergent validity. Furthermore, the psychometric properties of the PDRQ should be examined in a sample of children with type 2 diabetes for the purpose of extending external validity of the measure. Depending on initial results, a type 2 version of the PDRQ may be necessary, with items more specific and applicable to a T2D regimen.

Future studies should also attempt to determine the role of diabetes-specific routines in adolescents' emotional and behavioral problems. As noted in the literature, youth who lack routines tend to be at risk for more behavior problems (Fiese & Wamboldt, 2000; Jordan, 2003) and are also at risk for poor treatment adherence (Greening et al., 2007). Additionally, Fiese and colleagues (2005) found that caregivers and their youth who perceived routine asthma management as a chore and hassle each reported a poorer quality of life and were less emotionally invested in their youth's and their own asthma care. Future research should include developing and testing more extensive theoretical models evaluating the function of diabetes-specific routines as they relate to behavior problems, emotional stress, coping abilities, quality of life, and adherence.

Finally, future studies should focus on examining the clinical utility of the PDRQ:P/A and specifically the role that diabetes-specific routines may play in relation to treatment adherence, with a goal of improving adherence and glycemic control. This is particularly relevant in adolescents, as adherence has consistently been found to decrease

in adolescence (e.g., Duke et al.; 2008, Greening et al., 2007). Because the design of the current study was correlational, it cannot be assumed that more frequent diabetes-specific routines cause better treatment adherence. However, Fiese and Wambolt (2000) have developed specific therapeutic guidelines for teaching families how to establish a routine lifestyle and suggest that interventions aimed at improving asthma medication adherence have successfully done so by pairing medication taking with existing family routines and creating a routine to which medication taking can be linked (Fiese et al., 2005). Future research should focus on evaluation of current routines and implementation of such an intervention in adolescents with diabetes.

General Conclusions and Summary

In summary, the present study found promising results for the PDRQ:P/A, as a parent- and adolescent-report measure of frequency of diabetes-specific routines. CFA confirmed that the PDRQ:P/A is most appropriately used as a one-factor model using a Total Routines score. The PDRQ is the first measure to allow researchers to examine routines specific to the diabetes regimen, rather than general routines in adolescents with T1D. Support for internal consistency, temporal stability, and validity was maintained for the PDRQ:P and demonstrated for the PDRQ:A.

The present study answered several important questions regarding the measurement of diabetes-specific routines in adolescents. Specifically, results from this study revealed that routines and adherence continue to decline through adolescence, according to both adolescents themselves as well as their parents. Additionally, results provide evidence that lower scores on the PDRQ correspond to fewer routines and reveal true declines in adherence, negating the need for the development of age-based norms.

Results from the present study also revealed that parents and adolescents report a consistent overall level of frequency of diabetes-specific routines, providing evidence that parents are aware of their adolescents' routines, despite the developmental shift in responsibility of diabetes management.

In conclusion, despite emphasis commonly placed on the importance of routines in adolescents with chronic illnesses, data regarding efficacy of routines specific to the diabetes regimen remain limited. This study represents an attempt to further the development of a multi-rater measure of diabetes-specific routines and explore their relations to more common measures. Furthermore, the importance of routines in adhering to the diabetes regimen has been noted, though studies have previously been limited to general child routines. A decline in adherence to the diabetes regimen is typical in adolescence. Thus, the PDRQ:P/A should assist in future research on the impact of routines on adherence. More research is needed in this area before the utility of disease-specific routines can be confirmed.

APPENDIX A

PEDIATRIC DIABETES ROUTINES QUESTIONNAIRE – ORIGINAL VERSION

(PIERCE & JORDAN, 2012)

Routines are events that occur at about the same time, in the same order, or in the same way every time. Some children may do routines on their own while other children may need help or reminders from their parents or caretakers. **Please rate how often your child does each routine with or without help. Circle a rating ranging from 0 (never) to 4 (nearly always).** If an item **does not apply** to your child's diabetes management regimen, **please mark N/A**.

How **often** does it occur at about the **same time**, in the **same order** or in the **same way**?

0 = Never 3 = Often
1 = Rarely 4 = Nearly Always
2 = Sometimes N/A = Not Applicable

1.	My child follows a routine for testing for ketones when his/her blood sugar is high	0	1	2	3	4	N/A
2.	A routine is followed for refilling my child's prescriptions and diabetes supplies	0	1	2	3	4	N/A
3.	My child forgets or purposely does not to take his/her insulin	0	1	2	3	4	N/A
4.	My child is routinely supervised when I has a low blood sugar at school	0	1	2	3	4	N/A
5.	My child follows a routine for adhering to his/her diabetes regimen when I is away from home	0	1	2	3	4	N/A
6.	My child follows a routine for treating high blood sugars (e.g., give extra insulin, test 2 hours later)	0	1	2	3	4	N/A
7.	My child routinely follows his/her meal plan	0	1	2	3	4	N/A
8.	My child follows a routine for calculating his/her insulin dose at each meal and snack	0	1	2	3	4	N/A
9.	My child follows a routine for treating low blood sugars (e.g. test, eat glucose tablets, wait 15 minutes, test again).	0	1	2	3	4	N/A
10.	My child follows a routine for testing his/her blood sugar	0	1	2	3	4	N/A
11.	My child follows a routine for planning for meals that are eaten away from home (e.g., at a restaurant, at school, at a family member's or friend's house)	0	1	2	3	4	N/A
12.	My child routinely eats food that I is not supposed to	0	1	2	3	4	N/A
13.	My child forgets or purposely does not test his/her blood sugar	0	1	2	3	4	N/A
14.	My child follows a routine for taking his/her insulin (through injections or pump bolus)	0	1	2	3	4	N/A
15.	My child follows a routine for selecting or rotating injection or pump site	0	1	2	3	4	N/A
16.	My child routinely prepares for possible low blood sugar before exercise (e.g., eats snack before exercising, carries supplies to treat, decreases insulin dose)	0	1	2	3	4	N/A
17.	My child follows a routine for eating snacks	0	1	2	3	4	N/A
18.	My child routinely plans for diabetes care at special events like birthday parties and sleepovers	0	1	2	3	4	N/A
19.	My child follows a routine for adhering to his/her diabetes regimen while at school	0	1	2	3	4	N/A
20.	My child follows a routine for accessing diabetes equipment and emergency supplies at school	0	1	2	3	4	N/A
21.	My child routinely brings emergency supplies for treating low blood sugar (e.g., glucose tablets) when I leaves the house	0	1	2	3	4	N/A

APPENDIX B

PDRQ – ORIGINAL VERSION ITEM-TOTAL CORRELATION COEFFICIENTS

(PIERCE & JORDAN, 2012)

Subscale 1: Daily Regimen Routines	Subscale Item-Total Correlations	Total Scale Item-Total Correlations
4. forgets or purposely does not take insulin	.56	.45
14. eats food that I is not supposed to	.53	.48
6. adhering to diabetes regimen when is away from home	.64	.61
15. forgets or purposely does not test his/her blood sugar	.50	.47
23. eating snacks	.60	.55
12. testing blood sugar	.60	.58
16. taking insulin	.55	.56
8. follows meal plan	.66	.63
27. adhering to diabetes regimen while at school	.60	.62
13. planning for meals that are eaten away from home	.51	.55
5. supervised when low blood sugar at school	.36	.36
25. plans for diabetes care at special events	.56	.60
Subscale Alpha: .858		
Subscale 2: Technical/Situational Routines	Subscale Item-Total Correlations	Total Scale Item-Total Correlations
20. selecting or rotating injection or pump site	.47	.37
2. refilling prescriptions and diabetes supplies	.48	.35
7. treating high blood sugars	.60	.60
21. prepares for possible low blood sugar before exercise	.50	.51
9. calculating insulin dose at each meal and snack	.34	.34
1. testing for ketones when blood sugar is high	.35	.30
28. accessing diabetes equipment and emergency supplies at school	.51	.57
11. treating low blood sugars	.43	.45
29. brings emergency supplies for treating low blood sugar	.47	.48
Subscale Alpha: .758		

APPENDIX C

PDRQ – ORIGINAL VERSION TEST-RETEST RELIABILITY COEFFICIENTS

(PIERCE & JORDAN, 2012)

	PDRQ *n* = 57
PDRQ Subscale 1:	.83
PDRQ Subscale 2:	.70
PDRQ Total Routines Score	**.81**

APPENDIX D

CORRELATION MATRIX OF PDRQ – ORIGINAL VERSION AND OTHER MEASURES (PIERCE & JORDAN, 2012)

	PDRQ (n = 187)	PDRQ-DRR (n = 187)	PDRQ-TSR (n = 187)	CRQ (n = 179)	FRQ-RR (n = 140)	FRQ-RM (n = 139)	SCI (n = 153)	DFBC-S (n = 151)
PDRQ-DRR	.93***							
PDRQ-TSR	.83***	.57***						
CRQ	.50***	.47***	.41***					
FRQ-RR	.30***	.28***	.26***	.51***				
FRQ-RM	.31***	.26***	.32***	.53***	.38***			
SCI	.49***	.49***	.37***	.38***	.22**	.36***		
DFBC-S	.22**	.19*	.22*	.32***	.18*	.35**	.41***	
DFBC-N (n = 151)	-.39***	-.44***	-.20*	-.31***	-.21*	-.10	-.30***	.05

Note. PDRQ = Pediatric Diabetes Routines Questionnaire; PDRQ-DRR = Pediatric Diabetes Routines Questionnaire Daily Ritual Routines Scale; PDRQ-TSR = Pediatric Diabetes Routines Questionnaire Technical/Situational Routines Scale; CRQ = Child Routines Questionnaire; FRQ-RR = Family Routines Questionnaire Ritual Routine Total; FRQ-RM = Family Routines Questionnaire Ritual Meaning Total; SCI = Self-Care Inventory; DFBC-S = Diabetes Family Behavior Checklist Supportive Scale; DFBC-N = Diabetes Family Behavior Checklist Nonsupportive Scale

*$p < .05$, **$p < .01$, *** $p < .001$

APPENDIX E

PEDIATRIC DIABETES ROUTINES QUESTIONNAIRE, ADOLESCENT VERSION – TEST-RETEST CORRELATION COEFFICIENTS BY ITEM

1. I follow a routine for testing for ketones when my blood sugar is high	.662***
2. A routine is followed for refilling my prescriptions and diabetes supplies	.596***
3. I forget or purposely do not take my insulin†	.700***
4. I am routinely supervised when I have a low blood sugar at school	.644***
5. I follow a routine for adhering to my diabetes regimen when I am away from home	.647***
6. I follow a routine for treating high blood sugars (e.g., give extra insulin, test 2 hours later)	.633***
7. I routinely follow my meal plan	.598***
8. I follow a routine for calculating my insulin dose at each meal and snack	.303
9. I follow a routine for treating low blood sugars (e.g. test, eat glucose tablets, wait 15 minutes, test again).	.239
10. I follow a routine for testing my blood sugar	.313*
11. I follow a routine for planning for meals that are eaten away from home (e.g., at a restaurant, at school, at a family member's or friend's house)	.536**
12. I routinely eats food that I am not supposed to†	.600***
13. I forget or purposely do not test my blood sugar†	.681***
14. I follow a routine for taking my insulin (through injections or pump bolus)	.777***
15. I follow a routine for selecting or rotating injection or pump site	.420**
16. I routinely prepare for possible low blood sugar before exercise (e.g., eat snack before exercising, carry supplies to treat, decrease insulin dose)	.512**
17. I follow a routine for eating snacks	.377*
18. I routinely plans for diabetes care at special events like birthday parties and sleepovers	.550***
19. I follow a routine for adhering to my diabetes regimen while at school	.456**
20. I follow a routine for accessing diabetes equipment and emergency supplies at school	.172
21. I routinely bring emergency supplies for treating low blood sugar (e.g., glucose tablets) when I leaves the house	.587***
23. I follow a routine for adhering to my diabetes regimen while engaging in extracurricular activities (e.g., sports, clubs, etc.),"	.225
24. I follow a routine for adhering to my diabetes regimen while spending time with friends at my house	.740***
25. I follow a routine for adhering to my diabetes regimen while spending time with friends away from home	.617***

Note. †Denotes reversed scored item.

*$p < .05$, **$p < .01$, *** $p < .001$

APPENDIX F

PEDIATRIC DIABETES ROUTINES QUESTIONNAIRE, PARENT AND ADOLESCENT VERSIONS – INTER-RATER CORRELATION COEFFICIENTS BY ITEM

1. I follow a routine for testing for ketones when my blood sugar is high	.388***
2. A routine is followed for refilling my prescriptions and diabetes supplies	.120
3. I forget or purposely do not take my insulin†	.444***
4. I am routinely supervised when I have a low blood sugar at school	.447***
5. I follow a routine for adhering to my diabetes regimen when I am away from home	.337***
6. I follow a routine for treating high blood sugars (e.g., give extra insulin, test 2 hours later)	.235*
7. I routinely follow my meal plan	.518***
8. I follow a routine for calculating my insulin dose at each meal and snack	.356***
9. I follow a routine for treating low blood sugars (e.g. test, eat glucose tablets, wait 15 minutes, test again).	.292**
10. I follow a routine for testing my blood sugar	.446***
11. I follow a routine for planning for meals that are eaten away from home (e.g., at a restaurant, at school, at a family member's or friend's house)	.190*
12. I routinely eats food that I am not supposed to†	.411***
13. I forget or purposely do not test my blood sugar†	.374***
14. I follow a routine for taking my insulin (through injections or pump bolus)	.454***
15. I follow a routine for selecting or rotating injection or pump site	.391***
16. I routinely prepare for possible low blood sugar before exercise (e.g., eat snack before exercising, carry supplies to treat, decrease insulin dose)	.364***
17. I follow a routine for eating snacks	.204*
18. I routinely plans for diabetes care at special events like birthday parties and sleepovers	.264**
19. I follow a routine for adhering to my diabetes regimen while at school	.334***
20. I follow a routine for accessing diabetes equipment and emergency supplies at school	.195*
21. I routinely bring emergency supplies for treating low blood sugar (e.g., glucose tablets) when I leaves the house	.358***
23. I follow a routine for adhering to my diabetes regimen while engaging in extracurricular activities (e.g., sports, clubs, etc.),"	.362***
24. I follow a routine for adhering to my diabetes regimen while spending time with friends at my House	.331***
25. I follow a routine for adhering to my diabetes regimen while spending time with friends away from home	.447***

Note: †Denotes reversed scored item.

*$p < .05$, **$p < .01$, *** $p < .001$

APPENDIX G

INSITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **10121702**
PROJECT TITLE: **Examination of the Pediatric Diabetes Routines Questionnaire in Adolescents: Development of an Adolescent Self-Report Version and Confirmatory Factor Analysis**
PROPOSED PROJECT DATES: **11/01/2010 to 11/01/2011**
PROJECT TYPE: **Dissertation**
PRINCIPAL INVESTIGATORS: **Jessica Pierce**
COLLEGE/DIVISION: **College of Education & Psychology**
DEPARTMENT: **Clinical Psychology**
FUNDING AGENCY: **N/A**
HSPRC COMMITTEE ACTION: **Expedited Review Approval**
PERIOD OF APPROVAL: **01/04/2011 to 01/03/2012**

Lawrence A. Hosman
Lawrence A. Hosman, Ph.D.
HSPRC Chair

1-5-2011
Date

APPENDIX H

INSITUTIONAL REVIEW BOARD NOTICE OF COMMITTEE ACTION

INSTITUTIONAL REVIEW BOARD (FWA00004487)

REPORT OF PROTOCOL ACTION

NOTIFICATION OF EXPEDITED NEW STUDY APPROVAL

From:	Jay Salpekar, MD
To:	Randi Streisand, PhD
cc:	Jessica Pierce
Re:	Study#: Pro00001731 Examination of the Pediatric Diabetes Routines Questionnaire in Adolescents: Development of an Adolescent Self-Report Version and Confirmatory Factor Analysis
Risk:	Research/clinical investigations not involving greater than minimal risK

The IRB has reviewed and approved the protocol referenced above on 10/11/2011 11:26 AM for a period of 12 months. The IRB determined that the study meets the criteria for expedited review under category(ies):

This research will be performed on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or will employ a survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

This IRB approval will expire on 10/10/2012.

As appropriate, approval of the study and the consent form(s) is for the period of 10/11/2011 to10/10/2012. Please note that it is the Investigator's responsibility to ensure that the Continuing Review Report is submitted to the IRB in a timely fashion.

Specific sponsor requirements, if any, are listed below: none

The PI is required to inform the IRB immediately of any circumstances or new information which may potentially change the risk/benefit ratio. Please refer to the IRB Policies & Procedures on the OPHS/IRB Website at CNMC IRB/OPHS Intranet Site for information concerning Modification Requests, Unanticipated Problems, Adverse Event Reports, and Continuing Review Reports. For further information, please call the Office for the Protection of Human Subjects, 301-565-8452.

Sincerely,

Jay Salpekar, MD

Children's National Medical Center
111 Michigan Avenue, NW
Washington, DC 20010
(301) 565-8452

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