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The Role Of Authoritative Parenting In Type 1 Diabetes
Adolescent Outcomes

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THE ROLE OF AUTHORITATIVE PARENTING IN TYPE 1 DIABETES ADOLESCENT OUTCOMES

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University.

by

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Abstract

THE ROLE OF AUTHORITATIVE PARENTING IN TYPE 1 DIABETES ADOLESCENT OUTCOMES

By Zach Radcliff, B. S.

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University.

Virginia Commonwealth University, 2014

Director: Dr. Bruce Rybarczyk, Professor of Psychology

Due to psychosocial and hormonal changes, adolescents with Type 1 Diabetes (T1D) are at risk for poorer regimen adherence, quality of life (QOL), and glycemic control (HbA1c).

Authoritative parenting (AP) supports youth development during the transition into adolescence. To date, the mechanisms behind authoritative parenting and better HbA1c are yet to be examined. Parent-youth dyads completed measures of authoritative parenting, adherence, and QOL. As hypothesized, more authoritative parenting related to higher socioeconomic status (SES; $\beta = -.13, p = .04$) rather than ethnicity. Further, more authoritative parenting related to better glycemic control via the mechanisms of higher youth QOL ($\beta = .24, p < .001$) and better diabetes adherence ($\beta = .17, p = .008$). Parents who provide more authoritative parenting have youth with better QOL, better adherence, and better glycemic control. More authoritative parenting helps youth achieve better diabetes care and quality of life during the transition into adolescence.
The Role Of Authoritative Parenting In Type 1 Diabetes Adolescent Outcomes

Type 1 diabetes (T1D) is one of the most common pediatric medical conditions with more than 15,000 new diagnoses each year (Imperatore et al., 2012). In 2010, 2.4 per 1,000 youth under age 20 had T1D in the United States (Menke et al., 2013), compared to 1.5 per 1,000 in 2001 (SEARCH for Diabetes in Youth Study Group, 2006). As the incidence increases each year (Stanescu, Lord, & Lipman, 2012), the average age at diagnosis steadily decreases (SEARCH for Diabetes in Youth Study Group, 2007; Vehik et al., 2009).

Given that T1D is most commonly diagnosed during childhood, parents play an integral role in TID management. T1D is a complex illness with a multifaceted regimen to which youth and their parents must adhere. The transition to adolescence is often characterized by a decrease in regimen adherence and blood glucose control as youth struggle to manage tasks amidst other developmentally normative activities (Amed et al., 2013). Parental involvement is especially critical during the adolescent transition when youth assume more responsibility for disease care. More specifically, parenting style, the strategies parents utilize in child rearing, might have implications for youth regimen adherence (Mlynarczyk, 2013). Parenting style also improves youth quality of life (QOL), as supportive parents foster positive views of T1D and its associated regimen (Lawrence et al., 2012; Mlynarczyk, 2013). The proposed study will examine the relation between parenting style and youth diabetes outcomes (adherence, QOL, and glycemic control).

Insulin Dependent Diabetes Mellitus

Type 1 Diabetes (T1D), or insulin dependent diabetes mellitus, is an auto-immune disease that destroys beta cells in the pancreas (Gorrell, Williams, & Powell, 2003). Beta cells are responsible for the production and secretion of insulin, which regulates glucose uptake in the
blood (American Diabetes Association [ADA], 2012). Without the ability to produce insulin, patients must inject exogenous insulin to regulate blood glucose levels (ADA, 2012; Gorrell et al., 2003). As a result, T1D self-care is complex and requires youth and parents to constantly monitor blood glucose levels (BGL), insulin administration, diet, and exercise (ADA, 2012).

**Blood glucose monitoring.** Monitoring glucose levels in the blood stream is a critical component of diabetes care. Per recommendations from the American Diabetes Association (ADA, 2013), patients with T1D should strive to keep their BGLs between 70 and 130 mg/dL before a meal and less than 180 mg/dL after a meal. It is recommended that patients check their BGLs a minimum of four times daily to ensure proper insulin management (ADA, 2013; Gan, Albanese-O’Neill, & Haller, 2012; Gorrell et al., 2003). Patients may check at other times during the day if they suspect hypo- (low) or hyper- (high) glycemia. Without regular blood glucose monitoring, patients are at risk for short-term health complications that can result from hypo- or hyper-glycemia.

Hypoglycemia occurs when BGLs are below 70 mg/dL (ADA, 2005; Lehecka, Renukunta, & Heptulla, 2012). Adrenergic counter-regulatory hormones, such as epinephrine and norepinephrine, are released to stimulate and elevate BGLs in an attempt to restore euglycemia (Cryer, Davis, & Shamoon, 2003; Seaquist et al., 2013). As such, during hypoglycemia patients may experience secondary adrenergic symptoms of shakiness and weakness, blurry vision, dizziness, hunger, and sudden mood changes (ADA, 2005; Cryer, 2010). Severe hypoglycemia may result in seizures, loss of consciousness, coma, and death (Cryer, 2008; Seaquist et al., 2013).

Hyperglycemia, BGLs over 180 mg/dL, presents both short- and long-term complications (ADA, 2013). Hyperglycemia causes frequent urination and significant thirst as the body
attempts to dilute blood glucose concentrations and expel excess glucose from the body. High circulating levels of glucose may damage small blood vessels in the kidneys, eyes, and digits (Jacobson et al., 2013). As BGLs increase, patients are at risk for diabetic ketoacidosis (DKA), a life threatening condition which results from low insulin and high glucose levels (ADA, 2013; Rosenbloom, 2011). Due to an inability to process glucose into the cells, the body metabolizes fats to provide energy with a net effect of ketone accumulation in the blood. Secondary symptoms of hyperglycemia include dry mouth, fruity breath, shortness of breath, nausea and vomiting (Gan et al., 2012; Rosenbloom, 2011). If untreated, patients may become comatose, have cerebral edema, or die (Gan et al., 2012). Long-term effects of hyperglycemia include neuropathy, digit loss, limb loss, kidney disease, micro-albuminuria, and retinopathy (Gorrell et al., 2003; Jacobson et al., 2013; The Diabetes Control and Complications Trial Research Group, 1993). These complications lead to an increased mortality risk as well as poorer health-related QOL (Bryden, Dunger, Mayou, Peveler, & Neil, 2003; Jacobson et al., 2013).

While it is not easy to observe trends of hyper- and hypoglycemia, hemoglobin A1c (HbA1c) provides a measure of average BGLs over a three month interval (Sacks et al., 2011). HbA1c is the percentage of red blood cells that have been glycated, an irreversible reaction that occurs with excess glucose in the blood (ADA, 2013). HbA1c measures average glycemic control over the past three months with better diabetes management reflected by lower percentages. Youth under the age of six years are sensitive to insulin and should have HbA1c levels between 7.5% and 8.5% to avoid excessive glycemic variation (ADA, 2013; Silverstein et al., 2005). From ages 6-12 years, when youth can achieve more control of their diabetes management, ADA recommendations suggest HbA1c levels remain less than 8.0% (ADA, 2013; Silverstein et al., 2005). ADA recommendations suggest that adolescents (ages 13-19 years)
maintain HbA1c levels below 7.5% in an effort to prevent long-term negative complications (ADA, 2013; Silverstein et al., 2005).

**Insulin administration.** Many types of insulin and methods of administration exist. Patients work with their medical team to develop a regimen that matches their lifestyle, degree of insulin resistance, and general physical health (ADA, 2013; Dabelea et al., 2011; Gorrell et al., 2003). Approximately 26.4% of youth are insulin resistant or have insulin sensitivity in the bottom quartile compared to healthy peers (Dabelea et al., 2011).

Insulin administration occurs via injections or an insulin pump. Injections are administered via preloaded insulin “pens” or a syringe (Gan et al., 2012). Alternatively, a catheter, connected to an insulin pump, may be inserted subcutaneously to supply a constant basal amount of insulin (Gan et al., 2012; Pihoker et al., 2013; Scheiner et al., 2009). Injections are given anywhere from two to five times a day. Most patients inject themselves three times a day at mealtimes (Crasto, Jarvis, Khunti, & Davies, 2009; Gorrell et al., 2003; Mohammad, Farghaly, Metwalley, Monazea, & Abd El-Hafeez, 2012; Pihoker et al., 2013). Before eating, patients on a pump perform an insulin bolus, a dose that accounts for impending carbohydrate intake (Crasto et al., 2009; Pihoker et al., 2013; Scheiner et al., 2009). While a pump allows patients to avoid daily injections, subcutaneous sites must be rotated every 2-4 days (Scheiner et al., 2009). Youth may be prescribed long-acting insulin, short-acting insulin, or a combination. Long-acting insulin analogs remain active in the blood for up to 24 hours and serve to regulate BGLs between meals (Crasto et al., 2009; Gorrell et al., 2003). Quick-acting insulin analogs begin to process glucose in as little as 15 minutes and are often used in response to carbohydrate intake (Crasto et al., 2009; Pihoker et al., 2013).
With physician guidance, patients develop an administration regimen designed to mimic normal pancreatic function. Quick-acting insulins better mediate post-meal BGLs as well as have long-lasting positive health effects (Crasto et al., 2009; Gan et al., 2012; Pihoker et al., 2013). Use of an insulin pump or a flexible intensive injection regimen, which combines a long-acting insulin base with quick-acting insulin injections at mealtimes, improves glycemic control, HbA1c, and prevents long-term negative health complications (Guo et al., 2013; Jacobson et al., 2013; Mohammad et al., 2012; Perez Mendez et al., 2007; Pihoker et al., 2013; Scheiner et al., 2009). Regardless of the administration method and insulin analog used, insulin management is a complex, involved process that requires significant involvement from both youth and parent.

**Diet and Exercise.** Diet and exercise affect the amount of insulin needed for cellular metabolism and influence hyper- and hypo-glycemia (Bernardini et al., 2004; Dabelea et al., 2011; Mehta et al., 2008). Patients engaged in physical activity may experience hypoglycemia during or up to 12 hours after physical activity since aerobic exercise increases insulin sensitivity (Baldi, Cassuto, Foxx-Lupo, Wheatley, & Snyder, 2010; D’hooge et al., 2011; Heyman, Briard, Gratas-Delamarche, Delamarche, & De Kerdanet, 2005; Heyman et al., 2007). With regular exercise, patients with T1D may lower their HbA1c by 0.5%, decrease glycemic variability, and improve cardiac and pulmonary function (Baldi et al., 2010; Bernardini et al., 2004; Ruzic, Sporis, & Matkovic, 2008; Sideraviciute, Gabiuniene, Visagurskiene, & Vizbaraite, 2006; Wong et al., 2011). Comparative studies suggest regular aerobic exercise limits the negative effects of moderate hyperglycemia and prevents cardiovascular and bone damage (Melling et al., 2013). Addition of regular exercise to a flexible intensive insulin regimen may prevent the long-term harmful effects associated with hyperglycemia.
While regular aerobic exercise is part of healthy physical conditioning, monitoring carbohydrate intake is the most central component of healthy diet management for patients with T1D. Carbohydrates are readily processed into glucose by the body and greatly impact BGLs (Bantle et al., 2008). Mealtime insulin doses are calculated based on anticipated carbohydrate consumption (Pihoker et al., 2013; Scheiner et al., 2009). Failure to monitor carbohydrates may result in improper insulin administration. Too much insulin results in hypoglycemia and too little insulin results in hyperglycemia (Patton, 2011). An ADA recommended diet consists of 50-60% carbohydrates, 10-20% protein, and 30% fat with less than 7% of the total diet from saturated fat, to avoid elevated cholesterol and cardiovascular disease (Bantle et al., 2008; Gan et al., 2012; Patton, 2011). Proper dietary care relates to less variability in BGLs and better HbA1c levels (Mehta et al., 2008; Patton, Dolan, & Powers, 2007). With adherence to diet and exercise recommendations, patients with T1D may improve long-term health outcomes. These components of T1D care require youth to devote time to regular exercise and attend to nutritional information with greater level of complexity than their peers.

**Adherence**

A complex disease care regimen makes youth adherence, how closely a youth follows his/her regimen, difficult. Adherence may be measure through examination of preventive behaviors (e.g. regular exercise and healthy diet), modifications to regimen (e.g. when routines change), interventions (e.g. for hyper- or hypo- glycemia), and general care behaviors (e.g. endocrinology appointment attendance and education of friends and responsible adults in basic T1D care; Iannotti, Nansel et al., 2006). Closer adherence to a prescribed regimen results in lower HbA1c levels and fewer complications (Mulvaney et al., 2012; Rausch et al., 2012). However, greater than half of youth with T1D do not meet the guidelines prescribed by their
endocrinologist (Amed et al., 2013). Many factors impact adherence in youth with T1D including youth developmental stage, parental factors, and demographic factors, as described below (Amed et al., 2013; Amiel, Sherwin, Simonson, Lauritano, & Tamborlane, 1986; Chisholm et al., 2007; Hilliard, Wu, Rausch, Dolan, & Hood, 2013; Rustad et al., 2013; Wysocki & Greco, 2006).

Youth adherence is a difficult construct to capture as it is a constant aspect of life for youth with T1D that may vary based on context (Di Battista, Hart, Greco, & Gloizer, 2009). Most clinicians and researchers rely on youth and/or parent report to study adherence. Youth report may be subject to self-reporting biases and halo effects, where he/she may report better adherence than is true to appear as though his/her T1D is properly managed (Lewin et al., 2010). Parents are often the optimum reporters and provide less biased reports. Parental report also tends to contain similar content to that provided by youth report but with greater accuracy (Holmbeck, Li, Schurman, Friedman, & Coakley, 2002; Lewin et al., 2010; Shorer et al., 2011).

**Developmental factors.** Normative developmental factors related to the transition to adolescence can bring an added challenge to T1D management (Palladino & Helgeson, 2013), as diabetes care behaviors highlight differences from peers (Wysocki & Greco, 2006). During adolescence, youth strive to be like their peers and to conform to group norms (Anderson & Wolpert, 2004). With the demands of T1D care, youth are noticeably different from their peers. As they attempt to increase their social attachments, T1D may be perceived as a barrier that prevents engagement in activities or removes them from social situations (Anderson et al., 2009). Adolescents thus might decrease care behaviors in an attempt to appear more like their peers (Anderson & Wolpert, 2004; Dashiff, McCabe, & Cull, 2006; Schilling et al., 2006). As this transition period continues, poorer preventive care becomes common, with fewer blood glucose
checks and less frequent exercise (Hendricks, Monaghan, Soutor, Chen, & Holmes, 2013). Youth may decrease the number of care behaviors they engage in to appear similar to their peers, while unfortunately increasing their risk for long-term complications (Anderson et al., 2009; Schilling et al., 2006; Wysocki et al., 1996).

As adolescents strive to be more like their peers, they become more autonomous and independent from their parents (Anderson & Wolpert, 2004). Adherence often declines as youth transition into adolescence and assume greater responsibility for disease care (Amed et al., 2013; Hilliard et al., 2013; Morris et al., 1997; Schilling et al., 2006). Youth strive for greater autonomy and control over their lives, yet these normal developmental processes might negatively impact diabetes self-care as youth reject parental assistance (Anderson & Wolpert, 2004; Karlsson, Arman, & Wikblad, 2008). Adolescents assume responsibility for their own care as they spend more time away from home and their parents (Karlsson et al., 2008). While parents model care behaviors during the childhood years, more of the care falls on the youth during adolescence. Adolescents learn to make independent management decisions. Adherence behaviors often decline as adolescents become more autonomous (Karlsson et al., 2008; Schilling et al., 2006; Wysocki et al., 1996).

Furthermore, as puberty begins, insulin resistance increases, adding additional challenges to glycemic control (Amiel et al., 1986). Higher levels of pubertal hormones in the blood constantly change the sensitivity of cells to insulin and management of T1D becomes more complex. Youth who previously were able to navigate T1D management may find inexplicable fluctuations in BGLs. These constantly changing biological factors may require a youth to spend more time managing their T1D than previously. The combination of peer influence, desire for
autonomy, and puberty leads to worse adherence during adolescence and further investigation into factors that may prevent this decline is needed.

**Parenting during adolescence.** Parents who provide support, warmth, and foster T1D self-efficacy can help prevent a decline in adolescent adherence (Wiebe et al., 2005). For example, parents can support youth disease management via parental monitoring and involvement which helps youth assume more responsibility for their care, promotes healthy adherence, and improves glycemic control (Ellis et al., 2007; King, Berg, Butner, Butler, & Wiebe, 2013; Mlynarczyk, 2013; Ott, Greening, Palardy, Holderby, & DeBell, 2000; Palmer et al., 2011; Spencer, Cooper, & Milton, 2013). Youth with T1D likely develop self-efficacy for T1D care similar to how youth without T1D develop self-efficacy: through parental support and warmth (Cramm, Strating, Roebroeck, & Nieboer, 2013; King et al., 2013; Ott et al., 2000; Stupiansky, Hanna, Slaven, Weaver, & Fortenberry, 2013). With appropriate parental involvement, better youth adherence relates to better glycemic control. Thus, further examination of parental involvement in adherence behaviors during adolescence is important to examine.

**Sociodemographic factors.** Sociodemographic features, such as socioeconomic status (SES) and ethnicity, are associated with risk for poorer adherence (Amed et al., 2013; Hilliard et al., 2013; Lewin et al., 2010). These factors likely contribute to a youth’s ability to adhere as they shape his/her environment and the availability of resources. Minority ethnicity predicts poorer adherence (Hilliard et al., 2013). However, SES is strongly linked to both adherence and ethnicity in other studies (Cohen, Lumley, Naar-King, Partridge, & Cakan, 2004; Powell, Chen, Kumar, Streisand, & Holmes, 2013). When SES (based on parents’ education and occupation) is considered, it has a stronger association with adherence than ethnicity, such that lower SES relates to poorer adherence (Powell et al., 2013). Related to occupation is parent income; lower
income relates to depleted parental resources, lower acceptance of youth T1D diagnosis, and poorer metabolic control (Drew et al., 2011). Additionally, married caregivers tend to be of higher SES (Mullins et al., 2011) and to have youth who are more likely to adhere to his/her regimen, which suggests that multiple primary caregivers provide additional support for youth (Hilliard et al., 2013). These factors demonstrate the importance of parent-provided resources to promote adherence. With limited resources and caregiver strain, T1D regimen adherence may not be prioritized and T1D adherence may be less consistent.

**Parenting Style**

Parents assist their youths’ transition to adolescence and assumption of greater responsibility for diabetes care. Parents provide support and structure necessary to foster growth. How parents regulate, nurture, and communicate with their youth impacts development (Baumrind, 1967; Maccoby & Martin, 1983). Differences in levels of parental warmth, regulation, and communication are used to define different parenting styles (Baumrind, 1967; Baumrind, 1971). Based on these levels, parents can be classified as either authoritative, authoritarian, permissive, or neglectful (Maccoby & Martin, 1983). These patterns appear to be true of all parents, including parents of youth with a chronic medical condition (Pinquart, 2013).

Authoritative parenting is often regarded as the ideal style as it combines high parental warmth with reasonable youth regulation and high parent/youth communication (Baumrind, 1967; Baumrind, 1971; Lamborn, Mounts, Steinberg, & Dornbusch, 1991). These parents often encourage independence, listen to their youth, clearly communicate their expectations, and show warmth and nurturance (Baumrind, 1967; Baumrind, 1971; Lamborn et al., 1991; Maccoby & Martin, 1983). Further, authoritative parenting is consistent, which provides youth with stability and the ability to learn self-regulation. Youth of authoritative parents are more autonomous, self-
regulated, confident, and explorative (Baumrind, 1967; Baumrind, 1971; Lamborn et al., 1991; Maccoby & Martin, 1983). These youth tend to have happier dispositions and navigate social situations easily. Further, youth of authoritative parents perform better in school and adapt to new situations more readily (Lamborn et al., 1991). Authoritative parenting is regarded as having the most favorable outcomes for youth development (Baumrind, 1971; Lamborn et al., 1991).

Authoritarian parents also exhibit high control but do not exhibit the same levels of communication and warmth (Baumrind, 1967; Baumrind, 1971; Lamborn et al., 1991; Maccoby & Martin, 1983). These parents have stringent rules and are more demanding than authoritative parents. Further, they communicate less with their youth and will punish youth without explanation. Youth who are raised by authoritarian parents associate obedience with love, may have lower self-esteem, and behave aggressively outside of the home ((Baumrind, 1967; Baumrind, 1971; Lamborn et al., 1991; Maccoby & Martin, 1983). Additionally, these youth have difficulty in social situations and may act fearful or shy around peers. While authoritarian parenting results in youth who follow rules and directions well, it may lack the warmth and nurturance that developing youth need.

Contrasting authoritarian parents are permissive parents, who tend to accept and accommodate a youth’s desires. Permissive parents show high warmth but with few inconsistent regulatory behaviors (Baumrind, 1967; Baumrind, 1971; Lamborn et al., 1991; Maccoby & Martin, 1983). These parents tend to relate to their children as friends and may use toys, gifts, or food to reinforce good behavior. Youth with permissive parents often lack self-discipline, are self-involved, and may have difficulty navigating complex social situations (Baumrind, 1967; Baumrind, 1971; Lamborn et al., 1991).
Finally, parents that contrast the other three styles are grouped into the neglectful category. Neglectful parents exhibit low levels of warmth, communication, and regulation (Lamborn et al., 1991; Maccoby & Martin, 1983). They are distant from their youth and fail to provide supervision, requirements for behavior, and may show little affection. Youth raised by neglectful parents are fiercely independent, fending for themselves and fearing dependence on others (Lamborn et al., 1991; Maccoby & Martin, 1983). They are often emotional distant and avoid close relationships. These youth tend to have the poorest outcomes in school and may exhibit more delinquent behaviors during adolescence than their peers.

While the initial descriptions of parenting styles utilized direct observation of parent and youth behaviors by trained clinicians, recent research used rating scales to examine parenting styles. Parent-reported questionnaires understandably can contain reporter bias, and pose a methodological challenge for many researchers (Holmbeck et al., 2002). When parents rate themselves, they tend to report their parenting practices as more positive and healthy and minimize negative parenting practices (Pinquart, 2013). To avoid these biases and to obtain a more objective view of the parenting styles in the home, youth-report of parenting style is often used, especially in older youth above the age of 12 (Mlynarczyk, 2013). Adolescents are considered to be optimum reporters of parenting style (Holmbeck et al., 2002), as they provide less biased information than their parents about a construct of which he/she is a part.

**Chronic illness.** Parenting styles generally are constant across different situational contexts but different styles can be more adaptive in unique settings (Pinquart, 2013). Youth chronic illness changes the parent-youth relationship and impacts the parents’ role (Case-Smith, 2004; Coffey, 2006). Some illnesses require greater parent involvement, which results in increased parental regulation (Pinquart, 2013). While higher levels of warmth yield the best
youth outcomes, authoritarian parenting occurs more frequently in parents of youth with physical disabilities than in families without youth with physical disabilities (Holmbeck et al., 2002; Pinquart, 2013). Neglectful parenting behaviors are reported to occur at higher rates in parents of youth with epilepsy, asthma, and hearing impairments (Pinquart, 2013).

Parents worry about the health of their chronically ill youth; parents tend to remain more involved and to allow less autonomy as youth get older (Coffey, 2006; Holmbeck et al., 2002; Luyckx, Goossens, Missotten, & Moons, 2011). Other parents may exhibit less control, perhaps to avoid added restrictions on their chronically ill youth or to avoid perceived differences from other youth (Lim, Wood, Miller, & Simmens, 2011; Noll, McKellop, Vannatta, & Kalinyak, 1998; Park & Walton-Moss, 2012). Some parents may cope with their youth’s illness with overprotective, demanding, and rigid behaviors (e.g., authoritarian parents). While other parents may deny illness-related limitations, ignore the diagnosis, and fail to provide proper care (e.g., neglectful parents). Some parents allow their youth to manage illness care without parental support (e.g., permissive parents). These parenting practices may lead to worse physical and mental health outcomes while youth experience a decreased QOL.

Overall, the best youth outcomes typically occur in families with higher levels of warmth and communication by authoritative parents which yields better physical health and QOL (Luyckx et al., 2011; Park & Walton-Moss, 2012; Pinquart, 2013; Wake, Nicholson, Hardy, & Smith, 2007). Parental care, support, and acceptance provide youth with needed security to face illness-related challenges (Luyckx et al., 2011; Park & Walton-Moss, 2012). Parents who monitor their youth’s behavior but allow autonomy to develop, increase positive outcomes and better prepare their youth for the challenges of adulthood (Pinquart, 2013; Wake et al., 2007).
**Type 1 diabetes.** When a youth perceives his/her parents to be supportive, he/she is more likely to take responsibility for his/her T1D care (Ott et al., 2000); however, parental support, warmth, and monitoring all decrease as youth transition to adolescence (King et al., 2013), and decreased parental involvement relates to decreased adherence behaviors. Through collaboration with supportive parents, adolescents might be able to solve complex T1D management problems. However, only a few studies specifically examine parenting style in the context of T1D (Davis et al., 2001; Greene, Mandleco, Roper, Marshall, & Dyches, 2010; Mlynarczyk, 2013; Monaghan, Horn, Alvarez, Cogen, & Streisand, 2012; Sherifali, Ciliska, & O’Mara, 2009; Shorer et al., 2011).

Results of previous studies highlight the importance of authoritative parenting on youth T1D outcomes. In an initial exploratory study of 4-10 year-old children, 53 parents were surveyed about their parenting styles, their youth’s adherence, and HbA1c (Davis et al., 2001). Parental warmth was positively correlated with better youth adherence while higher levels of parental strictness related to higher HbA1c. Recent studies replicated the relation between more authoritative parenting style and lower HbA1c with adolescent populations (Greene et al., 2010; Shorer et al., 2011). Both studies had modest sample sizes and utilize parent report of parenting style, which may be subject to self-reporting biases (Holmbeck et al., 2002). However, in a larger sample of 5-12 year-olds, no relation was found between parenting style and HbA1c (Sherifali et al., 2009). The study sample was predominantly Caucasian, well-educated, from upper-middle class or higher, which is not representative of the current population of youth with T1D in the US (SEARCH for Diabetes in Youth Study Group, 2007). Further, parenting style was only assessed via parent report (Holmbeck et al., 2002). While the relation between parenting style and SES in
T1D has not yet been studied, these studies suggest higher SES parents engage in authoritative parenting more often.

Parenting style relates to youth T1D regimen adherence as well. Youth reported higher adherence when parents reported higher authoritative parenting (Greene et al., 2010; Shorer et al., 2011). However, Greene et al. (2010) reported that parents were susceptible to social desirability biases and reported more authoritative parenting behaviors than the general population. To examine this effect, Mlynarczyk (2013) examined youth report of parenting style. Prevalence rates of youth report of all parenting styles are consistent with previous rates described from observational studies in the general population (Lamborn et al., 1991; Mlynarczyk, 2013). As noted, higher levels of youth-reported authoritative parenting relates to better youth-reported adherence. However, no other parenting style related to youth regimen adherence (Greene et al., 2010; Mlynarczyk, 2013), which suggests the unique combination of higher levels of warmth, regulation, and communication that are characteristic of authoritative parenting are essential ingredients for better youth regimen adherence.

Parenting style might also be implicated in a youth’s QOL, although results may be dependent upon the age of youth studied and the source of reported parenting style. For example, a study of 216 parents and younger youth aged 5-12 years found trends to suggest parent-reported authoritative parenting relates to better parent- and youth-report of youth QOL (Sherifali et al., 2009). However, in adolescents, better youth-reported QOL related to higher levels of youth-reported authoritative parenting (Mlynarczyk, 2013). Use of youth as the only reporters makes this study susceptible to single source reporter bias, potentially skewing results in the same direction (Holmbeck et al., 2002). The discrepancy between these studies suggests a relation may exist when older youth report both QOL and parenting style, while parent report
Quality of Life

With such a complex regimen, T1D can have a significant impact on a youth’s life. Successful adaption to these changes can help avoid a negative impact on a youth’s QOL (Naughton et al., 2008; Reynolds & Helgeson, 2011). QOL is a construct that examines a person’s physical, emotional, mental, and social wellbeing (Wallander, Schmitt, & Koot, 2001). Better QOL is associated with positive T1D-related health outcomes, better family relationships, better T1D care behaviors, and less psychological distress (Lawrence et al., 2012; Naughton et al., 2008; Pereira, Berg-Cross, Almeida, & Machado, 2008; Reynolds & Helgeson, 2011).

Quality of life is a difficult concept to measure as the internal constructs of worry, stressors, and T1D-related difficulties vary by person (Wallander et al., 2001). However, measures are available such as the Pediatric Quality of Life, which are widely accepted and assess constructs of T1D problems, barriers, adherence, worry, and communication (Varni, 2003). Typically, youth are considered to be better reporters of their QOL than parents who provide a proxy report (Dey, Landolt, & Mohler-Kuo, 2013). Youth tend to provide more information about negative influences on their QOL, particularly social situations (Agnihotri, Awasthi, Singh, Chandra, & Thakur, 2010). However, parents provide valuable information related to treatment adherence and parent-youth communication (Nansel et al., 2008). Information combined from both reporters (e.g., average of the parent and youth Pediatric
Quality of Life total scores) provides a more comprehensive picture of QOL in youth (Agnihotri et al., 2010; Lawrence et al., 2012; Nansel et al., 2008).

Multiple reporters allow examination of a construct from different perspectives. The use of multiple reporters in research provides more statistical variance and range (Holmbeck et al., 2002). Additionally, single reporters may exhibit error across multiple constructs. Single-source error and bias may skew results of sole reporters about multiple constructs (Holmbeck et al., 2002). Parents may report fewer social difficulties for their youth in addition to better adherence across contexts as a result of halo effects, when in practice youth report poorer adherence in social contexts (Agnihotri et al., 2010). Moderate agreement exists between parents and youth on QOL measures but information from both reporters provides a more comprehensive picture that incorporates the unique perspectives of each informant (Agnihotri et al., 2010; Mlynarczyk, 2013).

**Type 1 diabetes.** When defined to encapsulate the many aspects of T1D that impact a youth’s daily life, QOL provides information that connects psychological factors with physiological outcomes. The glycosylated hemoglobin (HbA1c) assay is the most common measure of glycemic status; better HbA1c’s are related to better QOL (Hilliard, Mann, Peugh, & Hood, 2013; Lawrence et al., 2012; Nansel et al., 2008; Naughton et al., 2008; Reynolds & Helgeson, 2011). In contrast, lower QOL relates to poorer general health outcomes of increased comorbidities and complications in youth with T1D after ten years (Naughton et al., 2008; Wikblad, Leksell, & Wibell, 1996). At a 10-year follow-up, patients with HbA1c levels greater than 9% rate their physical and emotional health as significantly worse than those who had lower HbA1c levels. Additionally, those with lower HbA1c levels without severe episodes of hypoglycemia in the past six months rate their QOL at levels equal to those of subjects without
T1D (Wikblad, 1996). A number of factors play a role in the relation between QOL and physical health including better adherence (Lawrence et al., 2012); demographic factors (socioeconomic status and parent education; Lawrence et al., 2012; Naughton et al., 2008); and parenting factors such as warmth, support, and responsiveness (Lawrence et al., 2012; Naughton et al., 2008). While many of studies of QOL have large diverse samples, fundamental mechanisms that may define the relation between pediatric QOL and HbA1c, such as parenting style and demographic factors of SES and ethnicity, have yet to be evaluated.

Parenting style is one potential mechanism underlying the relation between QOL and HbA1c. Higher levels of parent support relate to lower levels of parent-youth conflict and higher QOL in youth (Laffel et al., 2003; Pereira et al., 2008). Diabetes-related parent-youth conflict at predicts poorer QOL, such that higher levels of conflict predict worse parent- and youth-reported youth QOL one year later (Laffel et al., 2003). Higher youth-reported QOL relates to higher levels of youth-reported responsive parenting, defined as warm and supportive (Botello-Harbaum, Nansel, Haynie, Iannotti, & Simons-Morton, 2008; Davidson, Penney, Muller, & Grey, 2004). When problem solving and emotional expression are fostered in youth by their parents, youth experience a better QOL (Jaser & White, 2011).

However, it is not just parental actions that contribute to youth QOL, as parental sociodemographic factors contribute to youth QOL. Parents who are less educated and less involved in T1D care are more likely to have youth with poorer QOL (Lawrence et al., 2012). Parental education contributes to SES (Hollingshead, 1975), such that attempts to understand QOL should detangle the potential effects of SES. Interestingly, while the effects of SES have yet to be studied in direct relation to QOL, when income is considered via public (e.g., Medicaid)
versus private insurance, those families who receive public assistance have youth with poorer QOL than those who have private insurance (Lawrence et al., 2012; Naughton et al., 2008).

**Statement of Problem**

Type 1 diabetes is a complex medical illness with a complicated treatment regimen. Most commonly diagnosed during childhood, much of the management responsibility is assumed by parents. When youth reach adolescence, responsibility for self-care is gradually transferred to youth. Adolescence is associated with increased risk for poorer regimen adherence and glycemic control as youth balance self-care with typical developmental challenges. Social factors may pressure youth to decrease adherence behaviors while the desire for autonomy may cause youth to reject parental guidance. Hormonal changes also impact insulin resistance and can worsen glycemic control. As youth adapt to these changes, T1D management can become more difficult.

Recent literature indicates that parents may buffer the difficulties faced by adolescents during this transition. Authoritative parents are parents who provide high levels of support and communication without high control and tend to have youth who experience better adolescent outcomes (Baumrind, 1971; Maccoby & Martin, 1983). For youth with a chronic illness, better self-care behaviors, adjustment to his/her illness, and improved health outcomes are found in families with authoritative parents. However, the literature currently over-relies upon sole parent-report of parenting style such that halo effects and single-source informant bias may inflate the strength of the association between parenting style and parent-report of adherence.

Youth with more authoritative parents report better QOL (Mlynarczyk, 2013). Similarly, youth with T1D who have more authoritative parents report higher diabetes-related QOL (Mlynarczyk, 2013; Sherifali et al., 2009). Further, youth experience a better QOL when they
perceive their regimen is manageable. Supportive parents may help youth better handle T1D management and foster youth quality of life.

The limited T1D literature suggests that youth with authoritative parents have higher QOL, better regimen adherence, and lower HbA1c. To date, studies are limited by smaller sample sizes and limited demographic representativeness (Davis et al., 2001; Mlynarczyk, 2013; Monaghan, Horn, Alvarez, Cogen, & Streisand, 2012). Additionally, most rely on the sole report of a single reporter, often the parent, which raises questions of single-reporter and social-desirability biases (Monaghan et al., 2012; Pinquart, 2013). A mixed-source method (youth-report, parent-report or combined youth-/parent-report), can minimize obvious biases and still provide richly layered information about the functioning of parent-youth dyads (Holmbeck et al., 2002).

The study method builds upon past research through use of multi-source data. Specifically, youth-report of parenting style, parent-report of adherence, and combined youth- and parent-report of QOL were evaluated from a large ethnically diverse population. Youth were old enough, 11 to 14 years, to provide reliable estimates of parenting style and QOL. Previous studies have not examined the relation among these variables at the same point in time. Youth-report of authoritative parenting was used to prevent parent self-report biases. Through similar logic, parent-report of youth adherence was used to avoid youth self-report bias. Parent- and youth-report of QOL were combined to ensure a complete representation of both internal and external aspects of QOL. This study builds on past research through exploration of diabetes adherence and quality of link as mediational links between more authoritative parenting and better glycemic control.

**Hypotheses**
1) More authoritative parenting will relate to higher SES than to ethnicity.

2) Higher levels adherence and youth quality of life will independently relate to better glycemic control (lower HbA1c). Further, better youth adherence will relate to higher youth quality of life.

3) Higher levels of authoritative parenting will be indirectly related to better glycemic control (lower HbA1c) through two mechanisms:
   a) First, higher authoritative parenting will relate to better glycemic control via higher levels of youth adherence.
   b) More authoritative parenting also will relate to better glycemic control through higher levels of youth quality of life.

**Methods**

**Participants**

Participants were 257 parent-youth dyads (youth aged 11-14 years) enrolled in a randomized clinical trial at two Mid-Atlantic children’s hospitals. Enrollment in the trial required willingness to participate in four brief coping or education intervention sessions at routine endocrinology visits. Data from the baseline assessment were used for this study. Eligibility requirements for the trial included diabetes duration of at least one year, absence of severe complications or other medical diagnoses, and English fluency. The sample consisted of dyads composed of one youth with T1D (49% female) and one parent (91% mothers); a majority were Caucasian (69%). Mean age at baseline assessment was 12.8 years ($SD = 1.2$), mean illness duration was 5.1 years ($SD = 3.1$), and mean HbA1c was 8.8% ($SD = 1.6$). See Table 1 for complete participant description.
Table 1

Demographic Information of Study Participants

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>Percentage (%)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>12.8 (1.2)</td>
<td>50.6</td>
<td>11-15</td>
</tr>
<tr>
<td>Gender: Male</td>
<td></td>
<td>69.9</td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td>19.1</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>69.9</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td></td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>Hispanic American</td>
<td></td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>Asian American</td>
<td>1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hollingshead Index of SES$^2$</td>
<td>46.6 (11.7)</td>
<td>12-66</td>
<td>6.3-14.0</td>
</tr>
<tr>
<td>Category Score</td>
<td>2.45 (.87)</td>
<td>1-5</td>
<td></td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>8.8 (1.6)</td>
<td>44.0</td>
<td></td>
</tr>
<tr>
<td>Duration of Disease (years)</td>
<td>5.1 (3.1)</td>
<td>3.0-12.67</td>
<td></td>
</tr>
<tr>
<td>Regimen (Insulin Pump)</td>
<td></td>
<td>44.0</td>
<td></td>
</tr>
<tr>
<td>QOL$^3$</td>
<td>66.18 (11.77)</td>
<td>34.07-97.83</td>
<td></td>
</tr>
<tr>
<td>Authoritative Parenting</td>
<td>9.02 (1.14)</td>
<td>3.0-12.67</td>
<td></td>
</tr>
<tr>
<td>Adherence (DBRS)$^4$</td>
<td>.67 (.11)</td>
<td>.27-.92</td>
<td></td>
</tr>
</tbody>
</table>

$^1$ Parent report of ethnicity
$^2$ SES = Socioeconomic Status, higher scores indicate higher SES
$^3$ QOL = Quality of Life
$^4$ DBRS = Diabetes Behavior Rating Scale

Procedures

The data for these analyses were baseline data collected from a randomized clinical trial (RCT) approved by Institutional Review Boards at each hospital and university. Eligible families were identified from endocrinology clinic rosters. Families were mailed an informational letter, which was followed by a phone call from trained research assistants. At a regularly scheduled endocrinology clinic visit, each youth and one parent provided assent and consent, respectively, and completed self-report questionnaires. Total testing time was approximately one hour. Youth received a $25 gift card for their participation.

Measures

Disease and demographic information. Background information was collected from parents with a questionnaire developed by the research team that included information about
youth age, gender, ethnicity, date of diagnosis, insulin regimen (pump versus injections), and caregiver marital status. SES was calculated using the Hollingshead Two-Factor Index, based on parental education and employment (Hollingshead, 1975).

**Parenting style.** The Parenting Styles Index (PSI) is a youth report measure of authoritative parenting (Steinberg, Lamborn, Dornbusch, & Darling, 1992). Youth report the frequency of authoritative parenting behaviors on this 26-item scale. A total score is summed from responses. Additionally, three subscales demonstrate moderate internal reliability as indicated by Cronbach’s alpha: Acceptance/Involvement ($\alpha = .72$), Strictness/Supervision ($\alpha = .76$), and Autonomy Granting ($\alpha = .82$). For this study, total scores were analyzed.

**Adherence.** Parents completed the Diabetes Behavior Rating Scale (DBRS; Iannotti et al., 2006). The DBRS asks respondents to rate the frequency with which routine T1D care behaviors (e.g., prevention, modification, and intervention behaviors) occurred over the previous week on a 5-point scale ranging from Never (0) to Always (4) for the first and last section and a 6-point scale ranging from No Times (0) to Five times (5) for the other sections. Two forms of the DBRS exist: one for youth on a regimen of insulin injections (36 items) and one for youth who an insulin pump (37 items). Scores are transformed from totals to represent a proportion of tasks completed (transformed scores between 0 and 1); higher scores indicate more frequent engagement in adherence behaviors. Transformed total scores were used for analyses. The DBRS has good internal consistency ($\alpha = .84$), test-retest reliability ($\alpha = .71$), and content validity (Pearson’s $r = .48$, $p < .001$; Iannotti et al., 2006). Total scores were analyzed.

**Quality of life.** Both parents and youth completed the Pediatric Quality of Life- Type 1 Diabetes Module questionnaire (Varni et al., 2003). The QOL is a self-report measure that examines five dimensions of QOL: Diabetes Problems, Treatment Barriers, Treatment
Adherence, Worry, and Communication. Participants rated each of the 28 items on a 5-point scale (Never=0 to Almost Always= 4). Each item score is reverse-scored and converted into a linear scale such that 0=100, 1=75, 2=50, 3=25, and 4=0. Finally, each dimension is averaged across items to give a dimension score such that higher scores indicate a better QOL and fewer problems. Dimension scores are summed to provide a total QOL score which was analyzed. Parent and youth scores were averaged for a combined total score. The QOL has good internal consistency (Parent Report Total α= .89; Youth Report Total α= .88).

Glycemic control. To assess glycemic control (HbA1c), HbA1c values were analyzed from a blood assay (DCA 2000, Bayer, Inc., Tarrytown, NY) during a routine endocrinology visit. The closest assay to participant entrance to the study was collected from youths’ medical charts. HbA1c provides information about T1D health over the previous three months. Lower values reflect better glycemic control.

Data Analysis Plan

Descriptive statistics and analyses used SPSS- Version 21 (IBM Inc., 2012). Hypothesis 1 stated that authoritative parenting would positively relate to higher SES and account for more variance than the relation between authoritative parenting and ethnicity. A stepwise hierarchical multiple regression analyzed authoritative parenting scores to determine the relative contribution of SES versus ethnicity. With authoritative parenting as the dependent variable, SES was entered into the model in the first step of the regression, and then ethnicity was entered in the second step.

Hypothesis 2 examined the interrelations among youth adherence, QOL, and HbA1c. Higher levels of parent-reported adherence and higher levels of QOL were hypothesized to independently relate to better glycemic control (lower HbA1c). Further, better parent-report of
youth adherence was hypothesized to relate to better QOL. A bivariate correlation matrix examined the relations among the three variables: QOL, adherence, and HbA1c.

Hypothesis 3 predicted higher levels of youth-reported authoritative parenting would be indirectly related to better glycemic control (lower HbA1c) via higher levels of parent-reported adherence and higher levels of youth- and parent-reported QOL. Hypothesis 3 was tested with MacKinnon et al.’s model for mediation (Hayes, 2013; MacKinnon, Fairchild & Fritz, 2007; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). As such, the relation between authoritative parenting and HbA1c was examined with multiple regressions. Separate mediation analyses were conducted to examine if QOL and adherence were mediators of the independent variable (authoritative parenting) and dependent variable (HbA1c). A Sobel test was conducted to determine if the relation between authoritative parenting and HbA1c significantly decreased when a mediator was included in the model.

Results

To examine Hypothesis 1, whether authoritative parenting was more related to socioeconomic status (SES) than ethnicity, a hierarchical linear regression was computed. First, SES was converted from a sum total score into a categorical variable with five levels (1-5) with a low SES equal to 5 to high SES equal to 1. The five levels are divided equally among the range of potential scores on the Hollingshead Two-Factor Index of SES. Participants were predominately in the middle SES (37.4%) and upper middle SES (40.1%) categories (see mean SES in Table 1) although each of the SES categories was represented in the study. See Table 2 for the categorical distribution.
Table 2

*Distribution of Socioeconomic Categories* by Study Participants

<table>
<thead>
<tr>
<th>SES Category</th>
<th>N</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- High</td>
<td>30</td>
<td>11.7</td>
</tr>
<tr>
<td>2- Upper Middle</td>
<td>103</td>
<td>40.5</td>
</tr>
<tr>
<td>3- Middle</td>
<td>96</td>
<td>37.4</td>
</tr>
<tr>
<td>4- Lower Middle</td>
<td>12</td>
<td>4.7</td>
</tr>
<tr>
<td>5- Low</td>
<td>7</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td>248</td>
<td>96.5</td>
</tr>
</tbody>
</table>

*Note. Calculated using the Hollingshead (1975) Two Factor Index of Socioeconomic Status*

Parents identified youth ethnicity (Table 1). Ethnic minorities (Black, Hispanic Americans, Asian Americans, and other) were examined with an Analysis of Variance (ANOVA) to determine if there were differences among the groups on the dependent variable of authoritative parenting. No significant differences occurred among the ethnic minorities on the dimension of authoritative parenting; thus minorities were grouped together to increase power (Figure 1). Ethnicity thus was treated as a dichotomous variable of Caucasians and minorities as a single group. Further, discussion of ethnicity will related to the difference between Caucasians and minorities as a group. SES was entered into the first step of a hierarchical regression model and ethnicity was entered into the second step. SES significantly related to parenting style, $F(1, 245) = 4.13$, $\beta = -.13$, $p = .04$, $R^2 = .02$. When ethnicity was entered into the model, it did not significantly improve the model, $\Delta R^2 = .007$, $\Delta F(1, 244) = 1.82$, $p = .18$. With both SES and ethnicity in the model, the complete model remained significant $F(2, 244) = 2.98$, $p = .05$, $R^2 = .02$. However, neither SES nor ethnicity remained as a significant individual variable related to authoritative parenting in the complete model (SES $\beta = -.13$, $p = .17$; ethnicity $\beta = -.22$, $p = .18$). As ethnicity and SES do not occur exclusively of one another and neither remained as significant individual correlates of authoritative parenting, these variables were not controlled in Hypothesis 2 or 3.
Figure 1. Parenting style by ethnicity. Scatterplot of youth-reported authoritative parenting scores on the PSI (Parenting Style Index) by ethnicity groups.

Hypothesis 2 examined the intercorrelations of the potential study mediators of quality of life, adherence and glycemic control with a bivariate correlation matrix (Table 4). Further, age, gender, SES, and insulin regimen were examined in the same analysis. Higher parent-reported adherence was significantly correlated with lower HbA1c ($r = -.30, p < .001$) and higher QOL ($r = -.31, p < .001$). Higher youth QOL significantly correlated with lower HbA1c ($r = -.34, p < .001$).
Table 3

Bivariate Correlations of Study Mediator Variables and Glycemic Control

<table>
<thead>
<tr>
<th></th>
<th>QOL</th>
<th>Adherence</th>
<th>HbA1c</th>
<th>Age</th>
<th>Gender</th>
<th>SES</th>
<th>Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>QOL</td>
<td>1</td>
<td>.31***</td>
<td>- .34***</td>
<td>-.21**</td>
<td>-.07</td>
<td>-.20**</td>
<td>-.03</td>
</tr>
<tr>
<td>Adherence</td>
<td>1</td>
<td></td>
<td>-.30***</td>
<td>-.14*</td>
<td>.03</td>
<td>-.20**</td>
<td>-.27***</td>
</tr>
<tr>
<td>HbA1c</td>
<td>1</td>
<td></td>
<td></td>
<td>.13*</td>
<td>-.07</td>
<td>.31***</td>
<td>.13*</td>
</tr>
<tr>
<td>Age</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>-.03</td>
<td>-.06</td>
<td>-.009</td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>-.18**</td>
<td></td>
<td>-.10</td>
</tr>
<tr>
<td>SES</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.30***</td>
<td></td>
</tr>
<tr>
<td>Regimen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Correlation significant at *p < .05, **p < .01, ***p < .001

1QOL = Quality of Life
2Measured with Diabetes Behavior Rating Scale
3HbA1c = glycosylated hemoglobin
4SES = Socioeconomic Status
5Regimen is dichotomous (intensive or conventional)

Next, mediators of authoritative parenting and glycemic control were evaluated with regression analyses. As hypothesized, more youth-reported authoritative parenting was related to better HbA1c via parent-reported better youth adherence (Hypothesis 3a; Figure 2). The model used for these mediation analyses does not require significant associations between the independent (authoritative parenting) and dependent (HbA1c) variables (Hayes, 2013; MacKinnon et al, 2007; MacKinnon et al., 2002). This model requires a significant Sobel test to show successful mediation. In keeping with this approach, authoritative parenting was not related directly to HbA1c (β = -.08, p = .19), although authoritative parenting was related to adherence (β = .17, p = .008). When both authoritative parenting and adherence were entered into a third regression model, the relation between adherence and HbA1c was significant (β = -.29, p < .001), while the relation between authoritative parenting and HbA1c remained non-significant (β = -.03, p = .63). Using the Sobel test, the magnitude of the relation between authoritative parenting and HbA1c was found to decrease significantly when youth adherence was included (z
Thus, adherence fully mediated the effect of authoritative parenting on HbA1c.

![Diagram](image)

Figure 2. Adherence as a mediator. Adherence as a mediator of the relation between authoritative parenting and glycemic control (HbA1c). Values shown are standardized regression coefficients. Values in parentheses represent unstandardized beta weights. Values in brackets account for the association of authoritative parenting on HbA1c after controlling for adherence and indicate full mediation by adherence (Sobel test $z = -2.44, p = .01$).

Next, the assertion that more authoritative parenting would relate to better glycemic control via better quality of life was tested (Hypothesis 3b; Figure 3). Again, authoritative parenting did not relate directly to HbA1c ($\beta = -.08, p = .19$) but authoritative parenting was related to QOL ($\beta = .24, p < .001$). When authoritative parenting and QOL were entered simultaneously into a third model, the relation between QOL and HbA1c was significant ($\beta = -.34, p < .001$) while the relation between authoritative parenting and HbA1c remained nonsignificant ($\beta = .00, p = .99$). Using the Sobel test, the magnitude of the relation between authoritative parenting and HbA1c decreased significantly when youth QOL was included ($z = -3.26, p = .001$). Thus, youth QOL fully mediated the effect of authoritative parenting on HbA1c.
Discussion

The role of authoritative parenting in youth diabetes management was explored in this study along with possible mechanisms by which it might relate to better glycemic control. More authoritative parenting was related to higher SES rather than Caucasian or minority ethnicity as expected (Hypothesis 1). Further, better youth quality of life (QOL), better adherence and better glycemic control all were interrelated favorably (Hypothesis 2). Finally, this study found important mediators of the relation between more authoritative parenting and better glycemic control via better adherence and higher quality of life (Hypothesis 3).

First, the demographic correlates of authoritative parenting were examined. As hypothesized, more authoritative parenting related to higher SES rather than ethnicity in this sample of youth with T1D (Hypothesis 1). Within the diabetes literature, SES and ethnicity often are highly inter-related but SES is more strongly associated with glycemic control and diabetes care behaviors (Hilliard et al., 2013; Powell et al., 2012). Consistent with this finding, higher SES was more strongly related to authoritative parenting than ethnicity. Higher SES
parents appear more likely to exhibit more authoritative parenting practices, which relate to better diabetes outcomes. Interestingly, no ethnic differences were found in authoritative parenting which further supports the assertion that SES, not ethnicity, is the more important factor related to this parenting style; however, it should be noted that this sample was primarily Caucasian, thus our ability to detect differences in other ethnic groups, if they exist, was limited. Due to the confound that often exists between SES and ethnicity (Hilliard, Mann, Peugh, & Hood, 2013), these results underscore the importance of measurement and control of SES as a precursor to better understand psychological effects often erroneously attributed to ethnicity.

Beyond sociodemographic factors, the relations among QOL, adherence, and glycemic control were evaluated. As predicted in Hypothesis 2, better adherence, higher QOL, and better glycemic control were all favorably interrelated. Current literature supports these findings; better youth adherence consistently is related to better glycemic control (Lawrence et al., 2012; Nansel et al., 2008; Naughton et al., 2008). Limited research indicates that better QOL is related to better adherence and glycemic control (Mlynarczyk, 2013; Sherifali et al., 2009). During adolescence, youth may find a regimen to be a challenge and strict adherence to a T1D regimen can be time consuming. However, better adherence and glycemic control are related to better youth QOL. Despite some possible constraints of adherence behaviors at times, youth and parents who more closely follow a prescribed regimen report better QOL. Experience of better QOL may contribute to a positive feedback loop that reinforces a youth with the importance of adherence and serves to maintain healthy glycemic control. This finding shows favorable relations among youth psychological function, as measured through higher QOL, better adherence behaviors and better physiological outcomes in T1D.
Previous literature has established a relation between authoritative parenting and HbA1c, yet mediators of the relation have yet to be explored. This study examined QOL and adherence as mediators of this relation. More authoritative parenting related to better HbA1c values through better youth adherence behaviors (Hypothesis 3a). See Figure 2. This model shows better adherence mediates the relation between more authoritative parenting and better glycemic control. Parents provide important support to their youth during the transition to adolescence as youth begin to assume more responsibility for adherence behaviors. Parents who provide support, warmth, and who communicate with their youth have youth who achieve better diabetes care and glycemic control during the transition into adolescence.

More authoritative parenting also relates to better glycemic control through higher youth QOL (Hypothesis 3b). Higher levels of authoritative parenting were related to better glycemic control through higher youth QOL. See Figure 3. In this study, QOL was measured with a T1D-related measure that included psychological constructs such as communication and worry as well as adherence behaviors. Few studies have examined QOL as it relates to either authoritative parenting or HbA1c and none have examined QOL as a mediator of the two (Mlynarczyk, 2013; Sherifali et al., 2009). These results support a relation between the psychological construct of authoritative parenting and a physiological marker of HbA1c through a combined psychological and behavioral construct of quality of life. In this way, the results of this study build on past literature to further link authoritative parenting and glycemic control and highlight the importance of authoritative parenting in youth with T1D.

**Limitations**

Data for this study were collected from a baseline assessment of a randomized clinical trial which limits the ability to make causal statements about the data. Additionally, a direct
relation between authoritative parenting and glycemic control was not significant in this study and should be weighed in the consideration of these results. Further, the present sample was primarily comprised of Caucasian, middle and upper middle SES families willing to enroll in a year-long treatment study. These families may be susceptible to self-selection biases as well, which may have resulted in higher numbers of higher SES, Caucasian families participating. Further, due to the limited number of minority subjects they were treated as one combined group for analyses as there was not sufficient power to examine them separately. Higher SES families report higher rates of authoritative parenting. Range restriction should be considered when viewing these results (Lamborn et al., 1991). Range restriction may increase the strength of the relations among authoritative parenting and better adherence, better QOL, and better HbA1c. Research with a broader range of SES could provide more information about the strength of relations among SES and elements of the T1D regimen.

**Strengths**

This study had a large sample of youths and parents who were representative of the national T1D population. Inclusion of a sizable minority population should enhance the generalization of the study results. The use of mediation analysis to examine the relation between authoritative parenting and HbA1c is novel in T1D literature. This study examined multiple mediators of better adherence and quality of life as potential mechanisms of the relation between more authoritative parenting and better glycemic control. Another advantage of this study is its careful selection of optimum report for each studied construct. Through the use of parent report of adherence and quality of life and youth report of authoritative parenting and quality of life, this study was able to measure each construct adequately to avoid well known single-source error
effects and bias. A mixed-source method can minimize reporting biases yet provide detailed information about the functioning of parent-youth dyads (Holmbeck et al., 2002).

**Future Directions**

Further examination of factors that comprise authoritative parenting could provide valuable information about which aspects of the parent/youth relationship foster better diabetes care management to enable more strategic interventions. Future studies also could examine all four parenting styles across SES levels. These studies could focus on different parenting styles utilized by parents with lower levels of authoritative parenting. Interventions could be designed to improve authoritative parenting practices, given its beneficial relations with disease care. With more information about the relation between parenting styles and T1D outcomes, clinicians should be better able to assist parents and youth to navigate the transition into adolescence.
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