2020

Analysis of the Impact of Family Structure and Type 2 Diabetes Among Adolescents

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Walden University
2020

Abstract

Analysis of the Impact of Family Structure and Type 2 Diabetes Among Adolescents

by

Danny Lee Self

MHA, Webster University, 2011

BA, Mid-Continent University, 2009

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

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Abstract

Type 2 diabetes (T2D) has increased among the adolescent population in the United States within the past 30 years. While the increase in T2D is linked to obesity and a lack of physical activity, it lacks contextual analysis within the structure of the non-traditional family unit. The purpose of this quantitative study was to examine family structure and prevalence of T2D among adolescents. Krieger's ecosocial theory guided the study. The research questions were designed to investigate whether family structure directly impacts T2D prevalence or indirectly through socioeconomic status. The research design was quantitative with cross-sectional analysis of secondary data. The population sample was obtained from the 2016 National Survey of Children's Health. The sample size was 45,302 adolescents ages 10-17. Multiple logistic regression was used to analyze family structure, parental education, and household income as predictors of diabetes among adolescents, controlling for demographic factors (gender, age, race/ethnicity), body mass index (BMI), and type of insurance coverage. The main findings indicated that the 3 key variables (family structure, parental education, and household income) did not significantly predict diabetes among adolescents. Three significant covariates were age (p = .006), type of insurance coverage (p = .000), and BMI (p = .019). The positive social change implications from the findings of the study may include use by policymakers and administrators to improve policies regarding physical activity, nutritional, and educational programs both at the child and parental levels to reduce obesity.

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Dedication

I dedicate this dissertation research to my wife, Susan Self, for being an incredible support during this exciting journey. I am forever grateful. To my mom and dad, Chuck and Carla Self for believing in me and providing a foundation for my education. To Bob and Judy Theado, my awesome father- and mother-in-law, for your support and encouragement throughout this journey. To my mentors LTC Donald Zimmerman, LTC Dave Worley, SFC Kenneth "Chip" Moore, Jamie Littlefield, and Toni Gordon Bailey for always pushing me to excel as a leader and an educator. All five of these individuals have said at one time that I was a "diamond in the rough" I just needed to be polished. Each of them has taken me under their wing at times and no matter what happens I can always call if I need to talk or have concerns about a situation.

Acknowledgements

I would like to thank my best friend and wife, Susan Self for the support she has given me through my PhD journey as well as my career. You are my rock and greatest supporter. You know exactly what to say and do to encourage me when I feel defeated. Thank you, my love.

I would like to offer a special thanks to LTC Dave Worley, SFC Kenneth "Chip" Moore, and Jamie Littlefield for always having my "six". You guys are my battle buddies and my brothers in arms. Each has helped me through my career both in the military and civilian world. Jamie told me in 1996 that I was the smartest combat medic he knew and that I should be a doctor. Well I did not choose to become a medical doctor my brother; however, I have pursued this PhD journey due to your advice, which seems like a lifetime ago in the 101st Airborne Division.

I would not have completed this dissertation research without the guidance of my Chair, Dr. Mary Lou Gutierrez. Dr. Gutierrez provided the much-needed support to allow me to explore research ideas and become a real scholar in the field of public health. Dr. Gutierrez has been a great resource for me as a chair and motivator. I have found it difficult at times to step away from my job/call as an invasive cardiovascular technologist and set aside time to finish my dissertation. I would like to also thank my committee member, Dr. Dan Okenu, who offered his expertise and insight regarding quantitative research.

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Chapter 1: Introduction to the Study

Introduction

Diabetes is a common complex disease among adults and increasing among children. The most common type of diabetes in children is Type 1 diabetes (T1D), also known as "juvenile diabetes (American Diabetes Association [ADA], 2018). There is an increasing prevalence of Type 2 diabetes (T2D) among youth within the past thirty years, which is known as adult-onset diabetes (Centers for Disease Control and Prevention [CDC], 2017). Public healthcare professionals and clinical professionals are concerned about the cause for the increasing prevalence of T2D in youth. In this chapter, I present the background for the study and the problem statement on which the study is founded. This chapter also includes the purpose of the study, research questions and hypothesis, theoretical base, nature of the study, definitions of terms, assumptions, scope and delimitations, limitations, significance, and a summary of the key points of the study.

Background of the Study

T2D was rare in children 30 years ago; however, this population has seen an increased prevalence of T2D. The ADA (2018) indicated that an estimated 193,000 Americans under 20 years of age were diagnosed with T2D. The incidence of adolescents diagnosed with T1D was 17,900 and 5,300 with T2D between 2011–2012 (ADA, 2018). T2D in adolescents is a significant public health concern as the epidemic increases. One concern is an increase cost of immediate and long-term healthcare.

T2D among racial/ethnic minorities has the highest prevalence among the American Indian population followed by non-Hispanic Blacks, Hispanics, Asians/Pacific Islanders and the lowest prevalence of T2D is in non-Hispanic Whites (Murray, 2014).

The SEARCH for Diabetes in Youth Study suggests an increase in T2D among adolescents (10–19years of age) compared to the rise in T1D in youth less than 10 years of age. Race/ethnicity is an important variable when evaluating T2D among adolescents. Throughout this paper, I will examine race/ethnicity with associated factors such as family structure, parental education and income.

The CDC (2017) indicated that one-third of youth in the United States is considered overweight, which is a significant contributor to the increase in T2D. The State of Obesity (2018) indicated that Utah had the lowest obesity rate in the United States, at 19.2%compared to Tennessee, which had the highest at 37.7%in 2016. The State of Obesity (2018) indicated a substantial prevalence of childhood obesity in the south and Midwest; however, an outlier in the highest obesity rate in North Dakota. The increase in childhood obesity in North Dakota is may be due to the large American Indian population within the state.

A dramatic change has occurred within the past 50 years regarding family structure (Blessing, 2017). Blessing (2017) describes six specific types of family structure that exist within society today. The six types of family structures include: the nuclear family, single-parent families, extended families, childless families, step-families, and grandparent families (Blessing, 2017). Other types of family structure include biracial families, adoptive families, cohabiting families, and same-sex families (Edwards, 2009; Sharma, 2013). The family structure of the Unites States continues to change, which may affect the health outcomes of children.

The American family is increasingly diverse and changing. Parker et al. (2015) suggested that dual-parent (nuclear) households are declining in the United States. as the

following are on the rise: divorce, remarriage, and cohabitation. The United States no longer has a dominant type of family structure like it did in the 1960s (Parker et al., 2015). In 2015, 46% of all children in the United States lived in a nuclear family (Parker et al., 2015). Parker et al. (2015) suggested a decline of nuclear families from 1960 to 2014.

In 2015, the question of whether the reduction in nuclear families affected specific racial/ethnic groups was answered using data from Child Trends (2015). These data indicated that Black children were less likely to live in a nuclear family compared to other racial/ethnicity groups. According to Child Trends data (2015) only a third (34%) of African American children were living in a nuclear family, compared with over three-fourths (83%) of Asian children and European American children (74%), and 60% of Hispanic children. The data also suggested that regardless of race/ethnicity children living in single-parent families live with their mother (Child Trends, 2015).

Social determinants of health must be considered when evaluating the relationship between family structure and the diagnosis of T2D in adolescents. Healthy People 2020 (2018) developed five key areas of social determinants of health (SDOH). The five key areas of SDOH are: economic stability, education, social and community context, health and health care, neighborhood and built environments (Healthy People 2020, 2018). In this study, I evaluated all five areas of SDOH. Family structure will be considered as the built environment. I also evaluated SES. The gaps in research suggest that more research is needed focusing on different types of structures and the increase in chronic diseases, specifically T2D in adolescents.

Problem Statement

Chronic diseases among children in the United States are on the rise, resulting in children with chronic disease estimated at 7–18% (Cousino & Hazen, 2013). T2D and obesity are increasingly prevalent epidemics in the United States among children and adolescents (Finkelstein et al., 2014; Reinehr, 2013), leading to diabetes as the third most common chronic disease in children (Pettitt et al., 2014). In addition to obesity and T2D increasing other chronic conditions, there are other public health concerns, such as an increase in management and treatment costs (ADA, 2016; Finkelstein et al., 2014).

The current generation of children are more likely to live in nontraditional family structures, such as single-parent families, stepparents, same-sex parents, and grandparents. In 2015, 65% of children under age 18 lived in dual-parent families, down from 85% in 1960 (Child Trends, 2015). The decline in the dual-parent family and diversification of family structures is correlated with lower income, which in turn has adverse effects on children, including poorer health, increased behavioral and emotional problems, and decreased access to health care (Child Trends, 2015). The decline in health among children living with a single parent is associated with decreased parental income, poorer housing, and loss of health benefits (Child Trends, 2015; Krueger et al., 2015; Golden, 2016; Gupta-Malhotra et al., 2016).

Several factors have strong links to family structure including socioeconomic status (SES), chronic disease, mental health, substance abuse, and violence (Golden, 2016). However, more attention is given in the literature to the study of the living arrangements of children as linked to developmental factors that affect the well-being of a child such as intellectual stimulation, progress through school, access to health care,

hospitalizations, and unhealthy behaviors, as well as health outcomes including asthma, migraines, ear infections, allergies, obesity, and global health (Krueger et al., 2015). Gupta-Malhotra et al. (2016) suggested that in addition to physical, mental, and behavioral problems, there is an increase in poverty, earlier onset of sexual activity, and lower scholastic achievement in children living with a single parent.

Family socioeconomic status (SES), including income and education, are critical determinants of health among children. Moore et al. (2002) suggested that family structures can affect children's risk of poor outcomes due to income. Dual-parent families are economically advantaged compared to single-parent families, with cohabiting households falling in the middle (Zoil-Guest et al., 2014). Similar findings among T1D youth indicate that SES was a determinant of health and psychosocial differences in T1D youth (Borschuk & Everhart, 2015). In addition, low socioeconomic position (SEP) was associated with higher childhood overweight when SEP was measured through parental education (Parikka et al., 2015).

Family structure and family SES are closely linked, and childhood health problems are more common in low SES single-parent families specifically. Children living with single-mother families and those children residing with stepfamilies have poorer health compared to those living with both biological parents (Zoil-Guest et al., 2014). Moncrief et al. (2014) indicated that children who live in a single-parent household are twice as likely to have a diagnosis of asthma compared to children living in a dual-parent family. Formisano et al. (2014) indicated that children living in a single-parent family tend to be heavier or gain more weight than children living among other family structures. Krueger et al. (2015) examined family structures including married

couples, cohabiting couples, single mother, single father, extended married couples, extended cohabiting couples, extended single mother, extended single father, and skipped generation. Krueger et al. indicated that children living in non-married families (especially single mother households) averaged worse health outcomes than children living with married families.

To my knowledge, no studies have examined the influence of family structure on the prevalence of T2D among adolescents within the context of social and biological processes, or whether family structure is directly associated or indirectly mediates the relationship between SES and T2D. The literature on family structure is not primarily about health, but about societal aspects of the fields of sociology, psychology, anthropology, and law, and the focus is on its effects on early childhood. Using a social epidemiology perspective, I viewed family structure as a mechanism for the reproduction of social class inequalities. I examined family structure as a proximal pathway to T2D while teasing out the cumulative interplay of exposure to declining SES, and susceptibility to obesity. Obesity has increased several-fold over the past 4 decades which is the same period that family structures have diversified.

Purpose of the Study

The purpose of the study was to examine family structure and prevalence of T2D among adolescents. I also examined whether family structure directly impacts T2D prevalence or indirectly through SES.

Research Questions and Hypotheses

Research Question 1 (RQ1): Is there an association between family structure and the prevalence of T2D among adolescents?

Null Hypothesis ($H_0$1): There are no association between family structure and the prevalence of T2D among adolescents.

Alternative Hypothesis (H_a1): There are associations between family structure and the prevalence of T2D among adolescents.

Research Question 2 (RQ2): Does parental education have a significant effect on the prevalence of T2D among adolescents?

Null Hypothesis ($H_0$2): There are no differences in parental education and prevalence of T2D among adolescents.

Alternative Hypothesis (H_a2): There are differences in parental education and prevalence of T2D among adolescents.

Research Question 3 (RQ3): Does household income have a significant effect on the prevalence of T2D among adolescents??

Null Hypothesis ($H_0$3): There are no differences between household income and prevalence of T2D among adolescents.

Alternative Hypothesis (H_a3): There are differences between household income and prevalence of T2D among adolescents.

Theoretical Base

I used the ecosocial theory developed by Krieger in 1994 as the theoretical framework for this study. The ecosocial theory is used to research links between social and biological processes (Krieger, 2004). Therefore, this method was appropriate to use when examining the relationship between family structure and T2D, and the effect of SES factors and obesity on this relationship among adolescents. The four key constructs of the ecosocial theory include: (a) embodiment; (b) pathways to embodiment; (c) the

cumulative interplay of exposure, susceptibly, and resistance; and (d) agency and accountability (Krieger, 2004). The embodiment is T2D and the pathway to embodiment is family structure. The cumulative interplay of exposure, susceptibly, and resistance were family income and education, and agency and accountability were clinical healthcare workers, social workers, and public health officials.

Nature of the Study

I used a quantitative, cross-sectional research design to examine the relationship between family structure and T2D among adolescents. Secondary data will be used for statistical analyses from the Data Resource Center for Child and Adolescent Health (DRC) specifically the 2011/2012 National Survey of Children's Health. I used the ecosocial theory of disease distribution for this study. The dependent variable in the study was T2D; the independent variables were family structure, parental education, and household income. I performed multiple regression performed along with testing for interaction between several variables in association with the prevalence of T2D among adolescents.

Definitions of Terms

Adolescent: The period of life from puberty to maturity (ages 10-19), the meanings of which, however, are often debated by health professionals (CDC, 2008).

Body mass index (BMI): A person's weight in kilograms divided by the square of height in meters (CDC, 2015).

Cardiovascular diseases (CVD): Refers to conditions that involve narrowed or blocked blood vessels that can lead to a heart attack, chest pain (angina) or stroke. Other

heart conditions, such as those that affect your heart's muscle, valves or rhythm, also are considered forms of CVD (Mayo Clinic, 2018).

Cohabiting family: Consists of a male and female who are not married; however, one or both have children within the family (Edwards, 2009; Sharma, 2013).

Coronary artery disease (CAD): The most common type of CVD, which involves the narrowing of coronary arties causing blockage and myocardial infarctions (MI) (Mayo Clinic, 2018).

Family structure: A group of individuals who ordinarily live in the same house unless the following conditions that require a member to temporarily live away from the shared house; work, study, imprisonment, confinement, or foreign sojourn (Sharna, 2013).

Myocardial infarction (MI): Also known as a heart attack, which is a life-threatening condition that occurs when blood flow to the heart muscle is abruptly cut off, causing tissue damage. An MI is due to a blockage in one or more of the coronary arteries. A blockage can develop due to a buildup of plaque, a substance mostly made of fat, cholesterol, and cellular waste products (Healthline, 2018).

Nuclear family: The traditional family consisting of a married male and female with their biological children (Edwards, 2009; Sharma, 2013).

Single-parent family: The sole providing parent is either the mother or father (Edwards, 2009).

Obesity: A BMI at or above the 95th percentile of BMI for age (Cheung et al., 2015; Pulgaron and Delmater, 2015; Sahoo et al., 2015).

Overweight: A BMI between the 85th to 95th percentile of BMI for age (Cheung et al., 2015; Pulgaron and Delmater, 2015; Sahoo et al., 2015).

Physical activity: Any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level (CDC, 2015).

Same-sex family: Both parents are either males or females, two fathers or two mothers (Edwards, 2009; Sharma, 2013).

Type 2 diabetes (T2D): A disease caused by insulin resistance which is the inadequate secretion of insulin (Wilson, 2013; Zeitler et al., 2014).

Assumptions

For this study, I assumed that the data gathered from the DRC datasets are accurate. I also considered that obesity was directly associated with the development of T2D in adolescents. I assumed that all other family structure types had an increased prevalence of T2D in youth compared to the nuclear family type. I also assumed that a decrease in parental education level and low SES had an increased prevalence of T2D in childhood. Finally, I assumed that racism/discrimination might take place within this population.

Scope and Delimitations

In this study, I focused on adolescents with T2D and the relationship between family structure and in the diagnosis of T2D in youth. I extracted data from the DRC database using the 2011/2012 National Survey of Children's Health. The primary delimitation or restitution of this study involved the limited data from DRC datasets.

Limitations

Three types of biases are associated with the study. The bias types include antecedent-consequent bias, selection bias, and recall bias. Antecedent-consequent bias occurs when the research cannot determine that exposure precedes the disease since both are established at the same time (Alexander et al., 2014). For example, did a child have T2D before the development of obesity or a change in family structure? Friis and Sellers (2014) defined selection bias as a misrepresentation that results from procedures used to select participants and from factors that influence these individuals in a study. Selection bias would pose concern if only a specific family structure, demographic, or socioeconomic status was chosen for the study. Recall bias, which is a type of information bias, is referred to when participants discuss past exposures rather than the controls (Friis and Sellers, 2014). The results of the study may have been threatened by recall bias due to the participants not truthfully answering the survey questions asked by the DRC. Another limitation is that incidence cannot be measured in a cross-sectional study.

Significance

This research may fill the gap in understanding how family structure influences T2D among adolescents. The knowledge gained from this study regarding family structure's influence on T2D in adolescents could lead to the development of family-based interventions. These interventions could be modified based on family structure, with different interventions developed specifically for single-parent and dual-parent families.

A single-parent family may not have the resources that a dual-parent family has, such as another parent available to monitor the adolescent's health or become a health advocate and provide timely medical care to that adolescent. The data set contains the following variables for family structure: two-parent currently married, two-parent not currently married, single mothers, and other family types. The results of this study could provide educators, parents, and healthcare providers the data needed to develop programs that would provide a single-parent family the additional resources to monitor adolescent health.

Summary and Transition

This chapter is an introduction to the concerns with the increasing epidemic of T2D among adolescents and how family structure affects the diagnosis of T2D. T2D among adolescents had an increased prevalence compared to thirty years ago when the diagnosis of T2D in youth was rare. The gaps in the literature suggest a lack of research, specifically associated with family structure and how it relates to T2D among adolescents. Chapter 2 includes a discussion of the increase in childhood obesity, which is directly associated with the increasing prevalence of T2D among adolescents.

Within the past 50 years, family structure has changed dramatically within the United States. The traditional two-parent (nuclear) family is not as common as it once was 30 years ago. Family structure in the 21st century consists of many variations such as the nuclear family, single-parent family, biracial family, cohabiting family, and same-sex families. In this study, I examined the effects of family structure and the increased diagnosis of T2D among adolescents. I also evaluated racism as a variable related to low-SES and different types of family structures.

Chapter 3 includes a description of the methodology for this study. Chapter 4 includes the descriptive statistics and analysis of results and Chapter 5 includes an interpretation of findings, recommendation for further studies, and implications for social change.

Chapter 2: Literature Review

Introduction

The purpose of the study was to examine family structure and prevalence of T2D among adolescents. In this study, I also examined whether family structure directly impacts T2D prevalence or indirectly through SES. In this chapter, I discuss the ecosocial theory, T2D, and childhood obesity. I also discuss family structure, social determinants of health, and socioeconomic status.

Literature Search Strategy

The literature review consisted of peer-reviewed articles dating from 2011 to 2018.While conducting a search various resources including Walden University Library, PubMed, Medline, Google, and Google Scholar. Key terms in the literature search consisted of *diabetes, type 2 diabetes, children, adolescents, youth, obesity, childhood obesity, ecosocial theory, family structure, social determinants of health,* and *social epidemiology.* The literature search employed the following key phrases: *type 2 diabetes and family structure, children/adolescents with type 2 diabetes and family structure, childhood obesity and family structure, social determinants of childhood obesity, social determinants of type 2 diabetes in children/adolescents, and family structure,* and *physical health outcomes.*

Theoretical Framework: Ecosocial Theory

Nancy Krieger developed the ecosocial theory in 1994. Krieger (2001) indicated that the ecosocial theory consist of for constructs which help answer the following question of "who and what drives current and changing patterns of social inequalities in health." The four constructs include (a) embodiment, (b) pathways of embodiment, (c)

cumulative interplay between exposure, susceptibility and resistance, and (d) accountability and agency (Krieger, 2001).

Embodiment is described as how an individual integrates, biologically, in societal and ecological context, the material and social world in which we live (Krieger, 2001, 2012). Krieger (2001, 2012) defined the pathways of embodiment as diverse, concurrent, and interacting pathways, which involve adverse exposure to social and economic deprivation, exogenous hazards, social trauma, targeted marketing of harmful commodities, inadequate or degrading health care, and degradation of ecosystems, including as linked to alienation of indigenous populations from their lands. The cumulative interplay between exposure, susceptibility, and resistance is defined by Krieger (2001, 2012) as the importance of timing and accumulation of, plus responses to, embodied exposures involving gene expression, not merely gene frequency. Krieger (2001, 2012) also defined accountability and agency as an agent such as the government who is responsible for the patterns of disease distribution in a given society.

Various questions in association with the four constructs of the ecosoical theory were applied to the study. Embodiment will consist of two questions, which includes (a) how does the prevalence of T2D among adolescents vary among different types of family structures and (b) how has the prevalence of T2D among adolescents change with the vast family structure differences today? Pathways of embodiment will consists of the following questions (a) what role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example, obesity, single parent families, low-income families and/or less educated parents and (b) to what extent is childhood obesity, lack of exercise

and increased sedentary lifestyles relevant to the increase prevalence of T2D among adolescents with different family structures? Cumulative interplay between exposure, susceptibility, and resistance is the third construct and includes the following questions (a) how does family structure affect the timing of the diagnosis of T2D among adolescents, (b) does the change in family structure increase the prevalence of T2D depending of various demographic and SES factors of the parents and (c) does considering family structure add new insight to the increase prevalence of T2D among adolescents? The fourth construct, accountability and agency, will consist of the following question: to what extent has clinical healthcare and public health professionals evaluated the effects of changing family structures in regard to T2D among adolescents?

Literature Related to Key Study Variables

Type 2 Diabetes

Epidemiology of Type 2 Diabetes. T2D is a growing public health concern in children and adolescents in the United States and globally. The epidemiology of T2D among children and adolescents is unclear at this time (ADA, 2000). T2D was thought to be a metabolic disorder affecting only adults; however, there has been an increase in T2D among adolescents in the past 2 decades, especially those with obesity (D'Adamo, & Caprio, 2011; Pulgaron, & Delamater, 2014; Reinehr, 2013). The CDC (2017) and the ADA (2017) indicated from the SEARCH for Diabetes in Youth Study data during 2011–2012 that approximately 193,000 children and adolescents had a new diagnosis of diabetes annually in the United States, which accounts for 24% of the youth population. The breakdown of the newly diagnosed diabetes in this population consists of 17,900 individuals diagnosed with T1D and 5,300 youth diagnosed with T2D annually (ADA,

2017; Centers for Disease Prevention and Control, 2017). Type 2 diabetes in adolescents is increasing internationally which was once thought to be an adult disorder. The increase is due in large part to obesity; however, the study will examine if family structure is a contributing factor with the increase in T2D over the past 2 decades?

All adolescents are predisposed to the diagnosis of T2D; however, there is an increase in T2D among minority populations. Several specific ethnic groups have an increased prevalence of T2D among youth, including African Americans, Hispanics, Asian/Pacific Islanders and Native Americans (D'Adamo, & Caprio, 2011; Pulgaron, & Delamater, 2014; Reinehr, 2013). The CDC (2017) and Pulgaron and Delmater (2014) indicated that Native Americans, African Americans, and Hispanic youth aged 10 to 19 years had the highest diagnosis of T2D followed by Asian/Pacific Islanders and non-Hispanic Whites with the lowest diagnosis. Ethnic minorities have a greater prevalence and incidence of T2D among youth; therefore, evaluation of family structure, income level, parental education, and the lifestyles of both children and parents are necessary.

T2D is a complex disease that affects various systems in the body. T2D is characterized by insulin resistance which is the inadequate secretion of insulin (Wilson, 2013; Zeitler et al., 2014). T2D, also known as hyperglycemia, results over time due to declining insulin secretion (Pulgaron & Delamater, 2014). The progression of T2D leads to chronic complications including accelerated development of cardiovascular disease (CVD), end-stage renal disease, loss of visual acuity, and limb amputations (D'Adamo, & Caprio, 2011; Pulgaron, & Delamater, 2014; Reinehr, 2013). Individuals with T2D have an increase in morbidity and mortality due to the chronic complications (D'Adamo, & Caprio, 2011; Pulgaron, & Delamater, 2014; Reinehr, 2013). Youth diagnosed with T2D

is an increasing epidemic which will increase the cost of healthcare and medical insurance within the United States for years to come.

The etiology of T2D is convoluted due to the various variables associated with the disease. The etiology of T2D includes genetics, physiologic, and lifestyle-related obesity, with hypercaloric dietary intake, lack of physical activity, and increased sedentary behavior (ADA, 2017; D'Adamo & Caprio, 2011; Pulgaron & Delamater. 2014; Reinehr, 2013; Wilson, 2013). Various studies relating to T2D have evaluated the previously listed variables; however, there is a lack of data evaluating these variables as they associate with T2D and family structure.

Prevalence and Incidence of Type 2 Diabetes. Due to the increasing incidence of T2D worldwide this disease ranks third as the most common disease of childhood (Pettitt et al., 2014). Nadeau, et al. (2016) indicated that there are an estimated 5,000 new cases per year of childhood T2D in the United States. The incident rate of T2D among adolescents in the United States is highest among Native Americans and African Americans (Farsani, Van der Aa, Van der Vorst, Knibbe, & De Boer, 2013; Temneanu, Trandafir, & Purcarea, 2016). As the incidence of T2D among adolescents increases so does the prevalence of this disease. There are numerous contributing factors such as obesity which lead to this increase.

The prevalence of T2D among children and adolescents is increasing every year. Statistics suggest that T2D in children and adolescents was a rare condition nearly 30 years ago (Nadeau, et al., 2016; Temneanu, Trandafir, & Purcarea, 2016). Fagot-Campagna, et al. (1999) indicated the Bogalusa Study reported a diabetes prevalence rate of 2.6 per 1,000 between 1992 and 1993. Two different studies indicated a higher

prevalence of T2D. The 1988-1994 National Health and Nutrition Examination Survey indicated the prevalence of T2D among 12 to 19 years was estimated at 4.1 per 1,000; whereas, the Cincinnati Study indicated a prevalence of 7.2 per 100,000 in 1994 (Campagna, et al., 1999). Researchers and clinicians discovered an increased incidence of T2D in this population globally during the mid-1990s (Nadeau et al., 2016; Temneanu, Trandafir, & Purcarea, 2016). As the incidence of T2D among children and adolescents increased over the years, researchers revealed a trend in the prevalence of T2D in adolescent females, which has a 60% higher prevalence compared to males of the same age group (Nadeau et al., 2016). Nadeau et al. (2016) indicate that the higher prevalence of T2D among adolescent females is currently unclear. As both the incidence and prevalence increase of T2D among children and adolescents one may ask if the same statistics are accurate when evaluating childhood obesity, especially when determining which gender has the higher incidence and prevalence.

The increase prevalence in T2D in American adolescents is currently greater than the prevalence of type 1 diabetes (T1D). Dabelea, et al. (2014) indicated that the prevalence of T1D increased 21.1% in American youth whereas, T2D prevalence among this population increased by 30.5% in between 2001 and 2009. Evidence from the SEARCH Study confirmed an increase prevalence of T2D among adolescents in America grew 21% from 0.29 per 1,000 in 2001 to 0.36 per 1,000 2009 (Yisahak, Beagley, Hambleton, & Narayan, 2014). Yisahak et al. (2014) indicated that the increase in the prevalence of T2D mirrors the increase prevalence of childhood overweight and obesity. Childhood obesity is preventable; therefore, T2D among adolescents is also preventable. Numerous factors contribute to this increase in prevalence in both childhood obesity and

T2D; however, little research has examined the effects that family structure has on the increased prevalence of both diseases.

Type 2 Diabetes and Racial/Ethnic Groups. T2D does not discriminate, meaning no one person or racial/ethnic group is safe from T2D. However, statistics indicate that specific racial/ethnic groups are more prone to an increasing incidence and prevalence of T2D along with geographical region (Nadeau et al., 2016). The United States has a complicated diversity when comparing race/ethnicity. In the 21st century, there are numerous racial/ethnic groups that are at increased risk of disease at all ages to include early on-set of T2D in adolescents (Nadeau et al., 2016). The following is a simple breakdown of the various racial/ethnic groups within the United States; Native Americans, Blacks, Asian, Hispanic, non-Hispanic (Whites) and others (middle eastern, Indians) will be analyzed with multiple logistic regression.

The prevalence of T2D among children and adolescents is comparable the adult populations when gender and race/ethnicity is a factor. Various studies indicate that the prevalence of T2D is higher among the female population. The American Indian population has the highest prevalence of T2D, followed by African-Americans, Hispanic and non-Hispanic White adolescents with the lowest prevalence (Dabelea, et al., 2014; Demmer, Zuk, Rosenbaum, & Desvarieux, 2013; Farsani, Van der Aa, Van der Vorst, Knibbe, & De Boer, 2013). Spanakis and Golden (2013) suggested that the increase in prevalence of T2D is due to genetics and clinical factors, health systems and social factors; however, family structure, geographical location, and lifestyle may be factors as to why specific racial/ethnic groups have an increased prevalence of T2D in children and

adolescents. The increase in both incidence and prevalence of T2D among adolescents will increase health-care costs, morbidity, and premature mortality.

Risk Factors of Type 2 Diabetes. The sudden increase in both incidence and prevalence of T2D in adolescents has led to research evaluating the risk factors for T2D in adolescents. Risk factors of T2D are divided into two categories: modifiable and nonmodifiable risk factors. Modifiable risk factors are (a) obesity, (b) lack or low physical activity, (c) high sedentary behavior, and (d) socioeconomic status; whereas, the nonmodifiable risk factors are (a) ethnicity, (b) family history of T2D, (c) puberty, (d) low birth weight, (e) exposure to diabetes in the uterus, (f) female sex, and (g) previous gestational diabetes (Wilmot and Idris, 2014). The following organizations, the ADA and the American Academy of Pediatrics (AAP), indicated that there are four primary risk factors for the development of T2D among adolescents which are obesity, ethnicity, family history of diabetes, and the presence of insulin resistance (Scott, 2013). Research has also indicated that being an adolescent female adds additional risk to the development of T2D, which corresponds with the increase incidence and prevalence of T2D in adolescent females (Scott, 2013; Wilmot and Idris, 2014). Dabelea et al. (2014) suggested that adolescent females are 1.63 times more likely to develop T2D than adolescent males. Various variables have led to the increase numbers of modifiable risk factors of T2D.

Determinants of Incident T2D in Adolescents. The incidence and prevalence have increased within the past decades which makes T2D the third most common disease diagnosed among children/adolescents which was once rarely diagnosed. What caused this increase in T2D among adolescents? Technology has increased at an extremely fast pace in the final half of the 20th century. Therefore, several reasons exist on why this

increase has occurred such as, the availability of fast food restaurants, the rapid pace in technology, lack of physical activity, SES, and family structure. The technologies that contribute to this increase are the increased availability of television (TV) sets and programming (Netflix and Hulu), cell phones, computers/tablets, and video games (Lascar, Brown, Pattison, Barnett, Baily and Bellary, 2018).

The increase in unhealthy lifestyles among adolescents' results in the diagnosis of T2D among all ages compared to just middle-aged individuals in the past (Astrup, 2017). Dabelea et al. (2014) described that the increase in prevalence in T2D is due to changes in population risk for T2, such as minority population growth, obesity, and exposure to diabetes in utero. The increase in T2D among adolescents' results in early complications, treatment, and cost.

Diagnosis of Type 2 Diabetes. Diagnosing T2D is not a straightforward approach especially in children and adolescents. Specific criteria must be met to diagnose youth with T2D which are different from diagnosing adults with T2D. Healthcare professionals should review the criteria for diagnosing an adult with T2D before considering the criteria for diagnosing youth with T2D. The ADA released diagnostic criteria for T2D in 2016; however, these guidelines are aimed at adults (Temneanu, Trandafir, & Purcarea, 2016). Temneanu et al. (2016) suggest that the criteria are based on blood glucose measurements and the presence or absence of symptoms among individuals. The criteria consist of four factors including (1) a fasting glucose (FPG) > 126 mg/dl, (2) a random plasma glucose sample ≥ 200 mg/dl, (3) 2 hours post glucose challenge ≥ 200 mg/dl, and (4) HbA1c ≥ 6.5% if tested in a certified lab (Temneanu et al. 2016). The adult criteria

are challenging especially since the diagnosis of diabetes in controversial when using exclusively A1c.

The criteria for diagnosing T2D in youth were established by the ADA and are different from adults. Zeitler et al. (2014) indicated that there are two steps that are required to diagnose T2D, which are confirmation of the presence of diabetes followed by determination of the type of diabetes an individual (Zeitler et al., 2014). The criteria for testing youth for T2D are presented in Table 1 (American Diabetes Association, 2017; Reinehr, 2013; Zeitler et al., 2014). One should take note that all the variables in the table are not required to diagnose T2D in youth. Therefore, the clinical health professional should know these criteria and educate parents as well as children at an early age.

Criteria	Description
Body Mass Index	
Overweight	BMI > 85 percentile for age and sex
Risk Factors	At least 2 of the following risk factors
Family History	Family History of T2D in first- or second-degree relative
Race/ethnicity	Race/ethnicity (American Indian, African American, Hispanic, Asian/Pacific Islander
Insulin Resistance	Signs of insulin resistance or conditions associated with insulin resistance (acanthosis nigricans, hypertension, dyslipidemia, polycystic ovarian syndrome
Age of Initiation	Age 10 years or at onset of puberty if puberty occurs at a younger age
Extreme Obesity	BMI > 99.5 percentile
Frequency	Test Every 2 years

Test	Fasting Plasma Glucose preferred

Figure 1. Criteria for Testing Children and Adolescents for Type 2 Diabetes. *Source:* http://www.ndei.org/ADA-diabetes-management-guidelines-children-adolescents-type-1-diabetes-type-2-diabetes.aspx.html

The criteria for the diagnosis of T2D among adolescents compared to adults varies. The parameters between adults and children/adolescents associated with T2D have a wide range of difference as well. The parameters include age, onset, sex, and pancreatic beta cells function declines, treatment, and complications/comorbidities. The age difference is greater than 40 years old for adults and greater than 10 years of age for children/adolescents, the onset for adults in insidious compared to children/adolescents which is stealthy and/or signs of hyperglycemia, both sexes are affected in adults whereas females are chiefly affected in children/adolescents, the pancreatic beta cells function declines are deceptive in adults and occur faster (under 4 years) among children/adolescents, lifestyle modifications and various types of oral antidiabetic agents are used for treatment among adults whereas lifestyle modifications and Metformin with or without insulin are used for children/adolescents, and complications/comorbidities occur late in adults and early (after approximately 2 to 2,5 years after onset) among children/adolescents (American Diabetes Association, 2017; Reinehr, 2013; Temneanu et al. 2016; Zeitler et al., 2014). The differences between the age groups are important when diagnosing either with T2D as well as educating parents.

Diabetic Complications. Complications of T2D can start at an early stage in life, regardless of whether or not the disease has been diagnosed. Adults with T2D present with chronic complications such as macrovascular disease, which lead to an increased development of cardiovascular disease (CVD) leading to stroke and myocardial infarction

(MI) developing from the early onset of coronary artery disease (CAD) (Reinehr, 2013). Adults also present with microvascular diseases such as retinopathy, nephropathy, and neuropathy leading to end-stage renal disease, loss of acuity, and limb amputation (Reinehr, 2013). Both macrovascular and microvascular diseases lead to excess morbidity and m mortality in individuals with T2D (Reinehr, 2013). The complications of T2D in adults can prove to be deadly; hence, adolescents with T2D may face the same outcome due to these complications at an earlier stage in life.

Compared to adults with T2D, adolescents have an increase in complications resulting from T2D (Reinehr, 2013). Adolescents with T2D develop complications early in life resulting in a longer duration of these specific diseases compared to adults that develop T2D. The complications for adolescents include obesity, hypertension, nephropathy, dyslipidemia, atherosclerosis and vascular dysfunction, polycystic ovarian syndrome, non-alcoholic fatty liver disease, systemic inflammation, obstructive sleep apnea, depression, orthopedic problems, pancreatitis, cholecystitis, pseudotumor cerebri, and deep tissue ulcers (Reinehr, 2013; Zeitler et al., 2014). Adolescents developing T2D have an increased risk for developing long-term CVD than middle-aged adults (Reinehr, 2013). Adolescents with T2D with CAD may develop an MI which is rarely seen this population. Therefore, the cardiac catheterization patient population will become younger. As the complications of T2D appear earlier in life, the cost of healthcare will also rise.

Ample evidence exists on the complications associated with T2D in adults; however, few have discussed these findings among adolescents with T2D. The TODAY study indicated that 14% of adolescents with T2D developed hypertension, 80% had low

HDL concentrations, and 10% had increased triglyceride levels (Reinehr, 2013; Zeitler et al., 2014). In comparison, the SEARCH study indicated that 65% of the adolescents with T2D presented with hypertension, 73% had low HDL, 60-65% had increased triglyceride levels, 92% had metabolic syndrome, 4% presented with retinopathy, and 28% with microalbuminuria (Reinehr, 2013; Zeitler et al., 2014). Both the TODAY and Search study presented with similar data linked with adolescents with T2D and the complications associated with the disease.

Childhood Obesity

Researchers have identified obesity as the hallmark of childhood T2D. Pulgaron and Delmater (2015) indicated that one-third of the children in the United States are considered overweight or obese and that an estimated 17% of this population meet the criteria for obesity. 35 million children were determined to be overweight or obese in 2010, and the number of children overweight or obese will double by 2020 (Santoro, 2013).

Childhood obesity is a significant public health concern in the United States as the prevalence of obesity among children has increased since the mid-1960s (Cheung et al., 2015; Pulgaron and Delmater, 2015; Sahoo et al., 2015). An individual who has an excess of body weight caused by chronic caloric imbalance with more calories consumed than expanded each day is obese (Pulgaron & Delmater, 2015). The Centers for Disease Control and prevention uses a percentile based on an individual's body mass index (BMI) to define overweight. An individual is defined as overweight by the CDC when he or she is at or above the 95th percentile of BMI for age and "at risk for overweight" as between the 85th to 95th percentile of BMI for age (Cheung et al., 2015; Pulgaron & Delmater,

2015; Sahoo et al., 2015). Kumar and Kelly (2017) indicate that a third category exists regarding weight, this is known as severe obesity. Severe obesity is defined as having a BMI at or greater than 120% of the 95th percentile, or a BMI at or above 35kg/m2 (Kumar & Kelly, 2017).

The increased prevalence of childhood obesity has occurred for several reasons. The causes of childhood obesity include genetics, basal metabolic rate, dietary factors, physical activity and sedentary behavior (Pulgaron & Delmater, 2015; Sahoo et al., 2015). Nutritional factors include the accessibility of sugary drinks, snack foods, fast food consumption, and portion sizes (Sahoo et al., 2015). Family structure may be a variable when evaluating dietary factors. Working two parent and single parent families tend to ask the child what he or she wants for lunch/dinner. This choice usually leads to places such as McDonalds and pizza restaurants, which are cheap and fast to accommodate the child's need for a meal. However, fast food consumption is not the healthiest choice for meals.

Complications of Childhood Obesity. Obesity occurs in children of all genders, race, ethnicity, and SES. However, the prevalence of childhood obesity varies due to gender, race, ethnicity, and SES (Kumar and Kelly, 2017). There are similarities between childhood obesity and T2D in terms of the prevalence with race and ethnicity; for example, childhood obesity is more common in African Americans, American Indians, Mexican Americans and then non-Hispanic whites (Kumar & Kelly, 2017). According to Kumar and Kelly (2017), low-income families/individuals have an increased prevalence of obesity. As discussed before obesity is the hallmark for T2D.

The increasing prevalence of childhood obesity increases the comorbidities associated with obesity. The comorbidities of childhood obesity include every system in the human body but not limited to the following, cardiovascular, endocrine, gastrointestinal, musculoskeletal, and pulmonary systems (Goran et al., 2003; Kumar& Kelly, 2017; Pulgaron & Delmater, 2015; Sahoo et al., 2015). Various comorbidities were associated with adults; however, the increase in childhood obesity has made the following common comorbidities among children, T2D, dyslipidemia, obstructive sleep apnea, and steatohepatitis (Kumar and Kelly, 2017). Another type of comorbidity associated with childhood obesity is related to psychosocial values such as poor-self-esteem, anxiety, depression, and decreased health-related quality of life (Kumar and Kelly, 2017). These comorbidities are costly and will result in long-term care if not treated at an early age and reverse obesity in children.

Social Determinants of Child Health

Several factors contribute to health, including family structure. The CDC (2018) defines social determinants of health as any condition which affects the health risks and outcomes of an individual where he or she lives, learns, works, and plays. Social determinants of health fall under five broad categories (Healthy People 2020, 2010). The five categories include policymaking, social factors, health services, individual behavior, and biology and genetics (Healthy People 2020, 2010). Three specific determinants of health will be explored which include SES (parents' income), parents' educational level, and family structure. Evidence indicates that individuals with low SES and educational levels have poorer health; however, the gap in research has not examined the affects that family structure associated with SES, educational level and T2D specifically.

Family Structure. Family structure has changed from the traditional dual-parent family to numerous types of families since the 1970s in the United States. Several types of family structure exist in the 21st century, including nuclear family (married biological mother and father), single parent (father or mother), cohabiting families, adoptive families, biracial family, grandparents as the parents, and same-sex families (Edwards, 2009; Sharma, 2013). The changing of family structure poses many questions about the behaviors, education, and healthcare of children.

It is important to identify what each family structure represents. Sharma (2013) defined family as a group of individuals who ordinarily live in the same house unless conditions require a member to temporarily live away from the shared house: work, study, imprisonment, confinement, or foreign sojourn. These conditions place a strain on a marriage, leading to divorce and breaking up families into the various family structures that exist. Today there are various types of non-traditional families which are not a result of a failed traditional family. The traditional family is known as the nuclear family, which consists of a married male and female with their biological children (Edwards, 2009; Sharma, 2013). The single-parent family refers to a mother or father who is the sole provider of a child or children (Edwards, 2009). The cohabiting family consists of a male and female who are not married, but one or both have children within the family (Edwards, 2009; Sharma, 2013). Edwards (2009) defines the adoptive family as having at least one child that has been adopted. In today's world, many biracial families exist which consist of both parents from different racial groups (Edwards, 2009). Two other types of family structures that are common are one in which the grandparents are the

parents as well same-sex families (Edwards, 2009; Sharma, 2013). It can be challenging to evaluate a child without knowing what type of family structure he or she originates.

More children live in cohabiting families than nuclear families in the 21st century (Brown et al., 2015). New types of family structures increased since the 1990s and 2000s due to the decline in nuclear families. Krueger et al. (2015) indicated that the following types of family structures were on the rise, single-parent (both mom and dad) and grandparents. The study from Krueger and associates did not examine the same-sex or biracial types of family structure. Two-parent families remained stable up to the 1970 at a rate of 83% - 85%; however, the rate of two-parent families fell to 73% between 1970 and 1990 as the rate of single-parent families rose from 13% to 25% (Blau and Klaauw, 2013). Zhang and Soukup (2012) determined that between 1980 to 2008 the percentage of children born to unwed mothers increased from 18.4% to 40.6% and single-parent families increased from 19.5% to 29.5%. Approximately 80% of single-parent families in the United States are headed by single-mothers (Zhang and Soukup, 2012; Blau and Klaauw, 2013). Blau and Klaauw (2013) indicated that in 2004, 58% of children were living with their married biological parents, 3% were living with cohabiting biological parents, 8% with only one biological parent and one step-parent or adoptive parent, 26% were living with only one parent, and 4% were living with neither parent.

Changing family structures are associated with a variety of problems among parents and the children. A child's health is indirectly affected by family structure through total family income (Zhang and Soukup, 2012). Irvin et al. (2018) conducted a study that evaluated children's unmet health-care needs within various family structures. The results of this study concluded that an estimated 10% of children in single-mother

families had unmet health-care needs compared to an estimated 9% of children with two-parent stepfamilies and 5% for children with two-parent biological/adoptive families (Irvin et al., 2018). The nuclear family is legally recognized and has a greater socioeconomic status and better access to health care compared to other family structures (Krueger et al., 2015). The single-parent family, such as single female household, can lead to worse schooling, behavioral, and health outcomes compared to nuclear families (Krueger et al., 2015). Zhang and Soukup (2012) indicated that children of single-mothers had an increased absentee rate in school compared to children of single-fathers. Single father family data are limited; however, some researchers suggest that there is a slight difference compared to the single mother family; whereas, other research has indicated that children living with single fathers have comparable or even superior health to children in nuclear families (Krueger et al., 2015). Krueger et al. (2015) indicated worse health and educational outcomes in children living in cohabiting families. Several types of family structures have limited data the educational and health outcomes on children such as biracial and same-sex families.

Single-parent families have numerous advantages and disadvantages as discussed previously. In general, children in single-parent families have a decreased education level compared to children in a nuclear family, an increased pregnancy rate as teenagers, increased risk for adverse health outcomes, and more likely to become dependent upon welfare (Leininger & Ziot-Guest, 2008). Compared to single mothers, single fathers are more likely to be employed, have a decreased chance of living within a lower SES, and economically stable (Leininger & Ziot-Guest, 2008). Therefore, single mothers have five times increase the risk of living in poverty compared to nuclear families and single father

families, and the lack of income contributes to the increased problems in children living in single-mother families (Golden, 2016). Zhang and Soukup (2012) suggested that children from single-father families had a better standard of well-being compared to children of single-mother families with the same income level.

Effects of Family Structure Associated with Obesity. Changes in family structure not only affect the parents but can affect a child in several ways including their health. Schmeer (2012) suggested that a change in family structure may lead to an increase in a child's BMI and risk for obesity. The increase to BMI and risk of obesity are due to the change in family structure which leads to increase stress, reduced resources and chaos in the family, decrease in healthy nutrition/physical activity, sleep routines, and emotional support (Schmeer, 2012).

A gap between family structure and the health outcomes of children are limited especially when evaluating childhood obesity. The nuclear family has some of the lowest childhood obesity rates when compared to other types of family structures (Augustine and Kimbro, 2013; Schmeer, 2012). Children in single-father or married step-parent families had a decrease in obesity (Augustine and Kimbro, 2013). Single-mother families have an increase in a child's BMI and the risk for obesity in comparison to stable married mothers (Augustine and Kimbro, 2013; Schmeer, 2012). The gap associated with childhood obesity and family structure continues to grow as family structures change.

Effects of Family Structure Associated with T2D. Research is limited associated with family structure and T2D; however, studies have been performed regarding T2D management and family structure. Fisher et al. (2000) suggested that disease management is best in families that are well organized, have clear traditional sex

roles, families that have an optimistic belief that life is understandable and manageable, and in families in which both parents can resolve differences of option associated with diabetes care. Knafl et al. (2017) conducted a study based on children with chronic physical conditions which examined the nature of family engagement. The chronic disease included asthma, diabetes, cancer, cystic fibrosis, blood disorders, and heart disease; however, only 16% of the individuals had diabetes (Knafl et al., 2017). The results of Knafl et al. (2017) study indicated that the interventions directed to families of child diabetics were more likely to focus on capacity building which strengthen parental role performance or family functions. Not only does a gap exist between family structure and childhood obesity a gap exists regarding family structure and T2D, specifically when evaluated how family structure types are linked to the increase in T2D among adolescents.

Socioeconomic Status. Parents need to be economically stable to raise children, not only with the necessary cost of raising a child but with healthcare too. Money and time are the two essential resources which parents provide children (Thomson et al., 1994). Therefore, a dual-parent family offers the best care to children due to the ability to invest adequate levels of time, money and affection to the well-being of a child compared to other family structures (Ganong & Coleman, 1988). Income is the most prominent variable of SES assessed for social determinants in child health research (Victorino & Gauthier, 2009). Puolakka et al. (2016) conducted a study examining whether family SES in childhood was associated with metabolic syndrome, impaired fasting glucose, or T2D in adulthood. Secondary data was obtained and examined using the Cardiovascular Risk in Young Finn Study. The results of Puolakka et al. (2016) study suggested that low SES

in childhood is associated with an increased risk for metabolic syndrome in adulthood as well as T2D. Factors such as family structure, parental education, and income contribute to the economic well-being of a family.

Racial/Ethnic Groups. Children and parents have numerous stressors that affect health. One key stressor which causes adverse health is racism towards minorities (Wade et al., 2016). The racial and ethnic diversity and SES disadvantage of the United States contribute to the increase in child population (Cheng et al., 2015). For example, the U.S Census Bureau projects by 2019, fewer than half of the children born will be White, non-Hispanic and by 2050, 36% will be White, on-Hispanic and 36% will be Hispanic (Cheng et al., 2015). Furthermore, minorities and their children suffer disproportionately from CVD, DM, asthma, and cancer compared to non-minorities (Betancourt, 2003). The increase in such diseases in minorities is associated with the lack of health care. However, it may also be related to other variables such as family structure, neighborhoods, social habits, and physical activity.

To understand what is meant by minorities, ethnicity needs to be defined. Ethnicity is described as a sophisticated multidimensional construct reflecting the confluence of biological factors and geographic origins, culture, economic, political, and legal factors, as well as racism (Spanakis & Golden, 2013). The highest prevalence of T2D is among race/ethnic minorities (Spanakis & Golden, 2013). Therefore, minority children have an increased possibility of developing T2D (Spanakis & Golden, 2013). Piccolo et al. (2016) indicated that SES factors had the most significant impact on explaining racial/ethnic disparities with evaluating T2D.

One concern relating to the increasing prevalence of T2D among racial/ethnic minorities specifically children is that this increase in the prevalence of T2D among adolescents is due to discrimination or racism. The ecosocial theory may help answer this question by answering who embodies this increase in T2D and what lead to the pathway of embodiment.

Social Change

The study may impact social change by explaining how family structure increases or decreases the risk of T2D among adolescents. The study will also explore the possibilities of racism related to the increasing prevalence of T2D among young minorities. The findings of the study could improve policies regarding physical activity programs, nutritional programs, and educational programs both on the child and parent levels. This study may also demonstrate that racism is an important variable associated with the increasing prevalence of T2D.

Summary and Conclusions

This chapter included a detailed description of Nancy Krieger's ecosocial theory. The description also included the four fundamental constructs of the ecosocial theory which include embodiment, pathways of embodiment, cumulative interplay between exposure, susceptibility and resistance, cumulative interplay between exposure, susceptibility and resistance, and accountability and agency (Krieger, 2001). The epidemiology of T2D along with the prevalence and incidence rates were included which specifically were associated with adolescents. The risk factors of T2D have were discussed as well as the reasons for the increasing prevalence of T2D among adolescents.

The criteria for diagnosing T2D can be difficult in children; therefore, there is a strict guideline for diagnosing T2D among this population.

Childhood obesity was discussed as well as the complications of childhood obesity. Childhood obesity is the hallmark for T2D among adolescents. Several types of family structures were discussed as well as the effects of family structure as it is associated with obesity and T2D in adolescents. An evaluation of social determinants of children's health and SES was performed.

Chapter 3 will include detailed description of the methodology and research design, sample size requirements, and participant recruitment. Chapter 3 will include a detailed discussion on data analysis and ethical considerations.

Chapter 3: Methods

Introduction

The purpose of the study examined family structure and prevalence of T2D among adolescents. In Chapter 3, I will describe the quantitative methodology for this study. The sections in Chapter 3 include research design and approach, target population, sample size and power calculations, sample size, threats to validity, instrumentation, and operationalization of constructs. In addition, the characteristics of selected data, data management, and data analysis plan to test the hypotheses of the research questions utilizing the secondary data source. Research Design and Approach

This study has a quantitative, cross-sectional research design, with a secondary data analysis as the approach. I examined the relationship between family structure and T2D among adolescents. The overall research question determined whether family structure has a significant effect on the prevalence of T2D among adolescents. I used a cross-sectional design to collect and analyze data from a specific time. The dependent variable in the study was T2D; the independent variables are family structure, parental education, and household income (Table 1).

Table 1

Operational Measures of Study Independent, Dependent, and Covariate Variables

Variables	Survey Questions	Data Code	Variable Type
Diabetes (T2D)	Currently have diabetes	0 = Do not have condition 1 = Ever told or currently have condition	Ordinal Dependent
Family Structure	Type of family structure	0 = Two parents currently married 1 = Two parents not currently married 2 = Single mother (currently married {living apart}, formerly married or never married) 3 = Other family type, no parent reported	Ordinal Predictor
Income	Household income (based on Federal Poverty Level, FPL {2016})	0 = 0-99% FPL (0 - $11,879) 1 = 100 – 199% FPL ($11,880 - $23,759) 2 = 200 – 399% FPL ($23,780 - $47,519) 3 = 400% FPL or greater (≥ $47,520)	Ordinal Predictor
Parental Education	Level of education	0 = Less than high school education 1 = High school graduate or GED 2 = some college or technical school 3 = college degree or higher	Ordinal Predictor
Race/Ethnicity	Type of race/ethnicity	0 = Hispanic 1 = White, non-Hispanic 2 = Black, non-Hispanic 3 = Other, non-Hispanic	Nominal Covariate
Age	Participant's age in years	0 = 0-5 years old 1 = 6-11 years old 2 = 12-17 years old	Ordinal Covariate
Gender	Gender	0 = Male 1 = female	Nominal Covariate

(Continued)

Variables	Survey Questions	Data Code	Variable Type
Body Mass Index (BMI)	Weight status based on BMI	0 = Underweight (less than 5th percentile) 1 = Normal weigh (5th to 84th percentile) 2 = Overweight (85th to 94th percentile) 3 = Obese (95th percentile or above)	Ratio Covariate
Physical Activity	Past week has child engaged in vigorous (($\geq$ 60 minutes) physical activity	0 = 0 days 1 = 1-3 days 2 = 4-6 days 3 = everyday	Ordinal Covariate
Health Insurance	Current health insurance	0 = Insured at time of survey 1 = not insured at time of survey	Ordinal Covariate
	Type of health insurance coverage	0 = Public health insurance only 1 = Private health insurance only 2 = Public and private insurance 3 = Insured but type is unknown 4 = Currently uninsured	Nominal Covariate

Methodology

Target Population

The target population for the study was adolescents within the United States with T2D. The ages for adolescents in this study will be 10 to 17 years. The ADA (2018) indicated that an estimated 193,000 Americans under 20 years of age were diagnosed with T2D. The percentage of adolescents with T2D is on the rise across the world. Secondary data from national surveys on child health was used to test the hypotheses. The data originated from the DRC using the 2011/2012 National Survey of Children's Health.

Sample Size and Power Calculations

Burkholder (n.d.) indicated that there are three factors that influence the power of a study: the alpha level, effect size, and sample size. The sample size was based on secondary data that was obtained for this study. Sample size was determined using the G Power 3.0 software. Multiple regression analysis was performed; therefore, the F test: Multiple Regression - omnibus (deviation of R^2 form zero), fixed model was used to determine the sample size. I used the effect size of 0.15, α error prob – 0.05, power (1 – β err prob) – 0.95, with the number of predictors of 3 and 7 covariates (10). The total sample size result was 172 participants and the actual power will be 0.95. The DRC collected a total of 45,302 child-level interviews from February 2011 thru June 2012 from ages 10 to 17.

Instrumentation and Operationalization of Constructs

I examined several secondary data set surveys that were specific to my dependent and independent variables. The most recent data set is the 2011/2012 National Survey of Children's Health. In the section on family structure of child's household, participants are asked about their relation to the child, "Complete the questions for each of the two adults in the household who are this child's primary caregivers. If there is just one adult, provide answers for that adult." "How are you related to this child?" (a) Biological or Adoptive Parent, (b) Step-parent (c) Grandparent, (d) Foster Parent, (e) Aunt or Uncle, (f) Other Relative, and (g) Other Non-Relative. The number of health indicators reported from a list of 26 survey items on health conditions indicators include diabetes among children 12–17years (items A5e/f, A6-A29, A34). I am not sure if the survey asked about same sex or multiracial families.

Characteristics of Selected Data

The DRC has over 200 child health indicators within the database of the system. The analysis consisted of descriptive statistics to describe the sample demographics, the independent variables, and the dependent variables association to T2D.. Frequency and percentages for the following variables: gender, family structure, parental education, and household income were analyzed.. Also, the evaluation of the following variables occurred for race/ethnicity, BMI, and physical activity. The analysis for the mean age and standard deviation of adolescents with T2D occurred.

Data Management

I used IBM SPSS Version 24 statistics to analyze the secondary data retrieved from the Data Resource Center for Child and Adolescent Health. The resolution of missing and invalid data from the 2011/2012 National Survey of Children's Health data documentation transpired.. The diabetes variables measure prevalence and severity. Based on the distribution of these variables gaining Walden Institutional Review Board (IRB) approval (IRB approval No. 02-06-19-0328931), I decided whether to use as a binomial distribution or as an ordinal variable with three categories.

Data Analysis

The primary objective of the study examined if family structure has a significant effect on the prevalence of T2D among adolescents. The study consisted of three independent variables and one dependent variable; therefore, multiple logistic regression will be used. According to Sullivan (2012) and Green and Salkind (2009), multiple logistic regression is used when a study has one dependent variable with two or three ordinal categories. The independent variables were the predictors of the odds of having

T2D, and the analyses was controlled by several covariates. The independent variables can be continuous or categorical (Sullivan, 2012; Green and Salkind, 2009).

Field (2013) indicated that an interaction effect is used to gauge moderation and determined by combining the effect of two or more predictor variables on an outcome variable. The interaction was evaluated between (a) Do household income and family structure have an interaction with adolescents with T2D? (b) Do household income and parental education have an interaction with adolescents with T2D? (c) Does family structure, and parental education have an interaction with adolescents with T2D?

Research Questions and Hypotheses

This study addressed three research questions. The dependent variable was diagnosis of diabetes (T2D). The independent variables included family structure, parental education, and household income. Statistical analysis was included for both descriptive and inferential statistics. Some of the descriptive statistics included frequency and percentage. The inferential statistics included odds ratios. The research questions are presented in sequence with their associated description of variables and statistical tests.

Research Question 1. Is there an association between family structure and the prevalence of T2D among adolescents?

Null Hypothesis ($H_0$1): There are no association between family structure and the prevalence of T2D among adolescents.

Alternative Hypothesis (H_a1): There are associations between family structure and the prevalence of T2D among adolescents.

I addressed Research Question 1 with multiple logistic regression which examined the extent to which family structure predicts T2D among adolescents. The

significance value ($p < .050$) and 95% confidence intervals determined whether the overall regression model was a good fit for the collected data and significance of association. SPSS was used to run analyses of the DRC data from the 2011/2012 National Survey of Children's Health. The covariates, which include BMI, race/ethnicity, age, gender, physical activity, and type of insurance coverage was examined in each regression model.

Research Question 1 refers to the key component of "embodiment" within Krieger's ecosocial theory. How does the prevalence of T2D among adolescents vary among different types of family structure was answered? The key component of "pathways of embodiment" within Krieger's ecosocial theory consisted of the following questions,(a) what role, if any, does family structure have on the increase in the prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example, obesity or single-parent families and (b) to what extent is childhood obesity and lack of exercise relevant to the increase prevalence of T2D among adolescents with different family structures?

Research Question 2. Does parental education have a significant effect on the prevalence of T2D among adolescents?

Null Hypothesis ($H_0 2$): There are no differences in parental education and prevalence of T2D among adolescents.

Alternative Hypothesis ($H_a 2$): There are differences in parental education and prevalence of T2D among adolescents.

Research Question 2 was answered with multiple logistic regression to examine the extent to which parental education predicts T2D among adolescents. The significance

value ($p < .050$) and 95% confidence intervals determined whether the overall regression model is a good fit for the collected data as well as assessing significance of association. The analyses of the DRC data from the 2011/2012 National Survey of Children's Health occurred with SPSS. The covariates, which include BMI, race/ethnicity, age, gender, physical activity, and type of insurance, were examined with multiple logistic regression.

Research Question 2 refers to the key component of "pathways of embodiment" within Krieger's ecosocial theory and answered what role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example less educated parents?

Research Question 3. Does household income have a significant effect on the prevalence of T2D among adolescents??

Null Hypothesis ($H_0$3): There are no differences between household income and prevalence of T2D among adolescents.

Alternative Hypothesis (H_a3): There are differences between household income and prevalence of T2D among adolescents.

Research Question 3 was also answered with multiple logistic regression to examine the extent to which household income predicts T2D among adolescents. The significance value ($p < .050$) and 95% confidence intervals will determine whether the overall regression model is a good fit for the collected data as well as assessing significance of association. SPSS will be used to run analyses of the DRC data from the 2011/2012 National Survey of Children's Health. The covariates, which include BMI, race/ethnicity, age, gender, physical activity, and health insurance type and coverage will also be examined in each regression model.

Research Question 3 referred to the key component of "pathways of embodiment" within Krieger's ecosocial theory. The question answered what role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example low-income families? This research question will also refer to the key component of "cumulative interplay between exposure, susceptibility and resistance" within Krieger's ecosocial theory. Research Question 3 answered whether change in family structure increased the prevalence of T2D depending on various demographic and SES factors of the parents. Table 3 shows how the ecosocial theory aligns with each of the three research questions.

Ecosocial Theory Key Component	Theory Questions	Research Questions
Embodiment	What role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example obesity or single parent families?	Research Question 1: Is there an association between family structure and the prevalence of T2D among adolescents?
Pathways of embodiment	What role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example obesity or single parent families?	Research Question 1: Is there an association between family structure and the prevalence of T2D among adolescents?
	To what extent is childhood obesity and lack of exercise relevant to the increase prevalence of T2D among adolescents with different family structures?	Research Question 1: Is there an association between family structure and the prevalence of T2D among adolescents?
	What role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example less educated parents?	Research Question 2: Does parental education have a significant effect on the prevalence of T2D among adolescents?
	What role, if any, does family structure have on the increase in prevalence of T2D among adolescents and who or what determines the extent of exposure to T2D, for example low-income families?	Research Question 3: Does household income have a significant effect on the prevalence of T2D among adolescents?
Cumulative interplay between exposure, susceptibility and resistance	What role, if any, does the change in family structure increase the prevalence of T2D depending of various demographic and SES factors of the parents?	Research Question 3: Does household income have a significant effect on the prevalence of T2D among adolescents?

Figure 2. Theory alignment with research questions

Threats to Validity

Field (2013) defined validity as whether an instrument measures what it was designed to measure. Two types of threats to validity are associated with quantitative research designs. The two types of validity include external and internal validity.

External Validity refers to how well data and different theories correspond from one experiment to another. The threat to external validity is an incorrect interpretation drawn by the researcher from the data to other persons, other settings, and past or future situations (Creswell, 2009). Creswell (2009) suggested that three types of threats to external validity exist. The three types of threats to external validity include interaction of selection and treatment, interaction of setting and treatment, and interaction of history and treatment (Creswell, 2009).

One may avoid interaction of selection and treatment by conducting additional statistical analysis with the same participants and different variables. The interaction of history and treatment can be eliminated by performing the study later to determine if the same results occur as in the earlier study (Creswell, 2009).

Internal Validity refers to how well an experiment or treatment will be performed. The threat of internal validity is an experiment, treatment, or experiences of the participants which threaten the researcher's ability to draw correct interpretations from the data bout the experimental population (Creswell, 2009). Creswell (2009) indicated that ten types of threats to internal validity exist, which include, history, maturation, regression, selection, mortality, diffusion of treatment, compensatory/resentful demoralization, compensatory rivalry, testing, and instrumentation.

All adolescent participants 12-17 with a Type 2 diabetes health condition will be included. The process of random selection will eliminate the possibility of choosing participants with low SES or a specific family structure. Each independent variable will be separated from one another avoiding the internal validity threat of diffusion of treatment.

Summary and Transition

Chapter 3 consists of the research design, target population, sample size, power calculations, threats to validity, instrumentation and operationalization of constructs, characteristics of selected data, data management, data analysis and a review of the research questions and hypothesis. Chapter 4 will include data collection, analysis, and interpretation of the data.

Chapter 4: Results

Introduction

The purpose of the study was to examine family structure and prevalence of T2D among adolescents. In Chapter 4 the focus is on providing the results of the quantitative methodology for this study. The sections in chapter 4 include data management and results. In addition, I present the results of the analyses discussed in the previous section using SPSS version 25.

Data Management

I obtained secondary data from the DRC using the 2011/2012 National Survey of Children's Health after gaining Walden Institutional Review Board (IRB) approval (IRB approval No. 02-06-19-0328931). The DRC collected data for the 2011/2012 survey from February 28, 2011 through June 25, 2012. Data were exported from the DRC website and imported into SPSS (Version 25) software for analysis. The sample size was larger than the minimum sample estimated in the power analysis in Chapter 3 with a total sample size of 45,309 adolescents for the final analysis. The ages for this study ranged from 10 to 17 years of age.

Before performing the data analysis, I recoded various variables. I recoded age to only include adolescents that were 10–17 years of age. The age variable was recoded into two groups, 10–13 years and 14–17 years. The family structure variable was recoded from nine variables to four variables. These variables included (a) two-parent (married), (b) two-parent (step-parent), (c) single mother, and (e) other. The body mass index variable was recoded as (a) less than the 5th percentile, (b) 5th percentile to less than the 85th percentile, (c) 85th percentile to less than the 95th percentile, and (d) equal to or

greater than the 95th percentile. Parental education was recoded as (a) less than high school, (b) high school graduate, (c) more than high school, (d) do not know, and (e) refused. The family income variable was recoded as (a) 0-99% FPL, (b) 100-199% FPL, (c) 200-399% FPL, and (d) 400% FPL or greater. One variable was excluded from analysis which was insurance; however, the type of insurance variable was used and was coded as (a) public insurance, (b) private insurance, and (c) currently uninsured.

There were 484 missing cases for type of insurance coverage, 552 missing cases for family structure, 824 missing cases for parental education, 987 missing cases for race/ethnicity, and 24,497 missing cases for BMI. A total of 27,344 cases were recoded as 99 and excluded from statistical analysis in SPSS.

Descriptive Statistics

Demographics Characteristics

Baseline demographic characteristics are displayed in Table 4. Over half (52%) of the sample (N = 45,309) consisted of males. Age was divided into two groups, 10 –13 years and 14–17 years. The mean age of the sample was 14 years of age. The majority of the sample (67.3%) was White, non-Hispanic followed by Hispanic (11.5%) and Black, non-Hispanic (9.4%). At the time of the survey 95% of the individuals had health insurance with 70% of these individuals having private insurance compared to the 24.2% that had public health insurance. Public insurance for adolescents includes Medicaid and/or state children's health insurance (S-CHIP). Almost a third (29.8%) of the adolescents had a BMI at the 5th percentile to less than 85th percentile, which indicates that the adolescent is normal or has a healthy weight, followed by 6.8% in the 85th percentile to less than 95th percentile, which suggests that adolescents are overweight,

6.7% in the equal to or greater than the 95th percentile, which indicate these adolescents are obese, and 2.6% in the less than the 5th percentile, which indicates the adolescents are underweight.

Table 2

Demographic Characteristics of Adolescents Ages 10-17

Demographic Variables	Frequency	Percent
Gender		
Male	23,597	52.1
Female	21,658	47.8
Age		
10–13	21,497	47.4
14–17	23,821	52.6
Race/ethnicity		
Hispanic	5,216	11.5
White, non-Hispanic	30,496	67.3
Black, non-Hispanic	4,242	9.4
Multiracial/other, non-Hispanic	4,368	9.6
Type of Health Insurance		
Public insurance (ex. Medicaid or SCHIP)	10,948	24.2
Private health insurance	31,715	70.0
Currently uninsured	2,162	4.8

Note, Data Source: Data Resource Center for Child and Adolescent Health. The 2011/2012 National Survey of Children's Health

Descriptive Statistics for Independent and Dependent Variables

The proportion of adolescents in this sample who were diagnosed with T2D was less than one percent (0.6%). The majority (64.4%) of the sample came from a two-parent currently married family structure. College or technical school had the largest

percentage for parental education (48.6%) with parents receiving a high school diploma or GED as the second (32.1%). When looking at reported household income, 400% FPL had the highest percentage (36.2%), followed by 200–399% FPL (30%), 100–199% FPL (18%), and 0–99% FPL (15.7%). Parents that reported an income within the ≥ 400% FPL category earned an income of ≥ $47,520 a year; whereas, parents that reported within the 0–99% FPL category earned an annual income between 0–$11,879.

Table 3

Independent and Dependent Variables

Demographic Variables	Frequency	Percent
Diabetes		
Yes	293	0.6
No	45,016	99.4
Family Structure		
Two-parent (Married)	29,264	64.4
Two-parent (step-parent)	5,131	11.3
Single mother	7,267	16.0
Other	3,095	6.8
Parental Education		
Less than high school education	6,117	13.5
High school graduate or GED	14,560	32.1
College or technical school	22,022	48.6
Household Income		
0-99% FPL (0-$11,879)	7,111	15.7
100-199% FPL ($11,880-$23,759)	8,165	18.0
200-399% FPL ($23,760-$47,519)	13,615	30.0
400% FPL (≥$47,520)	16,418	36.2

Note. The data was collected by the Data Resource Center for Child and Adolescent Health. The 2011/2012 National Survey of Children's Health

Sociodemographic Characteristics by Diabetes

Both T1D and T2D among adolescents was consistent by gender, age, race/ethnicity, family structure, parental education, family income, BMI, and type of insurance coverage, as illustrated in Table 4. Significant differences by the age (p = .010) of adolescents with diabetes included 10–13 years (.5%) and 14–17 years (.7%). White, non-Hispanic (.7%) and Black, non-Hispanic (.7%) adolescents were 1.75 times likely being diagnosed with diabetes (p = .007) compared to Hispanic (.4%) and multiracial/other, non-Hispanic adolescents. Finally, the type of insurance coverage (p = .000) was associated with adolescents with diabetes. Adolescents with public health insurance (.9%) and private health insurance (.6%) were nine and six times more likely to be diagnosed with diabetes compared to uninsured (.1%) adolescents.

Table 4

Sociodemographic Characteristics by Diabetes Status

Sociodemographic Factor	No Diabetes		Diabetes		Total		*p*
	%	*N*	%	*N*	%	*N*	
Gender						45309	.238*
Male	99.4%	23461	.6%	136	52%	23597	
Female	99.3%	21501	.7%	157	48%	21658	
Age						45309	.010*
10-13 years	99.5%	21380	.5%	117	47%	21497	
14-17 years	99.3%	23636	.7%	176	53%	23812	
Race/ethnicity						44322	.007*
Hispanic	99.6%	5195	.4%	21	12%	5216	
White, non-Hispanic	99.3%	30276	.7%	220	69%	30496	
Black, non-Hispanic	99.3%	4214	.7%	28	10%	4242	
Multiracial/other, non-Hispanic	99.6%	4351	.4%	17	10%	4368	
Family Structure						44757	.340*
Two-parents (Married)	99.4%	29078	.6%	186	65%	29264	
Two-parents (step-parent)	99.5%	5104	.5%	27	11%	5131	
Single mother	99.3%	7216	.7%	5	16%	7267	
Other	99.2%	3069	.8%	26	7%	3095	
Parental Education						44485	.414*
Less than high school	99.4%	6083	.6%	34	14%	6117	
High school graduate	99.3%	14456	.7%	104	33%	14560	
More than high school	99.3%	21875	.7%	147	50%	22022	
Family Income						45309	.674*
0-99% Federal Poverty Level	99.3%	7063	.7%	48	16%	7111	
100-199% Federal Poverty Level	99.4%	8120	.6%	45	18%	8165	
200-399% Federal Poverty Level	99.3%	13522	.7%	93	30%	13615	
≥ 400% Federal Poverty Level	99.3%	16311	.7%	107	36%	16418	
Body Mass Index (BMI)						20812	.333*
Less than the 5th percentile	99%	1176	1%	12	6%	1188	
5th to < 85th percentile	99.2%	13405	.8%	105	65%	13510	
85th to < 95th percentile	99.4%	3073	.6%	19	15%	3092	
≥ 95th percentile	99.4%	3005	.6%	17	15%	3022	
Type of Insurance Coverage						44825	.000*
Public health insurance	99.1%	10847	.9%	101	24%	10948	
Private health insurance	99.4%	31529	.6%	186	71%	31715	
Currently uninsured	99.9%	2159	.1%	3	5%	2162	

*Note. *Pearson Chi-Square*

Sociodemographic Characteristics by Family Structure

Family structure among adolescents varied by gender, age, race/ethnicity, diabetes, parental education, family income, BMI, and type of insurance coverage, as illustrated in Table 5. White, non-Hispanic (69%) adolescents were 5.75 to 6.9 times likely to have a stable family structure (p = .000) compared to Hispanic (12%), Black, non-Hispanic (10%), and multiracial/other/non-Hispanic adolescents. Significant differences in parental education (p = .000) included parents with more than a high school education (50%) compared to parents that were high school graduates (33%) and parents with less than a high school education (14%). Therefore, adolescents within all four categories of family structure were 1.5 to 3.6 times likely to have a parent with more than a high school education. Parents with more than a high school education (72.8%) were among adolescents that had two-parents (married) followed by single mothers (13.4%), two-parent (step-parent) (9.2%) and other (4.5%) types of family structure. The greatest family structure type with a high school diploma included two-parent (married) (6.34%) followed by single mothers (17.1%), two-parent (step-parent) (12.3%) and other (7.2%) types of family structure. Two-parent (married) (50.2%) had the greatest number of parents that had less than a high school education compared to singles mothers (21.8%), two-parent (step-parent) (15.7%) and other (12.4%) types of family structure. Significant differences were present among the four types of family income (p = .000) compared to the four types of family structure. Those adolescents with two-parents (married) were one to two times likely to have a family income of 400% FPL or greater (82.4%) compared to 200–399% FPL (70.5%), 100–199% FPL (52.1%), and 0–99% FPL (31.1%). Adolescents with two-parent (step-parents) were one and half to three times

likely to have a family income of 0–99% FPL (20.6%) compared to 100–199% FPL (15.2%), 200–399% FPL (10.6%), and 400% FPL or greater (6.4%). More single mother families had a family income of 0–99% FPL (38.4%) which, was one and half to five and half times less likely than the other family income categories. The second highest family income was within the 100–199% FPL (23.3%) followed by 200–399% FPL (11.9%) and 400% FPL or greater (6.8%). Other family structure types had the greatest family income within the 0–99% FPL (9.9%) followed by 100–199% FPL (9.5%) 200–399% FPL (6.9%) and 400% FPL or greater (4.3%). Two-parent (married) families had the highest family income within the 400% FPL or greater (82.4%) compared to the other three types of family structure which had the highest income within the 0–99% FPL. Therefore, adolescents with two-parents (married) were two to eight times less likely to have a family income within the 0–99% FPL (16%) meaning these families had an annual income great or equal to $47,520 compared to those earning less than $11,879. An adolescents BMI is associated not only with family structure but family income. Adolescents with two-parents (married) have the highest percentage with the less than the 5th percentile (67.7%) and the 5th percentile to less than the 85thpercentile (67%). Single mothers (24.6%) followed by two-parent (step-parent) (14.1%) and other (11.7%) types of family structure had the highest percentage with the equal o or great than 95th percentile. Therefore, adolescents with two-parents (married) were one to one and half times more likely to be underweight or normal weight compared to the other three types of family structures which were one to one and half more likely to become obese.

Table 5

Sociodemographic Characteristics by Family Structure Status

Sociodemographic Factor	Two-Parent (Married)		Two-Parent (Step-parent)		Single Mother		Other		Total		*p*
	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	
Gender										44757	.540*
Male	65.5%	15284	11.5%	2691	16%	3723	7.0%	1624	52%	23322	
Female	65.2%	13939	11.4%	2435	16.5%	3537	6.9%	1470	48%	21381	
Age										44757	.369*
10-13 years	65.4%	13889	11.2%	2386	16.3%	3466	7.1%	1498	47%	21239	
14-17 years	65.4%	15375	11.7%	2745	16.2%	3801	6.8%	1597	53%	23518	
Race/ethnicity										43780	.000*
Hispanic	64.6%	3329	12.4%	639	15.8%	814	7.2%	373	12%	5155	
White, non-Hispanic	65.3%	19674	11.6%	3488	16.4%	4948	6.7%	2012	69%	30122	
Black, non-Hispanic	65%	2722	10.9%	455	16.7%	700	7.4%	311	10%	4188	
Multiracial/other, non-Hispanic	67.4%	2910	10.0%	431	15%	647	7.6%	327	10%	4315	
Diabetes										44757	.340*
No diabetes	65.4%	29078	11.5%	5104	16.2%	7216	6.9%	3069	99%	44467	
Diabetes	64.1%	186	9.3%	27	17.6%	51	9.0%	26	1%	290	
Parental Education										44236	.000*
Less than high school	50.2%	3055	15.7%	953	21.8%	1326	12.4%	754	14%	6088	
High school graduate	63.4%	9183	12.3%	1787	17.1%	2472	7.2%	1037	33%	14479	
More than high school	72.8%	15967	9.2%	2027	13.4%	2933	4.5%	997	50%	21924	
Family Income										44757	.000*
0-99% FPL	31.1%	2174	20.6%	1437	38.4%	2680	9.9%	693	16%	6984	
100-199% FPL	52.1%	4193	15.2%	1220	23.3%	1874	9.5%	762	18%	8049	
200-399% FPL	70.5%	9506	10.6%	1433	11.9%	1607	6.9%	936	30%	13482	
≥ 400% FPL	82.4%	13391	6.4%	1041	6.8%	1106	4.3%	704	36%	16242	
Body Mass Index (BMI)										20594	.000*
Less than the 5th percentile	67.7%	800	10.7	127	14.7%	174	6.9%	81	6%	1182	
5th to < 85th percentile	67.0%	8959	11.4%	1522	14.6%	1952	7.0%	938	65%	13371	
85th to < 95th percentile	59.2%	1808	12.6%	386	18.8%	575	9.3%	284	15%	3053	
≥ 95th percentile	49.6%	1482	14.1%	421	24.6%	735	11.7%	350	15%	2988	
Type of Insurance Coverage										44280	.663*
Public health insurance	65.0%	7036	11.7%	1271	16.2%	1756	7.0%	757	24%	10820	
Private health insurance	65.5%	20513	11.4%	3585	16.3%	5091	6.8%	2135	71%	31324	
Currently uninsured	64.7%	1383	11.0%	234	16.6%	355	7.7%	164	5%	2136	

*Note. *Pearson Chi-Square; FPL = Federal Poverty Level*

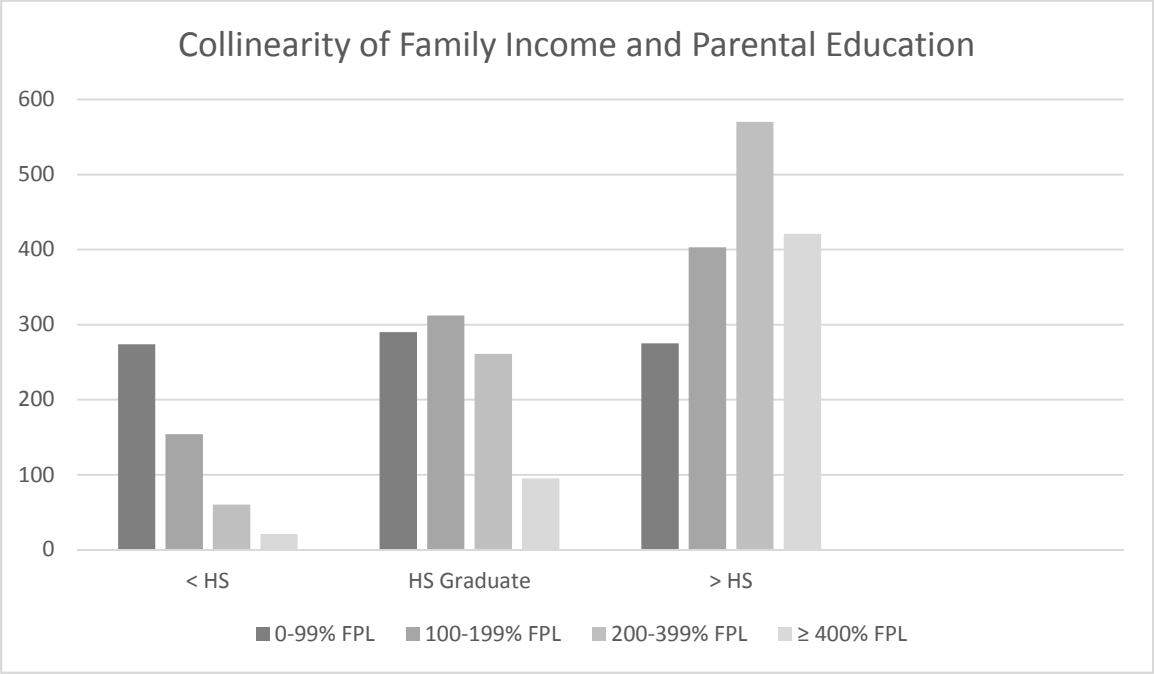

Figure 3. The Family Income Distribution of the Sample Population: Family Income versus Parental Education . *Data Source:* Data Resource Center for Child and Adolescent Health. The 2011/2012 National Survey of Children's Health.

Multivariate Results

To answer the research questions, I conducted multiple (binary) logistic regression analysis with diabetes as the dependent variable. The three independent variables were examined individually; however, various covariates were included in the analysis. These covariates included age, race/ethnicity, type of insurance, sex, and BMI.

Statistical Assumptions

Cross tabulation with chi-square is utilized to determine if there is an association between two variables measured at an ordinal or nominal level; and the two variables contain two or more categorical or independent groups (Laerd Statistics, n.d.). The assumptions for multiple logistic regression include that the dependent variable is measured on a dichotomous scale, it includes one or more continuous or categorical

independent variables, independence of observations and a correlative exclusive dependent variable (Laerd Statistics, n.d.). Statistical assumptions were met and cross-tabulation with chi-square and multiple logistic regression were conducted and analyzed for the dependent variable adolescents with T2D. Sullivan (2012) indicated that multiple logistic regression can be utilized to examine the effects of the independent variable on the dependent variable, controlling for various covariates.

Multivariate Analysis: Family Structure and Diabetes

Research Question 1 (RQ1): Is there an association between family structure and the prevalence of T2D among adolescents?

Null Hypothesis ($H_0$1): There are no association between family structure and the prevalence of T2D among adolescents.

Alternative Hypothesis (H_a1): There are associations between family structure and the prevalence of T2D among adolescents.

In the first research question, I evaluated the predictive association between family structure and the prevalence of diabetes among adolescents, controlling for gender, age, race/ethnicity, type of health insurance, and BMI.

The Hosmer-Lemeshow goodness-of-fit is used in logistic regression to investigate the model fit of the variables. The Hosmer and Lemeshow goodness-of-fit test for this analysis revealed non-significant ($p = .072$), indicating the model was a good fit for the data. The Hosmer-Lemeshow goodness-of-fit is good if $p > .05$.

A multiple logistic regression analysis was performed to investigate if family structure, controlling for gender, age, race/ethnicity, type of health insurance, and BMI, had an association with adolescents that have diabetes. The results of RQ1 are explained

below, and the study findings are presented in Table 6. The predictor variable, family structure was found to be non-significant (p = .901). Therefore, no statistically significant association was found between family income and adolescents with diabetes. However, the three significant covariates were age (p = .006), type of insurance coverage (p = .000), and BMI (p = .017). The null hypothesis was not rejected. There are no association between family structure and the prevalence of T2D among adolescents.

Table 6

Multiple Logistic Regression for Family Structure and Diabetes

				95% Confidence for Exp(B)	
	df	P-value	OR	Lower	Upper
Family Structure	1	.901	1.001	0.989	1.012
Age	1	.006	0.714	0.562	0.907
Race/ethnicity	1	.351	1.077	0.922	1.258
Insurance	1	.000	1.800	1.437	2.254
Sex	1	.070	0.825	0.670	1.016
BMI	1	.017	1.003	1.001	1.005
Constant	1	.000	92.153		

Note. Data Source: Data Resource Center for Child and Adolescent Health. The 2011/2012 National Survey of Children's Health: Controlling for Ethnicity, Age, Gender, BMI, Physical Activity, and Health Insurance (N = 45,309)

Multivariate Analysis: Parental Education and Diabetes

Research Question 2 (RQ2): Does parental education have a significant effect on the prevalence of T2D among adolescents?

Null Hypothesis ($H_0$2): There are no differences in parental education and prevalence of T2D among adolescents.

Alternative Hypothesis (H_a2): There are differences in parental education and prevalence of T2D among adolescents.

In the second research question, I evaluated the predictive association between parental education and the prevalence of diabetes among adolescents, controlling for gender, age, race/ethnicity, type of health insurance, and BMI.

The Hosmer-Lemeshow goodness-of-fit is used in logistic regression to investigate the model fit of the variables. The Hosmer and Lemeshow goodness-of-fit test for this analysis revealed non-significant ($p = .609$), indicating the model was a good fit for the data. The Hosmer-Lemeshow goodness-of-fit is good if $p > .05$.

A multiple logistic regression analysis was performed to investigate if parental education, controlling for gender, age, race/ethnicity, type of health insurance, and BMI, had an association with adolescents that have diabetes. The results of RQ2 are explained below, and the study findings are presented in Table 7. The predictor variable, parental education was found to be non-significant ($p = .093$). Therefore, no statistically significant association was found between parental education and adolescents with diabetes. However, the three significant covariates were age ($p = .006$), type of insurance coverage ($p = .000$), and BMI ($p = .019$). The null hypothesis was not rejected. There are no differences in parental education and prevalence of T2D among adolescents.

Table 7

Multiple Logistic Regression for Parental Education and Diabetes

				95% Confidence for Exp(B)	
	df	*p* - value	OR	Lower	Upper
Parental Education	1	.093	1.018	.997	1.040
Age	1	.006	.715	.563	.908
Race/ethnicity	1	.355	1.076	.921	1.257
Insurance	1	.000	1.803	1.440	2.257
Sex	1	.070	.825	.670	1.016
BMI	1	.019	1.003	1.000	1.005
Constant	1	.000	86.900		

Note. Data Source: Data Resource Center for Child and Adolescent Health. The 2011/2012 National Survey of Children's Health: Controlling for Ethnicity, Age, Gender, BMI, Physical Activity, and Health Insurance (N = 45,309)

Multivariate Analysis: Household Income and Diabetes

Research Question 3 (RQ3): Does household income have a significant effect on the prevalence of T2D among adolescents?

Null Hypothesis ($H_0$3): There are no differences between household income and prevalence of T2D among adolescents.

Alternative Hypothesis (H_a3): There are differences between household income and prevalence of T2D among adolescents.

In the third research question, I evaluated the predictive association between household income and the prevalence of diabetes among adolescents, controlling for gender, age, race/ethnicity, type of health insurance, and BMI.

The Hosmer-Lemeshow goodness-of-fit is used in logistic regression to investigate the model fit of the variables. The Hosmer and Lemeshow goodness-of-fit test for this analysis revealed non-significant ($p = .440$), indicating the model was a good fit for the data. The Hosmer-Lemeshow goodness-of-fit is good if $p > .05$.

A multiple logistic regression analysis was conducted to investigate if household income, controlling for gender, age, race/ethnicity, type of health insurance, and BMI, had an association with adolescents that have diabetes. The results of RQ3 are explained below, and the study findings are presented in Table 8. The predictor variable, household income was found to be non-significant ($p = .855$). Therefore, no statistically significant association was found between household income and adolescents with diabetes. However, the three significant covariates were age ($p = .006$), type of insurance coverage ($p = .000$), and BMI ($p = .018$). The null hypothesis was not rejected. There are no differences between household income and prevalence of T2D among adolescents.

Table 8

Multiple Logistic Regression for Household Income and Diabetes

	df	*p* - value	OR	95% Confidence for Exp(B) Lower	Upper
Income	1	.855	.990	.886	1.105
Age	1	.006	.714	.562	.907
Race/ethnicity	1	.350	1.077	.922	1.258
Insurance	1	.000	1.800	1.438	2.254
Sex	1	.070	.825	.670	1.016
BMI	1	.018	1.003	1.000	1.005
Constant	1	.000	95.133		

Data Source: Data Resource Center for Child and Adolescent Health. The 2011/2012 National Survey of Children's Health: Controlling for Ethnicity, Age, Gender, BMI, Physical Activity, and Health Insurance (N = 45,309)

Summary

In summary, I presented the results of the DRC using the 2011/2012 National Survey of Children's Health as it pertains to the family structure and adolescents with diabetes. The purpose of the study was to examine family structure and prevalence of T2D among adolescents. In this quantitative study, a total of 45,309 individuals were drawn from the DRC data base. Three research questions were constructed which evaluated the association between three predictive variables (family structure, parental education, and household income) and diabetes among adolescents ages 10–17. Multiple logistic regression was performed to evaluate the association between diabetes and the

predictive variables, controlling for gender, age, race/ethnicity, type of health insurance, and BMI. The multiple regression analysis indicated that there was no statistical significance between diabetes in adolescents and family structure, parental education, and household income; however, there was statistical significance between diabetes in adolescents with age, type of insurance, and BMI. Therefore, I failed to reject the null hypotheses of all three research questions.

In Chapter 5, I will provide a review of the purpose and nature of the study. The final chapter will consist of an interpretation of the findings, limitations of the study, and recommendations, and implications for positive change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of the study examined family structure and prevalence of T2D among adolescents. In Chapter 4 the focus is on describing the results for this study. The sections in Chapter 4 include data management, descriptive statistics, descriptive analysis, multivariate analysis results, and summary.

Interpretation of the Findings

The dependent variable for this study is T2D. T2D and obesity are increasingly prevalent epidemics in the United States among children and adolescents (Finkelstein et al., 2014; Reinehr, 2013), leading to diabetes as the third most common chronic disease in children (Pettitt et al., 2014). Approximately six percent (293) of the sample participants from the DRC data sets had either T1D or T2D. As the incidence of T2D among children and adolescents increased over the years, researchers revealed a trend in the prevalence of T2D in female adolescents, which has a 60% higher prevalence compared to male adolescents of the same age group (Nadeau et al., 2016). However, the study indicated that only 48% (157) of female adolescents had diabetes in this study.

Research Question 1

The first research question in this study was: is there an association between family structure and the prevalence of T2D among adolescents?

A dramatic change has occurred within the past 50 years regarding family structure (Blessing, 2017). The predictor variable of family structure consisted of four groups; two-parents (married), two-parents (step-parent), single mother, and other. Multiple logistic regression analysis indicated that family structure was not a significant

predictor of diabetes. Therefore, the null hypothesis was not rejected. There are associations between family structure and the prevalence of T2D among adolescents. The result of multiple logistic regression test with family structure as a predictor variable showed as Exp(B) 1.001, (95% CI = .989, 1.012), p = .901.

I confirmed that the traditional nuclear family (64%) (two-parent {married}) was decreasing, whereas, single mother family structures were on the rise (16%). These findings were consistent with previous studies such as Blau and Klaauw (2013), who indicated that the rate of two-parent families fell to 73% between 1970 and 1990 as the rate of single-parent families rose from 13% to 25%. Blau and Klaauw (2013) also indicated that single mothers head an estimated 80% of single-parent families within the United States. Blau and Klaauw (2013) indicated that in 2004, 58% of children were living with their married biological parents, 3% were living with cohabiting biological parents, 8% with only one biological parent and one step-parent or adoptive parent, 26% were living with only one parent, and 4% were living with neither parent, which was consistent with this study indicating that 64% of adolescents were living with two-parents (married), 16% living with single mothers, 11% living with two-parent (step-parent), and 7% had other types of family structures.

The two key factors associated with RQ1 were embodiment and pathways of embodiment. The prevalence of T2D among adolescents indicated that there was a variance among different types of family structures. BMI was statistically significant and was a pathway embodiment due to an increase in BMI that leads to obesity and eventually to T2D and other commodities.

Research Question 2

The second research question in this study was: does parental education have a significant effect on the prevalence of T2D among adolescents?

The predictor variable of parental education was categorized in the study into three groups: less than high school, high school graduate, and more than high school. Multiple logistic regression analysis indicated that parental education was not a significant predictor of diabetes. Therefore, the null hypothesis was not rejected. There are no differences in parental education and prevalence of T2D among adolescents. The result of multiple logistic regression test with parental education as a predictor variable showed as Exp(B) .1.018, (95% CI = .997, 1.040), p = .093.

Family structure had an association with parental education. The most significant family structure type with a high school diploma included two-parent (married) (6.34%) followed by single mothers (17.1%), two-parent (step-parent) (12.3%) and other (7.2%) types of family structure. Therefore, parental education and family structure were a pathway of embodiment.

Research Question 3

The third research question in this study was: does household income have a significant effect on the prevalence of T2D among adolescents?

Zhang and Soukup (2012) indicated in previous studies that a child's health is indirectly affected by family structure through family income. The predictor variable of family income was categorized in the study into four groups: 0–99% FPL, 100–199% FPL, 200–300% FPL, and 400% FPL or greater. Multiple logistic regression analysis indicated that family income was not a significant predictor of diabetes. Therefore, the

null hypothesis was not rejected. There are no differences between household income and prevalence of T2D among adolescents. The result of multiple logistic regression test with family income as a predictor variable showed as Exp(B) .990, (95% CI = .886, 1.105), *p* = .855.

In this study family structure had an association with family income and was a pathway of embodiment according to the Ecosocial theory. The findings in this study were consistent with the previous research by Krueger et al. (2015) which stated that the nuclear family is legally recognized and has a higher socioeconomic status and better access to healthcare compared to other family structures. Adolescents who had a two-parent (married) family structure were eight times more likely to be categorized within the 400% FPL or greater compared to those adolescents with single mothers and were approximately four times likely to be categorized within 0–99% FPL. The second key factor of the Ecosocial theory that was associated with RQ3 was cumulative interplay between exposure, susceptibility and resistance, due to low-income, less than a high school diploma, and race/ethnicity.

Applying the ecosocial theory to the findings from this study, lower income, less than HS education, Hispanic, African Americans and multi-racial groups, represent the cumulative interplay between exposure, susceptibility and resistance" where lower socioeconomic status contributes to the exposure, being of a minority group increases susceptibility, and embodiment and pathways of embodiment, such as family structure may or may not offer resistance to disease.

Limitations of the Study

The purpose of this quantitative study was to use data from the DRC using the 2011/2012 National Survey of Children's Health to examine family structure and the prevalence of T2D among adolescents. There are several limitations to this study. First, the National Survey of Children's Health is not mandatory; however, every state was represented with an estimated 1,850 interviews collected per state. Therefore, the results of the survey may only represent specific geographical regions of each state. Second, the survey was conducted through list-assisted random-digital-dial (RDD) sample of landline telephone numbers and supplemented with an independent RDD sample of cell-phone numbers. Therefore, individuals without a landline telephone or cellphone were not interviewed. Third, the survey data were gathered from self-reported response from parents, which are dependent upon memory of the child(s) disease states. The surveyors randomly choose a single child from households with one or more children, ages 0–17. Fourth, the survey consisted of 95,677 completed interviews. This study examined 45,309 adolescents ranging from ages 10–17; however, only 293 (6%) adolescents had diabetes, which may not be a representation of the adolescent diabetic population.

Recommendations

The following recommendations for future research are based on the findings of this study. Future researchers should concentrate on the diabetic adolescent community. These future studies should also focus on the many family structures within the United States. Longitudinal research is needed to examine the lifelong effects of diabetic adolescents. To include how family structure impacts not only the health of the adolescent(s), but the long-term health, healthcare, socioeconomic status, and educational

level as these adolescents reach adulthood. The longitudinal research could also include long-term demographics such as if the participants have children, current marital status (family structure), and the health of the children.

Future studies could include an exploratory examination of both private and public health insurance coverage. The examination may include cost, accessibility to health care, and if the two type of coverage offer preventive care and at what cost. Future research may focus on why the south United States has such a single mother family structure type, to include teen-age pregnancy. Other focuses on future research with teen-age pregnancy associated with family structure and family income would include access to healthcare via health insurance coverage.

Implications for Social Change

The findings from this study may promote healthcare professionals and educators to develop policies which may improve the eating and exercise habits of adolescents specifically designed to lower adolescents BMIs. These types of procedures may be beneficial within the private and public-school systems. If adolescents are taught to eat healthy in school and become physically active, the behavior of the adolescents may continue in their home life. This would promote healthy nutrition and exercise among siblings and parents. This study brings to light the need for additional paths to encourage education to parents and adolescents. State health departments may also conduct studies within the state, which would identify the regions of diabetic locations. This would allow state officials to pinpoint the areas of concern and promote programs designed explicitly for diabetic adolescents. The state could also support these new programs for free or adjust the cost according to family income.

Conclusion

In this study, my goal was to examine family structure and the prevalence of T2D among adolescents. The multiple logistic regression analysis indicated that there was no statistical significance between diabetes in adolescents and family structure, parental education, and household income. Therefore, I could not reject the three null hypotheses. However, the study indicated statistical significance in the following covariates: age (p = .006), type of insurance coverage (p = .000), and BMI (p = .019). The findings of this study provided knowledge regarding family structure and diabetic adolescents; however, more research is needed that focuses on the specific population.

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