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CONTRIBUTION OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS  
TO HEALTH OUTCOMES IN INNER-CITY AFRICAN AMERICANS WITH TYPE 2  
DIABETES

by

Jennifer A. Campbell

A Dissertation Submitted in  
Partial Fulfillment of the  
Requirements for the Degree of

Doctor of Philosophy  
in Public Health

at

The University of Wisconsin – Milwaukee

May 2020

## ABSTRACT

### CONTRIBUTION OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS TO HEALTH OUTCOMES IN INNER-CITY AFRICAN AMERICANS WITH TYPE 2 DIABETES

by

Jennifer A. Campbell

The University of Wisconsin-Milwaukee, 2020  
Under the Supervision of Professor Dr. Alice Yan

Diabetes is a complex disease that represents a major public health challenge due to its high prevalence, its association with increased morbidity, and early mortality. Inner-city African Americans with diabetes suffer a disproportionate burden of disease due to both economic and social disadvantage that reaches across individual, community, and health system levels of influence. Central to the principles of Public Health is the “pursuit of health equity for the elimination of health disparities, specifically in accordance to the empowerment of disenfranchised community members, aiming to ensure that the basic resources and conditions necessary for health are accessible to all”. To effectively achieve health equity in diabetes for inner-city African Americans and provide the basic resources and conditions necessary for health; establishment of barriers specific to diabetes care is paramount.

The current study addresses several gaps in the literature for inner-city African Americans with diabetes by first developing a framework for understanding barriers to diabetes care for inner-city African Americans that occur across multiple levels of influence. Specifically, this framework integrated two existing behavioral models for

diabetes and was informed by the literature and a social ecological model for health disparities to identify barriers at the individual, community, and health system level. Using the newly developed framework, this study then examined the influence of each barrier level on two important diabetes outcomes, glycemic control and quality of life, among inner-city African Americans with diabetes. Primary data from 241 inner-city African Americans with diabetes were analyzed. Hemoglobin A1C (A1C) was collected for each participant and served as the measure of glycemic control. The SF-12 was used to capture the physical component (PCS) and mental component (MCS) of quality of life. Advanced regression methods using four approaches including sequential, stepwise with backward and forward selection, and all possible subsets regression, were used to identify factors that may be key drivers of outcomes for inner-city African Americans with diabetes. The findings showed that factors across the three levels of influence: individual, community, and health system, have a differential relationship with glycemic control and quality of life.

For glycemic control, in the final adjusted model across all four approaches, individual level factors like age ( $\beta=-0.05$ ;  $p<0.001$ ); having 1-3 comorbidities ( $\beta=-2.03$ ;  $p<0.05$ ) having 4-9 comorbidities ( $\beta=-2.49$ ;  $p=0.001$ ) were associated with poorer glycemic control. Similarly, male sex ( $\beta=0.58$ ;  $p<0.05$ ), being married ( $\beta=1.16$ ;  $p=0.001$ ) and being overweight/obese ( $\beta=1.25$ ;  $p<0.01$ ) were associated with better glycemic control. Community and health system level factors were not significantly associated with glycemic control.

For quality of life, in the final adjusted models, having less than a high school education ( $\beta=-0.78$ ;  $p=0.006$ ), and having major depression ( $\beta=-1.51$ ;  $p<0.001$ ) were

associated with lower quality of life scores for MCS across all four regression approaches. Being employed was positively associated with better quality of life scores for PCS across all four regression approaches ( $\beta=0.44$ ;  $p=0.004$ ). PCS was higher across all four regression approaches ( $\beta=0.45$ ;  $p=0.004$ ) for those reporting a history of trauma. At the health systems level, usual source of care was associated with better PCS across three regression approaches.

This study serves as preliminary for understanding barriers unique to inner-city African Americans and identifying important factors that may be driving glycemic control and quality of life. Future steps need to examine the indirect pathways that may exist within this framework contributing to poor outcomes. Additionally, application of this framework for intervention development may allow for the development of tailored and specific interventions that promote health equity and improve outcomes in diabetes for inner-city African Americans.

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## TABLE OF CONTENTS

<b>CHAPTER 1: INTRODUCTION.....</b>	<b>1</b>
<b>1.1 INTRODUCTION.....</b>	<b>1</b>
1.1.1 OUTLINE OF THE HEALTH PROBLEM AND OVERALL GOAL OF THIS STUDY.....	1
1.1.2 INTRODUCTION TO THE DISSERTATION CHAPTERS .....	2
<b>1.2 BACKGROUND.....</b>	<b>4</b>
1.2.1 OVERVIEW OF DIABETES.....	4
1.2.2 HEALTH DISPARITIES AMONG AFRICAN AMERICANS .....	5
1.2.3 INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM BARRIERS .....	6
<b>1.3 UNIQUE BARRIERS FOR INNER-CITY AFRICAN AMERICANS WITH DIABETES .....</b>	<b>7</b>
<b>1.4 GAPS IN LITERATURE.....</b>	<b>14</b>
<b>1.5 SPECIFIC AIMS.....</b>	<b>15</b>
<b>1.7 CONCLUSION .....</b>	<b>18</b>
 <b>CHAPTER TWO: INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM LEVEL BARRIERS TO OPTIMAL DIABETES CARE FOR INNER-CITY AFRICAN AMERICANS: AN INTEGRATIVE REVIEW AND FRAMEWORK DEVELOPMENT .....</b>	 <b>19</b>
<b>2.1 SUMMARY OF CHAPTER TWO.....</b>	<b>19</b>
<b>2.2 INTRODUCTION.....</b>	<b>20</b>
<b>2.3 CONCEPTUAL OR THEORETICAL FRAMEWORK.....</b>	<b>24</b>
2.3.1 OVERVIEW .....	24
2.3.2 MINORITY HEALTH AND HEALTH DISPARITIES RESEARCH'S (NIMHD) MODEL .....	25
2.3.3 BROWN MODEL .....	27
2.3.4 CHRONIC CARE MODEL (CCM).....	29
2.3.5 STRENGTHS AND WEAKNESS OF THE BROWN MODEL AND CCM .....	31
2.3.6 INTEGRATION OF BEHAVIORAL MODELS (PROPOSED INTEGRATED FRAMEWORK FOR UNDERSTANDING BARRIERS TO DIABETES CARE FOR INNER-CITY AFRICAN AMERICANS) .....	32
<b>2.4 METHODS .....</b>	<b>35</b>
2.4.1 STUDY SELECTION AND DATA COLLECTION .....	35
2.4.2 INFORMATION SOURCES, ELIGIBILITY CRITERIA, AND SEARCH .....	36
<b>2.5 RESULTS .....</b>	<b>40</b>
2.5.1 STUDY SELECTION .....	40
2.5.2 STUDY CHARACTERISTICS AND OUTCOMES OF STUDIES .....	42
2.5.3 INDIVIDUAL LEVEL BARRIERS .....	50
2.5.4 COMMUNITY LEVEL BARRIERS .....	53
2.5.5 HEALTH SYSTEM LEVEL BARRIERS.....	55
2.5.7 SYNTHESIS OF FINDINGS .....	59
<b>2.6 DISCUSSION.....</b>	<b>64</b>
2.6.1 CONCLUSION AND PUBLIC HEALTH RELEVANCE .....	64
2.6.2 STRENGTHS AND LIMITATION .....	67
2.6.3 FUTURE DIRECTION.....	68
 <b>CHAPTER THREE: RELATIVE CONTRIBUTION OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS ON GLYCEMIC CONTROL AMONG INNER-CITY AFRICAN AMERICANS WITH TYPE 2 DIABETES .....</b>	 <b>70</b>
<b>3.1 SUMMARY OF CHAPTER THREE .....</b>	<b>70</b>
<b>3.2 INTRODUCTION.....</b>	<b>71</b>
<b>3.3 METHODS .....</b>	<b>73</b>
3.3.1 SAMPLE .....	73
3.3.2 CONCEPTUAL FRAMEWORK .....	74

3.3.3	MEASUREMENTS .....	76
3.3.4	STATISTICAL ANALYSES.....	84
3.4	RESULTS .....	85
3.5	DISCUSSION.....	96
<b>CHAPTER FOUR: QUANTIFYING THE INFLUENCE OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS ON QUALITY OF LIFE AMONG INNER-CITY AFRICAN AMERICANS WITH TYPE 2 DIABETES.....</b>		<b>103</b>
4.1	SUMMARY OF CHAPTER FOUR .....	103
4.2	INTRODUCTION.....	104
4.3	METHODS .....	106
4.3.1	CONCEPTUAL FRAMEWORK AND THEORY .....	106
4.3.2	STUDY SAMPLE .....	106
4.3.3	MEASUREMENTS .....	107
4.3.4	STATISTICAL ANALYSES.....	116
4.4	RESULTS .....	117
4.5	DISCUSSION.....	132
<b>CHAPTER FIVE: DISCUSSION.....</b>		<b>137</b>
5.1	DISCUSSION .....	137
5.2	PUBLIC HEALTH AND RESEARCH IMPLICATIONS .....	141
5.3	CLINICAL IMPLICATIONS .....	144
5.4	LIMITATIONS .....	149
<b>REFERENCES.....</b>		<b>152</b>
<b>APPENDICES.....</b>		<b>167</b>
APPENDIX A: INTEGRATIVE REVIEW EXTRACTION FORM .....		168
APPENDIX B: CHAPTER 3 MEASUREMENTS .....		169
APPENDIX C: CHAPTER 4 MEASUREMENTS .....		189
<b>CURRICULUM VITAE .....</b>		<b>209</b>



## LIST OF FIGURES

FIGURE 1. SAMPLE SIZE DIAGRAM.....	17
FIGURE 2. NIMHD MODEL.....	26
FIGURE 3. BROWN MODEL.....	27
FIGURE 4. CHRONIC CARE MODEL.....	30
FIGURE 5. PROPOSED INTEGRATED FRAMEWORK FOR UNDERSTANDING BARRIERS TO DIABETES CARE FOR INNER-CITY AFRICAN AMERICANS .....	34
FIGURE 6. PRISMA FLOW DIAGRAM .....	41
FIGURE 7. FINAL INTEGRATED FRAMEWORK FOR UNDERSTANDING BARRIERS TO DIABETES CARE FOR INNER-CITY AFRICAN AMERICANS .....	63
FIGURE 8. CAMPBELL AND EGEDE FRAMEWORK FOR UNDERSTANDING BARRIERS TO CARE FOR INNER-CITY AFRICAN AMERICANS .....	75

## LIST OF TABLES

TABLE 1. SEARCH TERMS .....	37
TABLE 2. SEARCH SUMMARY .....	38
TABLE 3. SUMMARY OF ARTICLES BY DESIGN AND BARRIER LEVEL .....	43
TABLE 4. SUMMARY OF ARTICLES BY OUTCOME AND BARRIER LEVEL .....	48
TABLE 5. SAMPLE CHARACTERISTICS.....	86
TABLE 6. UNADJUSTED LINEAR REGRESSION OF GLYCEMIC CONTROL BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS IN DIABETES .....	87
TABLE 7. SEQUENTIAL LINEAR REGRESSION MODELS OF GLYCEMIC CONTROL BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS IN DIABETES FOR INCLUSION IN FINAL MODEL .....	89
TABLE 8. FULLY ADJUSTED LINEAR REGRESSION OF GLYCEMIC CONTROL BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES (APPROACH 1: SEQUENTIAL) .....	92
TABLE 9. FULLY ADJUSTED LINEAR REGRESSION OF GLYCEMIC CONTROL BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES (APPROACH 2: BACKWARD SELECTION).....	94
TABLE 10. FULLY ADJUSTED LINEAR REGRESSION OF GLYCEMIC CONTROL BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES (APPROACH 3: FORWARD SELECTION).....	95
TABLE 11. FULLY ADJUSTED LINEAR REGRESSION OF GLYCEMIC CONTROL BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES (APPROACH 4: ALL POSSIBLE SUBSETS) .....	96
TABLE 12. SAMPLE CHARACTERISTICS.....	118
TABLE 13. UNADJUSTED LINEAR REGRESSION OF QOL (MCS/PCS) BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES .....	119
TABLE 14. SEQUENTIAL LINEAR REGRESSION MODELS OF QUALITY OF LIFE (MCS/PCS) BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS IN DIABETES FOR INCLUSION IN FINAL MODEL .....	122
TABLE 15. FULLY ADJUSTED LINEAR REGRESSION OF QUALITY OF LIFE (MCS) BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES .....	127
TABLE 16. FULLY ADJUSTED LINEAR REGRESSION OF QUALITY OF LIFE (PCS) BY INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEMS FACTORS IN DIABETES .....	131

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# CONTRIBUTION OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS TO HEALTH OUTCOMES IN INNER-CITY AFRICAN AMERICANS WITH TYPE 2 DIABETES

## CHAPTER ONE: INTRODUCTION

### 1.1. Introduction

#### 1.1.1. Outline of the Health Problem and Overall Goal of this Study

Diabetes is a complex disease that represents a major public health challenge due to its high prevalence, its association with increased morbidity, and early mortality (Center for Disease Control and Prevention [CDC], 2020). As the 7th leading cause of death in the United States (US), diabetes affects 13% of adults age 18 years and older (CDC, 2020). Type 2 diabetes, hereafter referred to as diabetes, accounts for 95% of all diabetes cases (CDC, 2020). Health disparities exist in both prevalence and burden of disease for diabetes, with African Americans suffering a disproportionate burden of disease compared to non-Hispanic whites (CDC, 2017; American Diabetes Association [ADA], 2019a; US Renal Data System [USRDS], 2016). Inner-city environments confer greater risk for poor diabetes outcomes (Bachman et al., 2003; Gaskin et al., 2014; Breton et al., 2013; Gebreab et al., 2017; Ryan et al., 2008) due to factors that occur at three levels: individual (Bains & Egede, 2011; Egede & Bonadonna, 2003), community (Den Braver et al., 2018), and health system levels (Ziemer et al., 2008; Zhang et al., 2012), which will be discussed in further detail below. Central to the principles of Public Health is the “pursuit of health equity for the elimination of health disparities, specifically

in accordance to the empowerment of disenfranchised community members, aiming to ensure that the basic resources and conditions necessary for health are accessible to all” (Public Health Leadership Society, 2002). To effectively achieve health equity in diabetes for inner-city African Americans and provide the basic resources and conditions necessary for health; a framework for intervention development is needed.

While evidence shows that barriers exists at the individual, community, and health system level for diabetes outcomes among inner-city African Americans, a framework for examining the individual and collective effects of each of these levels on diabetes outcomes is lacking. Therefore, the overarching goal of this study is to first develop a conceptual framework to identify barriers to optimal diabetes outcomes among inner-city African Americans at three levels of influence: individual, community and health systems, based on an integrative review. Secondly, this study will examine correlates of glycemic control among inner-city African American with diabetes using variables at the individual, community, and health system levels informed by the newly developed conceptual framework. Finally, this study will examine correlates of quality of life among inner-city African Americans with diabetes using variables at the individual, community, and health system levels informed by the conceptual framework.

#### 1.1.2. Introduction to the Dissertation Chapters

The findings of this study will be presented in the form of a dissertation manuscript style with a total of 5 chapters, 3 of which will be manuscripts. Each chapter will be presented as follows: the current chapter, chapter 1 of this dissertation, will provide an overview of diabetes and outline the national recommendations and standards of care used by diabetes care providers to achieve optimal outcomes and

summarize the existing health disparities for this study population. This will be followed by contextualizing individual, community, and health system levels for diabetes outcomes. A summary of the unique barriers at each of these levels and the known impacts on diabetes outcomes found in the literature for inner-city African Americans will then be presented along with the gaps that exist in the literature. Finally, Chapter 1 will conclude with a brief introduction to the specific aims and the sample that will be used in this study.

Chapter 2 of this dissertation will serve as Manuscript 1 synthesizing the literature by conducting an integrative review on the individual, community, and health system factors on diabetes outcomes among inner-city African Americans with diabetes. Two behavioral models and a social ecological model will be integrated to form a conceptual framework for understanding the barriers to diabetes care for inner-city African Americans across the individual, community, and health systems level.

Chapter 3 will serve as Manuscript 2 which will examine the relative contribution of each level of influence on glycemic control among inner-city African Americans with diabetes using the newly created conceptual framework.

Chapter 4 will serve as Manuscript 3 and will examine the relative contribution of each level of influence on quality of life among inner-city African Americans with diabetes using the newly created conceptual framework. Finally, Chapter 5 will serve as a conclusions chapter to discuss the study findings in summary and discuss relevant implications.

## **1.2. Background**

### **1.2.1. Overview of Diabetes**

Diabetes is characterized by insulin resistance and impaired glucose tolerance (ADA, 2019b). If not properly controlled, diabetes complications can develop, which include lower limb amputations, blindness, cardiovascular disease, as well as comorbid conditions such as stroke and kidney disease (CDC, 2018). Lifestyle modification such as weight loss and nutrition therapy that promotes a nutrient dense diet may improve insulin resistance along with pharmacological interventions, however insulin levels do not typically return to normal levels and while diabetes can be effectively managed it is most often a lifelong disease requiring intensive self-management (ADA, 2019b).

The cornerstone of diabetes management is self-management and lifestyle modification which includes self-glucose monitoring, eating a nutrient dense diet, and engaging in physical activity that includes at minimum 150 minutes of moderate to vigorous aerobic activity approximately 3 times per week (ADA, 2019b). Quality of care measures are considered the standards of care at the health systems level necessary for individuals with diabetes to avoid diabetes related complications (ADA, 2019b). Quality of care measures are set by the American Diabetes Association (ADA) who recommend that providers conduct annual Hemoglobin A1c (A1C) tests to assess the average blood glucose level across a 3-month time period (>7% A1C is considered poor glycemic control), foot exams to ensure nephropathy is not developing, and eye exams to ensure blindness is not developing (ADA, 2019b). Additionally, standard diabetes outcomes include blood pressure, cholesterol, dietary adherence, physical activity, and adherence to self-monitoring regime (ADA, 2019b). The ADA specifies that diabetes

outcomes are optimized when patient centered care is emphasized through collaborative team-based care management (ADA, 2019c). This includes providing management support through decision making, ensuring quality of care measures are met, and leveraging community networks and support within an individual's natural environment to promote self-management outside of clinical encounters (ADA, 2019d).

### 1.2.2. Health Disparities among African Americans

The incidence rate of diabetes for African Americans is 9 per 1,000 compared to 5.7 per 1,000 for non-Hispanic whites and approximately 13% of African Americans are living with diabetes compared to only 7% of non-Hispanic whites (ADA, 2019a). African Americans are twice as likely to develop diabetes retinopathy (ADA, 2019a), have a five-fold increased risk of developing kidney disease (ADA, 2019a; USRDS, 2019) and are nearly three times as likely to have a lower limb amputation related to diabetes complications (ADA, 2019a). Living in an inner city compounds the burden of disease for African Americans due to a number of factors including poverty (Bachman et al., 2003; Gaskin et al., 2014), unemployment (Breton et al., 2013) violence (Gebreab et al., 2017), discrimination (Ryan et al., 2008), and limited educational opportunities (Bachmann et al., 2003). Evidence also suggests that inner-city African Americans are less likely to receive recommended standards of care (Brown et al., 2005). Specifically, Brown et al. (2005) found that African Americans living in lower socioeconomic positions were less likely to receive an A1C measurement and cholesterol measurement in a managed care setting compared to non-Hispanic white patients in similar



socioeconomic positions (Brown et al., 2005). Which taken together may serve to compound existing vulnerability, allowing health disparities and inequity to persist.

### 1.2.3. Individual, Community, and Health System Barriers

Individual level barriers may be characterized by socio-demographic factors such as age, education, and employment, as well as psycho-social and behavioral factors such attitudes, beliefs, and knowledge about disease (Bains & Egede, 2011; Egede & Bonadonna, 2003). Evidence suggests that these factors impact how an individual engages in health promotion, and self-management behaviors for diabetes (Bains & Egede, 2011; Egede & Bonadonna, 2003). For example, in a study of low income predominately African American adults with diabetes, poor glycemic control was significantly related to diabetes knowledge, perception of health, and health literacy (Bains & Egede, 2011). Other research has shown that fatalistic beliefs, such as feelings of despair and hopelessness are significantly related to diabetes self-management among low income African Americans (Egede & Bonadonna, 2003).

At the community level, barriers such as the built environment, exposure to violence, and access to healthy food and transportation impact diabetes care (Den Braver et al., 2018). The Multi-Ethnic Study of Atherosclerosis (MESA) found across three sites in Baltimore, MD, Forsyth Country, NC, and Bronx, NY, that the presence environmental resources for physical activity and healthy food were associated with lower insulin resistance (Auchincloss et al., 2008). This study also showed that on average, African Americans across each site experienced more barriers in the environment for physical activity, more barriers in the environment for eating healthy food, and experienced the greatest distance to a neighborhood with good resources

(Auchincloss et al., 2008). Other neighborhood factors such as exposure to violence and neighborhood problems have been shown in the literature to be associated with greater odds of diabetes in inner-city African Americans (Gebreab et al., 2017). Specifically, the Jackson Heart Study demonstrated that reports of community violence and neighborhood problems were associated with 21% greater odds and 68% greater odds of diabetes prevalence, respectively, compared to not reporting community violence and neighborhood problems (Gebreab et al., 2017).

Health system level barriers broadly include access to health services and organizational resources that promote healthy lifestyles and disease prevention (Ziemer et al., 2008; Zhang et al., 2012). Evidence has shown that access to care, and access to the resources needed to utilize care, impact diabetes outcomes. Specifically, a study examining diabetes management among African Americans found that those who reported having difficulty finding a usual source of care for their diabetes, had an average A1C of 9.4%, and those reporting use of acute care clinics for their diabetes had an average A1C of 10.3% (Ziemer et al., 2008).

### **1.3. Unique Barriers for Inner-City African Americans with Diabetes**

#### **1.3.1. Individual Level Barriers**

The literature shows that for African Americans with diabetes living in an inner-city, individual level factors that serve as barriers to optimizing diabetes outcomes include household factors (Batts et al., 2001; El-Kebbi et al., 1996; Hill-Briggs et al., 2003; Pollard et al., 2014; Richardson et al., 2015), health literacy (Dalewitz et al., 2000; Mancuso, 2010; Mbaezue et al., 2010; Rhee et al., 2005), lack of knowledge (Calvin et al., 2001; Carter et al., 2011; Lee et al. 2016), depression (Mancuso, 2010; Musselman

et al., 2014; Crabtree et al., 2015), and diabetes awareness (El-Kebbi et al., 1996; Calvin et al., 2011; Carter et al., 2011). Household factors include the challenges that arise from having to adopt dietary guidelines for diabetes and being the only family member needing to do so, often resulting in cooking two separate meals or not following agreed diet recommendations at all. For example, Pollard et al. (2014) found that among African Americans with diabetes living in an inner-city, patients reported that following the recommended dietary regime required multiple meals be prepared to accommodate the individual patient needs with diabetes and family members who do not have diabetes (Pollard et al., 2014). In addition to household factors serving as an individual level barrier, having disease awareness and knowledge is also a key factor at the individual level for inner-city African Americans with diabetes (Pollard et al., 2014). Specifically, when examining disease awareness and knowledge, Calvin et al. (2011) found that among African Americans with diabetes living in an inner-city, approximately 67% of the study population were at risk for developing diabetes complications as indicated by poor glycemic control and blood pressure, however only 33% indicated that they did not believe they were at risk (Calvin et al., 2011). Additionally, 65% of the study population reported that they did not see diabetes as being permanent (Calvin et al., 2011).

Other individual level barriers that impact inner-city African Americans with diabetes include competing demands (Chard et al., 2016; Chlebowy et al., 2010; El-Kebbi et al., 1996), personal control (Crabtree et al., 2015; Chlebowy et al., 2010; Wan et al., 2012), food preferences (Lee et al., 2016; Richardson et al., 2015), resilience (DeNisco, 2011), and culture (Richardson et al., 2015; de Groot et al., 2003). DeNisco

(2011) found for example that resilience was significantly related to improved glycemic management among inner-city African Americans compared to those who reported low resilience. Specifically, individuals with higher resilience scores across five domains of resilience had lower A1C. The role of culture is also an important factor that has been identified as a barrier to optimizing diabetes outcomes for inner-city African Americans (Richardson et al., 2015; de Groot et al., 2003). For example, de Groot et al. (2003) found that participants who identified with traditional African American culture had limited engagement in dietary recommendations. Similarly, Richardson et al. (2017) found that patients reported following traditions made it difficult to adhere to recommended dietary regime despite knowing that the dietary selections are not optimal for diabetes management.

Another barrier that has been identified at the individual level is history of drug use (Wallace et al., 2017). Specifically, a qualitative study reported that patients with a history of drug use report intentionally not taking medications and insulin due to fear of relapse and fear of relying on a drug for a sense of well-being, even though medications are diabetes specific, patients reported seeing them as the same as taking drugs to alter physiological state (Wallace et al., 2017).

The literature has also identified time for self-management (Wanko et al., 2004), self-efficacy and the lack of confidence in performing self-management behaviors (Skelly et al. 1995), pain with blood glucose monitoring (Wanko et al., 2004), fear of blood glucose monitoring (Chlebowy et al., 2010), past trauma (Chard et al., 2016), and stress (Richardson et al., 2015) as being barriers at the individual level for inner-city African Americans managing diabetes. Additionally, perception of self-management

recommendations has been identified as a barrier, specifically, the belief that performing recommended physical activity levels may result in weight gain due to increased appetite (Pearte et al., 2004). For example, Pearte et al., 2004 found that individuals reporting the belief that exercise will increase appetite and lead to weight gain was associated with lower activity levels.

### 1.3.2. Community Level Barriers

The literature suggests that the role of support or lack of support is integral for optimizing diabetes outcomes (Chlebowy et al., 2010; Hill-Briggs et al., 2002; Shaw et al., 2006; Pollard et al., 2014). For inner-city African Americans, diabetes specific support characterized through family support and peer support for self-management behaviors is suggested to improve adherence to self-management behaviors and optimize outcomes. Chlebowy et al. (2010) found in a qualitative study that female family members served as diabetes management supporters through providing support for medication adherence. Participants reported regular medication adherence due to the availability of family support. Chlebowy et al. (2010) also found that from the patients' lived experience, the role of peer support for diabetes is critical. Specifically, participants described that a lack of peer networking with others who have diabetes for physical activity made adherence to physical activity challenging.

Neighborhood specific support has also been shown to be an important form of support for inner-city African Americans with diabetes (Shaw et al., 2006). Specifically, Shaw et al. (2006) assessed level of support among inner-city African Americans and found that participants reporting neighborhood specific support were more likely to engage in recommended self-management behaviors. Neighborhood specific support

was characterized as talking with neighbors who have experiences living with diabetes, spending time with neighbors during activities such as barbecues, exercising with neighbors, or sharing and discussing dietary recommendations with neighbors (Shaw et al., 2006).

Another important community level barrier includes food availability and food affordability (Lee et al., 2016; Chard et al., 2016). For example, Lee et al. (2016) explored barriers to healthy eating for diabetes using qualitative methods and found that participants reported the primary reason for not adhering to a diabetes recommended diet was due to the local stores not stocking the recommended food. Additionally, when the recommended food was available, cost then became the barrier. Other community level barriers found in the literature for inner-city African Americans include access to transportation (Richardson et al., 2015; Wan et al., 2012), neighborhood safety that impacts engaging in physical activity (Chard et al., 2016), crime (Hill-Briggs et al., 2002), and community norms such as discrimination and racism (Wagner et al., 2011). Wagner et al. (2011) found in a qualitative study that participants reported that racism impacted their ability to optimize self-management through increased stress, anger, and eating in order to cope with the stress.

### 1.3.3. Health System Level Barriers

Health system level barriers occur primarily through access to health services and organizational resources that promote healthy lifestyles and disease prevention (Zhang et al., 2012; Ricci-Cabello et al., 2013). The literature shows a number of unique barriers at the health system level for inner-city African Americans with diabetes. These include the role of management and decision support at the health systems level

(Fitzpatrick et al., 2016; Gary et al., 2009; Spencer et al., 2011; Welch et al., 2015; Ziemer et al., 1996; Erdman et al., 2002; El-Kebbi et al., 1997; Richardson et al., 2015). Management and decision support includes nurse case management (Fitzpatrick et al., 2016; Gary et al., 2009; Spencer et al., 2011; Welch et al., 2015; Ziemer et al., 1996; Erdman et al., 2002; Richardson et al., 2015), pharmacist management support (Jaber et al., 1996), and physician management support (Crabtree et al., 2015; Chlebowy et al., 2010; El-Kebbi et al., 1997). This level of support can be characterized as phone calls or in person meetings with a provider to discuss strategies to address high glucose readings, titration of medication based on glucose readings, and education and problem solving.

The role of communication between patients and physicians is also a key barrier for inner-city African Americans found in the literature (Dalewitz et al., 2000; Carter et al., 2011; Lee et al., 2016). Evidence suggests that communication around tests being ordered such as A1C tests, as well as discussing patient history including social factors that impact adherence to treatment plans, impacts outcomes for patients living in inner-city environments (Lee et al., 2016). Specifically, Lee et al. (2016) found in a study of patient living in an inner-city, that the majority of participants did not know what an A1C measurement was, and most did not know whether they had an A1C check even though their patient records indicated one had been ordered. While this may speak to patient awareness and knowledge, in this study the provider ordered the test and these findings indicate lack of communication on two levels. First, during the clinical encounter when orders for a test should be discussed with a patient, and second, after the clinical encounter to discuss results of the test. This lack of communication also suggests that

patients are not involved in their care management plan as A1C tests, among other diabetes outcome measures, are used to set care management goals and alert the patient to potential risk for complications.

Other barriers at the health system level found for inner-city African Americans includes cost of supplies and accessing benefits (Hill-Briggs et al., 2005; Batts et al., 2001; Hill-Briggs et al., 2003), the role of trust (Chard et al., 2016; Carter et al., 2011; Mancuso et al., 2010), physician knowledge and awareness (Crabtree et al., 2015; Chlebowy et al., 2010; Wallace et al., 2017; Hill-Briggs et al., 2005), the ability to make appointments and be seen in a timely manner (Wan et al., 2012; Ziemer et al., 1996; Hill-Briggs et al., 2003; Rhee et al., 2005), and delay in treatment for poorly controlled diabetes (Chard et al., 2016; El-Kebbi et al., 1997; Cook et al., 2001). Wallace et al. 2017 found that patients reported the perception that physicians had a lack of history awareness where patients intentionally practiced non-adherence to regime due to fear, and yet these concerns were never addressed in the patient-provider interaction. This suggests the complexity that some patients face with specific barriers such as having a history of drug use or fear of pain in self-monitoring that may cross levels of influence from individual levels to health system levels. For example, the individual decision to avoid medications due to a history of drug use, lack of trust in providers in order to disclose specific history, and lack of effective communicating to gain an understanding for the lack of adherence.

Other factors relating to physician knowledge and awareness have been shown in medication refills (Hill-Briggs et al., 2005). For example, Hill-Briggs et al. (2005) found



in a cross-sectional study that physicians not calling in a refill was a factor contributing to medication non-adherence for patients.

#### **1.4. Gaps in literature**

While the literature has provided evidence for barriers to diabetes care for African Americans, as well as for low-income African Americans, little has been done to evaluate the influence of individual, community, and health system barriers on diabetes care among inner-city African Americans. Specifically, there is limited research on the individual and collective effects of each of these levels on outcomes in this population. Additionally, existing evidence for interventions for inner-city African Americans with diabetes is fragmented by focusing on the individual level, community level, or health system level independent of one another, and little has been done to systematically identify, integrate, and address multilevel barriers specific to inner-city African Americans with diabetes (Noonan et al., 2016).

To effectively address health disparities in diabetes seen among inner-city African Americans, a public health approach is needed to develop interventions outside of the health system that incorporates the individual, community, and health system level of influence. This study aims to address this gap in knowledge by: 1) conducting an integrative review of the literature and develop a conceptual framework for understanding the barriers to diabetes care for inner-city African Americans across the individual, community, and health system level; and 2) estimating the incremental contribution of individual, community, and health systems factors on diabetes outcomes among inner-city African Americans using four regression approaches.

### **1.5. Specific Aims**

As demonstrated through the literature, diabetes is a complex disease that represents a major public health challenge due to its high prevalence, its association with increased morbidity, and early mortality (CDC, 2020). Inner-city African Americans with diabetes suffer a disproportionate burden of disease due to both economic and social disadvantage that reaches across individual, community, and health system levels of influence. The multi-level factors that represent barriers to care for inner-city African Americans with diabetes may be identified by evaluating the collective effects of each factor on diabetes outcomes. In so doing, policy and intervention development may be informed for establishing a targeted multifaceted approach that promotes sustained improvements in outcomes and achieves health equity in order to close the gap in health disparities experienced by inner-city African Americans with diabetes. Therefore, the overarching goal of this study is to identify the influence of individual, community, and health systems factors on diabetes outcomes among inner-city African Americans in order to create targeted interventions to improve diabetes outcomes in this population. The specific aims of this study include:

**Aim 1:** Develop a conceptual framework to identify barriers to optimal diabetes outcomes in inner-city African Americans at three levels of influence: individual, community and health system levels, based on an integrative review.

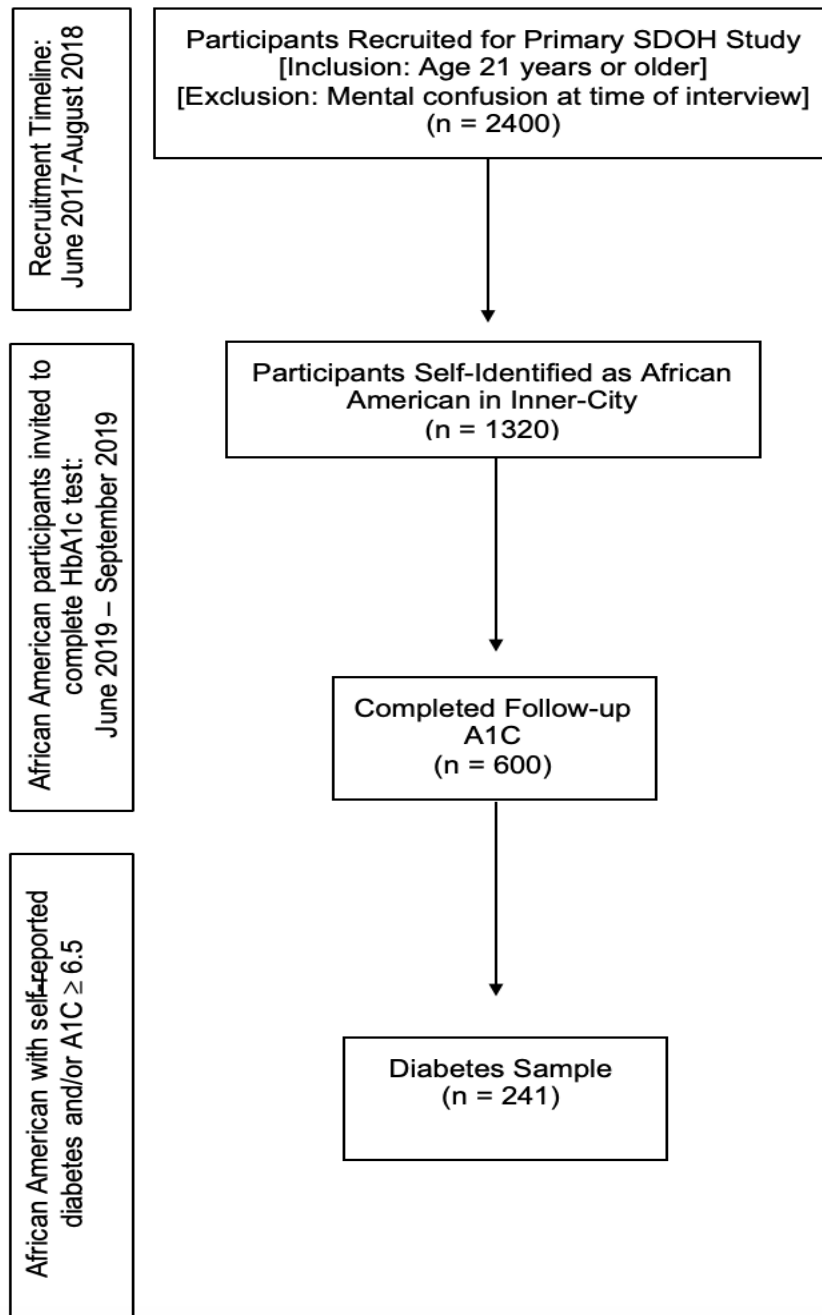
**Aim 2:** Examine correlates of glycemic control (A1C) among inner-city African American with diabetes using variables at the individual, community, and health system levels informed by the conceptual framework.

**Aim 3:** Examine correlates of quality of life (MCS and PCS) among inner-city African American with diabetes using variables at the individual, community, and health system levels informed by the conceptual framework.

### **1.6. Sample Size and Participants**

This study was cross-sectional with a sample of 241 African American adults with diabetes drawn from a larger community-based study conducted in the city of Milwaukee, WI between 2017 and 2018 on the social determinants of health. Participants were recruited from community organizations across the inner-city of Milwaukee including food pantries, local places of worship, and YMCAs. Announcements and goals of the study were shared at each location and interested participants were invited to complete the survey and a blood draw to measure their A1C. Participants were eligible if they self-identified as African American and were age 21 years or older and self-reported diabetes or had an A1C of  $\geq 6.5$ . Among this sample of 2,400, approximately 1,300 participants self-identified as African American and reported residence in one of 10 zip codes designated as inner-city Milwaukee. Among these 1,300 participants, 600 were re-contacted and completed questionnaires to measure health system barriers and provided a blood sample for A1C. Among the 600, 241 had self-reported diabetes or had an A1C of  $\geq 6.5$  indicating diabetes. This re-contacted sample will be used for the current study. All study procedures were approved by the Institutional Review Board at the Medical College of Wisconsin (PRO00028326) and all participants completed informed consent procedures with a signed informed consent form. Figure 1 below illustrates how the sample size will be drawn.

Figure 1. Sample Size Diagram



## **1.7 Conclusion**

In conclusion, evidence suggests that the barriers impacting inner-city African Americans with diabetes across the individual, community, and health system level are unique and complex. These factors confer risk for poor diabetes outcomes for African Americans who experience an already disproportionate burden of disease. However, little has been done to understand the collective impact of these three barrier levels on diabetes outcomes. Additionally, accounting for the lived experiences of individuals living in inner-city environments and how these experiences impact diabetes outcomes is of great importance.

Understanding the collective impact these barriers may have on diabetes outcomes can take place through first developing a conceptual framework that accounts for traditional diabetes factors and the lived experiences of the inner-city among African Americans with diabetes; and second testing this model to identify the specific factors impacting diabetes outcomes. Taken together, this study will lend to the pursuit of health equity for the elimination of health disparities, by understanding the barriers that exist across levels of influence as well as the collective impact barriers have on diabetes outcomes across levels of influence. These findings will be critical for addressing policy from a population health standpoint. At the research level, creating a framework for intervention development across the individual, community, and health system level will provide evidence for clinical practice and care management for African Americans with diabetes living in an inner-city.

## **CHAPTER TWO: INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM LEVEL BARRIERS TO OPTIMAL DIABETES CARE FOR INNER-CITY AFRICAN AMERICANS: AN INTEGRATIVE REVIEW AND FRAMEWORK DEVELOPMENT**

### **2.1 Summary of Chapter Two**

Health disparities in diabetes are disproportionately seen among inner-city African Americans. The American Diabetes Association (ADA) has called for research that will detect and identify contributing factors to disparities in diabetes using a population health approach. The purpose of this paper is to conduct an integrative review to: 1) elucidate the unique barriers experienced by inner-city African Americans for diabetes care; 2) Identify effective interventions for optimal diabetes care at the individual, community, and health systems levels; 3) Integrate two behavioral models and one social ecological model for framing public health interventions for inner-city African American to optimize diabetes care. PRISMA guidelines were followed to systematically search Pubmed, PsychInfo, and CINAHL. The search returned 1183 articles, 46 articles were synthesized after applying inclusion criteria. Multiple barriers for the individual level, community level, and health system level were identified. Major barriers include lack of knowledge, lack of social support, and self-management support. Interventions identified in this review show that among inner-city African Americans with diabetes, focus is placed at the health systems level with very limited focus toward addressing individual and community level barriers. These findings highlight fragmentation that may be occurring between policy, research, and practice for achieving health equity and addressing health disparities for diabetes care among inner-city African Americans.

## 2.2 Introduction

Diabetes is the 7th leading cause of death in the United States (US) and affects 13% of the US adult population (CDC, 2020). Diabetes is characterized by insulin resistance and impaired glucose tolerance (ADA, 2019a). If not properly controlled, diabetes complications can develop, which include lower limb amputations, blindness, cardiovascular disease, as well as comorbid conditions such as stroke and kidney disease (CDC, 2018). Lifestyle modification such as weight loss and diet may improve insulin resistance along with pharmacological interventions, however insulin levels do not typically return to normal levels and while diabetes can be effectively managed it cannot be reversed (ADA, 2019c).

Health disparities exist in both prevalence and burden of disease for diabetes (CDC, 2017; CDC, 2018; ADA, 2018), with African Americans suffering a disproportionate burden of disease compared to non-Hispanic whites (CDC, 2018; ADA, 2018). The incidence rate of diabetes for African Americans is 9 per 1,000 compared to 5.7 per 1,000 for non-Hispanic whites (CDC, 2018) and approximately 13% of African Americans are living with diabetes compared to only 7% of non-Hispanic whites (ADA, 2018). African Americans are twice as likely to develop diabetes retinopathy (ADA, 2018), have a five-fold increased risk of developing kidney disease (ADA, 2018; USRDS, 2016), and are nearly three times as likely to have a lower limb amputation related to diabetes complications (ADA, 2018). Living in an inner city compounds the burden of disease for African Americans due to a number of factors including poverty (Bachman et al., 2003; Gaskin et al., 2014), unemployment (Breton et al., 2013), violence (Gebreab et al., 2017), discrimination (Ryan et al., 2008), and limited education

(Bachmann et al., 2003). Evidence also suggests that inner-city African Americans are less likely to receive recommended standards of care (Brown et al., 2005), which taken together may serve to compound existing vulnerability, allowing health disparities and inequity to persist.

Persistence in health disparities in diabetes among vulnerable populations such as those seen among inner-city African Americans has gained increased attention at the national level (ADA, 2018). Specifically, national recommendations set forth by the ADA have been revised to place specific emphasis on research that will provide evidence for effective interventions in diabetes care among vulnerable populations (ADA, 2019a). According to the ADA Standards of Medical Care for 2019 (ADA, 2019a), there remains a dearth of evidence for the multilevel factors that serve as barriers for optimal care, particularly for vulnerable populations (ADA, 2019a), such as inner-city African Americans. As a result, the ADA has called for research that will detect and identify contributing factors to disparities in diabetes care, using a population health approach (ADA, 2019a). Specific evidence needed include barriers at the individual, community, and health systems level (ADA, 2019a).

Individual level barriers may be characterized by socio-demographic factors such as age, education, and employment, as well as psycho-social and behavioral factors such attitudes, beliefs, and knowledge about disease (Bains & Egede, 2011; Egede & Bonadonna, 2003). Evidence suggests that these factors impact how an individual engages in health promotion, and self-management behaviors for diabetes (Bains & Egede, 2011; Egede & Bonadonna, 2003). For example, in a study of low income predominately African American adults with diabetes, poor glycemic control was



significantly related to diabetes knowledge, perception of health, and health literacy (Bains & Egede, 2011). Other research has shown that fatalistic beliefs, such as feelings of despair and hopelessness are significantly related to diabetes self-management among low income African Americans (Egede & Bonadonna, 2003).

At the community level, barriers such as the built environment, exposure to violence, and access to healthy food and transportation impact diabetes care (Den Braver et al., 2018). The Multi-Ethnic Study of Atherosclerosis (MESA) found across three sites in Baltimore, MD, Forsyth Country, NC, and Bronx, NY, that environmental resources for physical activity and healthy food were associated with insulin resistance (Auchincloss et al., 2008). This study also showed that on average, African Americans across each site experienced more barriers in the environment for physical activity, more barriers in the environment for eating healthy food, and experienced the greatest distance to a neighborhood with good resources (Auchincloss et al., 2008). Other neighborhood factors such as exposure to violence and neighborhood problems have been shown in the literature to be associated with greater odds of diabetes in inner-city African Americans (Gebreab et al., 2017). Specifically, the Jackson Heart Study demonstrated that reports of community violence and neighborhood problems were associated with 21% greater odds and 68% greater odds of diabetes prevalence, respectively, compared to not reporting community violence and neighborhood problems (Gebreab et al., 2017).

Health system level barriers broadly include access to health services and organizational resources that promote healthy lifestyles and disease prevention (Ziemer et al., 2008; Zhang et al., 2012). Evidence has shown that access to care, and access

to the resources needed to utilize care, impact diabetes outcomes. Specifically, a study examining diabetes management among African Americans found that those who reported having difficulty finding a usual source of care for their diabetes, had an average A1C of 9.4%, and those reporting use of acute care clinics for their diabetes had an average A1C of 10.3% (Ziemer et al., 2008).

While the literature has provided evidence for barriers to diabetes care for African Americans, as well as for low-income African Americans, little has been done to specify barriers that are faced by inner-city African Americans across multiple levels of influence (Ricci-Cabello et al., 2013). Inner cities are characterized as distressed urban environments with disproportionately high rates of poverty and unemployment (Initiative for a Competitive Inner City [ICI], 2019), creating unique barriers for optimizing outcomes and receiving care among those living with diabetes, compared to living outside of an inner-city. For this reason, understanding the unique barriers to diabetes care that inner-city African Americans face need to be further elucidated. Moreover, existing evidence for interventions for inner-city African Americans with diabetes is fragmented by focusing on the individual level, community level, or health system level independent of one another, and little has been done to systematically identify, integrate, and address multilevel barriers specific to inner-city African Americans with diabetes (Noonan et al., 2016). By identifying the multi-level factors that represent barriers to care for inner-city African Americans with diabetes, policy and intervention development may be informed for establishing a targeted multifaceted approach that promotes sustained improvements in outcomes and achieves health equity in order to

close the gap in health disparities experienced by inner-city African Americans with diabetes.

In accordance to the call for research to address the gaps in literature identified by the ADA, this integrative review has three primary aims: 1) elucidate the unique barriers to care for inner-city African Americans with diabetes by conducting a review of the literature on barriers to optimal diabetes care at the individual level, the community level, and the health systems level; 2) Identify effective interventions/programs for optimal diabetes care at the individual, community, and health systems levels; 3) using the evidence from the review, a conceptual framework (i.e., model integration) will be developed using two behavioral models and one social ecological model for framing public health interventions for inner-city African American to optimize diabetes care.

The process for this integrative review will included: phase 1- preparing the guiding question (specified in the background and problem statement); phase 2- identify theory and behavioral models to explain phenomenon; phase 3- integrate behavioral models; phase 4- searching or sampling the literature; phase 5- data collection through extraction; phase 6- critical analysis of the studies included; and phase 7- final synthesis of evidence and model development.

## **2.3 Conceptual or Theoretical Framework**

### **2.3.1 Overview**

The guiding theory for this review will be drawn from the principles of social ecological models of health behavior (Stokols, 1992; Glanz et al., 2008). These principles include:

- 1) There are multiple influences on specific health behaviors, including factors at the intrapersonal, interpersonal, organizational, community, and public policy levels.
- 2) Influences on behaviors interact across these different levels.
- 3) Ecological models should be behavior specific, identifying the most relevant potential influences at each level.
- 4) Multi-level interventions should be most effective in changing behavior.

The process for developing a new conceptual framework will involve integration in two stages. The first stage of integration will include evaluation of two behavioral models established in the literature for explaining diabetes outcomes. The two behavioral models include 1) the Brown Model for Socioeconomic Position (SEP) and Health among Persons with Diabetes (Brown et al., 2004); and 2) The Chronic Care Model (CCM) (Wagner et al., 2001). These models were selected as both have been validated in the literature for explaining health disparities among African Americans with diabetes (Smalls et al., 2017; Walker et al., 2014). In order to integrate these two models accounting for multilevel influences, the National Institute for Minority Health and Health Disparities Research's (NIMHD) framework will be used as an example of a social ecological model (Alvidrez et al., 2019), hereafter referred to as the NIMHD model, for identifying relevant constructs within each level of influence. The second stage of integration will include identifying the unique barriers that fit into each construct across each level of influence.

### 2.3.2 Minority Health and Health Disparities Research's (NIMHD) Model

The NIMHD model was first created in 2015 as a descriptive illustration of the multilevel influences on minority health that specifies multiple domains of influence (Alvidrez et al., 2019). Created to serve as a social ecological model for health disparities research, this model specifies five domains of influence including the biological, behavioral, built environment, social environment, and healthcare system (Alvidrez et al., 2019). This model holds that each domain exerts influence across the individual, interpersonal, community, and societal level, with each level proposed to exert influence on individual health, family and organizational health, community health, and population health (Alvidrez et al., 2019).

Figure 2. NIMHD Model

<b>Health Disparity Populations: Race/Ethnicity, Low SES, Rural, Sexual/Gender Minority</b> <b>Other Fundamental Characteristics: Sex/Gender, Disability, Geographic Region</b>				
Domains of Influence	Levels of Influence			
	Individual	Interpersonal	Community	Societal
Biological	Biological Vulnerability and Mechanisms	Caregiver–Child Interaction Family Microbiome	Community Illness Exposure Herd Immunity	Sanitation Immunization Pathogen exposure
Behavioral	Health Behaviors Coping Strategies	Family Functioning School/Work Functioning	Community Functioning	Policies and Laws
Physical/Built Environment	Personal Environment	Household Environment School/Work Environment	Community Environment Community Resources	Societal Structure
Sociocultural Environment	Sociodemographics Limited English Cultural Identity Response to Discrimination	Social Networks Family/Peer Norms Interpersonal Discrimination	Community Norms Local Structural Discrimination	Societal Norms Societal Structural Discrimination
Health Care System	Insurance Coverage Health Literacy Treatment Preferences	Patient–Clinician Relationship Medical Decision-Making	Availability of Health Services Safety Net Services	Quality of Care Health Care Policies
Health Outcomes	Individual Health	Family/ Organizational Health	Community Health	Population Health

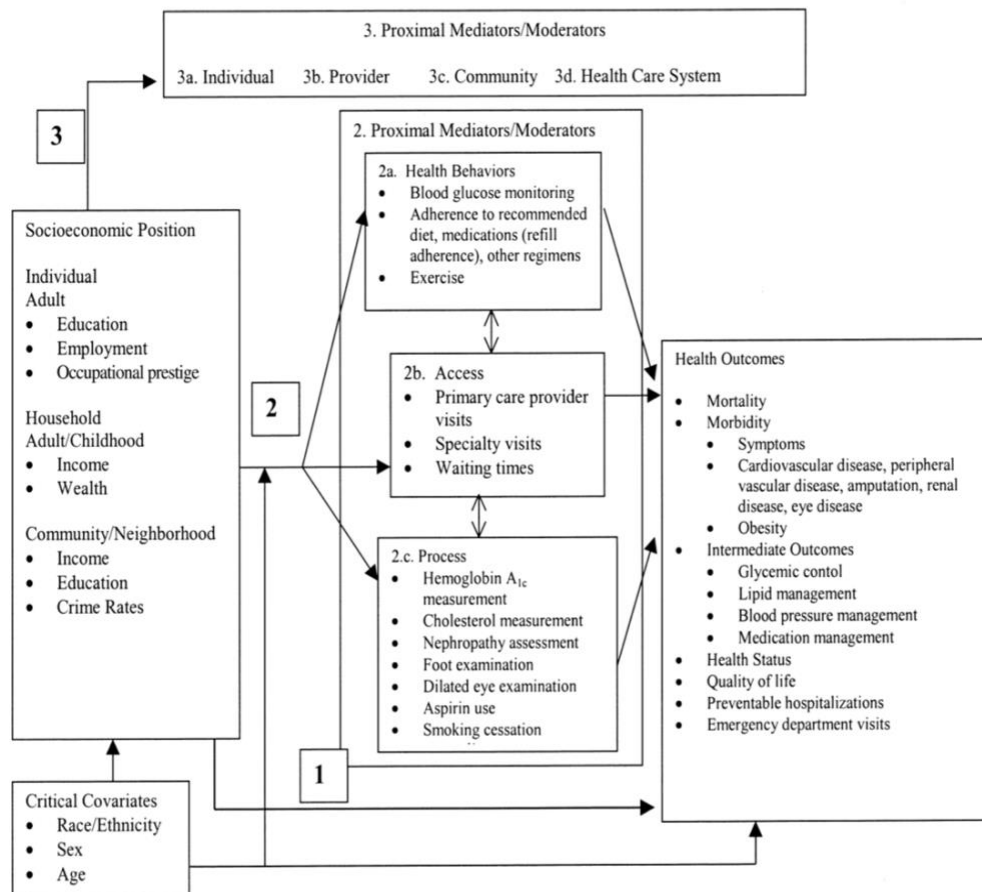
NIMHD provided this model to specify the importance of multiple levels of influence and to highlight the need for research to move toward a multilevel focus for

health disparities research (Alvidrez et al., 2019). This model provides an illustration for the complex nature of factors that influence minority health across the life span and is therefore not readily testable as an explanatory model. For this reason, this integrative review will draw in part from this model to develop a testable framework for understanding barriers to diabetes care for inner-city African Americans.

### 2.3.3 Brown Model

The Brown model was developed in 2004 to illustrate the role of SEP in diabetes outcomes. Based on evidence from the literature, this model demonstrates how SEP exerts influence through proximal factors on diabetes outcomes (Brown et al., 2004).

Figure 3. Brown Model



Placing individual factors and community factors within the construct of SEP, the Brown Model posits that SEP serves as the antecedent for poor diabetes outcomes over the life course (Brown et al., 2004). The individual level factors specified in this model are broadly defined and include education, employment, and occupational prestige. Additionally, household components at an income and wealth level are characterized as individual level factors. Community also includes income and education at the community level, as well as crime. The proximal factors in this model are characterized as either a moderator or mediator to diabetes outcomes and include diabetes specific health behaviors such as self-monitoring, adherence to treatment plan, and physical activity. Additionally, access to care and process measures are also considered in this model to be proximal factors. Process measures include quality of care measures for diabetes such as having an A1C test completed, cholesterol measurement, smoking cessation, and foot exams.

Since its development, the Brown model has been tested and validated for diabetes populations and has demonstrated that community level factors have a direct impact on glycemic control (Smalls et al., 2017). For example, one study found that among a predominately African American sample of 600 adults with diabetes, neighborhood social cohesion as well as food insecurity had a direct impact on A1C level (Smalls et al., 2017). This study also found that food insecurity indirectly impacted A1C through adherence behaviors, specifically for medication. Interestingly, this study did not find crime or neighborhood violence to have an effect on diabetes outcomes in this model, however this study sample reported low rates of crime and violence and was not conducted in an urban or inner-city environment where crime rates or violence may

be more prevalent (Smalls et al., 2017). Another study testing the Brown model in a diabetes population found that individual level factors such as number of hours worked, and beliefs and attitudes are directly related to A1C (Walker et al., 2014). Number of hours worked suggests the role of time and scheduling for following self-management behavior, as well as time for provider visits. While the Brown model was primarily designed to explain the role of SEP in diabetes outcomes, the evidence above suggests that both individual level, and community level factors may independently impact diabetes outcomes.

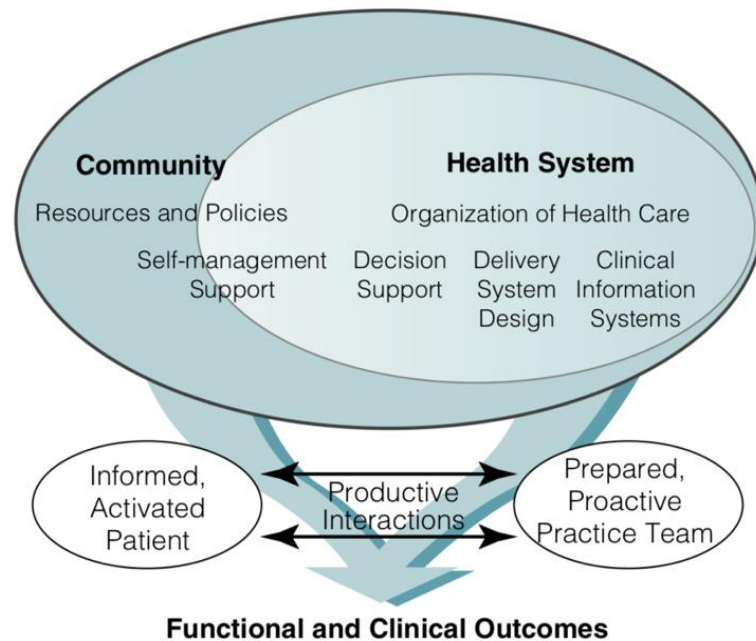
#### 2.3.4 Chronic Care Model (CCM)

The CCM was developed in the 1990s primarily to address the complex needs that many patients with chronic illness face but that are often not addressed during the clinical encounter (Wagner et al., 2001). The CCM is comprised of 6 major areas that are critical for optimizing care for chronic diseases such as diabetes (Wagner et al., 2001). These include: delivery of care; support for self-management; support for decision making; information systems to inform care team; community resources; and service delivery systems for a quality focused health system. This model places the health system within the broader community setting and emphasizes the importance of linked resources between the health system and the community (Wagner et al., 2001). Another emphasis of the CCM is the need for self-management support and decision support. Self-management support can include goal setting, problem solving, and empowerment through improved self-efficacy in self-management (Wagner et al., 2001), provided through the health system via the care team. Decision support is characterized as clinical decision support and involves feedback loops where collaborative decision



making between provider and patient informs care as well as the provider being informed by evidence-based practice for clinical decision making (Wagner et al., 2001).

Figure 4. Chronic Care Model



The overarching premise of CCM is that when the health system can leverage community resources to enhance support for the chronically ill, patient outcomes improve, and care becomes more patient-oriented (Wagner et al., 2001). The CCM has been widely studied in diabetes research and evidence supports the use of CCM for improved diabetes management within primary care settings (Baptista et al., 2016). A recent systematic review examined use of the CCM for interventions in diabetes and found that elements of the 6 major areas are often selected as a single focus for intervention development and delivery (Baptista et al., 2016). Specifically, self-care support; decision support; information systems; and service delivery systems. Of note, no study evaluated in the systematic review found community resources incorporated

into intervention development for diabetes (Baptista et al., 2016). Synthesis of findings showed that studies whose focus was placed on a single element of the CCM for diabetes, rather than multiple levels, did not demonstrate clinical improvements post intervention, suggesting the need for a multifaceted approach that incorporate multiple components of the CCM (Baptista et al., 2016).

### 2.3.5 Strengths and Weakness of the Brown Model and CCM

The Brown model is strengthened by its focus on individual and community factors that contribute to diabetes outcomes. Specifically, evidence has demonstrated this model is an effective explanatory model for understanding outcomes for African American adults with diabetes. The Brown model places individual and community level factors into a single construct and while important for conceptualizing SEP and its impact on health outcomes, may limit the ability to understand the multilevel influences that inner-city African Americans face when it comes to diabetes care. Additionally, the Brown model is limited by not including health system factors as an independent level of influence and does not illustrate how the levels interact to impact diabetes outcomes among inner-city African Americans.

A major strength of the CCM is the placement of the health system within the broader community. This allows for leveraging between these two levels of influence to optimize outcomes for chronic disease, such as diabetes. While the CCM serves as a broad model, its primary focus is on factors that affect chronic disease at the health systems level. Much of the literature using the CCM for diabetes specific interventions focus on factors independently to the exclusion of others. For example, while community level resources are characterized as important factors that promote the

health system, little has been done to incorporate these factors into health systems interventions (Baptista et al., 2016). Another limitation of the CCM is not accounting for the individual level factors that contribute to both the community level factors as well as the system level factors for diabetes care.

Taken together, the Brown model and the CCM specify important constructs that are critical for understanding and explaining health disparities for diabetes, however both are limited by not accounting for important levels of influence where barriers may exist, which may lead to a fragmented approach to addressing barriers, particularly for vulnerable populations such as inner-city African Americans. Specifically absent from the Brown model is the health system as an independent level of influence. Absent from the CCM is an individual level influence. Additionally, while both models specify multiple levels of influence, current focus is placed at testing independent associations with diabetes outcomes and do not account for a multi-level process of influence.

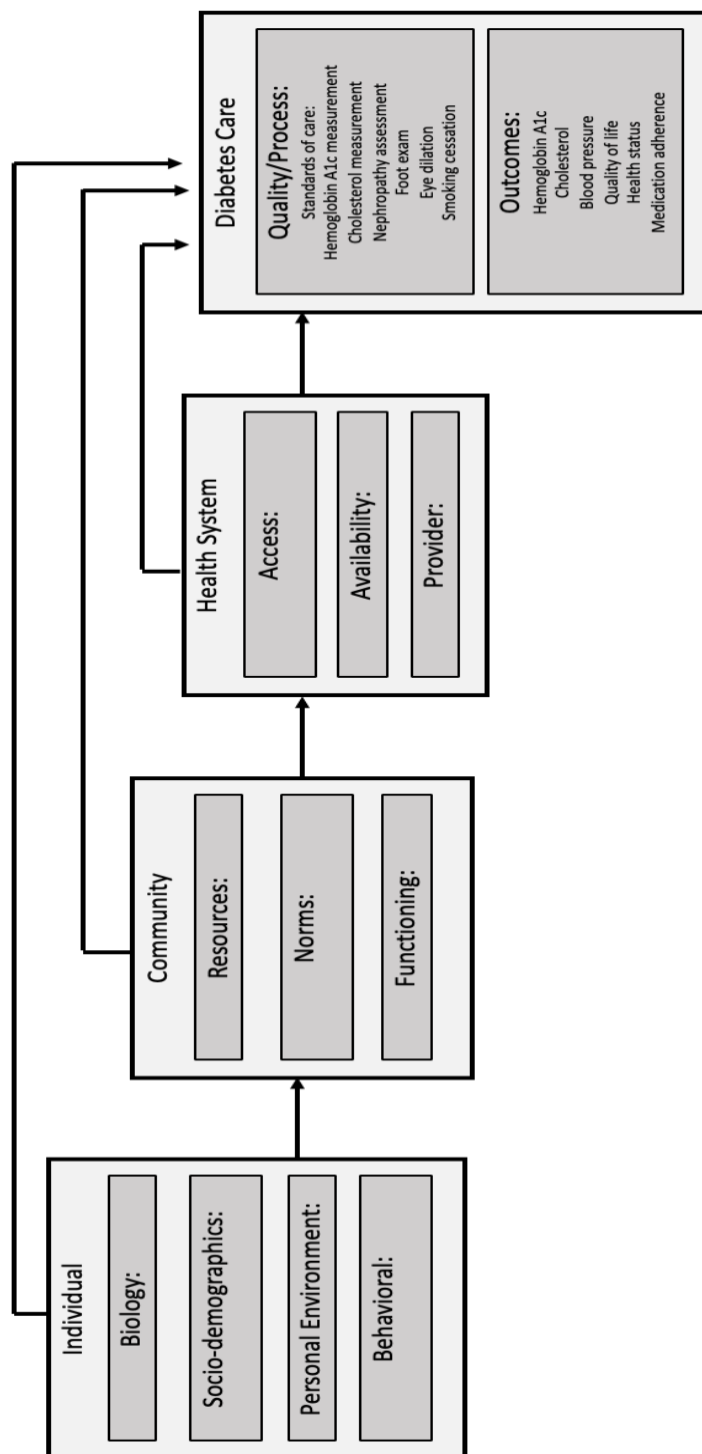
#### 2.3.6 Integration of Behavioral Models (Proposed Integrated Framework for Understanding Barriers to Diabetes Care for Inner-City African Americans)

Taking the strengths of Brown model and the CCM, a new proposed framework for explaining diabetes outcomes and care among inner-city African Americans is proposed in **Error! Reference source not found.**below. **Error! Reference source not found.** shows the individual level, the community level, and the health systems level as separate levels of influence that are proposed to have direct impact on diabetes care. **Error! Reference source not found.** incorporates all elements from the Brown model with the exception of health outcomes. What Brown specifies as process measures are included as outcomes in **Error! Reference source not found.**, consistent with ADA

guidelines. What Brown specifies as household, are included as Personal Environment in **Error! Reference source not found.**, consistent with NIMHD characterization.

Health behaviors as seen in the Brown model are included under the individual level of influence as is consistent with diabetes specific behaviors. **Error! Reference source not found.** also incorporates the major constructs from the CCM as well. Specifically, community and health system as two main levels of influence. Factors within the community and health system level as specified by the CCM include resources and policies, self-management support, organization of the health care system, decision support, delivery system design, and clinical information systems. These health systems factors specified by the CCM are characterized under provider in **Error! Reference source not found.**, and self-management support is included in the final model under access.

Figure 5. Proposed Integrated Framework for Understanding Barriers to Diabetes Care for Inner-City African Americans



The NIMHD model served to frame findings from this literature review therefore additional elements drawn from the NIMHD model were dependent upon factors identified from the literature review. Biology, socio-demographics, personal environment, and behavior are all specified as individual level constructs. At the community level, resources, norms, and functioning are the specified constructs. Health system level constructs include access, availability, and provider. Diabetes care represents the outcome and includes both quality/process and diabetes specific outcomes. Taken together, Figure 5 represents a new proposed framework that harnesses the strengths of the Brown and CCM and is informed by the NIMHD model.

Given the complex interplay of barriers that inner-city African Americans may experience when it comes to managing diabetes and achieving optimal outcomes, using the combined strengths of the Brown model and the CCM allows for understanding and explaining multi-level barriers. This framework in Figure 5 integrates levels of influence and constructs. Factors for each construct that serve as barriers to diabetes care will be informed by the findings of the review and will be further integrated into a final model.

## **2.4 Methods**

### **2.4.1 Study Selection and Data Collection**

The process for conducting this integrative review was drawn from Souza et al. (2010) who specifies four phases for conducting an integrative review that include: phase 1- preparing the guiding question; phase 2- searching or sampling the literature; phase 3- data collection through extraction; and phase 4- critical analysis of the studies included (Souza et al., 2010). For the purposes of this review, phases were slightly modified, and three additional phases were included. The final process for this

integrative review included: phase 1- preparing the guiding question; phase 2- identify theory and behavioral models to explain phenomenon; phase 3- integrate behavioral models; phase 4- searching or sampling the literature; phase 5- data collection through extraction; phase 6- critical analysis of the studies included; phase 7- final synthesis of evidence and model development. Phase 2- searching the literature, followed PRISMA guidelines (Moher et al., 2015) for identification, screening, eligibility, and selection for final synthesis of the literature search.

#### 2.4.2 Information Sources, Eligibility Criteria, and Search

Information sources, eligibility criteria, search strategy, and the extraction form (Appendices), were established a priori. A reproducible search strategy was used to identify studies meeting eligibility criteria for articles that examined diabetes care for inner-city African Americans. Three databases were used to identify articles, these include Pubmed, PsychInfo, and CINAHL. The search did not include a date parameter and was conducted up to March 2019. Table 1 outlines the search terms used. This review used Medical Subject Heading (MeSH) terms, all MeSH terms were validated prior to use using the Cochrane MeSH Database. MeSH terms were identified for individual level barriers, community level barriers, and health system level barriers. Additionally, MeSH terms were identified for diabetes, the population of interest (inner city African Americans), and the outcomes of interest. Separate searches were conducted for individual level barriers, community level barriers, and health system level barriers each with terms for diabetes, population, and outcomes.

**Table 1. Search Terms**

MeSH Terms – Diabetes	MeSH Terms – Population	MeSH Terms – Barrier Level: Individual	MeSH Terms – Barrier Level: Community	MeSH Terms – Barrier Level: Systems	Outcomes
Diabetes Mellitus, Type II Type 2 Diabetes Mellitus Type 2 Diabetes Diabetes, Type 2 Diabetes Mellitus, Adult-Onset Diabetes Mellitus, Adult Onset Diabetes Mellitus, Type 2/ethnology Diabetes Mellitus, Type 2/blood Diabetes Mellitus, Type 2/complications Diabetes Mellitus, Type 2/therapy* Glycated Hemoglobin A/analysis Diabetes Mellitus, Type 2/nursing*	African Americans* Urban Population*	Socioeconomic Factors Social Support* Health Behavior Health Status Health Knowledge, Attitudes, Practice Health Status Indicators Attitude to Health Educational Status Employment Educational Status Income Insurance, Health Cultural Characteristics Social Class	Neighborhoods Residence Characteristics Environment Designs Poverty Areas* Housing Poverty* Poverty Areas Crime Housing/standards Prejudice* Race Relations* Social Justice* Social Environment Social Segregation	Access to health care Access to information Accessibility to health services Accessibility, Health Services Health services Health services availability Health services accessibility Community Health Systems Health System, Community Acceptability of Health Care Patient Acceptance of Healthcare Health Services Needs and Demand Medically Uninsured Uncompensated Care Physician-Patient Relations Quality of Health Care Hospitals, County Outpatient Clinics, Hospital Patient Education as Topic Quality of Health Care	Blood Glucose Self-Monitoring Diet Exercise Diet therapy Self-care Glycated Hemoglobin A Blood Glucose Self-Monitoring Medication Adherence Smoking Quality of Life Blood Pressure Lipids

\*Indicates exploded term



Results from each search were then combined into a final database using EndNote where duplicates were then removed, see **Table 2**.

**Table 2. Search Summary**

System terms					
	Diabetes Terms	Population Terms	Barrier Terms	Outcome Terms	Final Combined
<b>Pubmed</b>	129995	103275	7488870	616036	602
<b>CINAHL</b>	12386	26046	920188	296570	12
<b>PsycInfo</b>	9529	21569	39203	80118	46
					<b>638</b>
Community terms					
	Diabetes Terms	Population Terms	Barrier Terms	Outcome Terms	Final Combined
<b>Pubmed</b>	129995	103275	366353	616036	96
<b>CINAHL</b>	12386	26046	776140	296570	8
<b>PsycInfo</b>	9529	21569	51380	80118	21
					<b>115</b>
Individual terms					
	Diabetes Terms	Population Terms	Barrier Terms	Outcome Terms	Final Combined
<b>Pubmed</b>	129995	103275	1420251	616036	316
<b>CINAHL</b>	12386	26046	1804874	296570	72
<b>PsycInfo</b>	9529	21569	143732	80118	90
					<b>430</b>
Total combined					<b>1183</b>
After removing duplicates					<b>738</b>

\* Filters: Human, English, Adult age 18 years or older

The inclusion criteria used for this review included the following: 1) published in English; 2) adult population at least 18 years of age; 3) sample population African American living in an inner-city environment, as specified in sample characteristics of each article; 4) type 2 diabetes; 5) at least one of the following diabetes outcomes were measured and reported in findings— diet; physical activity; self-monitoring; medication adherence; glycemic control including A1C or fasting glucose; lipids; blood pressure, and quality of life. Studies were excluded if they were not available in English and/or

were conducted outside of the US. Additionally, studies that examined racial differences in diabetes outcomes were excluded, as the primary focus of this review is to identify barriers to care. Clinical outcomes were selected based on clinical guidelines for diabetes care and standard of care measures set by the ADA. Qualitative studies as well as published reviews were also included in this review and selection criteria was the same, with the exception of outcomes where inclusion criteria included one or more of the selected diabetes outcomes being an objective or aim rather than measurement. This is consistent with Whitemore and Knafl (2005) definition of integrative reviews that incorporates the both qualitative, reviews, and quantitative data to present a complete picture of a phenomenon under study (Whitemore & Knafl, 2005).

Procedures for including studies began with a title and abstract review. The inclusion criteria listed above was used in the form of a checklist for study inclusion. Following completion of the title and abstract review, full text articles were then included for review. If after full text review, papers were found that did not meet the inclusion criteria, they were excluded. **Table 3. Summary of Articles by Design and Barrier Level** and **Table 4. Summary of Articles by Outcome and Barrier Level** summarize the final list of papers included for synthesis.

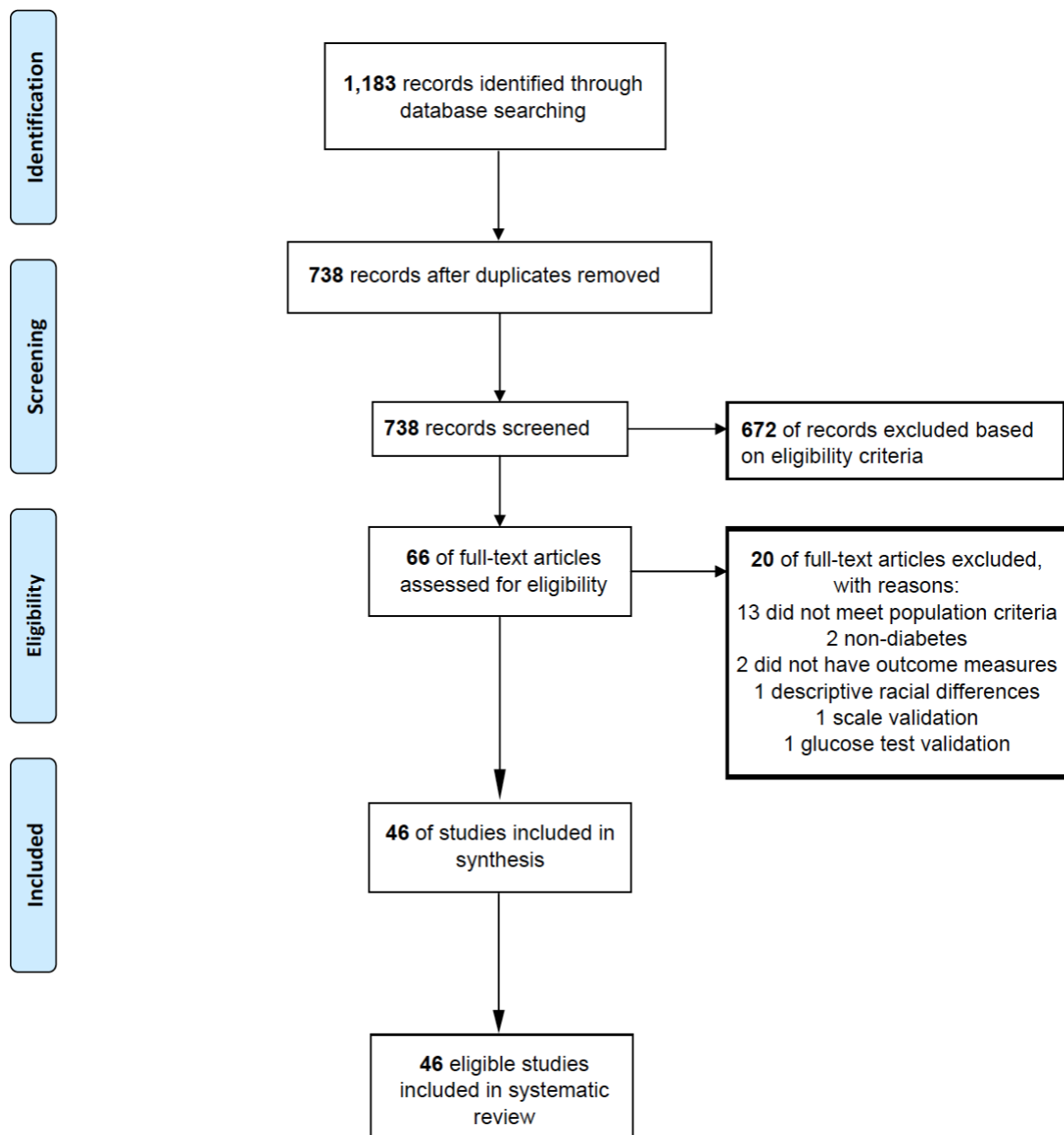
## **2.5 Results**

### **2.5.1 Study Selection**

Results for the identification, screening, eligibility, and final synthesis are shown in Figure 6. Records identified through the three searches in Pubmed, PsychInfo, and CINAHL returned 1183 articles. After duplicates were removed, 738 articles remained for screening. These 738 articles were screened using a title and abstract review based on the aforementioned inclusion criteria. After screening for eligibility, 66 articles met inclusion criteria and were included for full text review. Of these 66, 20 articles were excluded with reasons, see

*Figure 6.* A total of 46 articles were included for synthesis.

Figure 6. Prisma Flow Diagram



### 2.5.2 Study Characteristics and Outcomes of Studies

Tables 3 and 4 summarize the results of each study that met eligibility criteria. Table 3 summarizes articles by study design and barrier level. Articles varied by study design and included 18 cross-sectional designs, 11 experimental studies, 11 qualitative studies, and 6 cohort studies. There were no review articles that met full inclusion criteria and no quasi-experimental studies that met inclusion criteria. Across the 46 studies, individual level barriers were the most common with 34 of the 46 studies including individual level barriers, 27 including health system barriers, and 9 including community level barriers. Of the 46, 19 included 2 or more barriers, and only 5 included all 3 barrier levels.

**Table 3. Summary of Articles by Design and Barrier Level**

Author/Year	Study Design					Barrier Level		
	Cross Sectional	Cohort	Quasi- experimental	Experimental	Qualitative	Individual	Community	Health System
Balukonis et al., 2008	X					X		
Batts et al., 2001				X		X		X
Calvin et al., 2011	X					X		
Carter et al., 2011				X		X		X
Chard et al., 2017					X	X	X	X
Chlebowy et al., 2010					X	X	X	X
Cook et al., 2001		X				X		X
Cook et al., 2006		X				X		
Crabtree et al., 2015					X	X		X
Dalewitz et al., 2000	X					X		X
Welch et al., 2003	X					X		
DeNisco, 2011	X					X		
El-Kebbi et al., 1996					X	X		
El-Kebbi et al., 1997		X						X

Table continued.

Author/Year	Study Design					Barrier Level		
	Cross Sectional	Cohort	Quasi-experimental	Experimental	Qualitative	Individual	Community	Health System
El-Kebbi et al., 2003		X				X		X
Erdman et al., 2002		X						X
Fitzpatrick et al., 2016				X				X
Gary et al., 2000	X					X		
Gary et al., 2009				X				X
Gong et al., 2008	X					X		
Hill-Briggs et al., 2002	X					X	X	
Hill-Briggs et al., 2003					X	X		X
Hill-Briggs et al., 2005	X					X		X
Hill-Briggs et al., 2006	X					X		
Jaber et al., 1996				X		X		X
Lee et al., 2016					X	X	X	X
Mancuso, 2010	X					X		X
Mbaezue et al., 2010	X					X		



Table continued.

Author/Year	Study Design					Barrier Level		
	Cross Sectional	Cohort	Quasi- experimental	Experimental	Qualitative	Individual	Community	Health System
McDonald et al., 2002	X					X		
Miller et al., 2003				X				X
Musselman et al., 2014				X		X		
Pearte et al., 2004	X					X		
Pollard et al., 2014					X	X	X	
Ramsay Wan et al., 2012					X	X	X	X
Rhee et al., 2005	X							X
Rhee et al., 2005	X					X		
Richardson et al., 2015					X	X	X	X
Shaw et al., 2006	X						X	X
Skelly et al., 1995		X				X		
Spencer et al., 2011				X				X
Wagner et al., 2011					X		X	
Wallace et al., 2017					X	X		X

Table continued.

Author/Year	Study Design					Barrier Level		
	Cross Sectional	Cohort	Quasi- experimental	Experimental	Qualitative	Individual	Community	Health System
Wanko et al., 2004	X					X		
Welch et al., 2015				X				X
Ziemer et al., 1996				X				X
Ziemer et al., 2003				X				X

**Table 4. Summary of Articles by Outcome and Barrier Level** Summarizes articles by outcome measures and barrier level. Of the 46 articles, 20 included 2 or more outcome measures. Glycemic control was the most common outcome measure for studies examining individual level barriers and health system barriers, followed by self-monitoring.

Table 4. Summary of Articles by Outcome and Barrier Level

Author/Year	Outcomes								Barrier Level		
	Diet	PA	SM	MA	GC	Lipids	BP	QOL	Individual	Community	Health System
Balukonis et al., 2008					X	X		X	X		
Batts et al., 2001			X		X				X		X
Calvin et al., 2011					X				X		
Carter et al., 2011			X		X		X		X		X
Chard et al., 2017			X						X	X	X
Chlebowy et al., 2010			X						X	X	X
Cook et al., 2001					X				X		X
Cook et al., 2006					X				X		
Crabtree et al., 2015	X								X		X
Dalewitz et al., 2000					X				X		X
Welch et al., 2003	X		X						X		
DeNisco, 2011		X			X				X		
El-Kebbi et al., 1996	X								X		
El-Kebbi et al., 1997					X						X
El-Kebbi et al., 2003					X				X		X

PA=Physical activity; SM=Self-monitoring; MA=Medication adherence; GC=Glycemic control; BP=Blood pressure; QOL=Quality of life

Table continued.

Author/Year	Outcomes								Barrier Level		
	Diet	PA	SM	MA	GC	Lipids	BP	QOL	Individual	Community	Health System
Erdman et al., 2002					X	X					X
Fitzpatrick et al., 2016			X		X	X	X				X
Gary et al., 2000					X	X			X		
Gary et al., 2009					X						X
Gong et al., 2008					X				X		
Hill-Briggs et al., 2002					X	X	X	X	X	X	
Hill-Briggs et al., 2003			X	X					X		X
Hill-Briggs et al., 2005				X	X	X	X		X		X
Hill-Briggs et al., 2006		X	X	X	X				X		
Jaber et al., 1996					X				X		X
Lee et al., 2016	X								X	X	X
Mancuso, 2010					X				X		X
Mbaezue et al., 2010			X	X					X		
McDonald et al., 2002					X				X		

PA=Physical activity; SM=Self-monitoring; MA=Medication adherence; GC=Glycemic control; BP=Blood pressure; QOL=Quality of life

Table continued.

Author/Year	Outcomes								Barrier Level		
	Diet	PA	SM	MA	GC	Lipids	BP	QOL	Individual	Community	Health System
Miller et al., 2003					X						X
Musselman et al., 2014					X				X		
Pearte et al., 2004		X			X	X			X		
Pollard et al., 2014	X								X	X	
Ramsay Wan et al., 2012			X						X	X	X
Rhee et al., 2005					X						X
Rhee et al., 2005					X				X		
Richardson et al., 2015	X		X						X	X	X
Shaw et al., 2006			X							X	X
Skelly et al., 1995	X	X	X	X					X		
Spencer et al., 2011	X	X	X	X	X	X	X				X
Wagner et al., 2011	X		X		X					X	
Wallace et al., 2017				X					X		X
Wanko et al., 2004		X							X		

PA=Physical activity; SM=Self-monitoring; MA=Medication adherence; GC=Glycemic control; BP=Blood pressure; QOL=Quality of life

Table continued.

Author/Year	Outcomes								Barrier Level		
	Diet	PA	SM	MA	GC	Lipids	BP	QOL	Individual	Community	Health System
Welch et al., 2015			X		X						X
Ziener et al., 1996					X						X
Ziener et al., 2003	X				X	X					X

PA=Physical activity; SM=Self-monitoring; MA=Medication adherence; GC=Glycemic control; BP=Blood pressure; QOL=Quality of life

### 2.5.3 Individual Level Barriers

Individual level barriers were the most commonly cited barriers to diabetes care for inner-city African Americans across the 46 studies. These barriers varied widely with approximately 30 unique individual level barriers identified. The most common individual level barriers discussed included household factors (Balukonis et al., 2008; Batts et al., 2001; El-Kebbi et al., 1996; Hill-Briggs et al., 2003; Pollard et al., 2014; Richardson et al., 2015), health literacy (Dalewitz et al., 2000; Mancuso, 2010; Mbaezue et al., 2010; Rhee et al., 2005a), lack of knowledge (Calvin et al., 2011; Carter et al., 2011; Lee et al., 2016), depression, (Manusco et al., 2010; Musselman et al., 2014; Crabtree et al., 2015) and diabetes awareness (Calvin et al., 2011; Carter et al., 2011; El-Kebbi et al., 1996). Household factors primarily were characterized as the challenges that arise from having to adhere to dietary guidelines for diabetes and being the only family member needing to do so, often resulting in cooking two separate meals or not adhering to diet recommendations at all. When examining disease awareness and knowledge, one study found that most of the study population was at risk for developing diabetes complications as indicated by poor glycemic control and blood pressure, however indicated that they did not believe they were at risk (Calvin et al., 2011). Additionally, 65% of the study population reported that they did not see diabetes as being permanent (Calvin et al., 2011).

Other individual level barriers included competing demands (Balukonis et al., 2008; Chard et al., 2016; Chlebowy et al., 2010; El-Kebbi et al., 1996), personal control (Chard et al., 2016; Chlebowy et al., 2010; Wan et al., 2012), food preferences (Lee et al., 2016; Richardson et al., 2015), and lack of resilience (DeNisco, 2011). One study



found that resilience was significantly related to improved glycemic control among inner-city African Americans compared to those who reported low resilience (DeNisco, 2011). The role of culture was also identified as an important barrier (Welch et al., 2003; Richardson et al., 2015). For example, one study found that among participants who identified with traditional African American culture, lower adherence to dietary recommendations was observed (Welch et al., 2003). Another barrier that was identified was history of drug use (Wallace et al., 2017). Specifically, a qualitative study reported that patients with a history of drug use report intentional non-adherence to medications and insulin due to fear of relapse and fear of relying on a drug for a sense of well-being, even though medications are diabetes specific, patients reported seeing them as the same as taking drugs to alter physiological state (Wallace et al., 2017). Other barriers identified include time for self-management (Wanko et al., 2004), self-efficacy and the lack of confidence in performing self-management behaviors (Skelly et al., 1995), pain with self-glucose monitoring (Wanko et al., 2004), fear of self-glucose monitoring (Chlebowsky et al., 2010), past trauma (Chard et al., 2017), and stress (Richardson et al., 2015). Additionally, perception of self-management recommendations was identified as a barrier, specifically, the belief that performing recommended physical activity levels may result in weight gain due to increased appetite (Pearte et al., 2004). One study found that individuals reporting the belief that exercise will increase appetite and lead to weight gain was associated with lower activity levels (Pearte et al., 2004).

#### 2.5.4 Community Level Barriers

Community level barriers identified included 9 unique barriers. The most commonly cited barrier to diabetes care at the community level included the role of

support, or lack of support (Hill-Briggs et al., 2002; Shaw et al., 2006; Chlebowy et al., 2010; Pollard et al., 2014). For the purposes of this review, social support was included within the construct of functioning within the community level (Figure 5). While there is evidence for social support at the individual level, this current integrative review characterized social support based on the Hobfoll (1988) definition that social support is a process of social integration and supportive interactions through a process that embeds individuals within a social system (Hobfoll, 1988).

Support was identified as being primarily diabetes specific and was characterized through family support and peer support for self-management behaviors. For family support, one qualitative study found that female family members served as diabetes management supporters through providing support for medication adherence (Chlebowy et al., 2010). Participants reported that because this support was available, regular medication adherence occurred. This same study described the role of peer support for diabetes (Chlebowy et al., 2010). Specifically, participants described that a lack of peer networking with others who have diabetes for physical activity made adherence to physical activity challenging (Chlebowy et al., 2010).

In a cross-sectional study that assessed level of support among inner-city African Americans, participants reporting social support as well as neighborhood specific support were more likely to engage in recommended self-management behaviors (Shaw et al., 2006). Neighborhood specific support was characterized as talking with neighbors who have experiences living with diabetes, spending time with neighbors during activities such as barbecues, exercising with neighbors, or sharing and discussing dietary recommendations with neighbors (Shaw et al., 2006).

Another frequently cited community level barrier included the food availability and food affordability (Chard et al., 2016; Lee et al., 2016). For example, one qualitative study exploring barriers to healthy eating for diabetes found that participants reported the primary reason for not adhering to a diabetes recommended diet was due to the local stores not stocking the recommended food (Lee et al., 2016). Additionally, when the recommended food was available, cost then became the barrier (Lee et al., 2016). Other community level barriers included access to transportation (Ramsay-Wan et al., 2012; Richardson et al., 2015), neighborhood safety that impacts engaging in physical activity (Chard et al., 2016), crime (Hill-Briggs et al., 2002), community norms such as discrimination and racism (Wagner et al., 2011). Wagner et al. (2011) found in a qualitative study that participants reported that racism impacted their ability to optimize self-management through increased stress, anger, and eating in order to cope with the stress (Wagner et al., 2011).

#### 2.5.5 Health System Level Barriers

Of the studies that included health system level barriers, 11 unique barriers were identified. The most frequently cited health system level barrier discussed was the role of management and decision support at the health systems level (Fitzpatrick et al., 2016; Gary et al., 2009; Jaber et al., 1996; Spencer et al., 2011; Welch et al., 2015; Ziemer et al., 1996; Chlebowy et al., 2010; Crabtree et al., 2015; Richardson et al., 2015; El-Kebbi et al., 1997; Erdman et al., 2003). This included nurse case management (Fitzpatrick et al., 2016; Gary et al., 2009; Spencer et al., 2011; Welch et al., 2015; Ziemer et al., 1996; Richardson et al., 2015; Erdman et al., 2002), pharmacist management support (Jaber et al., 1996), and physician management support

(Chlebowy et al., 2010; Crabtree et al., 2015; El-Kebbi et al., 1997). This level of support was characterized as phone calls or in person meetings with a provider to discuss strategies to address high glucose readings, titration of medication based on glucose readings, and education and problem solving.

Another health system level barrier that was also commonly discussed was the role of communication between patients and physicians (Dalewitz et al., 2000; Carter et al., 2011; Lee et al., 2016). This included communication about tests being ordered such as A1C tests, as well as discussing patient history including social factors that impacted adherence to treatment plans. Specifically, one study found in a cross-sectional study that the majority of participants did not know what an A1C measurement was and most did not know whether they had had an A1C check even though their patient records indicated one had been ordered (Lee et al., 2016). While this may speak to patient awareness and knowledge, in this study the provider ordered the test and these findings indicate lack of communication on two levels. First, during the clinical encounter when orders for a test should be discussed with a patient, and second, after the clinical encounter to discuss results of the test. This lack of communication also suggests that patients are not involved in their care management plan as A1C tests, among other diabetes outcome measures, are used to set care management goals and alert the patient to potential risk for complications.

Other barriers included cost of supplies and accessing benefits (Hill-Briggs et al., 2005; Batts et al., 2001; Hill-Briggs et al., 2003), the role of trust (Mancuso, 2010; Carter et al., 2011; Chard et al., 2016), physician knowledge and awareness (Hill-Briggs et al., 2005; Chlebowy et al., 2010; Crabtree et al., 2015; Wallace et al., 2017), the ability to

make appointments and be seen in a timely manner (Rhee et al., 2005; Ziemer et al., 1996; Hill-Briggs et al., 2003; Ramsay-Wan et al., 2012), and delay in treatment for poorly controlled diabetes (Chard et al., 2016; Cook et al., 2001; El-Kebbi et al., 1997). Physician knowledge and awareness varied widely, for instance, one qualitative study where patients discussed history of drug use as a barrier to medication adherence, reported that the lack of history awareness by the physician was also a barrier to adhere (Wallace et al., 2017). This suggests the complexity that some patients face with specific barriers such as having a history of drug use that may cross levels of influence. For example, the individual decision to avoid medications due to a history of drug use, lack of trust in providers in order to disclose specific history, and lack of effective communicating to gain an understanding for the lack of adherence.

Other factors relating to physician knowledge and awareness related to medication refills (Hill-Briggs et al., 2002). For example, Hill-Briggs et al. (2005) found in a cross-sectional study that physicians not calling in a refill was a factor contributing to medication non-adherence for patients (Hill-Briggs et al., 2002).

#### 2.5.6 Intervention Studies

Of the 46 studies, 11 studies tested an intervention to improve diabetes outcomes among inner-city African Americans. Of these 11, 7 interventions addressed barriers at the health systems level only (Fitzpatrick et al., 2016; Gary et al., 2009; Miller et al., 2003; Spencer et al., 2011; Ziemer et al., 2003), 3 interventions addressed barriers at both the individual and health systems level (Batts et al., 2001; Carter et al., 2011; Jaber et al., 1996), and 1 intervention addressed barriers at the individual level only (Musselman et al., 2014). Six of the 7 interventions that addressed barriers at the

health systems level demonstrated significant reductions in A1C post intervention among the intervention group. These 6 interventions focused on providing self-management support at the health systems level (Fitzpatrick et al., 2016; Gary et al., 2009; Spencer et al., 2011; Welch et al., 2015; Ziemer et al., 1996; Ziemer et al., 2003). One study provided physicians with tools to receive decision support at the clinic level via a rapid A1C test, no significance on patient outcomes were observed (Miller et al., 2003).

The 3 interventions addressing barriers at the individual and health systems level utilized case management (Batts et al., 2001; Carter et al., 2011; Jaber et al. 1996). One study used pharmacist case management approach (Jaber et al., 1996), one study used nurse case management (Batts et al., 2001), and one study used nurse case management via telehealth (Carter et al., 2011). Results of the pharmacist case management intervention showed that use of a high intensity management led by a pharmacist improved glycemic control (Jaber et al., 1996). Patients met with a pharmacist weekly until glycemic control was achieved where the pharmacist provided one on one education and glycemic management support for patients (Jaber et al., 1996).

The traditional face to face nurse case management intervention (Batts et al., 2001) allowed patients to specify their greatest needs and challenges that they wanted to address with their case manager. The results of this study showed that the greatest patient reported diabetes needs included social and household needs as well as accessing benefits (Batts et al., 2001). Cost of diabetes supplies was reported as a barrier for not engaging in self-monitoring activities. Post intervention outcomes showed

significant improvements in healthy eating, physical activity, and medication adherence (Batts et al., 2001).

The nurse case management via telehealth intervention (Carter et al., 2011) provided patients with a laptop equipped for blood pressure monitoring, blood glucose monitoring, and a scale for weight measurement. Patients were given access to an online portal where they could have face to face calls with a nurse case manager where together the nurse and patient would review readings for blood pressure, glucose monitoring, and weight. Behavioral strategies were targeted toward patient readings, and diabetes specific education was provided. The results showed that participants in the intervention group were 4 times more likely to achieve target A1C compared to the control group (Carter et al., 2011).

The intervention to address barriers at the individual level only, involved provision of diabetes education to improve knowledge about diabetes (Musselman et al., 2014). This study found that over the course of 12 months, diabetes education significantly reduced A1C. This study also found that depression was a major predictor of A1C among study participants and that patients with higher depression scores had on average higher A1C levels (Musselman et al., 2014).

#### 2.5.7 Synthesis of Findings

Results from this integrative review summarize the major factors identified in the literature as barriers to care for inner-city African Americans with diabetes at the individual, community, and health systems level. Among barriers for the individual level include lack of knowledge, household factors, depression, health literacy, diabetes awareness, competing demands, food preferences, the role of culture, resilience,

personal control, self-efficacy, trauma, and history of drug use. Among the community level barriers lack of social and peer support, food availability and food affordability, access to transportation, neighborhood safety, crime, and racism. At the health systems level the barriers identified include self-management and decision support, role of trust, physician knowledge and awareness, the ability to make appointments and be seen in a timely manner, and finally delay in treatment.

Individual level barriers were the most common barriers identified based on the findings of this review, however interventions addressing barriers at the individual level were the least represented in these findings. Specifically, this review only found one intervention study that was focused solely at the individual level. Historically individual level interventions have been the focus of intervention development within the field of diabetes, however the results of this search, yielding only one intervention focused at the individual level, may suggest that diabetes interventions among inner-city African Americans do not focus solely at the individual level. While this one intervention focused at the individual level demonstrated reduction in A1C post intervention, other studies found in this review also show significant impact of individual level barriers integrated with health system factors. For example, three interventions addressed individual level barriers along with health system barriers with a primary focus on knowledge at the patient level through education, and self-management support at the health system level. Each of these three studies demonstrated a significant reduction in A1C post intervention.

Health system barriers were the second most common barrier examined based on the findings of this review and the most common barrier addressed in the



interventions. Of interest, self-management support was the most frequently cited barriers at the health system level and was addressed in 6 of the 7 health system interventions and each showed statistically significant reductions in A1C post intervention. The one intervention addressing a health system barrier study that did not show statistically significant reductions in A1C provided decision support to physicians. While these findings suggest the importance of self-management support at the health system level for inner-city African Americans, it does not suggest that decision support interventions are ineffective in this population, rather it may reflect the type of decision support made available to physicians serving this population.

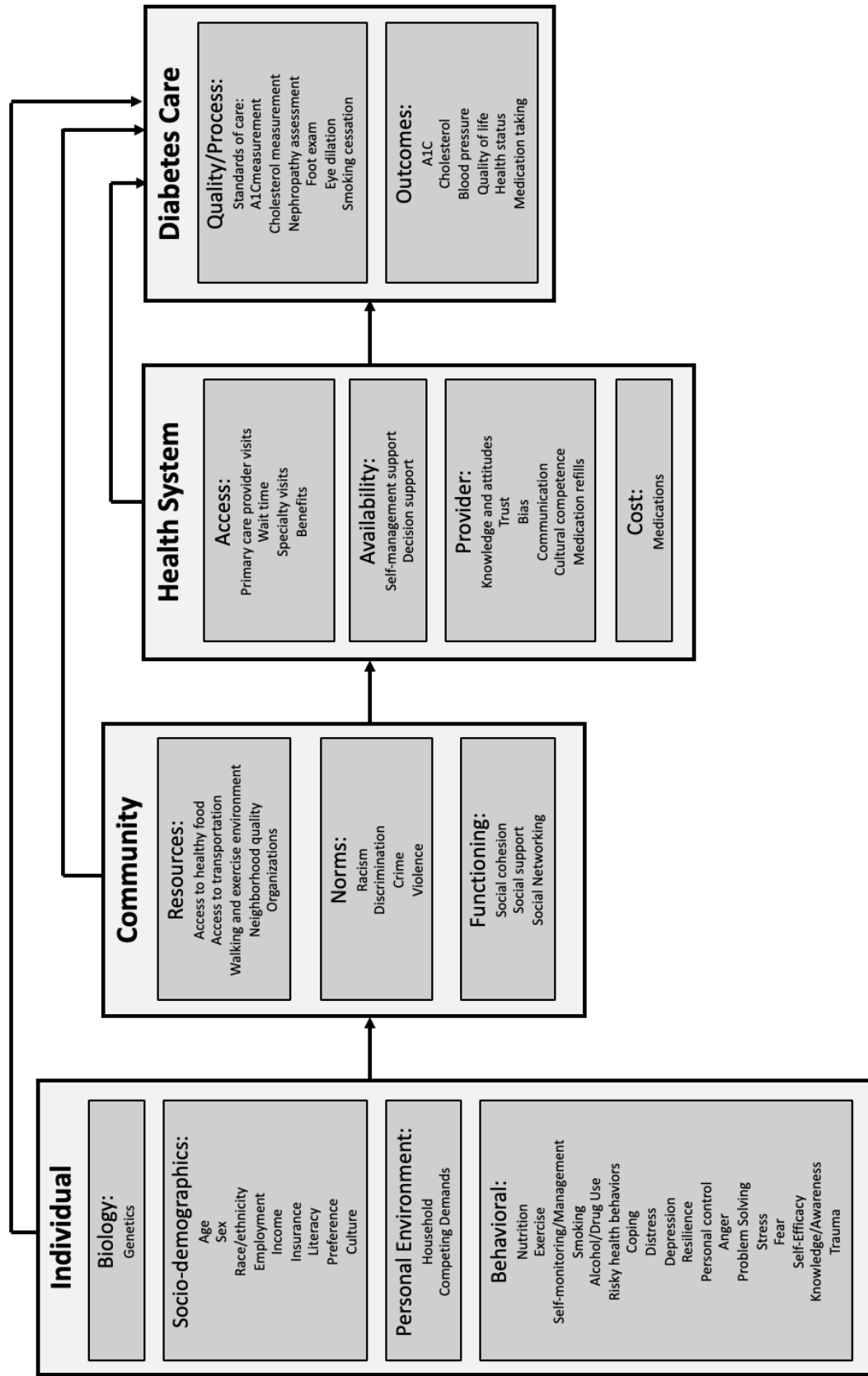
Community level factors were the least common barriers found in this review. Of interest, of the 9 studies that addressed community level barriers, 7 of these studies were qualitative and 2 were cross-sectional. This suggests that interventions are not readily developed that address barriers at the community level or incorporate factors at the community level to leverage existing resources in an individual's natural environment. As inner cities are characterized as distressed urban environments, the lack of studies developing interventions within the community or leveraging community resources may suggest a lack of infrastructure available for developing interventions at the community level. This also points to a major gap in our understanding of effective interventions to address community level barriers impacting diabetes outcomes for inner-city African Americans. Of the two cross-sectional studies examining community level factors, one study found that among those with housing insecurity and reported exposure to street crime had lower quality of life scores and one study found that neighborhood support, social support, and organizational support were significantly

related to higher odds of self-monitoring. These results suggest that community level factors are important considerations for diabetes care for inner-city African Americans, however these findings highlight the gap in our understanding of community level barriers for diabetes.

Taken together, these findings provide specific barriers that occur across three levels of influence for inner-city African Americans with diabetes and provide further support that the Brown model and CCM alone may not be adequate models to address the complex barriers that inner-city African Americans face when it comes to diabetes care. Rather, integration of these models informed by the NIMHD model and evidence from the literature may provide a unified framework that may explain the barriers to diabetes care for this population.

Integration of each factor found in this review has therefore been integrated into *Figure 5*, and further expanded to provide a unified framework for explaining the barriers to diabetes care for inner-city African Americans. See *Figure 7* below.

Figure 7. Final Integrated Framework for Understanding Barriers to Diabetes Care for Inner-City African Americans



## 2.6 Discussion

### 2.6.1 Conclusion and Public Health Relevance

As demonstrated through the literature, diabetes is a complex disease that represents a major public health challenge due to its high prevalence, its association with increased morbidity, and early mortality (CDC, 2020). Inner-city African Americans with diabetes suffer a disproportionate burden of disease due to both economic and social disadvantage that reaches across individual, community, and health system levels of influence. Central to the principles of Public Health is the pursuit of health equity for the elimination of health disparities, specifically in accordance to the “empowerment of disenfranchised community members, aiming to ensure that the basic resources and conditions necessary for health are accessible to all” (Public Health Leadership Society, 2002). To effectively achieve health equity in diabetes for inner-city African Americans and provide the basic resources and conditions necessary for health; establishment of barriers specific to diabetes care is paramount. This can be done by identifying, detecting, and targeting factors through policy and interventions that lead to poor outcomes for diabetes. Evidence from this review is an important step in the pursuit of health equity for inner-city African Americans with diabetes by identifying specific barriers to diabetes care. These barriers are complex and occur across multiple levels of influence. Interventions identified in this review show that among inner-city African Americans with diabetes, focus is placed at the health systems level with very limited focus toward addressing individual and community level barriers, despite individual level barriers being the most common form of barrier discussed.

The findings of this review highlight fragmentation that may be occurring between policy, research, and practice for achieving health equity and addressing health disparities for diabetes care among inner-city African Americans. Specifically, this fragmentation can be seen at two levels. First, while the ADA has called for multi-level interventions to address health disparities in diabetes among vulnerable populations, based on the findings from this review, current interventions for inner-city African Americans with diabetes are focused primarily at the health systems level. Those that do incorporate more than one level are few and limited to inclusion of individual level factors and health system level factors and not community level factors. While the interventions summarized in this review have shown improvements in diabetes outcomes, the lack of integration across levels of influence may be an important factor that allows for disparities to persist over time as change in outcomes may be transient due to a focus on a single level. Specifically, this review identified a number of qualitative studies that were designed to understand the lived experience of diabetes among inner-city African Americans. However, the barriers and themes identified throughout these qualitative studies were not well represented among the interventions identified in this review.

The absence of individuals' lived experiences incorporated into intervention and program development further suggests the important role of social justice in addressing health inequity among inner-city African Americans with diabetes. Specifically, there is a need for greater collaboration, empowerment, and patient centeredness in intervention and program development that takes into account the lived experiences of individuals with diabetes, including the individual level factors, the community level factors, and the

health system level factors. Incorporation of each of these levels from the experiences of those living with diabetes in an inner-city, will allow interventions and programs for diabetes to reach beyond the clinical encounter and include the full sphere of influence for diabetes.

The second level of fragmentation that this review highlights is that ADA policy calls for evidence-based practice, particularly for vulnerable populations who are at risk for poor diabetes outcomes, however based on the findings of this review, evidence for the unique barriers to diabetes care for inner-city African Americans may not be fully incorporated into intervention development and subsequent practice, as suggested by the single level interventions found in this review. Furthermore, the limited data available for community level factors specific to diabetes care among inner-city African Americans hinders the ability to generate an evidence base for intervention and program development.

As the ADA national standards specify that diabetes outcomes are optimized when patient centered care is emphasized through collaborative team-based care management, including the provision of management support through decision making, ensuring quality of care measures are met, and leveraging community networks and support within an individual's natural environment to promote self-management outside of clinical encounters (ADA, 2019a); understanding how community resources can be enhanced and leveraged to maximize care for diabetes among inner-city African Americans is of critical importance, as each level of influence may be interconnected. Future work is needed to test the proposed model presented in this integrative review

and to further develop interventions that will address barriers across multiple levels of influence for inner-city African Americans with diabetes.

### 2.6.2 Strengths and Limitation

This integrative review is strengthened by including multiple study designs and both qualitative and quantitative studies in the final synthesis and model development. By looking at both descriptive studies and intervention studies, this review identified the barriers to diabetes specific to inner-city African Americans as well as the extant interventions to improve diabetes outcomes among inner-city African Americans. Additionally, a major strength of this study is integration of two behavioral models and one social ecological model into a new evidence-based model for explaining the multilevel barriers that inner-city African Americans experience for diabetes care from a public health standpoint. While this study is strengthened by the integrative methods and theory used, there are three main limitations to this review that warrant consideration. First, the search conducted in this review was limited to published articles and therefore results may be subject to publication bias if studies that were not significant were not published or if quality improvement projects were conducted to address barriers in this population for diabetes and were not published. Second, this review only included papers that explicitly defined their population as being urban or inner-city, therefore articles that examined diabetes care among inner-city African Americans but did not specify may have been excluded. Third, this review is considered narrative and no statistical methods were used to determine statistical significance and therefore cannot speak to any causal relationships or any statistical differences in the

barriers identified. Finally, the findings of this review may not be generalizable to across inner-city African Americans with diabetes.

### 2.6.3 Future Direction

Using the evidence from this integrative review, integration of the Brown Model and CCM, informed by the NIMHD model allows for a unified model for understanding barriers to diabetes care for inner-city African Americans with diabetes. This new model is based on the underlying theory of social ecological model of health behavior and as such specifies the following:

- 1) There are multiple influences on diabetes outcomes for inner city African Americans, including factors at the individual, community, and health system levels.
- 2) Influences on behaviors interact across these different levels.
- 3) This model is diabetes behavior specific, identifying the most relevant potential influences at each level.

Next steps will include validation of this new proposed model and subsequent intervention development. This model has been developed so that future studies may validate the constructs and barriers at each level for inner-city African Americans with diabetes. Validation of this model will take place by collecting primary data among inner-city African Americans. Results will have policy implications as it will provide evidence in direct response to the ADA call for research and may help elucidate factors that promote health disparities among a vulnerable population. Additionally, validation of this model will further inform intervention development that accounts for the multi-levels of



influence across barriers for diabetes care for inner-city African Americans with diabetes from a public health standpoint.

In conclusion, diabetes represents a burgeoning public health issue as the 7th leading cause of death in the US and its association with other serious chronic health conditions. Health disparities seen in diabetes among inner-city African Americans can be considered a public health crisis as national standards have been modified to address the inequity in diabetes care and outcomes seen among this vulnerable population. To effectively address health disparities in diabetes seen among inner-city African Americans, a public health approach is needed to develop interventions outside of the health system and that incorporates the individual, community, and health system level of influence. This new integrated model for explaining the barriers that occur at each level of influence is an important next step to address health disparities in diabetes care for inner-city African Americans.

## **CHAPTER THREE: RELATIVE CONTRIBUTION OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS ON GLYCEMIC CONTROL AMONG INNER-CITY AFRICAN AMERICANS WITH TYPE 2 DIABETES**

### **3.1 Summary of Chapter Three**

Health disparities are disproportionately impacting inner-city African Americans, however limited information exists on the contribution of individual, community, and health system barriers on diabetes outcomes. A cross-sectional study collected primary data from 241 inner-city African Americans with type 2 diabetes. A conceptual framework was used to specify measurements across the individual level, such as age and comorbidities, community level, such as neighborhood factors and support, and health systems level such as access, trust, and provider communication. Based on current best practices, four regression approaches were used: sequential, stepwise with forward selection, stepwise with backward selection, and all possible subsets. Variables were entered in blocks based on the theoretical framework in the order of individual, community, and health systems factors and regressed against A1C. In the final adjusted model across all four approaches, individual level factors like age ( $\beta=-0.05$ ;  $p<0.001$ ); having 1-3 comorbidities ( $\beta=-2.03$ ;  $p<0.05$ ) having 4-9 comorbidities ( $\beta=-2.49$ ;  $p=0.001$ ) were associated with lower glycemic control. Similarly, male sex ( $\beta=0.58$ ;  $p<0.05$ ), being married ( $\beta=1.16$ ;  $p=0.001$ ), and overweight/obesity ( $\beta=1.25$ ;  $p<0.01$ ) were associated with higher glycemic control. However, community and health system level factors were not significantly associated with glycemic control. Individual level factors are key drivers of glycemic control among inner-city African Americans. These factors should be targeted for intervention development and delivery. Further research is needed to

examine the indirect pathways via community and health system factors that may explain the relationships with glycemic control.

### **3.2 Introduction**

Diabetes has reached epidemic proportions affecting population health through increased morbidity, national expenditures, and mortality (CDC, 2017; ADA, 2019a). According to the Center for Disease Control and Prevention (CDC), diabetes remains the 7<sup>th</sup> leading cause of death, affecting over 30 million people in the US and approximately 13% of all US adults (CDC, 2020). Annual cost of diabetes has increased over the last 5 years and in 2017 was estimated at \$327 billion, accounting for both direct and indirect medical costs (ADA, 2019a). Having diabetes confers increased risk for comorbid conditions including stroke, hypertension, and kidney failure (CDC, 2017). In addition, poor glycemic control can lead to complications such as retinopathy (Cheung et al., 2010), lower limb amputation (Goldman et al., 2018), and early mortality (Landman et al., 2010).

Health disparities in prevalence and burden of disease are disproportionately impacting vulnerable populations (Egede, 2006; Williams et al., 2016; Walker et al., 2016). Specifically, African Americans have nearly two times the rate of diabetes compared to non-Hispanic whites (CDC, 2017). Additionally, African Americans experience comorbid conditions related to diabetes at a higher rate (Carnethon et al., 2017), have worse diabetes related outcomes (CDC, 2017), have less access to community level resources for diabetes management (Auchincloss et al., 2008), and are less likely to receive recommended quality of care measures compared to their white counterparts (Brown et al., 2005; Ricci-Cabello et al., 2013).

Evidence suggests that the existing burden of disease African Americans experience may be further compounded by living in an inner-city (Gaskin et al., 2004; Bachman et al., 2003). For example, a recent integrative review summarized barriers for achieving optimal diabetes outcomes for African Americans living in inner-cities at the individual, community, and health system level (Campbell & Egede, 2019). Major factors impacting diabetes outcomes for inner-city African Americans included diabetes specific factors such as knowledge about diabetes (Calvin et al., 2011), diet (Lee et al., 2016), physical activity (Wanko et al., 2004), and self-management (Hill-Briggs et al., 2005). Other factors identified included non-diabetes specific social determinants of health such as household context (Pollard et al., 2014), competing demands (Chlebowsky et al., 2010), and psychosocial factors such as trauma, stress, and depression (Chard et al., 2016; Richardson et al., 2015). Additionally, evidence suggests that for inner-city African Americans, the lived experience is critical for understanding barriers that impact diabetes outcomes, however very little has been done to quantify these experiences collectively on glycemic control (Campbell & Egede, 2019).

While the health disparities literature has highlighted the barriers that exist for diabetes outcomes for inner-city African Americans, major gaps that remain include a lack of theory driven analysis to understand the contribution of multiple levels of influence on diabetes outcomes among inner-city African Americans; focus on diabetes specific factors such as knowledge, beliefs, attitudes, and self-care to the exclusion of social determinant factors and the lived experiences of living in an inner-city; and a lack of methodological rigor that allows for testing multiple predictors to understand which factors may be driving poor diabetes outcomes among inner-city African Americans.

Therefore, the primary aim of this paper is to identify the incremental contributions of individual, community, and health systems factors on diabetes outcomes among inner-city African Americans accounting for non-diabetes specific factors using a theory-based framework and advanced regression methods. We hypothesize that the individual, community, and health system barriers will have significant impact on diabetes outcomes as measured by glycemic control among inner-city African Americans.

### **3.3 Methods**

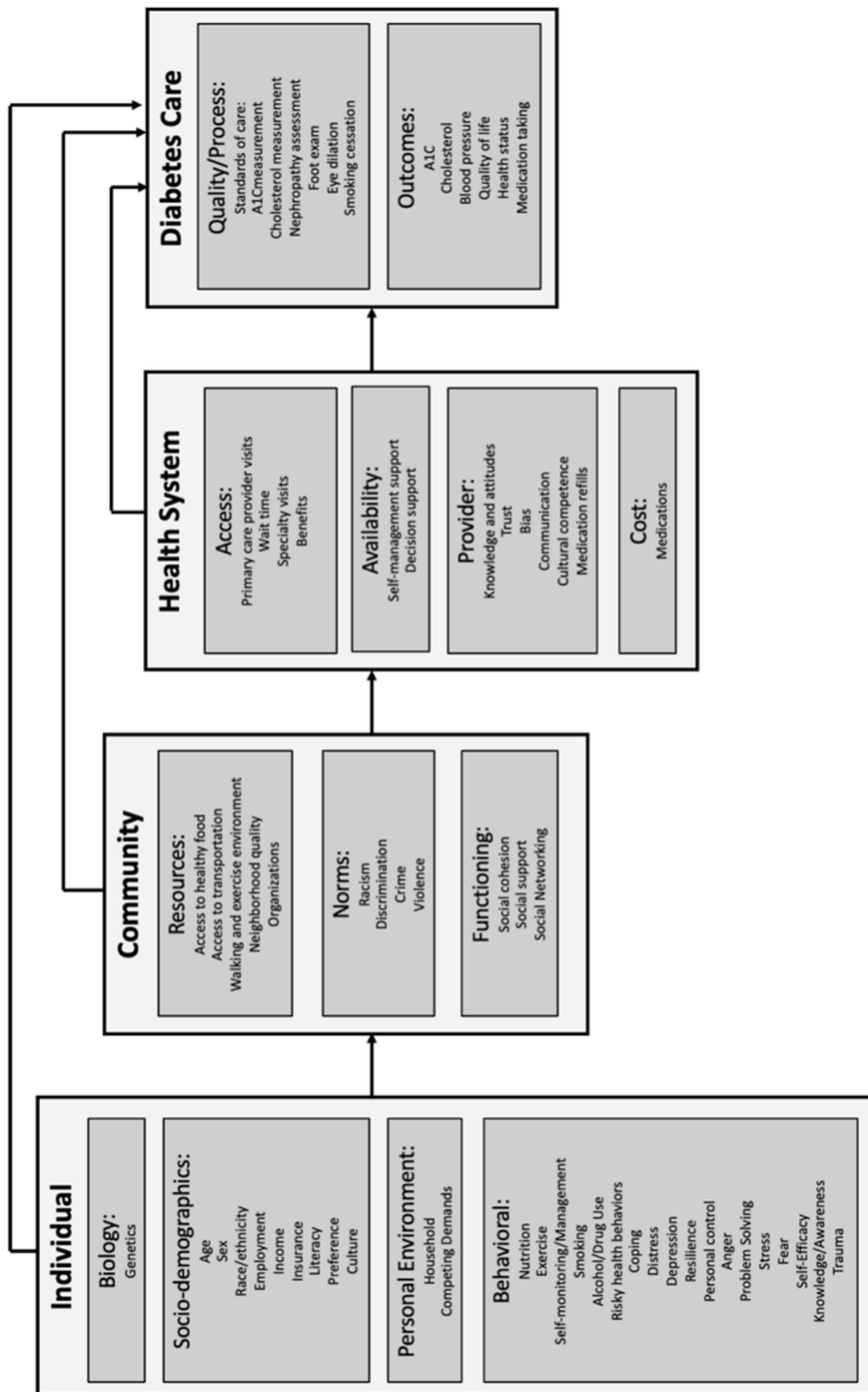
#### **3.3.1 Sample**

This study was cross-sectional with a sample of 241 African American adults with diabetes conducted in the city of Milwaukee, WI between 2017 and 2018 on the social determinants of health. Participants were recruited from community organizations across the inner-city of Milwaukee including food pantries, local places of worship, and YMCAs. Announcements and goals of the study were shared at each location and interested participants were invited to complete the survey and a blood draw to measure their hemoglobin A1c (A1C). Participants were eligible if they self-identified as African American and were age 21 years or older and self-reported diabetes or had an A1C of  $\geq 6.5$ . All study procedures were approved by the Institutional Review Board (IRB) at the Medical College of Wisconsin (MCW) and all participants completed informed consent procedures with a signed informed consent document. All participants completed a set of validated questionnaires to capture individual, community, and health system barriers based on the conceptual framework in Figure 8.

### 3.3.2 Conceptual Framework

Figure 8 is the Campbell and Egede framework for understanding barriers to diabetes care for inner-city African Americans (Campbell & Egede, 2019). This framework was developed from an integrative review of the literature for how each barrier at the individual, community, and health system level may impact diabetes outcomes among inner-city African Americans and is among one of the first published models to specify barriers from the patients lived experience among inner-city African Americans with diabetes (Campbell & Egede, 2019). This conceptual framework summarizes the major factors identified in the literature as barriers to care for inner-city African Americans with diabetes at the individual, community, and health systems level and variables were selected based on this framework. All measures were selected based on the conceptual framework.

Figure 8. Campbell and Egede Framework for Understanding Barriers to Care for Inner-City African Americans



### 3.3.3 Measurements

#### *Primary Outcome*

A1C was the primary outcome of interest. A1C was measured using a venous blood hemoglobin A1c. A1C was collected at the site of survey administration by registered nurses and certified phlebotomists who were part of the study team. Additionally, height and weight were measured and were used to calculate body mass index (BMI).

#### *Individual level variables*

The individual level of influence was measured using socio-demographic variables and behavioral/psychosocial variables. Socio-demographics include spirituality, financial hardship, lifecourse SES, and competing needs. Behavioral/psychosocial variables include nutrition, physical activity, self-management, health behaviors, coping, distress, depression, resilience, personal control, stress, and trauma. Each will be detailed further below.

#### *Socio-demographics.*

Demographics. Previously validated items from the National Health Behavioral Risk Factor Surveillance System (BRFSS, 2014) were used to capture age, gender, race/ethnicity, marital status, education, occupation, household income, and health insurance.

Lifecourse Socio-economic Status (SES). Lifecourse SES was measured through a series of questions to understand early-life socioeconomic disadvantage. These variables included the education level of the father, education level of the mother, size of family, birth order, and level of education (Wamala et al., 2001). Total lifecourse SES



score was computed and used as a continuous variable. Scores ranged from 0 to 6 with higher numbers indicating higher lifecourse SES.

**Financial Hardship.** Financial hardship was measured using the 7-item financial resources scale previously validated by Behavioral Risk Factor Surveillance System (BRFSS, 2014). Financial hardship was treated as dichotomous and coded as yes had financial hardship or no did not have financial hardship.

**Competing Needs.** Competing needs were measured using questions developed by Cunningham et al. (1999) to understand the impact of competing subsistence needs (Cunningham et al., 1999). Competing needs was also treated as a dichotomous variable and coded as yes had competing needs or no do not have competing needs.

**Spirituality.** Spirituality was measured using the Daily Spiritual Experiences Scale (DSES) (Underwood et al., 2002) A 6-item scale assessing daily experiences of spirituality. Questions include statements such as “I feel God’s presence” and “I find strength and comfort in my religion”. Responses range from “Many times a day” to “Never or almost never”. Spirituality was coded as a continuous variable with lower scores indicating higher spirituality.

#### *Behavioral/Psychosocial.*

**Medication Adherence.** Medication adherence was a self-reported measure using the general form of the Brooks Medication Adherence Scale (BMAS) a 6-item scale assessing adherence to medication over the past 3 months (Brooks et al., 1994). Medication adherence was treated as a dichotomous variable and coded as yes medication adherent or no, not medication adherent. Responses of no to any of the 6

items were considered not adherent to medications. Responses of yes to all 6 were considered adherent to medications.

**Health Behaviors.** Health behavior measures included tobacco use and risky HIV behavior using questions from the 2014 BRFSS (BRFSS, 2014) Tobacco use was treated as a categorical variable that included current smoker, former smoker, or never smoked. Alcohol Use was also assessed using a single item from the Alcohol Use Disorders Identification Test (AUDIT-C) (Bush et al., 1998) this variable was coded as yes drinks alcohol or no does not drink alcohol.

**Diet.** Diet was measured using the Dietary Screener Questionnaire (DSQ) (National Health and Nutrition Examination Survey [NHANES], 2009). The DSQ was coded using the recommended DSQ scoring protocol provided by NHANES that captures dietary habits (NHANES, 2009). Food items which include fruits and vegetables, added sugars, whole grains, dairy, calcium, and fiber were coded as daily intake according the NHANES DSQ scoring protocol.

**Physical Activity.** Physical activity was measured using the International Physical Activity Questionnaire (IPAQ) short form (Booth, 2000). Standard scoring protocols published by the IPAQ team were used to assess physical activity as a continuous variable.

**Coping.** Coping was measured using the 8-item emotional approach coping measure that measures emotional processing and emotional expression (Stanton et al., 2000). Both domains of coping were treated as two continuous variables.

**Resilience.** Resilience was measured using the 25-item resilience scale (Wagnild & Young, 1993). Items range from “Disagree to Agree”. A resilience score was

calculated and treated as a continuous variable with higher scores indicating higher levels of resilience.

**Personal Control.** Personal control was measured using the Experience of Current Situation scale (Wallhagen et al., 1999). This scale measures the extent to which an individual feels they have control over the events that occur in their life across 15-items. Items are scored with higher scores indicating higher levels of perceived control. This variable was treated as continuous.

**Depression.** Depression was measured using the PHQ-9 (Kroenke et al., 2001). For this analysis depression was treated as a categorical variable and was coded as no major depression or yes major depression. Greater than or equal to 10 was categorized as major depression.

**Perceived Stress.** Perceived stress was measured using the perceived stress scale (PSS) (Andreou et al., 2011) which produces a continuous score of levels of perceived stress.

**Trauma.** The Adverse Childhood Experiences scale was used to measure trauma exposure during childhood (Felitti et al., 1998). ACEs were coded as has 1 or more ACE or has 0 ACEs.

**Distress.** Distress was measured using the K6 scale (Kessler et al., 2002) and was treated as a dichotomous variable with yes representing distress and no representing no distress. Greater than or equal to a score of 13 was categorized as distressed.

### *Community Barriers*

The community level of influence was measured using resource, norms, and functioning variables at the community level. Variables to assess resources include food insecurity and neighborhood quality. Variables to assess norms include perceived discrimination, exposure to crime, and exposure to violence. Variables to assess functioning include social support and social cohesion. Each will be detailed further below.

#### *Resources.*

Food Insecurity. Food insecurity was measured using the six-item food insecurity scale with the full set of adult items within the intermediate range of severity captured by the full scale (Bickel et al., 2000). Responses endorsing moderate food insecurity were coded as yes food insecure and responses indicating no food insecurity were coded as not food insecure.

Walking and exercise environment. The walking and exercise environments and neighborhood quality were assessed using the Neighborhood Characteristics questionnaire that includes six scales and four indices (Escheverria et al., 2004). The six scales assess the aesthetic quality and consist of 7 items; walking/exercise environment scale consisting of 11 items; an access to healthy foods scale consisting of 11 items. All walking and exercise environment questions were measured as continuous.

#### *Norms.*

Norm measures included perceived discrimination, exposure to crime, and exposure to violence. All norm variables were treated as dichotomous variables and coded as yes or no.

Perceived discrimination. Perceived discrimination was measured using the DISTANCE survey (Moffet et al., 2009). Items measure how often in the past 12 months individuals perceived they were treated poorly race/ethnicity, level of education, sex/gender, or language.

Exposure to crime and violence. Both exposure to crime and violence were measured using the Neighborhood Characteristics two crime/safety scales (safety had 3 items and crime had 4 items) (Escheverria et al., 2004).

#### *Functioning.*

Social support. Social support was measured using The Medical Outcomes Study (MOS) questionnaire that assesses social support across four domains of support including emotional/informational, tangible, affectionate support, and positive social interactions (Sherbourne & Stewart, 1991). For the purposes of this analysis, social support was measured as a continuous variable.

Social cohesion. Social cohesion was measured using the social cohesion scale consisting of 5 items. The scale ranges from “strongly agree to strongly disagree” on items such as “this is a close-knit or unified neighborhood” (Escheverria et al., 2004). Social cohesion was treated as continuous and measured as a score with higher values indicating lower social cohesion.

#### *Health System*

The health system level of influence was measured at the patient level to capture the lived experience of encounters with the health system. These include experiences with access, providers, and cost. Variables to measure access include primary care provider visits, specialty visits, wait times, and travel time. Variables to measure

experiences with providers include attitudes, trust, communication, and cultural competence, and cost of medication. Each will be detailed further below.

#### *Access.*

Primary Care Provider Visits. Primary care provider visits were measured using validated questions from the National Health Interview Survey (NHIS) 2017 Adult Access to Healthcare and Utilization that included asking participants if they had a usual source of care and to specify where they usually go when needing routine care or preventive services (NHIS, 2017).

Specialty visits. Specialty visits were measured by asking participants if in the past 12 months they had seen or talked to any of the following regarding their own health: mental health professional, optometrist, foot doctor, chiropractor, physical therapist, any other specialist other than obstetrician, gynecologist, psychiatrist, or ophthalmologist. If participants responded to seeing one or more of these providers, this was coded as yes seen a specialist (NHIS, 2017).

Wait time. Wait time was measured using two variables that captured delay in care and travel time to provider. Delay in care was treated as dichotomous based on responses to the following question: have you delayed getting needed medical care in the past 12 months due to not getting through on the telephone, not getting appointments soon enough, having to wait too long, clinic not being open, no transportation. A response of yes to was coded as yes experienced delay in care (BRFSS, 2014). Travel time was measured with the following question: how long does it usually take you to get to the provider? Responses were coded as greater than 60 minutes or less than 60 minutes (MEPS, 2010).

### *Provider.*

**Attitudes.** Perceived attitude of provider was measured using a single item from the NHIS 2017 Adult Access to Healthcare and Utilization questionnaire that asks participants how often they are treated with respect by their health care provider (NHIS, 2017). Response were coded as always or not always.

**Trust.** Trust in provider was measured using the 17-item Multidimensional Trust in Health Care Systems Scale (MTHCSS) (Egede & Ellis, 2008). For this analysis the previously validated 10-item sub-scale of the MTHCSS was used (Egede & Ellis, 2008). Trust was coded as a continuous variable with higher scores representing higher levels of trust in provider.

**Communication.** Communication was measured using the patient centered care and satisfaction with care variables asking participants how often providers taken enough time to answer questions and how often understandable information is presented from provider. Responses to communication were coded as continuous with lower responses indicating higher levels of communication (MEPS, 2010).

**Cultural Competence.** Perceived provider cultural competence was measured using a single item from the NHIS 2017 Adult Access to Healthcare and Utilization questionnaire that asked participants how important it was that providers were similar to and understood race, religion, gender, or beliefs. Responses were coded as either very important or not important (NHIS, 2017).

### *Cost.*

**Medications.** Cost of medications was measured using the following question from the BRFSS 2014 questionnaire: was there a time in the past 12 months

when you did not take your medications as prescribed because of cost? Responses were coded as yes or no (BRFSS, 2014).

### 3.3.4 Statistical Analyses

All analyses for this study were performed using Stata version 14. Sample demographics were described using frequencies, percent, means, and standard deviations. The primary outcome was glycemic control (A1C) measured as a continuous variable. The primary independent variables were measured variables identified by the theoretical framework and variables were entered in blocks by individual, community and health systems variables.

Four recommended regression approaches were used to account for discordance and controversy in recommendations when modeling a number of predictors with a single outcome (Whittingham et al., 2006). Specifically, when dealing with multiple regressors, three primary concerns have been noted in the literature that arise when using stepwise regression. These include 1- bias in parameter estimation for model selection; 2- inconsistency in the model selection by forward selection, backward elimination, and stepwise; and finally 3- over reliance on a single best model (Whittingham et al., 2006). In order to account for these challenges and to remove uncertainty in our final model selection, the following four regression approaches were selected as they have been used in the literature to overcome bias in parameter estimation, inconsistency in model selection, and over reliance on a single best model (Dawson et al., 2019). These included sequential regression, stepwise regression with forward then backward selection, and all possible regressions.



Sequential regression was the first regression approach used. Predictors were entered in blocks based on the theoretical framework and were entered in the order of individual, community, and health systems and regressed against A1C. Variables were retained and included at a p-value of  $<0.25$ . Retaining variables at a p-value of  $<0.25$  is a well-established criterion for variable selection (Bendel & Afifi, 1977; Mickey & Greenland, 1989; Hosmer & Lemeshow, 2000). This cut point is recommended over a cut point of 0.05 to appropriately identify important variables when building a model (Hosmer & Lemeshow, 2000). In addition, variables which have known clinical importance were also included regardless of cut point as is also recommended by Hosmer and Lemeshow (2000). Finally, variables that were entered into the model and reduced the  $R^2$  were removed to find the best fitting, most parsimonious model. Variables that were significant or that held clinical importance were then regressed against the outcome of A1C using the second regression approach, stepwise regression with forward selection, followed by the third regression approach stepwise regression with backward selection. The final model contained significant variables that were retained using backward selection and were then regressed against the outcome using all possible regressions. All possible regressions is recommended to use with up to 15 predictor variables and regresses each predictor against the outcome until the best model is determined (Hintze, 2007). Multiple linear regression was then performed using the 7 predictors to examine their relationship with A1C.

### **3.4 Results**

Sample characteristics are summarized in **Table 5**. The average age of participants was 57 years, and 62% were women. The majority of the sample had less than a high

school education (66%) and 82% were unemployed. Approximately 85% earned less than \$25,000 per year and 83% were not married. Comorbidities were high among this sample with 66% reporting over three.

<b>Table 5. Sample Characteristics</b>	
n=241	Percent or Mean (Standard Deviation)
Age	57.1 (10.8)
Mean Age	
Sex	
Female	62.2
Educational Attainment	
< High School Graduate	65.7
Employment Status	
Unemployed	81.7
Household Income	
< \$25,000	85.1
Insurance Status	
Insured	85.1
Marital Status	
Not Married	83.2
Comorbidities	
0 comorbidities	4.2
1-3 comorbidities	30.1
4-9 comorbidities	65.7
Body Mass Index (kg/m <sup>2</sup> )	
≥ 25 (Overweight/Obese)	90.0

**Table 6** shows the unadjusted relationship between glycemic control and each level of influence. Among individual level factors, older age ( $\beta=-0.05$ ;  $p<0.001$ ), having 1-3 comorbidities ( $\beta=-1.94$ ;  $p<0.01$ ) and 4-9 comorbidities ( $\beta=-2.17$ ;  $p<0.001$ ) were significantly associated with lower glycemic control (lower signifying better glycemic control). Additionally, medication adherence ( $\beta=-0.56$ ;  $p<0.05$ ) lower emotional processing coping ( $\beta=-0.12$ ;  $p<0.01$ ), lower resilience ( $\beta=-0.01$ ;  $p<0.01$ ), and trauma ( $\beta=-0.97$ ;  $p<0.01$ ) were all significantly associated with lower glycemic control. Male sex

( $\beta=0.52$ ;  $p<0.05$ ), being married ( $\beta=1.07$ ;  $p<0.01$ ) and being overweight/obese ( $\beta=1.15$ ;  $p<0.01$ ) were significantly associated with higher glycemic control (higher signifying worse glycemic control). Among community factors, having social support ( $\beta=-0.01$ ; CI -0.02; 0.00) was significantly associated with lower glycemic control. For the health system factors, satisfaction with care ( $\beta=-0.23$ ; CI -0.47; 0.00) was significantly associated with lower glycemic control.

**Table 6. Unadjusted Linear Regression of Glycemic Control by Individual, Community, and Health System Factors in Diabetes**

Level of Influence	HbA1c $\beta$	P-Value
<b>Individual Factors</b>		
<b>Socio-demographics/Culture</b>		
Age	<b>-0.05***</b>	0.000
Male‡	<b>0.52*</b>	0.050
Married‡	<b>1.07**</b>	0.002
< High School Graduate‡	0.03	0.901
Employed‡	0.38	0.249
Income< \$25,000‡	0.23	0.517
Insured‡	-0.25	0.491
Lifecourse SES	-0.01	0.887
Has Financial Hardship‡	-0.01	0.959
Has Competing Needs‡	0.08	0.750
Spiritual	0.03	0.091
<b>Behavioral/Psychosocial</b>		
<b>Comorbidities‡</b>		
1-3	<b>-1.94**</b>	0.004
4-9	<b>-2.17***</b>	0.001
Overweight/Obese‡	<b>1.15**</b>	0.007
<b>Diet</b>		
Fruit and Vegetable Intake	0.03	0.827
Fruit Intake	-0.10	0.693
Sugar Intake	0.01	0.528
Whole Grain Intake	0.38	0.341
Dairy Intake	-0.10	0.652
Fiber Intake	0.06	0.077
Calcium Intake	-0.00	0.800
Total Physical Activity	0.00	0.358

Medication Adherence†		
Yes	<b>-0.56*</b>	0.050
Smoking Status‡		
Former	-0.74	0.835
Never	0.39	0.177
Alcohol Consumption†		
Yes	-0.02	0.942
Risky Behavior†		
Yes	-0.20	0.626
Coping		
Emotional Processing	<b>-0.12**</b>	0.006
Emotional Expression	-0.07	0.075
Distress†		
Yes	0.3	0.266
Depression‡		
Major Depression	-0.10	0.718
Anxiety†		
Yes	-0.18	0.526
Resilience	<b>-0.01**</b>	0.008
Personal Control	-0.02	0.085
Stress	0.04	0.387
Trauma†		
Yes	<b>-0.97**</b>	0.003
<b>Community Factors</b>		
<b>Resources</b>		
Food Insecurity‡		
Food Secure	-0.32	0.212
Neighborhood Characteristics		
Access to Healthy Food	0.03	0.169
Walkability	0.02	0.181
Aesthetics	0.25	0.465
Rating	-0.03	0.806
Compared to Others	-0.01	0.932
<b>Norms</b>		
Perceived Discrimination	0.07	0.417
Crime Exposure	-0.18	0.197
Violence Exposure	-0.03	0.462
<b>Functioning</b>		
Social Cohesion	-0.01	0.734
Social Support	<b>-0.01*</b>	0.045
<b>Health System Factors</b>		
<b>Access</b>		
Travel Time‡		

>60 minutes	1.23	0.055
Primary Care Provider Visits		
Yes Usual Source of Care†	0.18	0.633
Yes Personal Doctor†	-0.39	0.236
Wait Time		
Yes Delay in Treatment†	-0.08	0.767
Received Specialist Visits†	-0.61	0.073
<b>Provider</b>		
Respect‡		
Always	-0.47	0.203
Trust	-0.02	0.261
Communication	-0.03	0.294
Cultural Competence‡		
Important	-0.50	0.124
Satisfied with Care	<b>-0.23*</b>	0.050
Dissatisfied with Care	0.12	0.185
<b>Cost</b>		
Medication Hardship†		
Yes	-0.16	0.629

\*p<.05; \*\*p<.01; \*\*\*p<.001; †Reference Groups = No; ‡Other Reference Groups: Sex Ref: Female; Education Ref: >High School; Income Ref: >=\$25,000; Comorbidity Ref: 0; BMI Ref: Underweight/Normal; Smoking Status Ref: Never; Food Insecurity Ref: Food Insecure; Travel Time Ref: <60 minutes; PCP Respect Ref: Not Always; Cultural Competence Ref: Not Important

**Table 7** shows the sequential linear regression model of glycemic control by individual, community, and health system factors. Among the individual level factors, older age ( $\beta=-0.04$ ;  $p<0.001$ ), having 4-9 comorbidities ( $\beta=-1.55$ ;  $p<0.05$ ), medication adherence ( $\beta=-.70$ ;  $p<0.05$ ) and trauma ( $\beta=-1.10$ ;  $p<0.01$ ) were all significantly associated with lower glycemic control. Being married ( $\beta=1.10$ ;  $p<0.01$ ) was significantly associated with higher glycemic control. Among the health system factors, having to travel >60 minutes to see a provider ( $\beta=1.39$ ;  $p<0.05$ ) was significantly associated with higher glycemic control. No community level factors were statistically significant with glycemic control in the sequential linear model.

**Table 7. Sequential Linear Regression Models of Glycemic Control by Individual, Community, and Health System Factors in Diabetes for Inclusion in Final Model**

Level of Influence	HbA1c $\beta$	P-Value
<b>Individual Factors</b>		
<b>Socio-demographics/Culture</b>		
Age	<b>-0.04</b>	0.001
Male $\ddagger$	<b>0.51</b>	0.053
Married $\dagger$	<b>1.10</b>	0.003
< High School Graduate $\ddagger$	-0.21	0.554
Employed $\dagger$	-0.19	0.583
Income< \$25,000 $\ddagger$	<b>0.55</b>	0.196
Insured $\dagger$	0.15	0.691
Lifecourse SES	0.04	0.741
Has Financial Hardship $\dagger$	0.01	0.944
Has Competing Needs $\dagger$	0.02	0.941
Spiritual	<b>0.02</b>	0.207
<b>Behavioral/Psychosocial</b>		
Comorbidities $\dagger$		
1-3	<b>-1.30</b>	0.073
4-9	<b>-1.55</b>	0.030
Overweight/Obese $\ddagger$	<b>1.29</b>	0.002
Total Physical Activity	<b>0.00</b>	0.108
Medication Adherent $\dagger$		
Yes	<b>-0.70</b>	0.023
Smoking Status $\ddagger$		
Former	-0.00	0.998
Never	0.19	0.549
Alcohol Consumption $\dagger$		
Yes	0.02	0.934
Risky Behavior $\dagger$		
Yes	-0.25	0.582
Coping		
Emotional Processing	<b>-0.13</b>	0.082
Emotional Expression	0.07	0.326
Distress $\dagger$		
Yes	0.09	0.753
Depression $\ddagger$		
Major Depression	-0.20	0.625
Anxiety $\dagger$		
Yes	-0.07	0.867
Resilience	<b>-0.01</b>	0.117

Personal Control	0.00	0.841
Stress	-0.03	0.650
Trauma†		
Yes	<b>-1.10</b>	0.006
<b>Community Factors</b>		
<b>Resources</b>		
Food Insecurity‡		
Food Secure	<b>-0.34</b>	0.232
Neighborhood Characteristics		
Access to Healthy Food	0.03	0.324
Walkability	0.22	0.355
Aesthetics	-0.01	0.881
Rating	0.08	0.743
Compared to Others	0.14	0.419
<b>Norms</b>		
Perceived Discrimination	0.04	0.682
Crime Exposure	<b>-0.40</b>	0.052
Violence Exposure	-0.05	0.292
<b>Functioning</b>		
Social Cohesion	-0.06	0.289
Social Support	<b>-0.01</b>	0.072
<b>Health System Factors</b>		
<b>Access</b>		
Travel Time‡		
>60 minutes	<b>1.39</b>	0.048
Primary Care Provider Visits		
Yes Usual Source of Care†	0.36	0.365
Yes Personal Doctor †	-0.13	0.720
Wait Time		
Yes Delay in Treatment†	<b>-0.36</b>	0.246
Received Specialist Visits†	-0.23	0.610
<b>Provider</b>		
Respect‡		
Always	<b>-0.48</b>	0.217
Trust	-0.00	0.913
Communication	0.03	0.420
Cultural Competence‡		
Important	<b>-0.46</b>	0.173
Satisfied with Care	<b>-0.30</b>	0.109
Dissatisfied with Care	<b>0.17</b>	0.088
<b>Cost</b>		

Medication Hardship†	-0.17	0.623
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Bold=p<0.25. Variables with p<0.25 for each level were included in final models in Table 4.

†Reference Groups = No; ‡Other Reference Groups: Sex Ref: Female; Education Ref: >High School; Income Ref: >=\$25,000; Comorbidity Ref: 0; BMI Ref: Underweight/Normal; Smoking Status Ref: Never; Food Insecurity Ref: Food Insecure; Travel Time Ref: <60 minutes; PCP Respect Ref: Not Always; Cultural Competence Ref: Not Important

**Table 8** shows the results of the final adjusted model using the four regression approaches. Only individual level factors were associated with glycemic control across all four approaches. For approach 1 using sequential regression among individual level factors, older age ( $\beta=-0.04$ ;  $p<0.01$ ), having 1-3 comorbidities ( $\beta=-1.77$ ;  $p<0.05$ ) having 4-9 comorbidities ( $\beta=-2.20$ ;  $p=0.01$ ) were significantly associated with lower glycemic control. Being married ( $\beta=1.07$ ;  $p=0.01$ ) and being overweight/obese ( $\beta=1.00$ ;  $p<0.05$ ) were significantly associated with higher glycemic control.

**Table 8. Fully Adjusted Linear Regression of Glycemic Control by Individual, Community, and Health Systems Factors in Diabetes (Approach 1: Sequential)**

**Approach 1: Sequential**

Adjusted R <sup>2</sup> =0.21		
	HbA1c $\beta$	P-Value
<b>Individual Factors</b>		
<b>Socio-demographics/Culture</b>		
Age	<b>-0.04**</b>	0.007
Male‡	0.54	0.070
Married†	<b>1.07*</b>	0.010
Spiritual	0.03	0.262
<b>Behavioral/Psychosocial</b>		
Comorbidities‡		
1-3	<b>-1.77*</b>	0.038
4-9	<b>-2.20*</b>	0.010
Overweight/Obese‡	<b>1.00*</b>	0.028
Medication Adherence†		
Yes	0.34	0.263
Coping		



Emotional Processing	-0.05	0.375
Trauma $\ddagger$		
Yes	-0.46	0.225
<b>Community Factors</b>		
<b>Resources</b>		
Neighborhood		
Walkability	0.00	0.790
<b>Norms</b>		
Perceived Discrimination	0.07	0.515
Crime Exposure	-0.19	0.235
Violence Exposure	-0.02	0.660
<b>Functioning</b>		
Social Support	-0.00	0.688
<b>Health System Factors</b>		
<b>Access</b>		
Travel Time $\ddagger$		
>60 minutes	0.31	0.640
<b>Provider</b>		
Respect $\ddagger$		
Always	-0.16	0.676
Communication	0.07	0.101
Cultural Competence $\ddagger$		
Important	-0.41	0.220
Satisfied with Care	-0.11	0.557
Dissatisfied with Care	0.12	0.216

\*p<.05; \*\*p<.01; \*\*\*p<.001; . $\ddagger$ Reference Groups = No;  $\ddagger$ Other Reference Groups: Sex Ref: Female; Married Ref: Not Married; Comorbidity Ref: 0; BMI Ref: Underweight/Normal; Travel Time Ref: <60 minutes; PCP Respect Ref: Not Always; Cultural Competence Ref: Not Important

For approach 2 using backward selection, older age ( $\beta$ =-0.04; p<0.01); having 1-3 comorbidities ( $\beta$ =-1.99; p<0.05) having 4-9 comorbidities ( $\beta$ =-2.44; p<0.01) were significantly associated with lower glycemic control. Male sex ( $\beta$ =0.68; p<0.05), being married ( $\beta$ =1.02; p<0.05), and being overweight/obese ( $\beta$ =1.04; p<0.05) were all significantly associated with higher glycemic control.

**Table 9. Fully Adjusted Linear Regression of Glycemic Control by Individual, Community, and Health Systems Factors in Diabetes (Approach 2: Backward Selection)**

<b>Adjusted R<sup>2</sup>=0.23</b>		
	<b>HbA1c <math>\beta</math></b>	<b>P-Value</b>
<b>Individual Factors</b>		
<b>Socio-demographics/Culture</b>		
Age	<b>-0.04**</b>	0.003
Male <sup>‡</sup>	<b>0.68*</b>	0.015
Married <sup>†</sup>	<b>1.02*</b>	0.010
<b>Behavioral/Psychosocial</b>		
Comorbidities <sup>‡</sup>		
1-3	<b>-1.99*</b>	0.015
4-9	<b>-2.44**</b>	0.003
Overweight/Obese <sup>‡</sup>	<b>1.04*</b>	0.019
Medication Adherence <sup>†</sup>		
Yes	-0.45	0.115
Coping		
Emotional Processing	-0.07	0.129
Trauma <sup>†</sup>		
Yes	-0.44	0.240
<b>Community Factors</b>		
<b>Norms</b>		
Crime Exposure	-0.21	0.160
<b>Provider</b>		
Communication	0.04	0.197
Cultural Competence <sup>‡</sup>		
Important	-0.45	0.169
Satisfied with Care		
Dissatisfied with Care	0.12	0.203

\*p<.05; \*\*p<.01; \*\*\*p<.001; †Reference Groups = No; ‡Other Reference Groups: Sex Ref: Female; Married Ref: Not Married; Comorbidity Ref: 0; BMI Ref: Underweight/Normal; Cultural Competence Ref: Not Important

Approach 3 using forward selection similarly showed that older age ( $\beta$ =-0.04; p<0.01); having 1-3 comorbidities ( $\beta$ =-1.92; p<0.05) having 4-9 comorbidities ( $\beta$ =-2.35; p<0.01) were significantly associated with lower glycemic control. Male sex ( $\beta$ =0.61;

p<0.05), being married ( $\beta=1.07$ ; p<0.01), and being overweight/obese ( $\beta=1.02$ ; p<0.05) were also significantly associated with higher glycemic control.

**Table 10. Fully Adjusted Linear Regression of Glycemic Control by Individual, Community, and Health Systems Factors in Diabetes (Approach 3: Forward Selection)**

Adjusted R <sup>2</sup> =0.23		
	HbA1c $\beta$	P-Value
<b>Individual Factors</b>		
<b>Socio-demographics/Culture</b>		
Age	<b>-0.04**</b>	0.003
Male $\ddagger$	<b>0.61*</b>	0.033
Married $\ddagger$	<b>1.07***</b>	0.007
Spiritual	0.03	0.268
<b>Behavioral/Psychosocial</b>		
Comorbidities $\ddagger$		
1-3	<b>-1.92*</b>	0.019
4-9	<b>-2.35**</b>	0.004
Overweight/Obese $\ddagger$	<b>1.02*</b>	0.022
Medication Adherence $\ddagger$		
Yes	-0.44	0.123
Coping		
Emotional Processing	-0.07	0.165
Trauma $\ddagger$		
Yes	-0.45	0.227
<b>Community Factors</b>		
<b>Norms</b>		
Crime Exposure	-0.20	0.170
<b>Health System Factors</b>		
<b>Provider</b>		
Communication	0.05	0.152
Cultural Competence $\ddagger$		
Important	-0.44	0.183
Dissatisfied with Care	0.11	0.208

\*p<.05; \*\*p<.01; \*\*\*p<.001;  $\ddagger$ Reference Groups = No;  $\ddagger$ Other Reference Groups: Sex Ref: Female; Married Ref: Not Married; Comorbidity Ref: 0; BMI Ref: Underweight/Normal; Cultural Competence Ref: Not Important

For approach 4 using all possible regressions, the same individual level factors were significantly associated with glycemic control as with the other approaches, with

slightly lower p-values. For example, older age ( $\beta=-0.05$ ;  $p<0.001$ ); having 1-3 comorbidities ( $\beta=-2.03$ ;  $p<0.05$ ) having 4-9 comorbidities ( $\beta=-2.49$ ;  $p=0.001$ ) were significantly associated with lower glycemic control. Male sex ( $\beta=0.58$ ;  $p<0.05$ ), being married ( $\beta=1.16$ ;  $p=0.001$ ), and being overweight/obese ( $\beta=1.25$ ;  $p<0.01$ ) were also significantly associated with higher glycemic control.

**Table 11. Fully Adjusted Linear Regression of Glycemic Control by Individual, Community, and Health Systems Factors in Diabetes (Approach 4: All Possible Subsets)**

Adjusted R <sup>2</sup> =0.23		
	HbA1c $\beta$	P-Value
<b>Individual Factors</b>		
<b>Socio-demographics/Culture</b>		
Age	<b>-0.05***</b>	0.000
Male <sub>‡</sub>	<b>0.58*</b>	0.029
Married <sub>‡</sub>	<b>1.16***</b>	0.001
<b>Behavioral/Psychosocial</b>		
Comorbidities <sub>‡</sub>		
1-3	<b>-2.03*</b>	0.011
4-9	<b>-2.49***</b>	0.001
Overweight/Obese <sub>‡</sub>	<b>1.25**</b>	0.003
Medication Adherence <sub>‡</sub>		
Yes	-0.32	0.240

\* $p<.05$ ; \*\* $p<.01$ ; \*\*\* $p<.001$ ; †Reference Groups = No; ‡Other Reference Groups: Sex Ref: Female; Married Ref: Not Married; Comorbidity Ref: 0; BMI Ref: Underweight/Normal

### 3.5 Discussion

In this study of 241 inner-city African Americans with type 2 diabetes we found that individual level, community level, and health system level factors were significantly associated with glycemic control in the unadjusted models. In the final adjusted model, individual level factors were significantly associated with glycemic control. Specifically,

older age and having comorbidities were significantly associated with lower glycemic control, indicating that individuals in this sample that are older and have a higher number of comorbid conditions have better glycemic control compared to those who are younger and do not have comorbid conditions. Whereas men, those who are married, and being overweight/obese have worse glycemic control. These findings are consistent with our hypothesis in our sequential model showing factors across each level of influence were significantly associated with glycemic control. In the fully adjusted models, factors at the individual level were the only factors that remained significant.

The current findings showing that older age is significantly associated with better glycemic control is consistent with the literature. Specifically, longitudinal studies have found that among minority patients with diabetes, older age is consistently related to lower glycemic control compared to younger age (Benoit et al., 2005; Chiu et al., 2010). The finding that comorbidities are significantly related to lower glycemic control is mixed in the literature. For example, some studies have found that over time, comorbidity does not significantly impact glycemic control (Luijks et al., 2015); whereas other findings suggest that diabetes specific behaviors for self-management are impacted by total comorbidity count (Kerr et al., 2007). Additionally, the finding that being overweight/obese is related to higher glycemic control is also consistent with the diabetes literature as being overweight/obese is considered a risk factor for poor diabetes outcomes (CDC, 2017).

Of interest, in this study sample, men and those who are married had worse glycemic control. These findings vary from what the current literature shows where women, particularly African American women, have worse diabetes outcomes

compared to men (Legato et al., 2006; Kirk et al., 2011). Evidence suggests that psychosocial factors in addition to biologic factors play a key role in poor diabetes outcomes for women (Kautzky-Willer et al., 2016). The current findings suggest that certain factors may be indirectly driving poor glycemic control among inner-city African American men and/or that inner-city African American women may have protective factors against poor glycemic control. However, more advanced methodology using structural equation modeling and path analysis may be needed to better understand factors that are driving the current results. Additionally, the literature has shown that social support is a key factor in not only preventing poor diabetes outcomes but also improving diabetes outcomes (Tang et al., 2008; Stopford et al., 2013; Heisler et al., 2019); specifically, being married has been shown to be protective against poor health (Manfredini et al., 2017). In the Atherosclerosis Risk in Communities (ARIC) cohort study, African Americans who were single and women had a higher risk of developing diabetes (Shwandt et al., 2016). However, the current results show that social support was not significantly related to glycemic control and that being married specifically was related to worse glycemic control.

Taken together, this is one of the first studies to test the incremental contribution of individual, community, and health system factors on glycemic control among inner-city African Americans using a conceptual framework designed to understand the barriers to optimal diabetes care among inner-city African Americans. Prior work has focused attention at a single level of influence rather than emphasizing the cumulative effect of social determinant factors on diabetes care among inner-city African Americans (Jack et al., 2012). Findings from the current study allow for understanding the relative

contribution of multiple levels of influence across the individual, community, and health system factors on glycemic control. Use of a conceptual framework with advanced regression techniques increases validation by providing consistent results across regression approaches. Specifically, this study allowed for examination of factors in combination rather than individually, showing that glycemic control among inner-city African Americans may be driven by factors that have not been adequately accounted for by focusing at a single level of influence as seen in the current diabetes literature.

The literature examining community level factors such as neighborhood resources and food availability among inner-city African Americans with diabetes have primarily been examined through qualitative studies or examined the impact of these factors on self-management behavior such as medication taking and following a healthful diet (Shaw et al., 2006; Chard et al., 2016; Lee et al., 2016) and have not examined these factors specific with glycemic control. While neighborhood factors such as the aesthetic environment have been shown to have a direct impact on glycemic control (Smalls et al., 2015) as well as neighborhood supports association with lower glycemic control (Diaz del Carpio et al., 2016) this has not been tested specifically among African Americans with diabetes living in an inner-city.

Evidence for the role of health system factors on glycemic control among inner-city African Americans with diabetes suggests that availability and provider factors (Figure 8) are important for optimizing outcomes, specifically through intervention delivery targeting glycemic control (Campbell & Egede, 2019). However, interventions examining the role of health systems on glycemic control are often examined at the level of the health system and do not account for other levels of influence.

With the recent emergence of social determinants in clinical care for diabetes these findings have implications across research, clinical, and policy levels for diabetes care. Specifically, evidence suggests that fragmentation may be occurring between policy, research, and practice for achieving health equity and addressing health disparities for diabetes care among inner-city African Americans. For example, evidence suggests that to address the impact that social determinants of health have on health disparities for diabetes among vulnerable populations, multi-level interventions that address barriers to care are needed (ADA, 2019a). However, current diabetes interventions for inner-city African Americans are focused primarily at the health systems level (Campbell & Egede, 2019). The results of this study show that individual level factors may be major drivers of glycemic control compared to factors at the community and health system level. This does not suggest that one level of influence is of greater importance than the other. Rather, these findings suggest that traditional models of care may not be adequate to address the complex barriers that patients with diabetes living in inner-cities experience and highlight the importance of a multilevel approaches that account for the contribution of individual, community, and health system factors when addressing diabetes among inner-city African Americans.

The lack of integration across levels of influence may be an important factor that allows for disparities to persist over time as change in outcomes may be transient due to a focus on a single level and not accounting for the lived experience of the inner-city. Specifically, evidence examining the lived experience of diabetes among inner-city African Americans show that factors across the individual, community, and health system levels may have an important role to play in diabetes outcomes (Campbell et al.,



2019). However, very few studies have been conducted to quantify these experiences and examine the incremental effects on diabetes outcomes. Incorporation of each of these levels from the experiences of those living with diabetes in an inner-city, in addition to traditional diabetes specific factors will allow interventions and programs for diabetes to reach beyond the clinical encounter and include the full sphere of influence for diabetes.

### **3.6 Limitations**

While this study is strengthened by its use of primary data collection and use of a conceptual framework to examine the contribution of multilevel barriers on glycemic control, there are some limitations that should be considered. First, this study is cross-sectional and therefore cannot speak to any causal relationships. Second, data were self-reported and may be subject to some recall bias. Specifically, measures of neighborhood and health systems are subjective based on the individuals' lived experience and do not include objective measures of community resources or of health system operations. Finally, this study was conducted among inner-city African Americans in a midwestern city and may not be generalizable to all inner-city environments. However, the use of a conceptual framework derived from the literature for inner-city African Americans may help overcome this limitation.

### **3.7 Conclusion**

These results offer preliminary understanding of how individual, community, and health system factors incrementally contribute to glycemic control for inner-city African Americans using a theoretical framework that accounts for both the lived experience of patients as well as traditional diabetes specific factors. Specifically, by using a

theoretical framework, these results add to the literature by identifying factors that may be driving glycemic control among inner-city African Americans using multiple statistical approaches. Future work should focus on alternative pathways that may exist using this theoretical framework that may not be captured using traditional regression methods. Specifically, the use of regression limits the ability to test direct and indirect effects that may exist in the pathway between and among each level of influence across individual, community, and health system factors for inner-city African Americans with diabetes. Other studies examining social determinants of health using structural equation modeling have found indirect effects with glycemic control (Walker et al., 2015; Smalls et al., 2015). Therefore, using more sophisticated analysis to examine the impact of these levels of influence may elucidate alternative pathways that are not captured using regression. Additionally, these results suggest that a holistic perspective to diabetes care may be needed that accounts for multiple levels of influence as only focusing on a single level of influence may yield misleading results.

## **CHAPTER FOUR: QUANTIFYING THE INFLUENCE OF INDIVIDUAL, COMMUNITY, AND HEALTH SYSTEM FACTORS ON QUALITY OF LIFE AMONG INNER-CITY AFRICAN AMERICANS WITH TYPE 2 DIABETES**

### **4.1 Summary of Chapter Four**

There is limited research on the individual and collective contributions of individual, community, and health system factors on quality of life among inner-city African Americans with type 2 diabetes. Primary data from 241 inner-city African Americans with type 2 diabetes were analyzed. The Short Form Health Survey (SF-12) was used to capture the physical component (PCS) and mental component (MCS) of quality of life. Four regression approaches (sequential, stepwise with backward and forward selection, and all possible subsets regression) were used to examine the influence of individual, community, and health system factors on PCS and MCS after adjusting for relevant covariates using a conceptual framework. In fully adjusted models, having less than a high school education ( $\beta=-0.78$ ;  $p=0.006$ ), and having major depression ( $\beta=-1.51$ ;  $p<0.001$ ) were associated with lower quality of life scores for MCS across all four regression approaches. Being employed was positively associated with better quality of life scores for PCS across all four regression approaches ( $\beta=0.44$ ;  $p=0.004$ ). PCS was higher across all four regression approaches ( $\beta=0.45$ ;  $p=0.004$ ) for those reporting a history of trauma. At the health systems level, usual source of care was associated with better PCS across three regression approaches. These results highlight key factors that influence quality of life among inner-city African Americans with type 2 diabetes that could be targets for interventions in this population. However

additional research is needed to understand existing pathways that may be driving many of these relationships.

## **4.2 Introduction**

Diabetes remains a leading cause of death worldwide (WHO, 2016) and poses a significant public health threat through diminished population health and increased economic burden (CDC, 2020; Cannon et al., 2018). Recent estimates show that the global cost of diabetes exceeds \$1 trillion dollars, accounting for 1.8% of the global gross domestic product (GDP) (Bommer et al., 2017). This accounts for both the direct costs of living with diabetes such as hospitalizations, complications, and cost of medications, as well as, the indirect costs of diabetes such as lower physical and mental functioning as a result of diminished quality of life (Bishu et al., 2015; Cannon et al., 2018).

Quality of life is a multidimensional concept that encompasses the physical, mental, and social well-being of individuals (Rubin & Perot, 1999). As a patient reported outcome that is key for diabetes management, lower quality of life not only contributes to increased health expenditures (Campbell et al., 2017) but is also associated with individual self-management behaviors (Glassgow et al., 2001; Cochran & Conn, 2008; ADA, 2020). African Americans experience worse diabetes outcomes and higher levels of diabetes related distress compared to any other racial/ethnic group (Cunningham et al., 2018), which may lead to disparities in quality of life, and negative influence on self-care behaviors (Cochran & Conn, 2010). Evidence shows that major factors associated with lower quality of life among African Americans include stress (Glover et al., 2016), discrimination (Dawson, et al., 2015; Achuko et al., 2016), and depression (Egede &

Ellis, 2008). Moreover, quality of life for African Americans with diabetes who dwell within inner cities may be worsened due to the intersectionality of adverse social, environmental, and economic factors (Diez Roux, 2016; Tung & Chin, 2020) across the individual, community, and health system level.

As quality of life is central to achieving optimal outcomes and mitigating the burgeoning burden of diabetes (Hoogendorn et al., 2020), a greater understanding of contextual factors impacting quality of life for inner-city African Americans across multiple levels of influence is greatly needed. Evidence suggests that individual level factors such as household and caretaking demand negatively influence quality of life for inner-city African Americans with diabetes (Hill-Briggs et al., 2002). Additionally, community level factors such as crime and housing may also negatively influence quality of life across the physical, mental, and social well-being domains (Hill-Briggs et al., 2002). However, little has been done to understand the individual and collective contribution of individual, community, and health systems level factors on physical and mental health quality of life in this vulnerable population.

As diabetes care moves from a traditional model of care to a patient centered model that accounts for both diabetes specific outcomes and patient reported outcomes, understanding the contextual factors that impact quality of life from a holistic approach is critical for intervention development (Hoogendorn et al., 2020; Tung and Chin, 2020). The aim of this study is to examine the association of individual, community, and health system level factors on quality of life for inner-city African Americans with type 2 diabetes. Specifically, this study uses a newly developed conceptual framework (Campbell & Egede, 2019) for quantifying contextual factors

across levels of influence that impact quality of life for inner-city African Americans with type 2 diabetes. We hypothesized that independent correlates of quality of life would occur at the individual, community, and health system levels among inner-city African Americans after adjusting for relevant covariates.

## **4.3 Methods**

### **4.3.1 Conceptual Framework and Theory**

The theoretical underpinnings of this study are based on the newly developed conceptual framework that specifies barriers to diabetes care for inner-city African Americans with type 2 diabetes, see Figure 8. Drawn from a social ecological model, this recently published framework was developed based on integration of two behavioral frameworks for diabetes and informed by the literature on diabetes outcomes for inner-city African Americans (Campbell & Egede, 2019). This conceptual framework was used to select measured variables for inclusion in this study that represent barriers for inner-city African Americans with type 2 diabetes across the individual, community, and health systems level.

### **4.3.2 Study Sample**

Data from 241 inner-city African Americans were analyzed from a study conducted in the City of Milwaukee, Wisconsin between 2017 and 2018. Participants were community dwelling adults age 21 years and older, self-identified as being African American, and reported a clinical diagnosis of diabetes or had an A1C of 6.5 or higher. Recruitment took place across the inner city of Milwaukee and included locations such as local places of worship, barbershops, beauty salons, food pantries, and YMCAs. The Institutional Review Board at the Medical College of Wisconsin approved all study

procedures. All participants signed an informed consent prior to participation. Once participants signed the informed consent, they were considered enrolled in the study. Once enrolled, participants completed a paper-based survey on social determinants of health, had their height and weight measured by members of the study team for body mass index (BMI) calculation, and provided blood A1C. Participants received a modest incentive for time spent completing the assessment. Participants were excluded from participation if they demonstrated confusion indicating dementia or an inability to complete the questionnaire.

#### 4.3.3 Measurements

##### *Primary Outcome*

The primary outcome for this study is quality of life as measured by the SF-12 Version 1 (Ware, 1995). The SF-12 is a validated and well-established measure of general health status that measures quality of life across two domains, physical health component (PCS) and mental health component (MCS) (Ware, 1995). The physical health component assesses physical health through 1) functioning: the ability to carry out moderate physical activities such as carrying groceries and walking up a flight of stairs; 2) role physical: being limited physically or accomplished less than what was desired to physical limitations; 3) bodily pain: having pain interfere with activities; 4) general self-rated health. The mental health component assesses mental health through 1) vitality: energy; 2) social functioning: social time; 3) role emotional: accomplished less than what was desired to emotional problems or were not carefully focused on tasks due to emotional problems; 4) mental health: feeling peaceful or blue and sad. The SF-

12 was coded according to publicly available algorithm for SF-12 Version 1 and standardized to the US population of 1990 for national norms (range 13-69 SF-12 PCS; 10-70 SF-12 MCS) (Ware, 1995).

### *Individual Level Barriers*

The individual level of influence was measured using socio-demographic variables and behavioral/psychosocial variables. Socio-demographics include spirituality, financial hardship, lifecourse SES, and competing needs. Behavioral/psychosocial variables include nutrition, physical activity, self-management, health behaviors, coping, distress, depression, resilience, personal control, stress, and trauma. Each will be detailed further below.

### *Socio-demographics.*

Demographics. Questions that capture age, sex, marital status, insurance status, and educational attainment were single question items drawn from the Behavioral Risk Factor Surveillance System (BRFSS, 2014).

Spirituality. The Daily Spiritual Experiences Scale (DSES) (Underwood et al., 2002) is a 6-item scale assessing daily experiences of spirituality and was used to measure spirituality as a continuous variable. Higher scores represent being more spiritual and lower scores represent being less spiritual.

Financial Hardship. Three items were used from a 7-item financial resource scale (BRFSS, 2014) to measure financial hardship. These include yes/no items stating financial hardship, having to worry about paying the mortgage, and having to worry about buying food because of not having enough money. Each item was treated as binary and coded as yes or no.



Lifecourse SES. Lifecourse SES was assessed across five items that include education level of the father, education level of the mother, size of family, birth order, and level of education. A disadvantage index was created based on recommendations for measuring life course socioeconomic factors (Pollitt et al., 2005) ranging from 0-6 with higher numbers indicating poorer lifecourse SES (Wamala et al., 2001).

Competing Needs. Competing needs were assessed using items developed by Cunningham et al. 1999 to assess whether medical care was postponed because finances needed to go toward other needs such as housing, food, clothing etc. (Cunningham et al., 1999). Responses to having competing needs were coded as yes (had competing needs) or no (do not have competing needs).

#### *Behavioral/Psychosocial.*

Nutrition. Nutrition was measured using the Dietary Screener Questionnaire (DSQ) (NHANES, 2009). The National Health and Nutrition Examination Survey (NHANES) provides a scoring protocol which was used to code and score this screener (NHANES, 2009). Nutritional items measured across this scale include fruits and vegetables, added sugars, whole grains, dairy, calcium, and fiber.

Physical Activity. The International Physical Activity Questionnaire (IPAQ) short form (Booth 2000) was used to measure physical activity. Authors of the IPAQ provide standard scoring protocols which were used to code and score this scale as a continuous variable.

Self-management. Self-management was measured as medication adherence using the general form of the Brooks Medication Adherence Scale (BMAS). The BMAS is a 6-item scale assessing adherence to medication over the past 3 months (Brooks et

al., 1994). Medication adherence was treated as a dichotomous variable and coded as yes (medication adherent) or no (not medication adherent). Responses of no to any of the 6 items were considered not adherent to medications. Responses of yes to all 6 were considered adherent to medications.

**Health Behaviors.** Measures of health behaviors included tobacco use and alcohol use both drawn from the BRFSS 2014 questionnaire (BRFSS, 2014). Tobacco use was treated as a categorical variable that included current smoker (currently smoke cigarettes every day or some days), former smoker (recently quit smoking in the last 12 months or quit smoking previously), or never smoked (never smoked cigarettes.). Alcohol Use was also assessed using a single item from the Alcohol Use Disorders Identification Test (AUDIT-C) (Bush et al., 1998) this variable was coded as yes (drinks alcohol) or no (does not drink alcohol).

**Coping.** Coping was measured using the 8-item emotional approach coping measure that measures emotional processing and emotional expression (Stanton et al., 2000). Both domains of coping were treated as two continuous variables.

**Distress.** Distress was measured using the K6 scale (Kessler et al., 2002) and was treated as a dichotomous variable with yes representing distress and no representing no distress. Greater than or equal to a score of 13 was categorized as distressed.

**Depression.** Depression was measured using the Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001). For this analysis depression was treated as a categorical variable and was coded as major depression or no major depression. Greater than or equal to 10 was categorized as major depression.

Resilience. Resilience was measured using the 25-item resilience scale (Wagnild & Young, 1993). Items range from “Disagree to Agree”. A resilience score was calculated and treated as a continuous variable with higher scores indicating higher levels of resilience.

Personal Control. Personal control was measured using the Experience of Current Situation scale (Wallhagen et al., 1999). This scale measures the extent to which an individual feels they have control over the events that occur in their life across 15-items. Items are scored with higher scores indicating higher levels of perceived control. This variable was treated as continuous.

Stress. Stress was measured using the perceived stress scale (PSS) (Andreou et al., 2011) which produces a continuous score of levels of perceived stress.

Trauma. Trauma was measured using the Adverse Childhood Experiences scale (Felitti et al., 1998). Adverse childhood experiences (ACEs) were coded as has 1 or more ACEs or has 0 ACEs.

#### *Community Level Barriers*

The community level of influence was measured using resource, norms, and functioning variables at the community level. Variables to assess resources include food insecurity and neighborhood quality. Variables to assess norms include perceived discrimination, exposure to crime, and exposure to violence. Variables to assess functioning include social support and social cohesion. Each will be detailed further below.

#### *Resources.*

Food Insecurity. Food insecurity was measured using the six-item food insecurity scale with the full set of adult items within the intermediate range of severity captured by the full scale (Bickel et al., 2000). Consistent with standard coding for the six-item scale, scores of 2 or higher indicating low or very low food security were coded as yes food insecure and responses indicating high or marginal food security were coded as not food insecure.

Neighborhood Quality. Neighborhood quality were assessed using the Neighborhood Characteristics questionnaire that includes six scales and four indices (Escheverria et al., 2004). The six scales assess the aesthetic quality and consist of 7 items; walking/exercise environment scale consisting of 11 items; an access to healthy foods scale consisting of 11 items. All neighborhood quality questions were treated as continuous.

#### *Norms.*

Perceived Discrimination. Perceived discrimination was measured using the DISTANCE survey (Moffet et al., 2009). Items measure how often in the past 12 months individuals perceived they were treated poorly based on race/ethnicity, level of education, sex/gender, or language.

Exposure to Crime and Violence. Both exposure to crime and violence were measured using the Neighborhood Characteristics safety from crime scale consisting of 3 items and the neighborhood quality consisting of 7 items assessing violence. Neighborhood safety questions included “I feel safe walking in my neighborhood during the evening” and responses ranged from 1 “strongly agree” to 5 “strongly disagree”. Questions to assess violence included “during the past 6 months, how often was there a

fight in this neighborhood in which a weapon was used?”. Response options ranged from 1 “often” to 4 “never”. (Escheverria et al., 2004).

#### *Functioning.*

**Social Support.** Social support was measured using The Medical Outcomes Study (MOS) questionnaire that assesses social support across four domains of support including emotional/informational, tangible, affectionate support, and positive social interactions (Sherbourne & Stewart, 1991). For the purposes of this analysis, social support was measured as a continuous variable with higher values indicating more support.

**Social Cohesion.** Social cohesion was measured using the Social Cohesion scale consisting of 5 items. The scale ranges from “strongly agree to strongly disagree” on items such as “this is a close-knit or unified neighborhood” (Escheverria et al., 2004). Social cohesion was treated as continuous and measured as a score with higher values indicating lower social cohesion.

#### *Health System Barriers*

The health system level of influence was measured at the patient level to capture the lived experience of encounters with the health system. These include experiences with access, providers, and cost. Variables to measure access include primary care provider visits, specialty visits, wait times, and travel time. Variables to measure experiences with providers include attitudes, trust, communication, and cultural competence, and cost of medication. Each will be detailed further below.

#### *Access.*

Primary Care Provider Visits. Primary care provider visits were measured using validated questions from the National Health Interview Survey (NHIS) 2017 Adult Access to Healthcare and Utilization that included asking participants if they had a usual source of care and to specify where they usually go when needing routine care or preventive services (NHIS, 2017).

Specialty Visits. Specialty visits were measured by asking participants if in the past 12 months they had seen or talked to any of the following regarding their own health: mental health professional, optometrist, foot doctor, chiropractor, physical therapist, any other specialist other than obstetrician, gynecologist, psychiatrist, or ophthalmologist. If participants responded to seeing one or more of these providers, this was coded as having seen a specialist (NHIS, 2017).

Wait Time. Wait time was measured using two variables that captured delay in care and travel time to provider. Delay in care was treated as dichotomous based on responses to the following question: have you delayed getting needed medical care in the past 12 months due to not getting through on the telephone, not getting appointments soon enough, having to wait too long, clinic not being open, no transportation. A response of yes was coded as experienced delay in care (BRFSS, 2014).

Travel Time. Travel time was measured with the following question: how long does it usually take you to get to the provider? Responses were coded as  $\geq 60$  minutes or  $< 60$  minutes (MEPS, 2010).

*Provider.*

**Attitudes.** Perceived attitude of provider was measured using a single item from the NHIS 2017 Adult Access to Healthcare and Utilization questionnaire that asks participants how often they are treated with respect by their health care provider (NHIS, 2017). Response were coded as always or not always.

**Trust.** Trust in provider was measured using the 17-item Multidimensional Trust in Health Care Systems Scale (MTHCSS) (Egede & Ellis, 2008). For this analysis the previously validated 10-item trust in provider sub-scale of the MTHCSS was used (Egede & Ellis, 2008). Trust was coded as a continuous variable with higher scores representing higher levels of trust in provider.

**Communication.** Communication was measured using the patient centered care and satisfaction with care variables asking participants how often providers take enough time to answer questions and how often understandable information is presented from provider. Responses to communication were coded as continuous with lower scores indicating higher levels of communication (MEPS, 2010).

**Cultural Competence.** Perceived provider cultural competence was measured using a single item from the NHIS 2017 Adult Access to Healthcare and Utilization questionnaire that asked participants how important it was that providers were similar to and understood race, religion, gender, or beliefs. Responses were coded as either very important or not important (NHIS, 2017).

**Cost.**

**Medications.** Cost of medications was measured using the following question from the BRFSS 2014 questionnaire: was there a time in the past 12 months when you

did not take your medications as prescribed because of cost? Responses were coded as yes or no (BRFSS, 2014).

#### 4.3.4 Statistical Analyses

Stata version 14 was used for all analyses in this study. Frequencies, percent, means, and standard deviations were used to describe sample characteristics. The primary outcomes were the physical and mental components of quality of life (PCS, MCS), each measured as continuous variables. The measured variables listed above identified by the conceptual framework served as the primary independent variables. All independent variables were entered in blocks according to level of influence (individual, community and health systems).

Given the large number of covariates in the conceptual model and limited sample size ( $n=241$ ), we used multiple modeling strategies to identify independent correlates of MCS and PCS in this population. The four modeling strategies included: 1) sequential regression with variables entered in blocks; 2) stepwise regression with backward selection; 3) stepwise regression with forward selection, and 4) all possible subsets regression (Wang & Chen, 2016). For the first approach, variables were entered in blocks (i.e. individual, community and health systems factors) and regressed against the outcome variables (PCS, MCS). Variables were retained if they had a p-value of  $\leq 0.25$  and/or known clinical significance based on established guidelines (Bendel & Afifi, 1977; Mickey & Greenland, 1989; Hosmer & Lemeshow, 2000). Then, significant variables from each of the block models were included in the final model. The second approach utilized stepwise regression with backward selection. For this approach stepwise regression was used to select variables for the final model using a p-value



of  $\leq 0.25$  for retention in the model (Bendel & Afifi, 1977; Mickey & Greenland, 1989; Hosmer & Lemeshow, 2000). The third approach also used stepwise regression, but used forward selection with variables entered in the final model using a p-value of  $\leq 0.25$  for retention in the model (Bendel & Afifi, 1977; Mickey & Greenland, 1989; Hosmer & Lemeshow, 2000). While stepwise regression is a well-known approach for variable selection, particularly when a model has a large number of predictors and a single outcome, there is valid criticism that this approach may lead to bias in parameter estimation for model selection; inconsistency in the model selection by forward selection or backward elimination; and over reliance on a single best model (Whittingham et al., 2006). To appropriately account for these concerns, we used a newer methodology known as all possible subsets or best subsets regression (Wang & Chen, 2016). This method compares all possible models using a specified set of possible predictors and then displays the best-fitting model that contain the pre-identified number of final predictors (Wang & Chen, 2016). For this approach we used numbers of unique predictors from the other three approaches to determine the number of pre-specified variables to retain in the all possible subsets model. The Stata command “tryem” was used to identify the best fitting model based on the adjusted  $R^2$  with 7 variables (Hintze, 2007). We used 7 variable subsets because it yielded the highest r-square compared to a 5 variable subset and was consistent with results from other models and clinically meaningful (Wang & Chen, 2016). After identifying the best all possible subset with 7 final variable predictors, we used multiple linear regression to assess their independent relationship with the outcome variables (PCS, MCS).

#### **4.4 Results**

Table 12. summarizes the sample characteristics. Overall, the study sample was slightly older (mean age 57 years), were mostly women (62%), and unemployed (82%).

Approximately 83% of the study sample reported not being married. Nearly 66% reported having between 4 and 9 comorbid conditions, and 90% of the study sample were overweight/obese based on BMI.

**Table 12. Sample Characteristics**

n=241	Percent or Mean (Standard Deviation)
Age	
Mean Age	57.1 (10.8)
Sex	
Female	62.2
Educational Attainment	
< High School Graduate	65.7
Employment Status	
Unemployed	81.7
Household Income	
< \$25,000	85.1
Insurance Status	
Insured	85.1
Marital Status	
Not Married	83.2
Comorbidities	
0 comorbidities	4.2
1-3 comorbidities	30.1
4-9 comorbidities	65.7
Body Mass Index	
Overweight/Obese	90.0
Quality of Life	
MCS	55.9 (2.3)
PCS	56.3 (0.9)

**Table 13** shows the unadjusted relationship between quality of life by individual, community, and health system level. Several factors across the individual level were significantly associated with lower MCS (lower quality of life for the mental health component), having less than a high school education ( $\beta=-0.98$ ;  $p=0.002$ ), income less

than \$25,000 ( $\beta=-1.07$ ;  $p=0.011$ ), having financial hardship ( $\beta=-0.81$ ;  $p=0.009$ ), having competing demands ( $\beta=-1.20$ ;  $p<0.001$ ), having 4-9 comorbidities ( $\beta=-1.91$ ;  $p=0.011$ ); being distressed ( $\beta=-0.93$ ;  $p=0.003$ ); having major depression ( $\beta=-2.08$ ;  $p<0.001$ ); having anxiety ( $\beta=-1.87$ ;  $p<0.001$ ); stress ( $\beta=-0.20$ ;  $p<0.001$ ); and reporting trauma ( $\beta=-1.12$ ;  $p=0.004$ ). Factors associated with higher MCS included being married ( $\beta=1.31$ ;  $p=0.001$ ); medication adherence ( $\beta=0.96$ ;  $p=0.004$ ); being a former smoker ( $\beta=1.00$ ;  $p=0.015$ ); resilience ( $\beta=0.02$ ;  $p<0.001$ ); and personal control ( $\beta=0.07$ ;  $p<0.001$ ). For PCS, being employed and reporting trauma were the only individual level factors in the unadjusted model significantly associated PCS and was associated with higher PCS (higher physical component of quality of life) ( $\beta=0.45$ ;  $p=0.003$ ) ( $\beta=0.44$ ;  $p=0.004$ ), respectively.

Among community level factors, being food secure ( $\beta=0.76$ ;  $p=0.011$ ); and having social support ( $\beta=0.02$ ;  $p<0.001$ ) were the only two factors that were associated with higher MCS. Exposure to neighborhood crime ( $\beta=-0.41$ ;  $p=0.012$ ) and violence ( $\beta=-0.14$ ;  $p=0.001$ ) were significantly associated with lower MCS. No community level factors were associated with PCS in the unadjusted model.

For the health systems level, trust in provider ( $\beta=0.05$ ;  $p=0.016$ ) and satisfaction with care ( $\beta=0.42$ ;  $p=0.002$ ) were associated with higher MCS. Whereas having a usual source of care ( $\beta=0.35$ ;  $p=0.032$ ) was associated with higher PCS and dissatisfaction with care ( $\beta=-0.09$ ;  $p=0.027$ ) was associated with lower PCS.

**Table 13. Unadjusted Linear Regression of QOL (MCS/PCS) by Individual, Community, and Health Systems Factors in Diabetes**

MCS		PCS	
$\beta$	P-value	$\beta$	P-value

<b>Individual Level of Influence</b>				
<b>Sociodemographic/Culture</b>				
Age	0.01	0.294	0.00	0.686
Male†	-0.44	0.152	-0.09	0.473
Married†	<b>1.31**</b>	<b>0.001</b>	-0.03	0.847
< High School Graduate†	<b>-0.98**</b>	<b>0.002</b>	-0.18	0.131
Employed†	0.64	0.101	<b>0.45**</b>	<b>0.003</b>
Income< \$25,000†	<b>-1.07*</b>	<b>0.011</b>	-0.27	0.094
Insured†	0.14	0.742	0.09	0.559
Lifecourse SES	-0.23	0.043	-0.04	0.320
Has Financial Hardship†	<b>-0.81**</b>	<b>0.009</b>	0.16	0.167
Worried About Making Mortgage†	<b>-0.85**</b>	<b>0.005</b>	0.10	0.403
Worried About Buying Food†	<b>-0.82**</b>	<b>0.007</b>	0.09	0.434
Has Competing Needs†	<b>-1.20***</b>	<b>0.000</b>	-0.04	0.697
Spiritual	-0.01	0.821	0.01	0.449
<b>Behavioral/Psychosocial</b>				
Comorbidities				
1-3	-0.81	0.294	0.31	0.320
4-9	<b>-1.91*</b>	<b>0.011</b>	0.19	0.521
Overweight/Obese†	-0.59	0.240	0.00	0.982
Diet				
Fruit and Vegetable Intake	0.15	0.419	0.03	0.701
Fruit Intake	0.22	0.342	-0.01	0.928
Sugar Intake	-0.00	0.664	0.00	0.920
Whole Grain Intake	-0.08	0.864	0.01	0.955
Dairy Intake	-0.16	0.264	0.02	0.784
Fiber Intake	-0.03	0.407	-0.00	0.928
Calcium Intake	-0.00	0.234	0.00	0.682
Total Physical Activity	-0.00	0.846	-1.21	0.967
Medication Adherence†				
Yes	<b>0.96**</b>	<b>0.004</b>	-0.02	0.892
Smoking Status				
Former	<b>1.00*</b>	<b>0.015</b>	0.08	0.633
Never	<b>0.68*</b>	<b>0.044</b>	0.10	0.454
Alcohol Consumption†				
Yes	-0.21	0.492	0.21	0.075
Risky Behavior†				
Yes	-0.44	0.369	-0.04	0.843
Coping				

Emotional Processing	0.07	0.189	-0.00	0.819
Emotional Expression	0.07	0.149	-0.01	0.427
Distress†				
Yes	<b>-0.93**</b>	<b>0.003</b>	-0.18	0.133
Depression‡				
Major Depression	<b>-2.08***</b>	<b>0.000</b>	0.17	0.162
Anxiety†				
Yes	<b>-1.87***</b>	<b>0.000</b>	-0.11	0.406
Resilience	<b>0.02***</b>	<b>0.000</b>	0.00	0.276
Personal Control	<b>0.07***</b>	<b>0.000</b>	0.00	0.625
Stress	<b>-0.20***</b>	<b>0.000</b>	-0.01	0.445
Trauma†				
Yes	<b>-1.12**</b>	<b>0.004</b>	<b>0.44**</b>	<b>0.004</b>
<b>Community Level of Influence</b>				
<b>Resources</b>				
Food Insecurity‡				
Food Secure	<b>0.76*</b>	<b>0.011</b>	0.13	0.263
Neighborhood Characteristics				
Access to Healthy Food	-0.02	0.342	-0.00	0.852
Walkability	-0.01	0.607	-0.01	0.230
Aesthetics	0.00	0.928	-0.02	0.161
Rating	-0.29	0.068	-0.02	0.794
Compared to Others	-0.23	0.057	-0.06	0.217
<b>Norms</b>				
Perceived Discrimination	<b>-0.47***</b>	<b>0.000</b>	0.01	0.833
Crime Exposure	<b>-0.41*</b>	<b>0.012</b>	-0.04	0.530
Violence Exposure	<b>-0.14**</b>	<b>0.001</b>	-0.02	0.273
<b>Functioning</b>				
Social Cohesion	-0.09	0.070	-0.01	0.516
Social Support	<b>0.02***</b>	<b>0.000</b>	-0.00	0.965
<b>Health System</b>				
<b>Access</b>				
Travel Time‡				
>60 minutes	-0.14	0.853	-0.22	0.447
Primary Care Provider Visits				
Yes Usual Source of Care	0.20	0.638	<b>0.35*</b>	<b>0.032</b>
Yes Personal Doctor	0.34	0.383	-0.06	0.666
Wait Time†				
Yes Delay in Treatment	-0.59	0.076	-0.23	0.069

Received Specialist Visits†	-0.52	0.192	0.05	0.753
<b>Provider</b>				
Respect				
Always	0.02	0.967	-0.05	0.777
Trust	<b>0.05*</b>	<b>0.016</b>	-0.00	0.870
Communication	0.03	0.337	0.01	0.538
Cultural Competence‡				
Important	-0.42	0.265	0.19	0.186
Satisfied with Care	<b>0.42**</b>	<b>0.002</b>	0.02	0.760
Dissatisfied with Care	-0.19	0.069	<b>-0.09*</b>	<b>0.027</b>
<b>Cost</b>				
Medication Hardship†	0.31	0.416	0.12	0.434

\*p<.05; \*\*p<.01; \*\*\*p<.001; †Reference Groups = No; ‡Other Reference Groups: Sex Ref: Female; Married Ref: Not Married; Education Ref: >High School; Income Ref: >=\$25,000; BMI Ref: Underweight/Normal; Food Insecurity Ref: Food Insecure; Travel Time Ref: <60 minutes; PCP Respect Ref: Not Always; Cultural Competence Ref: Not Important

**Table 14** shows the sequential linear regression model used for final variable selection based on a p-value of 0.25 or less. Variables retained across the individual level, community level, and health systems level are in bold text in Table and included in the final models in Table 15 and Table 16.

<b>Table 14. Sequential Linear Regression Models of Quality of Life (MCS/PCS) by Individual, Community, and Health System Factors in Diabetes for Inclusion in Final Model</b>				
	<b>MCS</b>		<b>PCS</b>	
	<b>β</b>	<b>P-value</b>	<b>β</b>	<b>P-value</b>
<b>Adjusted for Individual Level Factor</b>				
<b>Socio-demographic/Culture</b>				
Age	<b>0.02</b>	0.238	0.01	0.377
Male‡	-0.27	0.381	-0.06	0.619
Married†	<b>0.80</b>	0.060	-0.04	0.820
< High School Graduate‡	<b>-0.70</b>	0.038	-0.06	0.648
Employed†	0.23	0.573	<b>0.46</b>	0.008
Income< \$25,000‡	0.25	0.616	-0.13	0.534
Insured†	-0.05	0.902	0.12	0.519
Lifecourse SES	-0.13	0.301	-0.01	0.919
Has Financial Hardship†	0.77	0.357	0.32	0.352

Has Competing Needs†	<b>-0.94</b>	0.002	-0.04	0.754
Spiritual	-0.01	0.823	0.01	0.409
<b>Behavioral/Psychosocial</b>				
Comorbidities‡				
1-3	-0.64	0.443	<b>0.44</b>	0.213
4-9	<b>-1.63</b>	0.050	0.36	0.299
Overweight/Obese‡	-0.27	0.589	0.00	0.998
Diet				
Fruit and Vegetable Intake	-1.61	0.421	-0.50	0.575
Fruit Intake	-0.67	0.263	-0.24	0.377
Sugar Intake	0.00	0.843	-0.00	0.938
Whole Grain Intake	0.08	0.901	0.27	0.360
Dairy Intake	<b>-0.98</b>	0.186	<b>-0.45</b>	0.176
Fiber Intake	<b>-0.23</b>	0.053	<b>-0.10</b>	0.067
Calcium Intake	<b>0.00</b>	0.240	<b>0.00</b>	0.148
Total Physical Activity	0.00	0.333	-8.76	0.801
Medication Adherent†				
Yes	0.27	0.417	0.05	0.739
Smoking Status‡				
Former	<b>0.77</b>	0.076	0.16	0.406
Never	<b>0.42</b>	0.239	<b>0.22</b>	0.167
Alcohol Consumption†				
Yes	0.06	0.843	0.15	0.283
Risky Behavior†				
Yes	-0.03	0.950	-0.09	0.685
Coping				
Emotional Processing	-0.06	0.487	-0.00	0.829
Emotional Expression	0.04	0.570	-0.02	0.523
Distress†				
Yes	<b>-0.38</b>	0.250	<b>-0.23</b>	0.121
Depression†				
Major Depression	<b>-1.31</b>	0.003	-0.07	0.709
Anxiety†				
Yes	-0.41	0.398	0.04	0.847
Resilience	<b>0.02</b>	0.019	0.00	0.683
Personal Control	<b>0.03</b>	0.171	-0.00	0.763
Stress	<b>0.10</b>	0.158	-0.03	0.412
Trauma†				
Yes	<b>-0.90</b>	0.038	<b>0.56</b>	0.005

<b>Adjusted for Community Level Factor</b>				
<b>Resources</b>				
Food Insecurity†				
Food Secure	0.19	0.546	0.13	0.310
Neighborhood Characteristics				
Access to Healthy Food	0.01	0.696	0.01	0.399
Walkability	0.03	0.293	-0.01	0.598
Aesthetics	-0.00	0.985	<b>-0.03</b>	0.175
Rating	-0.06	0.819	<b>0.14</b>	0.194
Compared to Others	-0.08	0.662	<b>-0.09</b>	0.258
<b>Norms</b>				
Perceived Discrimination	<b>-0.36</b>	0.001	0.03	0.573
Crime Exposure	-0.18	0.429	0.01	0.943
Violence Exposure	<b>-0.08</b>	0.085	0.02	0.338
<b>Functioning</b>				
Social Cohesion	0.02	0.733	-0.00	0.854
Social Support	<b>0.02</b>	0.003	-0.00	0.767
<b>Adjusted for Health System Level Factor</b>				
<b>Access</b>				
Travel Time†				
>60 minutes	0.08	0.924	-0.17	0.586
Primary Care Provider Visits				
Yes Usual Source of Care†	-0.17	0.714	<b>0.36</b>	0.044
Yes Personal Doctor†	-0.04	0.931	<b>-0.25</b>	0.123
Wait Time†				
Yes Delay in Treatment	-0.29	0.427	<b>-0.23</b>	0.100
Received Specialist Visits†	-0.22	0.670	0.10	0.630
<b>Provider</b>				
Respect†				
Always	-0.07	0.879	0.01	0.973
Trust	0.01	0.532	-0.00	0.688
Communication	<b>-0.10</b>	0.047	0.01	0.564
Cultural Competence†				
Important	<b>-0.52</b>	0.184	<b>0.22</b>	0.146
Satisfied with Care	<b>0.66</b>	0.003	-0.05	0.541
Dissatisfied with Care	-0.11	0.327	<b>-0.08</b>	0.054
<b>Cost</b>				
Medication Hardship†	0.36	0.364	0.13	0.403



Bold= $p < 0.25$ . Variables with  $p < 0.25$  for each level were included in final models in Table 4.  
†Reference Groups = No; ‡Other Reference Groups: Sex Ref: Female; Education Ref: >High School; Income Ref:  $\geq \$25,000$ ; Comorbidity Ref: 0; BMI Ref: Underweight/Normal; Smoking Status Ref: Never; Food Insecurity Ref: Food Insecure; Travel Time Ref: <60 minutes; PCP Respect Ref: Not Always; Cultural Competence Ref: Not Important

**Table 15** shows the fully adjusted linear regression model for MCS with individual, community, and health system factors as covariates across all four regression approaches. For approach 1 using sequential regression, only factors at the individual level and health system level were significantly associated with MCS. Specifically, having less than a high school education ( $\beta = -0.66$ ;  $p = 0.037$ ) was associated with lower MCS, as was major depression ( $\beta = -1.38$ ;  $p < 0.001$ ). For the health systems level, provider communication ( $\beta = -0.10$ ;  $p = 0.022$ ) was associated with lower MSC. Whereas satisfaction with care ( $\beta = 0.39$ ;  $p = 0.044$ ) was associated with higher MCS.

For approach 2, stepwise regression using backward selection, individual level factors were significantly associated with lower MCS. These included having less than a high school diploma ( $\beta = -0.59$ ;  $p = 0.05$ ), having 4-9 comorbidities ( $\beta = -0.59$ ;  $p = 0.042$ ), and having major depression ( $\beta = -1.33$ ;  $p < 0.001$ ). At the health systems level, provider communication was significantly associated with lower MCS ( $\beta = -0.11$ ;  $p = 0.013$ ); and satisfaction with care was significantly associated with higher MCS ( $\beta = 0.40$ ;  $p = 0.033$ ). No factors at the community level were significantly associated with MCS.

For approach 3, stepwise regression using forward selection, having less than a high school education ( $\beta = -0.67$ ;  $p = 0.026$ ) and having major depression ( $\beta = -1.33$ ;  $p < 0.001$ ) were the individual level factors that were significantly associated with lower

MCS. Resilience ( $\beta=0.01$ ;  $p=0.025$ ) was associated with higher MCS. The health system level factors associated with MCS using forward selection included provider communication ( $\beta=-0.11$ ;  $p=0.008$ ) and was significantly associated with lower MCS; and satisfaction with care ( $\beta=0.43$ ;  $p=0.019$ ) which was associated with higher MCS.

For the final approach using all subsets regression, only individual level factors were associated with MSC. Specifically, having less than a high school education ( $\beta=-0.78$ ;  $p=0.006$ ), having competing needs ( $\beta=-0.55$ ;  $p=0.049$ ), having 4-9 comorbidities ( $\beta=-1.58$ ;  $p=0.04$ ), and having major depression ( $\beta=-1.51$ ;  $p<0.001$ ) were all significantly associated with lower MCS. Resilience ( $\beta=0.01$ ;  $p=0.002$ ) was significantly associated with higher MCS.

**Table 15. Fully Adjusted Linear Regression of Quality of Life (MCS) by Individual, Community, and Health Systems Factors in Diabetes**

	Approach 1		Approach 2		Approach 3		Approach 4	
	Sequential		Backward Selection		Forward Selection		All Possible Subsets	
	Adjusted R <sup>2</sup> =0.285	P-value	Adjusted R <sup>2</sup> =0.303	P-value	Adjusted R <sup>2</sup> =0.301	P-value	Adjusted R <sup>2</sup> =0.320	P-value
	β		β		β		β	
<b>Individual Level of Influence</b>								
<b>Sociodemographic/Culture</b>								
Age	-0.01	0.399						
Married <sup>†</sup>	0.45	0.280	0.52	0.189	0.48	0.227		
< High School Graduate <sup>†</sup>	<b>-0.66*</b>	<b>0.037</b>	<b>-0.59*</b>	<b>0.050</b>	<b>-0.67*</b>	<b>0.026</b>	<b>-0.78**</b>	<b>0.006</b>
Worried About Making Mortgage <sup>†</sup>	-0.44	0.156	-0.35	0.231	-0.33	0.264		
Has Competing Needs <sup>†</sup>	-0.42	0.161	-0.46	0.109	-0.45	0.117	<b>-0.55*</b>	<b>0.049</b>
<b>Behavioral/Psychosocial</b>								
Comorbidities <sup>†</sup>								
1-3	-0.03	0.976					-0.95	0.214
4-9	-0.55	0.542	<b>-0.59*</b>	<b>0.042</b>	-0.56	0.061	<b>-1.58*</b>	<b>0.040</b>
Diet								
Fruit and Vegetable Intake	0.33	0.159	0.36	0.080				
Dairy Intake	-0.21	0.674	-0.18	0.205				
Fiber Intake	-0.07	0.350	-0.06	0.225				
Calcium Intake	0.00	0.941						
Smoking Status <sup>†</sup>								
Former	0.51	0.216					0.47	0.198
Never	0.13	0.690					0.09	0.764
Distress <sup>†</sup>								



**Table 16** shows the fully adjusted linear regression model of PCS by individual, community, and health system factors across all four regression approaches. Results were similar across all four approaches with factors at the individual and health system level having a significant association with higher PCS. Specifically, being employed, reporting trauma, and having a usual source of care were all significantly associated with higher PCS across all four approaches.

For approach 1 using sequential regression, being employed ( $\beta=0.46$ ;  $p=0.005$ ) and reporting trauma ( $\beta=0.36$ ;  $p=0.032$ ) were both significantly associated with higher PCS at the individual level, and having a usual source of care ( $\beta=0.36$ ;  $p=0.045$ ) was significantly associated with higher PCS at the health systems level.

For approach 2 using stepwise regression with backward selection, being employed ( $\beta=0.45$ ;  $p=0.004$ ) and reporting trauma ( $\beta=0.39$ ;  $p=0.012$ ) were both significantly associated with higher PCS at the individual level, and having a usual source of care ( $\beta=0.37$ ;  $p=0.032$ ) was significantly associated with higher PCS at the health systems level.

For approach 3 using stepwise regression with forward selection, being employed ( $\beta=0.45$ ;  $p=0.004$ ) and reporting trauma ( $\beta=0.39$ ;  $p=0.012$ ) were both significantly associated with higher PCS at the individual level, and having a usual source of care ( $\beta=0.37$ ;  $p=0.032$ ) was significantly associated with higher PCS at the health systems level.

For approach 4 using all subsets regression, being employed ( $\beta=0.44$ ;  $p=0.004$ ) and reporting trauma ( $\beta=0.45$ ;  $p=0.004$ ) were both significantly associated with higher

PCS at the individual level. Having a usual source of care ( $\beta=0.32$ ;  $p=0.066$ ) was marginally significant with PCS at the health systems level.

**Table 16. Fully Adjusted Linear Regression of Quality of Life (PCS) by Individual, Community, and Health Systems Factors in Diabetes**

	Approach 1		Approach 2		Approach 3		Approach 4	
	Sequential		Backward Selection		Forward Selection		All Possible Subsets	
	Adjusted R <sup>2</sup> =0.106	P-value	Adjusted R <sup>2</sup> =0.116	P-value	Adjusted R <sup>2</sup> =0.116	P-value	Adjusted R <sup>2</sup> =0.137	P-value
	β		β		β		β	
<b>Individual Level of Influence</b>								
<b>Socio-demographic/Culture</b>								
Employed <sup>†</sup>	<b>0.46**</b>	<b>0.005</b>	<b>0.45**</b>	<b>0.004</b>	<b>0.45**</b>	<b>0.004</b>	<b>0.44**</b>	<b>0.004</b>
<b>Behavioral/Psychosocial</b>								
Comorbidities <sup>‡</sup>								
1-3	0.26	0.469	0.16	0.211	0.16	0.211	0.25	0.446
4-9	0.12	0.736					0.11	0.736
Alcohol Consumption <sup>†</sup>								
Yes	0.10	0.412						
Distress <sup>†</sup>								
Yes	-0.12	0.354						
Trauma <sup>†</sup>								
Yes	<b>0.36*</b>	<b>0.032</b>	<b>0.39*</b>	<b>0.012</b>	<b>0.39*</b>	<b>0.012</b>	<b>0.45**</b>	<b>0.004</b>
<b>Community Level of Influence</b>								
<b>Resources</b>								
Neighborhood Characteristics								
Aesthetics	-0.03	0.122	-0.03	0.088	-0.03	0.088	-0.03	0.051
Rating	0.00	0.951						
<b>Health System Level of Influence</b>								
<b>Access</b>								
Primary Care Provider Visits								
Yes, Usual Source of Care <sup>†</sup>	<b>0.36*</b>	<b>0.045</b>	<b>0.37*</b>	<b>0.032</b>	<b>0.37*</b>	<b>0.032</b>	0.32	0.066
Yes, Personal Doctor <sup>†</sup>	-0.18	0.274	-0.18	0.250	-0.18	0.250		
Wait Time <sup>†</sup>								
Yes, Delay in Treatment	-0.26	0.051	-0.25	0.052	-0.25	0.052	-0.23	0.065
<b>Provider</b>								
Cultural Competence <sup>†</sup>								
Important	0.18	0.194	0.19	0.189	0.19	0.189		
Dissatisfied with Care	-0.07	0.108	-0.07	0.078	-0.07	0.078	-0.06	0.141

\*p<0.05; \*\*p<0.01; \*\*\*p<0.001; <sup>†</sup>Reference Groups = No; <sup>‡</sup>Other Reference Groups: Comorbidity Ref: 0; Cultural Competence Ref: Not Important

## **4.5 Discussion**

This is one of the first studies to systematically evaluate the individual and collective contributions of factors at the individual, community, and health system levels on quality of life for inner-city African Americans with diabetes. The results of this study found that among inner-city African Americans with diabetes, factors across the individual, community, and health system level were significantly associated with quality of life in unadjusted models. However, in fully adjusted models based on a conceptual framework and using four different regression approaches, factors at the individual and health system level were differentially associated with quality of life. Community level factors were not significantly associated with quality of life in this population after accounting for other levels of influence.

In this sample, factors associated with the mental functioning component of quality of life largely occur at the individual level, namely through low educational attainment, competing demands, high number of comorbid conditions, depression, and resilience. These findings are consistent with existing literature examining quality of life among inner-city African Americans with diabetes (Hill-Briggs et al., 2002). Specifically, Hill-Briggs et al. (2002) found that competing demands and comorbidities were associated with the mental functioning component of quality of life among inner-city African Americans with diabetes. Additionally, the association between depression and the mental functioning component of quality of life is not surprising as this relationship has been found across populations (Goldney et al., 2004; Egede & Ellis, 2008; Lewko & Misiak, 2015).



Less is known however, about the role of resilience and quality of life among inner-city African Americans with diabetes. Resilience is characterized as both an inherent capacity and trait to not only withstand difficulty but to adapt to changing circumstances as a result of difficulty and hardship (Bradshaw et al., 2007). Evidence shows that higher levels of resilience are linked to improved glycemic control (DeNisco, 2011), self-management (Steinhardt & Mamerow, 2009), and increased physical activity (Bradshaw et al., 2007) among adults with diabetes. These results add to the body of evidence by showing the impact of resilience on quality of life among inner-city African Americans with diabetes; however, the mechanisms underlying this relationship warrant further examination. Specifically, understanding the indirect pathways between resilience and diabetes outcomes is greatly needed for developing resilience-based skills interventions for diabetes management.

In contrast to mental functioning, factors that impact the physical functioning component of quality of life in this sample occurred at both the individual (employment and exposure to trauma) and health system (having a usual source of care) levels. The positive relationship between employment and physical functioning is not surprising and evidence from the literature has shown that having diabetes is associated with missed workdays due to poor physical functioning (Breton et al., 2013). Conversely, the positive association between exposure to trauma and higher physical functioning was not expected. Existing evidence shows that in national studies amongst the general population, experiencing trauma such as Adverse Childhood Experiences (ACEs) has a dose response relationship with physical functioning, such that the greater number of ACEs experienced, the lower physical functioning in adulthood (Campbell et al., 2016).

However, this has not been examined amongst diabetes populations, and has not been studied among inner-city African Americans with diabetes. Given the role of resilience, seen in this study, as well as others in individuals with diabetes (DeNisco, 2011; Steinhardt & Mamerow, 2009; Bradshaw et al., 2007), this observed relationship between trauma and the physical component of quality of life may be occurring indirectly through factors such as resilience, however additional research is needed to examine what is driving increased quality of life scores through physical functioning among those who have been exposed to trauma. Finally, the finding that having a usual source of care is associated with higher physical functioning is also not surprising and emphasizes the importance of engaging the health care system for optimal health in individuals with diabetes (ADA, 2020).

Taken together, these findings have implications for research, clinical care, and policy. From a research standpoint, while the importance of quality of life among individuals with diabetes is known, limited interventions exist to improve quality of life as an outcome for diabetes (Hoogendorn et al., 2020), particularly for inner-city African Americans. Several systematic reviews summarizing racial differences in diabetes outcomes (Campbell et al., 2012), effective behavioral interventions for diabetes (Walker et al., 2013), and the impact of social determinants on diabetes outcomes (Walker et al., 2014) have found that little attention has been placed on quality of life as an outcome for diabetes. Specific for inner-city African Americans, an integrative review exploring the barriers across the individual, community, and health system level found that across 46 studies, 2 focused on quality of life as an outcome for diabetes (Campbell & Egede, 2019). The current findings suggest that quality of life should be

considered more frequently in outcome studies and factors at the individual, community and health system level should be incorporated into interventions to improve quality of life among inner-city African Americans with diabetes.

From a clinical standpoint, health care providers need to consider the importance of patient-centered care and communication on quality of life and finds ways of enhancing both during clinical encounters. Finally, from a policy standpoint, inner-city populations are particularly vulnerable and already have multiple barriers to optimal health outcomes. Therefore, as policies are enacted, there is need to consider how barriers at multiple levels of influence could impact the health of inner-city populations with diabetes. For example, programs that provide diabetes self-management education/support (DSME/S) need to consider cultural and environmental barriers that need to be overcome in order to improve diabetes outcomes and quality of life for inner-city populations.

#### **4.6 Limitations**

This study has limitations that should be considered in interpreting the study results. First, this was a cross-sectional study, therefore it cannot speak to causality. Second, while validated measures were used for the study, the possibility of recall bias cannot be excluded. Third, this study was conducted in the midwestern United States, so the finding may not generalize to inner-city African American populations from different regions of the United States.

#### **4.7 Conclusions**

This is one of the first studies to systematically evaluate the individual and collective contributions of factors at the individual, community, and health system levels

on quality of life for inner-city African Americans with diabetes. The study results highlight key factors that influence quality of life among inner-city African Americans with type 2 diabetes that could be targets for interventions in this population. However additional research is needed to understand existing pathways that may be driving many of these relationships.

## **CHAPTER FIVE: DISCUSSION**

### **5.1 Discussion**

The prevalence and burden of diabetes represents a major public health crisis in the US. According to the Center for Disease Control and Prevention's (CDC) National Diabetes Statistic Report for 2020, diabetes prevalence has increased over the last 5 years, with 13% of US adults age 18 and older now living with diabetes (CDC, 2020). In addition to prevalence, cost of diabetes continues to rise in the US with the latest estimates placing the annual cost at \$327 billion (ADA, 2020). From a population standpoint, the American Diabetes Association (ADA) reports that 77% of individuals with diabetes do not meet treatment targets for diabetes outcomes, substantially increasing risk for complications and financial burden at the individual and societal level (ADA, 2020).

Vulnerable populations, individuals who are marginalized due to severe economic hardship, have multiple comorbid conditions, and who are ethnic minorities; experience an even greater burden of disease (ADA, 2020). Moreover, adverse social, environmental, and economic factors may intersect with existing risk factors creating multidimensional adversity (Tung & Chin, 2020) that serves to compound already poor diabetes outcomes (ADA, 2020). For example, the health disparities that exist for African Americans with diabetes compared to non-Hispanic Whites have been well established (Egede, 2006; Peek et al., 2007; Campbell et al., 2012; Meng et al., 2016; Walker et al., 2016). However, less focus is placed on the risk that inner city's confer among African Americans with diabetes that include psychosocial stressors, economic

hardships, environmental racism, and limited access to care (Williams et al., 2016).

These factors present within inner cities may not only impede diabetes self-management but worsen diabetes outcomes leading to complications and early mortality among an already vulnerable population.

Inner cities can be defined as distressed urban environments and are characterized by low employment opportunities, limited educational opportunities, and high rates of poverty (ICI, 2019). Inner cities once represented the hub of economic activity before experiencing systematic neglect both economically and socially during the 20<sup>th</sup> century (Mills & Lubuele, 1997; Wilson & Aponte, 1985; Teitz & Chapple, 1998). Therefore, the term “inner city” has historical significance as it relates to understanding and mitigating health disparities. African Americans are disproportionality represented across inner cities in the US and as such, recent suggestions to retire the term would be to suppress the historical origins of long-standing inequity that relates to many existing barriers that preclude the achievement of optimal health, particularly for those living with diabetes (Kooragayala, 2016; Axel-Lute, 2017).

While the literature has shown that inner-city African Americans experience worse diabetes outcomes and lower quality of life compared to those who are not living in an inner-city, there remains a dearth of evidence on effective interventions that account for the multi-level factors that serve as barriers to diabetes care (Campbell & Egede, 2019). The current study adds to the body of literature by first developing a framework for understanding barriers to diabetes care for inner-city African Americans with diabetes that occur across multiple levels of influence Figure 8. Specifically, this framework integrated two existing behavioral models for diabetes and was informed by

the literature and a social ecological model for health disparities. Through the development of this framework, the major factors identified in the literature as barriers to care for inner-city African Americans with diabetes included individual level barriers such as lack of knowledge, household factors, depression, health literacy, diabetes awareness, competing demands, food preferences, the role of culture, resilience, personal control, self-efficacy, trauma, and history of drug use. Community level barriers include lack of social and peer support, food availability and food affordability, access to transportation, neighborhood safety, crime, and racism. At the health systems level, the barriers identified include self-management and decision support, role of trust, physician knowledge and awareness, the ability to make appointments and be seen in a timely manner, and finally delay in treatment.

Using the newly developed framework, this study then examined the contribution of each barrier level on two important diabetes outcomes, glycemic control and quality of life, among inner-city African Americans with diabetes. This was accomplished through advanced regression methods using four approaches to identify factors that may be key drivers of outcomes for inner-city African Americans with diabetes. The findings showed that factors across the three levels of influence, individual, community, and health system, have a differential relationship with glycemic control and quality of life.

For glycemic control, consistent significant relationships across adjusted models in all four approaches included individual level factors of age ( $\beta=-0.05$ ;  $p<0.001$ ); having 1-3 comorbidities ( $\beta=-2.03$ ;  $p<0.05$ ) and having 4-9 comorbidities ( $\beta=-2.49$ ;  $p=0.001$ ). Similarly, male sex ( $\beta=0.58$ ;  $p<0.05$ ), being married ( $\beta=1.16$ ;  $p=0.001$ ) and being

overweight/obese ( $\beta=1.25$ ;  $p<0.01$ ) were associated with better glycemic control consistently across the four methods. Community and health system level factors were not significantly associated with glycemic control in this study population, which may be due to the relatively small sample size. The lack of significance observed between community level factors and health system level factors on glycemic control does not suggest that these levels should not be considered for inner-city African Americans with diabetes. Rather, the results suggest the importance of individual level factors in driving glycemic control that taken together, traditional models of care focusing on a single level at a time may not be adequate to address the complex barriers that patients with diabetes living in inner-cities experience.

Similar methods were used to examine the three levels of influence on quality of life among inner-city African Americans with diabetes. In the final adjusted models, the results showed that quality of life for mental functioning is largely influenced by factors at the individual level. Specifically, having less than a high school education ( $\beta=-0.78$ ;  $p=0.006$ ), as well as having major depression ( $\beta=-1.51$ ;  $p<0.001$ ) were both related to lower quality of life scores for mental functioning across all four regression approaches. Quality of life scores for physical functioning were impacted by employment status, such that being employed was associated with better quality of life scores across all four regression approaches ( $\beta=0.44$ ;  $p=0.004$ ). Additionally, among participants who reported experiencing trauma during their childhood, quality of life scores for physical functioning were higher across all four regression approaches ( $\beta=0.45$ ;  $p=0.004$ ). At the health systems level, reporting a usual source of care was also associated with better quality of life scores for physical functioning across sequential ( $\beta=0.36$ ;  $p=0.045$ );



stepwise with backward selection ( $\beta=0.37$ ;  $p=0.032$ ); stepwise with forward selection ( $\beta=0.37$ ;  $p=0.032$ ); and marginally significant in the all possible subsets model ( $\beta=0.32$ ;  $p=0.066$ ).

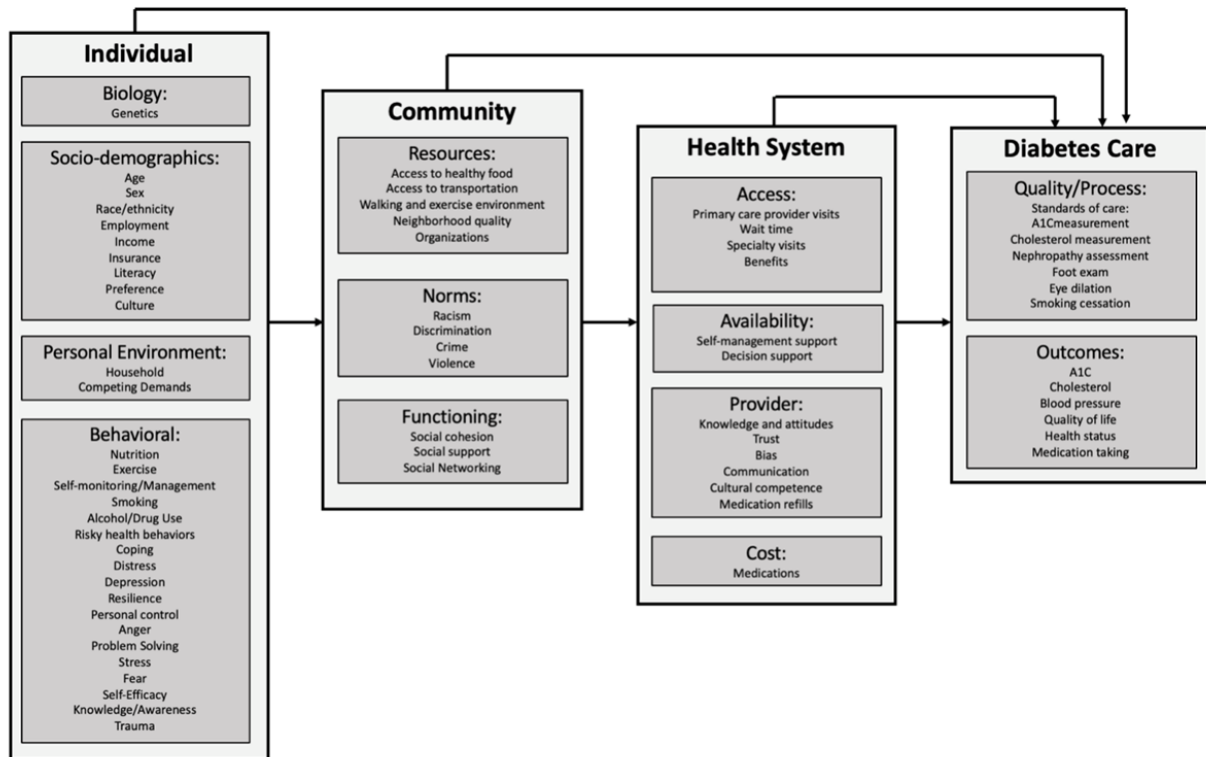
The importance of the methodology used in these analyses is that the use of four regression approaches allows for understanding the importance of contextual factors across the individual, community, and health system level within a conceptual framework. Specifically, the four approaches show significance from a theoretical, statistical, and variance standpoint. As such, factors identified in this study that are significant across all four approaches are likely key drivers of glycemic control and quality of life among inner-city African Americans with diabetes. Therefore, this study has contributed to the body of evidence by specifying factors that should be taken into consideration for intervention development for inner-city African Americans with diabetes.

## **5.2 Public Health and Research Implications**

The findings of this study support the public health approach for eliminating health disparities as specified by the CDC (CDC, 2020), and have implications for addressing diabetes as a public health challenge. Specifically, use of a public health approach for the elimination of health disparities can be seen through 1) defining and monitoring a problem; 2) identifying risk and protective factors; 3) developing and test prevention strategies; and 4) assuring widespread adoption (CDC, 2020). The findings from this study have provided preliminary information for defining the problem of barriers to diabetes care among inner-city African Americans, with barriers occurring across the individual, community, and health system level.

The framework developed in this study (Chapter one) identifies the factors across these multiple levels of influence that may serve as risk factors for diabetes management. Testing of this framework further specify factors that may be key for developing prevention and intervention strategies to mitigate the burden of diabetes among inner-city African Americans. Specifically, for glycemic control, older age, having comorbidities, being married, and obesity are important factors for prevention and intervention strategies. For quality of life, at the individual level having less than a high school education, having major depression, being employed, and having a usual source of care are important factors for consideration for prevention and intervention strategies.

Figure 8. Campbell and Egede Framework for Understanding Barriers to Care for Inner-City African Americans



Future work is needed to examine the direct and indirect pathways that may exist across levels of influence for diabetes outcomes to better understand mechanisms that may be serving as risk factors for poor diabetes outcomes as well as potential protective factors. For example, this study found that the physical component of quality of life was higher among participants reporting a history of trauma. Understanding pathways underlying this relationship and whether resilience is a key factor is critical to understand. Additionally, the results of this study support the need for a model of care that emphasizes a more holistic view of diabetes management by contextualizing risk factors across levels of influence. Evidence suggests the importance of social

conditions as fundamental causes of disease and suggest caution be used when focus is placed solely on individualized risk for disease (Link and Phelan, 1995). Specifically, models of care that view risk factors in isolation of other levels of influence limits the ability to understand mechanisms across levels of influence (Link and Phelan, 1995).

### **5.3 Clinical Implications**

Diabetes care is complex requiring a multifaceted approach that includes daily management from the patient, front-line education from diabetes educators, and the clinical decision making from providers and clinicians. The findings of this study have clinical implications across these three areas including the patient perspective, diabetes educators, and clinicians. In addition, clinical implications will be discussed aligned with the framework **Figure 8** for understanding barriers to care for inner-city African Americans at individual, community, health system levels.

Clinical implications for the patient include integration of the patients' lived experience into the framework for understanding barriers to diabetes care. Findings from literature review conducted as a part of this study found an absence of the patients' lived experiences incorporated into intervention and program development for inner-city African Americans with diabetes. The framework created drew from qualitative and quantitative studies to specify barriers directly from patients across the individual, community, and health system level. Future incorporation of each of these levels from the experiences of those living with diabetes in an inner-city, will allow interventions and programs for diabetes to reach beyond the clinical encounter and include the full sphere of influence for diabetes.

Clinical implications for diabetes educators can be found through the delivery of Diabetes Self-Management Education and Support (DSMES). Diabetes educators are integral to the care team for diabetes and serve at the front line in mitigating diabetes complications through effective education and skills training. DSMES is a well-established mechanism for providing knowledge, skills, and education across populations with diabetes, accounting for the cultural and environmental needs that can be leveraged to improve diabetes outcomes and quality of life (Powers et al., 2017). The ADA specifies in the Standards of Medical Care for diabetes, that DSMES services are critical, specifically for marginalized populations with diabetes, such as inner-city African Americans (ADA, 2020). In addition to the findings of this study identifying factors statistically significantly related to glycemic control and quality of life, the framework developed in this study has applied significance as well. Specifically, this framework can be used as a resource to support and promote the National Standards for DSMES. The National Standards for DSMES specify 10 standards for effective and person-centered support for diabetes management that include the internal structure for DSMES services (Standard 1); stakeholder input (Standard 2); evaluation of the population served (Standard 3); quality coordination in overseeing DSMES services (Standard 4); the DSMES team (Standard 5); curriculum (Standard 6); individualization (Standard 7); ongoing support (Standard 8); participant progress (Standard 9); and quality improvement (Standard 10). Application of this framework to each standard will be delineated below (Beck et al., 2018).

Standard 1 specifies the importance of the mission statement as well as goals for the internal structure for DSMES services (Beck et al., 2018). In support of this standard

for DSMES, this framework can be used as a resource for fostering communication between small or large health care organizations and social services providers within the internal structure for advancing DSMES services that are central to the ongoing organizational mission and goals. For example, a defined leadership between health care organizations (at the health system level in the framework) and social services providers (at the community level in the framework) is needed to remove any diabetes service-related obstacles and find community resources (i.e., identify community resources to support healthy lifestyle). In addition, for smaller or independent providers of DSMES, they can identify and document their own mission, goal, and structure to fit in the community they serve (based on the multi-level factors identified in the framework).

Standard 2 specifies the importance of receiving stakeholder input that is specific to the quality of DSMES services that accounts for various barriers that would preclude participant utilization of DSMES services (Beck et al., 2018). This framework can be used as a tool for identifying relevant stakeholders (DSMES participants, practitioners who refer patients to DSMES, and community-based diabetes advocacy groups). As highlighted in the framework developed in chapter one, the social determinants at the individual levels (e.g. insurance coverage, income, literacy), community level (e.g., access to healthy food, access to transportation, and neighborhood safety, racism), and the health system level (e.g., access to primary care physician, non-adherence to medication due to financial difficulties) related to the patient population served can be used to guide stakeholder selection.

Standard 3 specifies the need for evaluation of the population being served in order to understand existing and needed resources that will allow for maximizing DSMES services across communities (Beck et al., 2018). Although DSMES is associated with improved diabetes knowledge and self-care behaviors (Norris et al., 2002) reports indicate that only 5-7% eligible for DSMES through Medicare or a private insurance plan actually receive it (Stawbridge et al., 2015). To increase participation, the framework can be used in support of Standard 3 by serving as a framework for evaluating resources across the individual, community, and health system level. For example, health care providers can use the framework to understand their patients' demographic characteristics, including ethnic/cultural background, level of education, literacy and numeracy, as well as perception of diabetes risk. Additionally, this framework specifies the existing barriers that have been documented in the literature for African Americans with diabetes living in an inner-city environment. Diabetes care and education specialists can leverage this framework as a tool to identify individualized resources and additional barriers not captured to maximize DSMES services. Furthermore, this framework can be adapted across community needs and populations.

Standard 4 specifies the essential role of the quality coordinator within DSMES services, with a specific focus on evidence-based practice in overseeing DSMES services (Beck et al., 2018). Ensuring quality of a person-centered health care is a critical component of the chronic care model (Stellefson et al., 2013). The framework can be used as a tool to promote Standard 4 by identifying and integrating multi-level social determinants data (at individual, community, and health system levels) into the traditional use of electronic health record (EHR). The data integrations would allow

healthcare organizations and payers to better evaluate the effectiveness of DSMES for populations with diabetes who may be at higher risk for complications and disease burden due to adverse social determinants of health across multiple levels of influence.

Standards 5 and 6 specify the importance of the DSMES team that is interprofessional and the process of curriculum development (Beck et al., 2018). This framework supports both Standards 5 and 6 as it can be used to identify barriers across multilevel systems best addressed using an interprofessional team. Additionally, this framework provides an evidence-based framework for curriculum development as evidence suggests that the curriculum should include problem-solving approaches, addressing psychosocial issues, behavior change, and strategies to sustain self-management efforts (Piatt et al., 2006; Weinger, 2011). The multi-level framework developed in this study allows the curriculum to be dynamic by incorporating the individual, community, and health systems level that can be used as a tool for specialized training for diabetes paraprofessionals.

Standards 7-10 specify the importance of DSMES services providing individualization, ongoing support, continuous monitoring and measuring participant progress (e.g., their behavior changes, clinical outcomes and complications, as well as the quality of life), and evaluating quality improvement (Beck et al., 2018). The framework developed in this study can promote each of these standards by first fostering collaboration and empowerment as an assessment tool between diabetes care and education specialists and participants through prioritizing needs and setting attainable goals that are individualized. Second, being used as a framework to identify resources across each level of influence to provide ongoing support. Third, monitoring



progress by serving as a framework for a personalized and comprehensive process that allows for assessing goals across each level of influence and evaluating and adjusting targets based on participant needs and priorities. Finally, this framework can be used as a resource to promote quality improvement by identifying gaps and barriers across the individual, community, and health system level of influence and integrating with the Institute for Healthcare Improvement.

Finally, at the clinician level, the implications from this study may be similar to that of diabetes educators, however, specifically may be drawn from the collective framework as well as each construct represented within the framework. For example, having a framework for barriers that occur at the individual level, clinicians may draw from the personal environment and assess during the clinical encounter what specific elements of the household may be contributing to self-management or which may be serving as a barrier. Similarly, assessing resources with the patient at the community level to leverage support to meet care goals may enhance the care plan. Additionally, understanding patient perspectives of the health system and the importance of access and perceived provider communication may promote better communication and more patient centeredness.

#### **5.4 Limitations**

Overall, while this study is strengthened by developing an integrative framework for understanding barriers to diabetes care for inner-city African Americans, followed by testing this framework on two important diabetes outcomes among a community dwelling sample of adults living in inner-city with diabetes, it is not without limitations. First, for the integrative review and framework development, the search conducted was

limited to published articles and therefore results may be subject to publication bias if studies that were not significant were not published or if quality improvement projects were conducted to address barriers in this population for diabetes and were not published. Additionally, the review only included papers that explicitly defined their population as being urban or inner-city, therefore articles that examined diabetes care among inner-city African Americans but did not specify may have been excluded. The review is considered narrative and no statistical methods were used to determine statistical significance and therefore cannot speak to any causal relationships or any statistical differences in the barriers identified. Second, for the data analysis portion of this study, data is cross-sectional and therefore cannot speak to any causal relationships. Additionally, data were self-reported and may be subject to some recall bias. Specifically, measures of neighborhood and health systems are subjective based on the individuals' lived experience and do not include objective measures of community resources or of health system operations. Finally, this study was conducted among inner-city African Americans in a midwestern city and may not be generalizable to all inner-city environments. However, the use of a conceptual framework derived from the literature for inner-city African Americans may help overcome this limitation.

## **5.5 Conclusion**

In conclusion, the disproportionate burden of diabetes experienced by inner-city African Americans necessitates a population health approach. This includes the pursuit of health equity for the elimination of health disparities, specifically in accordance to the empowerment of disenfranchised community members, aiming to ensure that the basic resources and conditions necessary for health are accessible to all using a person-

centered approach (Public Health Leadership Society, 2002). To effectively achieve health equity in diabetes for inner-city African Americans and provide the basic resources and conditions necessary for health; establishment of barriers specific to diabetes care is paramount. This study serves as preliminary in specifying these barriers through developing a framework for understanding barriers unique to inner-city African Americans and identifying important factors that may be driving glycemic control and quality of life. Future steps need to examine the indirect pathways that may exist within this framework contributing to poor outcomes. Additionally, application of this framework for intervention development may allow for the development of tailored and specific interventions that promote health equity and improve outcomes in diabetes for inner-city African Americans.

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## **APPENDICES**

Appendix A: Extraction Form

Appendix B: Measurements for Chapter 3

Appendix C: Measurement for Chapter 4

## Appendix A: Integrative Review Extraction Form

<b>A. Identification</b>	
Title of the article	
Title of the journal	
Authors	Name _____ Institution _____ Background _____
Country	
Language	
Year of publication	
<b>B. Institution</b>	
Hospital	
University	
Research center	
Sole institution	
Multicenter study	
Other institutions	
No identification of setting	
<b>C. Type of publication</b>	
Nursing publication	
Medical publication	
Publication in another area of health. Which area?	
<b>D. Methodological characteristics of the study</b>	
1. Type of publication	1.1 Research ( ) Quantitative approach ( ) Experimental design ( ) Quasi-experimental design ( ) Non-experimental design ( ) Qualitative approach 1.2 Non research ( ) Literature review ( ) Report of experience ( ) Others
2. Objective or investigation question	
3. Sample	3.1 Selection ( ) Random ( ) Convenience ( ) Other 3.2 Size (n) ( ) Initial ( ) Final 3.3 Characteristics Age _____ Sex: M ( ) F ( ) Race _____ Diagnosis _____
4. Treatment of data	
5. Interventions performed	5.1 Independent variable _____ 5.2 Dependent variable _____ 5.3 Control group: yes ( ) no ( ) 5.4 Measurement instrument: yes ( ) no ( ) 5.5 Duration of the study _____ 5.6 Methods employed to measure the intervention _____
6. Results	
7. Barriers	

## Appendix B: Chapter 3 Measurements

Aim 2 Measurements included individual, community, and health system levels of influence as independent variables. Variables were measured using validated scales. As many scales required authorization for use, this measurement table has been included to represent the survey measurements. The Aim 2 outcome was glycemic control measured as the Hemoglobin A1c.

<b>Individual Level of Influence:</b> The individual level of influence was measured using socio-demographic variables and behavioral/psychosocial variables. Socio-demographics include spirituality, financial hardship, lifecourse SES, and competing needs. Behavioral/psychosocial variables include nutrition, physical activity, self-management, health behaviors, coping, distress, depression, resilience, personal control, stress, and trauma.		
Measures	Description and Reference for Measures	Link to scale or reference if publicly available
<b>Outcome</b>		
Hemoglobin A1c	<p>The test can be done by intravenous blood draw. The A1C test measures the percentage of your red blood cells that have sugar-coated hemoglobin. A higher A1C percentage corresponds to higher average blood sugar levels. The higher your A1C level, the higher your risk of developing diabetes or complications of diabetes.</p> <p>A normal A1C level is below 5.7%, a level of 5.7% to 6.4% indicates prediabetes, and a level of 6.5% or more indicates diabetes.</p>	Not applicable
<b>Socio-demographic</b>		
Demographics: age, sex, marital status, insurance status, educational attainment	<p>Demographics were measured using the BRFSS (Behavioral Risk Factor Surveillance System) 2014 questionnaire developed by the Centers for Disease Control and Prevention.</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services,</p>	<a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a>

	<p>Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: “The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC’s Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam.” Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	
Lifecourse SES	<p>Lifecourse Socio-economic Status (SES) Scale is a five item scale developed by Wamala, Lynch, and Kaplan that includes education level of the father, education level of the mother, size of family, birth order, and level of education. A disadvantage index was created based on recommendations for measuring life course socioeconomic factors ranging from 0-6 with lower numbers indicating lower lifecourse SES.</p> <p>Wamala SP, Lynch J, Kaplan GA. Women’s exposure to early and later life socioeconomic disadvantage and coronary heart disease risk: the Stockholm Female Coronary Risk Study. <i>Int J Epidemiol</i> 2001, 30: 375-384.</p>	<a href="https://doi.org/10.1093/ije/30.2.275">https://doi.org/10.1093/ije/30.2.275</a>
Financial Hardship	Financial hardship was measured using the Financial Resource scale from the BRFSS 2014 questionnaire	<a href="https://www.cdc.gov/brfss/questionnaires/pdf-">https://www.cdc.gov/brfss/questionnaires/pdf-</a>

	<p>developed by the Centers for Disease Control and Prevention. This scale is a 7-item financial resource scale that measures financial hardship. These include yes/no items stating financial hardship, having to worry about paying the mortgage, and having to worry about buying food because of not having enough money.</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: "The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC's Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam." Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	<p>ques/2014_BRFSS.pdf</p>
Competing Demands	<p>Competing Demands was measured using the Competing Subsistence Needs and Barriers scale developed by Cunningham, Andersen, Katz, Stein, and Turner (1999). Cunningham WE, Andersen RM, Katz MH, Stein MD, Turner BJ, et al. This scale includes 8 items assess whether medical care was postponed because finances needed to go toward other needs such as</p>	<p><a href="https://journals.lww.com/lww-medicalcare/Fulltext/1999/12000/The_Impact_of_Competing_Subsistence_Needs_and.10.aspx">https://journals.lww.com/lww-medicalcare/Fulltext/1999/12000/The_Impact_of_Competing_Subsistence_Needs_and.10.aspx</a></p>

	<p>housing, food, clothing etc. Additionally, competing needs also assess barriers to receiving care such as transportation or work.</p> <p>Cunningham et al. The impact of competing subsistence needs and barriers on access to medical care for persons with human immunodeficiency virus receiving care in the United States. <i>Medical Care</i>, 1999; 37(12): 1270-1281.</p>	
Spirituality	<p>Spirituality was measured using the The Daily Spiritual Experience Scale (DSES) developed by Underwood and Teresi (2002). The DSES is a 6-item scale assessing daily experiences of spirituality and was used to measure spirituality as a continuous variable.</p> <p>Underwood LG &amp; Teresi JA. The daily spiritual experience scale: development, theoretical description, reliability, exploratory factor analysis, and preliminary construct validity using health-related data. <i>Ann Behav Med</i>, 2002; 24(1):22-33</p> <p>Reliability and Validity: The scale is validated and evidenced good reliability across several studies with internal consistency estimated in the .90s.</p>	<p><a href="https://doi.org/10.1207/S15324796ABM2401_04">https://doi.org/10.1207/S15324796ABM2401_04</a></p> <p>The authoritative version of the DSES scale for research use  <a href="http://www.dsescall.org/DSES.pdf">http://www.dsescall.org/DSES.pdf</a></p>
<b>Behavioral/Psychosocial</b>		



Self-management	<p>Self-management was measured using the Brooks Medication Adherence Scale (BMAS). The BMAS is a 6-item scale. It asked simple “yes-no” questions to assess adherence to medication over the past 3 months. The BMAS scale was created by Brooks, Richards, Kohler, Martin, Windsor, and Bailey (1994).</p> <p>Brooks C, Richards J, Kohler C, Soong S, Martin B, Windsor R, Bailey W. Assessing adherence to asthma medication and inhaler regimens: A psychometric analysis of adult self-report scales. <i>Medical Care</i>, 1994;32(3):298-307.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high ranging from 0.67 to 0.80.</p>	<a href="https://www.jstor.org/stable/3765792">https://www.jstor.org/stable/3765792</a>
Health Behaviors: tobacco use and alcohol use	<p>Health behaviors consisted of tobacco use and alcohol use. Tobacco use was measured using the BRFSS 2014 questionnaire for tobacco use. This questionnaire includes asking participants whether they are a current smoker (currently smoke cigarettes every day or some days), former smoker (recently quit smoking in the last 12 months or quit smoking previously), or never smoked (never smoked cigarettes.).</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: “The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based,</p>	<p><a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a></p> <p><a href="https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/208954">https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/208954</a></p>

	<p>CDC-assisted health- data collection project and partnership of state health departments, CDC's Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam." Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p> <p>Alcohol Use was also assessed using the Alcohol Use Disorders Identification Test (AUDIT-C) Alcohol Use Disorders Identification Test (AUDIT-C) is a 3-item screener that is both sensitive and specific for identifying alcohol abuse and misuse (Bush et al. 1998).</p> <p>Bush K, Kivlahan DR, McDonell MB, et al. The AUDIT Alcohol Consumption Questions (AUDIT-C): An effective brief screening test for problem drinking. <i>Arch Internal Med</i>, 1998 (3): 1789-1795.</p>	
Nutrition	<p>Nutrition was measured using the Dietary Screener Questionnaire (DSQ) Provided by National Health and Nutrition Examination Survey, a 26-item dietary assessment Nutritional items measured across this scale include fruits and vegetables, added sugars, whole grains, dairy, calcium, and fiber.</p> <p>National Health and Nutrition Examination Survey. 2009-2010 Dietary Screener.</p>	<a href="http://epi.grants.cancer.gov/nhanes/dietscreen/questionnaires.html#paper">http://epi.grants.cancer.gov/nhanes/dietscreen/questionnaires.html#paper</a>

Physical Activity	<p>Physical activity was measured using the International Physical Activity Questionnaire (IPAQ) short form. The IPAQ measures vigorous, moderate, and mild physical activity across the last 7 days using 7 items (Booth 2000).</p> <p>Booth ML. Assessment of physical activity: an international perspective. <i>Research Quarterly for Exercise and Sport</i>, 2000; 71(2): s114-120.</p> <p>Validity and Reliability: The IPAQ-SF has been validated across 23 studies (Lee et al. 2011) and is considered an acceptable measure of self-reported physical activity.</p>	<p><a href="https://journals.plos.org/plosone/article/file?type=supplementary&amp;id=info:doi/10.1371/journal.pone.0219193.s010">https://journals.plos.org/plosone/article/file?type=supplementary&amp;id=info:doi/10.1371/journal.pone.0219193.s010</a></p> <p>The IPAQ-SF can be found here  <a href="http://www.sdp.univ.fvg.it/sites/default/files/IPAQ_English_self-admin_short.pdf">http://www.sdp.univ.fvg.it/sites/default/files/IPAQ_English_self-admin_short.pdf</a></p>
Coping	<p>Coping was measured using the 8-item emotional approach coping measure that measures emotional processing (4-item) and emotional expression (4-item) developed by Stanton et al 2000.</p> <p>The Emotional Approach Coping Scales were designed to measure coping through emotional processing and emotional expression. The initial item pool included items from the COPE (Carver et al., 1989), and other published emotion-focused coping scales as well as author-constructed items. The final Emotional Approach Coping Scales comprise 16 items that form two sub-scales; Emotional Processing (8 items) and Emotional Expression (8 items). This study used the 4 item sub scale for Emotional Processing and the 4 item sub scale for Emotional Expression (Stanton et al. 2000). The items have a 4-point scale of "I don't do this at all", "I do this a little bit", "I do this a medium amount" and "I do this a lot". The</p>	<p><a href="https://pdfs.semanticscholar.org/e9f1/f3eae14e50034ecb090dd587d26f4a3b2b2b.pdf">https://pdfs.semanticscholar.org/e9f1/f3eae14e50034ecb090dd587d26f4a3b2b2b.pdf</a></p>

	<p>mean item score is calculated for each subscale.</p> <p>Stanton AL, Kirk SB, Cameron CL, Danoff-Burg S. Coping through emotional approach: scale construction and validation. <i>J Pers Soc Psychol</i>, 2000; 78: 1150-1169.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.91.</p>	
Resilience	<p>Wagnild and Young (1993) developed the Resilience Scale (RS). Resilience was measured by the RS. The scale is composed of 25 items rated on a 7-point Likert scale ranging from 1, strongly disagree, to 7, strongly agree. Scores varied between 25 and 175, with the highest scores indicating higher resilience.</p> <p>Example questions include "When I make plans, I follow through with them".</p> <p>Wagnild GM and Young HM. Development and psychometric evaluation of the resilience scale. <i>J of Nursing Measurement</i>, 1993; 1(2): 165-178.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.89.</p>	<a href="https://www.ncbi.nlm.nih.gov/pubmed/7850498">https://www.ncbi.nlm.nih.gov/pubmed/7850498</a>
Personal Control	<p>Personal control was measured using the Experience of Current Situation scale (Wallhagen et al., 1999). This scale measures the extent to which an individual feels they have control over the events</p>	<a href="https://doi.org/10.1177/014572179902500409">https://doi.org/10.1177/014572179902500409</a>

	<p>that occur in their life across 15-items. Items are scored with higher scores indicating higher levels of perceived control.</p> <p>Wallhagen MI, Lacson M. Perceived control and psychosocial/physiological functioning in African American elders with type 2 diabetes. <i>Diabetes Educ</i>, 1999 Jul-Aug;25(4):568–575.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.93.</p>	
Depression	<p>Depression was measured using the Patient Health Questionnaire (PHQ-9) a 9-item scale assessing mild to severe depression.</p> <p>Kroenke K, Spitzer RL, Williams JB. (2001) The PHQ-9: validity of a brief depression severity measure. <i>J Gen Intern Med</i>, 16:606-613.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.85 (Bian 2011).</p>	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495268/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495268/</a>
Stress	<p>Stress was measured using the 4-item Perceived Stress Scale that assess level of perceived stress across example situations over the last month. Response options range from 0 – 4 as never to very often. For example, “In the last month, how often have you felt that you were unable to control the important things in your life?”</p>	<a href="https://doi.org/10.3390/ijerph8083287">https://doi.org/10.3390/ijerph8083287</a>

	<p>Andreou E, Alexopoulos EC, Lionis C, Varvogli L, Gnardellis C, Chrousos GP, Darviri C. Percieved stress scale: reliability and validity study in Greece. <i>Int J Environ Res Public Health</i>, 2011;8:3287-3298.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.69 (Andreou 2011).</p>	
Trauma	<p>Trauma was measured using the Adverse Childhood Experience Scale (ACE) developed by Felitti (1998). The ACE scale measures traumatic experiences occurring before the age of 18 across domains of abuse and family dysfunction.</p> <p>Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the adverse childhood experience study. <i>Am J Prev Med</i>, 1998;14(4):245-58.</p> <p>Reliability and Validity: Ford et al. used confirmatory factor analysis and exploratory factor analysis to examine fit statistics for scale and found that the scale adequately fit across samples of national data (Ford et al. 2014).</p>	<p><a href="https://doi.org/10.1016/S0749-3797(98)00017-8">https://doi.org/10.1016/S0749-3797(98)00017-8</a></p> <p><a href="https://doi.org/10.1037/a0037723">https://doi.org/10.1037/a0037723</a></p>
Distress	<p>Distress was measured using the Serious Psychological Distress Scale (K6 Scale). The K6 is a 6-item scale developed by Kessler et al. that measures distress on a scale of 1 "All of the time" to 5 "None of the time". Example questions include:</p>	<p><a href="https://www.ncbi.nlm.nih.gov/pubmed/12214795">https://www.ncbi.nlm.nih.gov/pubmed/12214795</a></p>

	<p>“During the past 30 days, about how often did you feel nervous?”</p> <p>Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SLT, Walters EE, Zaslavsky AM. Short screening scales to monitor population prevalence and trends in non-specific psychological distress. <i>Psychological Medicine</i>, 2002;32:959-976.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.86.</p>	
Body Mass Index (BMI)	<p>Clinical Measure from height and weight</p> <p>Weight was measured using a Health o meter Professional 349KLX Digital Floor Medical Scale. Height was measured using height measurement stick.</p>	Not applicable
Comorbidities	<p>Comorbidities were measured using single comorbidity questions from the BRFSS 2014 questionnaire developed by the Centers for Disease Control and Prevention. 18 items assess whether a participant has ever been told by a health care professional if they have a specific condition, diabetes or hypertension for example. These include yes/no items.</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: “The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based,</p>	<p><a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a></p>

	<p>CDC-assisted health- data collection project and partnership of state health departments, CDC's Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam." Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	
<p><b>Community Level of Influence:</b> The community level of influence was measured using resource, norms, and functioning variables at the community level. Variables to assess resources include food insecurity and neighborhood quality. Variables to assess norms include perceived discrimination, exposure to crime, and exposure to violence. Variables to assess functioning include social support and social cohesion.</p>		
<b>Resource</b>		
Food Insecurity	<p>Food insecurity was measured using the six-item food insecurity scale with the full set of adult items within the intermediate range of severity captured by the full scale (USDA Food Insecurity Scale). Questions included: "This food that we bought just didn't last, and we didn't have money to get more." Consistent with standard coding for the six-item scale, scores of 2 or higher indicating low or very low food security were coded as yes food insecure and responses indicating high or marginal food security were coded as not food insecure.</p> <p>Bickel, Gary, Mark Nord, Cristofer Price, William Hamilton, and John Cook: <i>Guide to Measuring Household Food Security, Revised 2000</i>. U.S. Department of Agriculture, Food and Nutrition Service, Alexandria VA. March,</p>	<p><a href="https://fns-prod.azureedge.net/sites/default/files/FSGuide.pdf">https://fns-prod.azureedge.net/sites/default/files/FSGuide.pdf</a></p>



	2000. Or in short form as USDA, <i>Guide 2000</i> .	
Neighborhood Quality	<p>Neighborhood quality were assessed using the Neighborhood Characteristics questionnaire that includes six scales and four indices developed by Escheverria et al 2004. The six scales assess the aesthetic quality and consist of 7 items; walking/exercise environment scale consisting of 11 items; an access to healthy foods scale consisting of 11 items. This is a self-reported measure of neighborhood characteristics.</p> <p>Echeverria SE, Dietz-Roux AV, Link BG. Reliability of self-reported neighborhood characteristics. <i>J Urban Health</i>, 2004;81(4):682-701.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.77 to 0.94.</p>	<a href="https://link.springer.com/article/10.1093%2Furban%2Fjth151">https://link.springer.com/article/10.1093%2Furban%2Fjth151</a>
<b>Norm</b>		
Perceived Discrimination	<p>Perceived discrimination was measured using the Discrimination scale drawn from the Distance Survey from the Keiser Division of Research and the University of California. This scale contains 4-items with questions such as "In the past 12 months, how often have you felt that people treated you poorly or made you feel inferior because of your race or ethnicity?" Responses ranged from Never to Often.</p> <p>Moffet HM, Adler N, Schillinger D, Ahmed AT, Laraia B, Selby JV, Neugebauer R, Liu JY, Parker MM, Warton M, Karter AJ. Cohort Profile:</p>	<a href="https://doi.org/10.1093/ije/dyn040">https://doi.org/10.1093/ije/dyn040</a>

	Diabetes Study of North California (DISTANCE) – objectives and design of a survey follow-up study of social health disparities in a managed care population. <i>Int J Epidemiol</i> , 2009;38(1):38-47.	
Exposure to Crime and Violence	<p>Both exposure to crime and violence were measured using the Neighborhood Characteristics safety from crime scale consisting of 3 items and the neighborhood quality consisting of 7 items assessing violence. Neighborhood safety questions included “I feel safe walking in my neighborhood during the evening” and responses ranged from 1 “strongly agree” to 5 “strongly disagree”. Questions to assess violence included “during the past 6 months, how often was there a fight in this neighborhood in which a weapon was used?”. Response options ranged from 1 “often” to 4 “never”. (Escheverria et al 2004).</p> <p>Echeverria SE, Dietz-Roux AV, Link BG. Reliability of self-reported neighborhood characteristics. <i>J Urban Health</i>, 2004;81(4):682-701.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.77 to 0.94.</p>	<a href="https://link.springer.com/article/10.1093%2Fjurban%2Fjth151">https://link.springer.com/article/10.1093%2Fjurban%2Fjth151</a>
<b>Functioning</b>		
Social Support	Social support was measured using the Medical Outcomes Study (MOS) Social Support Survey that assesses level of support across four domains, characterized as 1) tangible support; 2) affection; 3) positive social interaction; and 4) emotional or informational support.	<a href="https://www.ncbi.nlm.nih.gov/pubmed/2035047">https://www.ncbi.nlm.nih.gov/pubmed/2035047</a>

	<p>Sherbourne, C. D., &amp; Stewart, A. L. (1991). The MOS Social Support Survey. <i>Social Science and Medicine</i>, 32, 705-14.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.97.</p>	
Social Cohesion	<p>Social cohesion was measured using the Social Cohesion subscale from the Self-reported Neighborhood Characteristics developed by Echeverria et al. 2004. This is a 5-item scale with questions that include whether participants agree or disagree with statements such as "This is a close-knit or unified neighborhood."</p> <p>Echeverria SE, Dietz-Roux AV, Link BG. Reliability of self-reported neighborhood characteristics. <i>J Urban Health</i>, 2004;81(4):682-701.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.77 to 0.94.</p>	<a href="https://link.springer.com/article/10.1093%2Fjurban%2Fjth151">https://link.springer.com/article/10.1093%2Fjurban%2Fjth151</a>
<p><b>Health System Level of Influence:</b> The health system level of influence was measured at the patient level to capture the lived experience of encounters with the health system. These include experiences with access, providers, and cost. Variables to measure access include primary care provider visits, specialty visits, wait times, and travel time. Variables to measure experiences with providers include attitudes, trust, communication, and cultural competence, and cost of medication.</p>		
<b>Access</b>		
Primary Care Provider Visits	<p>Access was measured using the National Health Interview Survey (NHIS) 2017 Adult Access to Healthcare and Utilization that included asking participants if they had a usual source of care and to specify where they usually go when</p>	<a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HIS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HIS/Survey_Questionnaires/NHIS/2017/english/</a>
Specialty Visits		
Wait Time		

Travel Time	<p>needing routine care or preventive services; if in the past 12 months they had seen or talked to any of the following regarding their own health: mental health professional, optometrist, foot doctor, chiropractor, physical therapist, any other specialist other than obstetrician, gynecologist, psychiatrist, or ophthalmologist; have you delayed getting needed medical care in the past 12 months due to not getting through on the telephone, not getting appointments soon enough, having to wait too long, clinic not being open, no transportation; and how long does it usually take you to get to the provider?</p> <p>Centers for Disease Control and Prevention. (2018). National health interview survey. 2017. <i>National center for health statistics, health data interactive from www. cdc. gov/nchs/hdi. htm.</i></p> <p>Reliability and Validity: “The content of the NHIS questionnaire is revised periodically, with the last major revisions occurring in 1982 and 1997. The redesigned NHIS questionnaire introduced in 1997 consists of a Core that remains largely unchanged from year to year, plus an assortment of Supplements that may be sponsored by agencies other than NCHS, with the assortment varying from year to year. The Core consists of four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult Core”. (CDC, 2018)</p>	
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<b>Provider</b>		
Attitudes	<p>Perceived attitude of provider was measured using a single item from the National Health Interview Survey (NHIS) 2017 Adult Access to Healthcare and Utilization questionnaire that asks participants how often they are treated with respect by their health care provider.</p> <p>Centers for Disease Control and Prevention. (2018). National health interview survey. 2017. <i>National center for health statistics, health data interactive from www. cdc. gov/nchs/hdi. htm.</i></p> <p>Reliability and Validity: “The content of the NHIS questionnaire is revised periodically, with the last major revisions occurring in 1982 and 1997. The redesigned NHIS questionnaire introduced in 1997 consists of a Core that remains largely unchanged from year to year, plus an assortment of Supplements that may be sponsored by agencies other than NCHS, with the assortment varying from year to year. The Core consists of four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult Core”. (CDC, 2018)</p>	<a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HS/Survey_Questionnaires/NHIS/2017/english/</a>
Trust	<p>Trust was measured using the The Multidimensional Trust in Health Care Systems Scale (MTHCSS), a 17-item scale that assesses participant trust across 3 domains of the health care system including providers, institutions, and payers.</p>	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2517872/pdf/11606_2008_Article_613.pdf">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2517872/pdf/11606_2008_Article_613.pdf</a>

	<p>This scale was developed by Egede and Ellis (2008) and is assessed on a 5-point likert scale.</p> <p>Egede L &amp; Ellis C. Development and testing of the multidimensional trust in health care systems scale. <i>JGIM</i>, June 2008; 23(6):808-815.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.72 to 0.90.</p>	
Communication	<p>Perceived provider communication was measured using the Patient Centered Care scaled from the Medical Expenditure Panel Survey (MEPS), 2010. This scale assesses patient centeredness through perceived communication from the patient standpoint across 7-items. These include questions such as "Are you involved in decisions about your care as much as you want?" or "Does your physician take enough time to answer your questions?" Responses range from "Always" to "Never".</p> <p>Medical Expenditure Panel Survey (2010). Survey Questionnaire, Medical Expenditure Panel Survey. <i>Agency for Healthcare Research and Quality</i>.</p>	<a href="http://meps.ahrq.gov/mepsweb/survey_comp/survey_questionnaires.jsp">http://meps.ahrq.gov/mepsweb/survey_comp/survey_questionnaires.jsp</a>
Cultural Competence	<p>Perceived provider cultural competence was measured using a single item from the NHIS 2017 Adult Access to Healthcare and Utilization questionnaire that asked participants how important it was that providers were similar to and understood race, religion, gender, or beliefs.</p>	<a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/</a>

	<p>Centers for Disease Control and Prevention. (2018). National health interview survey. 2017. <i>National center for health statistics, health data interactive from www. cdc. gov/nchs/hdi. htm.</i></p> <p>Reliability and Validity: “The content of the NHIS questionnaire is revised periodically, with the last major revisions occurring in 1982 and 1997. The redesigned NHIS questionnaire introduced in 1997 consists of a Core that remains largely unchanged from year to year, plus an assortment of Supplements that may be sponsored by agencies other than NCHS, with the assortment varying from year to year. The Core consists of four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult Core”. (CDC, 2018)</p>	
<b>Cost</b>		
Cost of Medications	<p>Cost of medications was measured using the following question from the BRFSS 2014 questionnaire: was there a time in the past 12 months when you did not take your medications as prescribed because of cost?</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p>	<p><a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HS/Survey_Questionnaires/NHIS/2017/english/</a></p>

	<p>Reliability and Validity: “The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC’s Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam.” Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	
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## Appendix C: Chapter 4 Measurements

Aim 3 Measurements included individual, community, and health system levels of influence as independent variables. Variables were measured using validated scales. As many scales required authorization for use, this measurement table has been included to represent the survey measurements. The Aim 3 outcome was quality of life, measurement detail below.

<b>Individual Level of Influence:</b> The individual level of influence was measured using socio-demographic variables and behavioral/psychosocial variables. Socio-demographics include spirituality, financial hardship, lifecourse SES, and competing needs. Behavioral/psychosocial variables include nutrition, physical activity, self-management, health behaviors, coping, distress, depression, resilience, personal control, stress, and trauma.		
Measures	Description and Reference for Measures	Link to scale or reference if publicly available
<b>Outcome</b>		
Quality of Life	Quality of life was measured using the SF-12, a validated and well-established measure of general health status that measures quality of life across two domains, physical health component (PCS) and mental health component (MCS) and developed by Ware, 1995. The physical health component assesses physical health through 1) functioning: the ability to carry out moderate physical activities such as carrying groceries and walking up a flight of stairs; 2) role physical: being limited physically or accomplished less than what was desired to physical limitations; 3) bodily pain: having pain interfere with activities; 4) general self-rated health. The mental health component assesses mental health through 1) vitality: energy; 2) social functioning: social time; 3) role emotional: accomplished less than what was desired to emotional problems or were not carefully focused on tasks due to emotional problems; 4)	<a href="https://www.researchgate.net/publication/291994160_How_to_score_SF-12_items">https://www.researchgate.net/publication/291994160_How_to_score_SF-12_items</a>

	<p>mental health: feeling peaceful or blue and sad.</p> <p>Ware, J. E., Kosinski, M., &amp; Keller, S. D. (1995). SF-12. <i>How to score the SF-12 physical and mental health summary scales</i>, 1995.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.91.</p>	
<b>Socio-demographic</b>		
Demographics: age, sex, marital status, insurance status, educational attainment	<p>Demographics were measured using the BRFSS (Behavioral Risk Factor Surveillance System) 2014 questionnaire developed by the Centers for Disease Control and Prevention.</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: "The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC's Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam." Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	<p><a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a></p>

Lifecourse SES	<p>Lifecourse Socio-economic Status (SES) Scale is a five item scale developed by Wamala, Lynch, and Kaplan that includes education level of the father, education level of the mother, size of family, birth order, and level of education. A disadvantage index was created based on recommendations for measuring life course socioeconomic factors ranging from 0-6 with lower numbers indicating lower lifecourse SES.</p> <p>Wamala SP, Lynch J, Kaplan GA. Women's exposure to early and later life socioeconomic disadvantage and coronary heart disease risk: the Stockholm Female Coronary Risk Study. <i>Int J Epidemiol</i> 2001, 30: 375-384.</p>	<a href="https://doi.org/10.1093/ije/30.2.275">https://doi.org/10.1093/ije/30.2.275</a>
Financial Hardship	<p>Financial hardship was measured using the Financial Resource scale from the BRFSS 2014 questionnaire developed by the Centers for Disease Control and Prevention. This scale is a 7-item financial resource scale that measures financial hardship. These include yes/no items stating financial hardship, having to worry about paying the mortgage, and having to worry about buying food because of not having enough money.</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p>	<a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a>

	<p>Reliability and Validity: “The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC’s Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam.” Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	
Competing Demands	<p>Competing Demands was measured using the Competing Subsistence Needs and Barriers scale developed by Cunningham, Andersen, Katz, Stein, and Turner (1999). Cunningham WE, Andersen RM, Katz MH, Stein MD, Turner BJ, et al. This scale includes 8 items assess whether medical care was postponed because finances needed to go toward other needs such as housing, food, clothing etc. Additionally, competing needs also assess barriers to receiving care such as transportation or work.</p> <p>Cunningham et al. The impact of competing subsistence needs and barriers on access to medical care for persons with human immunodeficiency virus receiving care in the United States. <i>Medical Care</i>, 1999; 37(12): 1270-1281.</p>	<p><a href="https://journals.lww.com/lww-medicalcare/Fulltext/1999/12000/The_Impact_of_Competing_Subsistence_Needs_and.10.aspx">https://journals.lww.com/lww-medicalcare/Fulltext/1999/12000/The_Impact_of_Competing_Subsistence_Needs_and.10.aspx</a></p>
Spirituality	<p>Spirituality was measured using the The Daily Spiritual Experience Scale (DSES) developed by Underwood and Teresi (2002). The DSES is a 6-item scale assessing daily</p>	<p><a href="https://doi.org/10.1207/S15324796ABM2401_04">https://doi.org/10.1207/S15324796ABM2401_04</a></p>

	<p>experiences of spirituality and was used to measure spirituality as a continuous variable.</p> <p>Underwood LG &amp; Teresi JA. The daily spiritual experience scale: development, theoretical description, reliability, exploratory factor analysis, and preliminary construct validity using health-related data. <i>Ann Behav Med</i>, 2002; 24(1):22-33</p> <p>Reliability and Validity: The scale is validated and evidenced good reliability across several studies with internal consistency estimated in the .90s.</p>	<p>The authoritative version of the DSES scale for research use <a href="http://www.dsescall.org/DSES.pdf">http://www.dsescall.org/DSES.pdf</a></p>
<b>Behavioral/Psychosocial</b>		
Self-management	<p>Self-management was measured using the Brooks Medication Adherence Scale (BMAS). The BMAS is a 6-item scale. It asked simple "yes-no" questions to assess adherence to medication over the past 3 months. The BMAS scale was created by Brooks, Richards, Kohler, Martin, Windsor, and Bailey (1994).</p> <p>Brooks C, Richards J, Kohler C, Soong S, Martin B, Windsor R, Bailey W. Assessing adherence to asthma medication and inhaler regimens: A psychometric analysis of adult self-report scales. <i>Medical Care</i>, 1994;32(3):298-307.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high ranging from 0.67 to 0.80.</p>	<p><a href="https://www.jstor.org/stable/3765792">https://www.jstor.org/stable/3765792</a></p>
Health Behaviors: tobacco use and alcohol use	<p>Health behaviors consisted of tobacco use and alcohol use. Tobacco use was measured using the BRFSS 2014 questionnaire for tobacco use. This questionnaire</p>	<p><a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a></p>

	<p>includes asking participants whether they are a current smoker (currently smoke cigarettes every day or some days), former smoker (recently quit smoking in the last 12 months or quit smoking previously), or never smoked (never smoked cigarettes.).</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: "The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC's Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam." Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p> <p>Alcohol Use was also assessed using the Alcohol Use Disorders Identification Test (AUDIT-C) Alcohol Use Disorders Identification Test (AUDIT-C) is a 3-item screener that is both sensitive and specific for identifying alcohol abuse and misuse (Bush et al. 1998).</p> <p>Bush K, Kivlahan DR, McDonell MB, et al. The AUDIT Alcohol Consumption Questions (AUDIT-C):</p>	<p><a href="https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/208954">https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/208954</a></p>
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	An effective brief screening test for problem drinking. <i>Arch Internal Med</i> , 1998 (3): 1789-1795.	
Nutrition	<p>Nutrition was measured using the Dietary Screener Questionnaire (DSQ)          Provided by National Health and Nutrition Examination Survey, a 26-item dietary assessment Nutritional items measured across this scale include fruits and vegetables, added sugars, whole grains, dairy, calcium, and fiber.</p> <p>National Health and Nutrition Examination Survey. 2009-2010 Dietary Screener.</p>	<a href="http://epi.grants.cancer.gov/nhanes/dietscreen/questionnaires.html#paper">http://epi.grants.cancer.gov/nhanes/dietscreen/questionnaires.html#paper</a>
Physical Activity	<p>Physical activity was measured using the International Physical Activity Questionnaire (IPAQ) short form. The IPAQ measures vigorous, moderate, and mild physical activity across the last 7 days using 7 items (Booth 2000).</p> <p>Booth ML. Assessment of physical activity: an international perspective. <i>Research Quarterly for Exercise and Sport</i>, 2000; 71(2): s114-120.</p> <p>Validity and Reliability: The IPAQ-SF has been validated across 23 studies (Lee et al. 2011) and is considered an acceptable measure of self-reported physical activity.</p>	<p><a href="https://journals.plos.org/plosone/article/file?type=supplementary&amp;id=info:doi/10.1371/journal.pone.0219193.s010">https://journals.plos.org/plosone/article/file?type=supplementary&amp;id=info:doi/10.1371/journal.pone.0219193.s010</a></p> <p>The IPAQ-SF can be found here  <a href="http://www.sdp.univ.fv.g.it/sites/default/files/IPAQ_English_self-admin_short.pdf">http://www.sdp.univ.fv.g.it/sites/default/files/IPAQ_English_self-admin_short.pdf</a></p>
Coping	<p>Coping was measured using the 8-item emotional approach coping measure that measures emotional processing (4-item) and emotional expression (4-item) developed by Stanton et al 2000.</p> <p>The Emotional Approach Coping Scales were designed to measure</p>	<a href="https://pdfs.semanticscholar.org/e9f1/f3eae14e50034ecb090dd587d26f4a3b2b2b.pdf">https://pdfs.semanticscholar.org/e9f1/f3eae14e50034ecb090dd587d26f4a3b2b2b.pdf</a>

	<p>coping through emotional processing and emotional expression. The initial item pool included items from the COPE (Carver et al., 1989), and other published emotion-focused coping scales as well as author-constructed items. The final Emotional Approach Coping Scales comprise 16 items that form two sub-scales; Emotional Processing (8 items) and Emotional Expression (8 items). This study used the 4 item sub scale for Emotional Processing and the 4 item sub scale for Emotional Expression (Stanton et al. 2000). The items have a 4-point scale of "I don't do this at all", "I do this a little bit", "I do this a medium amount" and "I do this a lot". The mean item score is calculated for each subscale.</p> <p>Stanton AL, Kirk SB, Cameron CL, Danoff-Burg S. Coping through emotional approach: scale construction and validation. <i>J Pers Soc Psychol</i>, 2000; 78: 1150-1169.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.91.</p>	
Resilience	<p>Wagnild and Young (1993) developed the Resilience Scale (RS). Resilience was measured by the RS. The scale is composed of 25 items rated on a 7-point Likert scale ranging from 1, strongly disagree, to 7, strongly agree. Scores varied between 25 and 175, with the highest scores indicating higher resilience.</p> <p>Example questions include "When I make plans, I follow through with them".</p>	<p><a href="https://www.ncbi.nlm.nih.gov/pubmed/7850498">https://www.ncbi.nlm.nih.gov/pubmed/7850498</a></p>



	<p>Wagnild GM and Young HM. Development and psychometric evaluation of the resilience scale. <i>J of Nursing Measurement</i>, 1993; 1(2): 165-178.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.89.</p>	
Personal Control	<p>Personal control was measured using the Experience of Current Situation scale (Wallhagen et al., 1999). This scale measures the extent to which an individual feels they have control over the events that occur in their life across 15-items. Items are scored with higher scores indicating higher levels of perceived control.</p> <p>Wallhagen MI, Lacson M. Perceived control and psychosocial/physiological functioning in African American elders with type 2 diabetes. <i>Diabetes Educ</i>, 1999 Jul-Aug;25(4):568–575.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.93.</p>	<a href="https://doi.org/10.1177/014572179902500409">https://doi.org/10.1177/014572179902500409</a>
Depression	<p>Depression was measured using the Patient Health Questionnaire (PHQ-9) a 9-item scale assessing mild to severe depression.</p> <p>Kroenke K, Spitzer RL, Williams JB. (2001) The PHQ-9: validity of a brief depression severity measure. <i>J Gen Intern Med</i>, 16:606-613.</p>	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495268/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1495268/</a>

	<p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.85 (Bian 2011).</p>	
Stress	<p>Stress was measured using the 4-item Perceived Stress Scale that assess level of perceived stress across example situations over the last month. Reponse options range from 0 – 4 as never to very often. For example, “In the last month, how often have you felt that you were unable to control the important things in your life?”</p> <p>Andreou E, Alexopoulos EC, Lionis C, Varvogli L, Gnardellis C, Chrousos GP, Darviri C. Percieved stress scale: reliability and validity study in Greece. <i>Int J Environ Res Public Health</i>, 2011;8:3287-3298.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.69 (Andreou 2011).</p>	<p><a href="https://doi.org/10.3390/ijerph8083287">https://doi.org/10.3390/ijerph8083287</a></p>
Trauma	<p>Trauma was measured using the Adverse Childhood Experience Scale (ACE) developed by Felitti (1998). The ACE scale measures traumatic experiences occurring before the age of 18 across domains of abuse and family dysfunction.</p> <p>Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the adverse childhood experience study. <i>Am J Prev Med</i>, 1998;14(4):245-58.</p>	<p><a href="https://doi.org/10.1016/S0749-3797(98)00017-8">https://doi.org/10.1016/S0749-3797(98)00017-8</a></p> <p><a href="https://doi.org/10.1037/a0037723">https://doi.org/10.1037/a0037723</a></p>

	<p>Reliability and Validity: Ford et al. used confirmatory factor analysis and exploratory factor analysis to examine fit statistics for scale and found that the scale adequately fit across samples of national data (Ford et al. 2014).</p>	
Distress	<p>Distress was measured using the Serious Psychological Distress Scale (K6 Scale). The K6 is a 6-item scale developed by Kessler et al. that measures distress on a scale of 1 "All of the time" to 5 "None of the time". Example questions include: "During the past 30 days, about how often did you feel nervous?"</p> <p>Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SLT, Walters EE, Zaslavsky AM. Short screening scales to monitor population prevalence and trends in non-specific psychological distress. <i>Psychological Medicine</i>, 2002;32:959-976.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.86.</p>	<p><a href="https://www.ncbi.nlm.nih.gov/pubmed/12214795">https://www.ncbi.nlm.nih.gov/pubmed/12214795</a></p>
Body Mass Index (BMI)	<p>Clinical Measure from height and weight</p> <p>Weight was measured using a Health o meter Professional 349KLX Digital Floor Medical Scale. Height was measured using height measurement stick.</p>	Not applicable
Comorbidities	<p>Comorbidities were measured using single comorbidity questions from the BRFSS 2014 questionnaire developed by the Centers for Disease Control and Prevention. 18</p>	<p><a href="https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf">https://www.cdc.gov/brfss/questionnaires/pdf-ques/2014_BRFSS.pdf</a></p>

	<p>items assess whether a participant has ever been told by a health care professional if they have a specific condition, diabetes or hypertension for example. These include yes/no items.</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: “The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC’s Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam.” Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	
<p><b>Community Level of Influence:</b> The community level of influence was measured using resource, norms, and functioning variables at the community level. Variables to assess resources include food insecurity and neighborhood quality. Variables to assess norms include perceived discrimination, exposure to crime, and exposure to violence. Variables to assess functioning include social support and social cohesion.</p>		
<p><b>Resource</b></p>		
Food Insecurity	<p>Food insecurity was measured using the six-item food insecurity scale with the full set of adult items within the intermediate range of severity captured by the full scale (USDA Food Insecurity Scale). Questions included: “This food that we bought</p>	<p><a href="https://fns-prod.azureedge.net/sites/default/files/FSGuide.pdf">https://fns-prod.azureedge.net/sites/default/files/FSGuide.pdf</a></p>

	<p>just didn't last, and we didn't have money to get more." Consistent with standard coding for the six-item scale, scores of 2 or higher indicating low or very low food security were coded as yes food insecure and responses indicating high or marginal food security were coded as not food insecure.</p> <p>Bickel, Gary, Mark Nord, Cristofer Price, William Hamilton, and John Cook: <i>Guide to Measuring Household Food Security, Revised 2000</i>. U.S. Department of Agriculture, Food and Nutrition Service, Alexandria VA. March, 2000. Or in short form as USDA, <i>Guide 2000</i>.</p>	
Neighborhood Quality	<p>Neighborhood quality were assessed using the Neighborhood Characteristics questionnaire that includes six scales and four indices developed by Escheverria et al 2004. The six scales assess the aesthetic quality and consist of 7 items; walking/exercise environment scale consisting of 11 items; an access to healthy foods scale consisting of 11 items. This is a self-reported measure of neighborhood characteristics.</p> <p>Echeverria SE, Dietz-Roux AV, Link BG. Reliability of self-reported neighborhood characteristics. <i>J Urban Health</i>, 2004;81(4):682-701.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.77 to 0.94.</p>	<a href="https://link.springer.com/article/10.1093%2Fjurban%2Fjth151">https://link.springer.com/article/10.1093%2Fjurban%2Fjth151</a>
<b>Norm</b>		

Perceived Discrimination	<p>Perceived discrimination was measured using the Discrimination scale drawn from the Distance Survey from the Keiser Division of Research and the University of California. This scale contains 4-items with questions such as “In the past 12 months, how often have you felt that people treated you poorly or made you feel inferior because of your race or ethnicity?” Responses ranged from Never to Often.</p> <p>Moffet HM, Adler N, Schillinger D, Ahmed AT, Laraia B, Selby JV, Neugebauer R, Liu JY, Parker MM, Warton M, Karter AJ. Cohort Profile: Diabetes Study of North California (DISTANCE) – objectives and design of a survey follow-up study of social health disparities in a managed care population. <i>Int J Epidemiol</i>, 2009;38(1):38-47.</p>	<a href="https://doi.org/10.1093/ije/dyn040">https://doi.org/10.1093/ije/dyn040</a>
Exposure to Crime and Violence	<p>Both exposure to crime and violence were measured using the Neighborhood Characteristics safety from crime scale consisting of 3 items and the neighborhood quality consisting of 7 items assessing violence. Neighborhood safety questions included “I feel safe walking in my neighborhood during the evening” and responses ranged from 1 “strongly agree” to 5 “strongly disagree”. Questions to assess violence included “during the past 6 months, how often was there a fight in this neighborhood in which a weapon was used?”. Response options ranged from 1 “often” to 4 “never”. (Escheverria et al 2004).</p> <p>Echeverria SE, Dietz-Roux AV, Link BG. Reliability of self-reported</p>	<a href="https://link.springer.com/article/10.1093%2Fjurban%2Fjth151">https://link.springer.com/article/10.1093%2Fjurban%2Fjth151</a>

	<p>neighborhood characteristics. <i>J Urban Health</i>, 2004;81(4):682-701.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.77 to 0.94.</p>	
<b>Functioning</b>		
Social Support	<p>Social support was measured using the Medical Outcomes Study (MOS) Social Support Survey that assesses level of support across four domains, characterized as 1) tangible support; 2) affection; 3) positive social interaction; and 4) emotional or informational support.</p> <p>Sherbourne, C. D., &amp; Stewart, A. L. (1991). The MOS Social Support Survey. <i>Social Science and Medicine</i>, 32, 705-14.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.97.</p>	<a href="https://www.ncbi.nlm.nih.gov/pubmed/2035047">https://www.ncbi.nlm.nih.gov/pubmed/2035047</a>
Social Cohesion	<p>Social cohesion was measured using the Social Cohesion subscale from the Self-reported Neighborhood Characteristics developed by Echeverria et al. 2004. This is a 5-item scale with questions that include whether participants agree or disagree with statements such as "This is a close-knit or unified neighborhood."</p> <p>Echeverria SE, Dietz-Roux AV, Link BG. Reliability of self-reported neighborhood characteristics. <i>J Urban Health</i>, 2004;81(4):682-701.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.77 to 0.94.</p>	<a href="https://link.springer.com/article/10.1093%2Fjurban%2Fjth151">https://link.springer.com/article/10.1093%2Fjurban%2Fjth151</a>

<b>Health System Level of Influence:</b> The health system level of influence was measured at the patient level to capture the lived experience of encounters with the health system. These include experiences with access, providers, and cost. Variables to measure access include primary care provider visits, specialty visits, wait times, and travel time. Variables to measure experiences with providers include attitudes, trust, communication, and cultural competence, and cost of medication.		
<b>Access</b>		
Primary Care Provider Visits	<p>Access was measured using the National Health Interview Survey (NHIS) 2017 Adult Access to Healthcare and Utilization that included asking participants if they had a usual source of care and to specify where they usually go when needing routine care or preventive services; if in the past 12 months they had seen or talked to any of the following regarding their own health: mental health professional, optometrist, foot doctor, chiropractor, physical therapist, any other specialist other than obstetrician, gynecologist, psychiatrist, or ophthalmologist; have you delayed getting needed medical care in the past 12 months due to not getting through on the telephone, not getting appointments soon enough, having to wait too long, clinic not being open, no transportation; and how long does it usually take you to get to the provider?</p> <p>Centers for Disease Control and Prevention. (2018). National health interview survey. 2017. <i>National center for health statistics, health data interactive from www. cdc. gov/nchs/hdi. htm.</i></p> <p>Reliability and Validity: "The content of the NHIS questionnaire is revised periodically, with the last major</p>	<a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/</a>
Specialty Visits		
Wait Time		
Travel Time		



	<p>revisions occurring in 1982 and 1997. The redesigned NHIS questionnaire introduced in 1997 consists of a Core that remains largely unchanged from year to year, plus an assortment of Supplements that may be sponsored by agencies other than NCHS, with the assortment varying from year to year. The Core consists of four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult Core". (CDC, 2018)</p>	
<b>Provider</b>		
Attitudes	<p>Perceived attitude of provider was measured using a single item from the National Health Interview Survey (NHIS) 2017 Adult Access to Healthcare and Utilization questionnaire that asks participants how often they are treated with respect by their health care provider.</p> <p>Centers for Disease Control and Prevention. (2018). National health interview survey. 2017. <i>National center for health statistics, health data interactive from www. cdc. gov/nchs/hdi. htm.</i></p> <p>Reliability and Validity: "The content of the NHIS questionnaire is revised periodically, with the last major revisions occurring in 1982 and 1997. The redesigned NHIS questionnaire introduced in 1997 consists of a Core that remains largely unchanged from year to year, plus an assortment of Supplements that may be sponsored by agencies other than NCHS, with the</p>	<p><a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/</a></p>

	assortment varying from year to year. The Core consists of four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult Core". (CDC, 2018)	
Trust	<p>Trust was measured using the The Multidimensional Trust in Health Care Systems Scale (MTHCSS), a 17-item scale that assesses participant trust across 3 domains of the health care system including providers, institutions, and payers. This scale was developed by Egede and Ellis (2008) and is assessed on a 5-point likert scale.</p> <p>Egede L &amp; Ellis C. Development and testing of the multidimensional trust in health care systems scale. <i>JGIM</i>, June 2008; 23(6):808-815.</p> <p>Reliability and Validity: Cronbach's coefficient <math>\alpha</math> is high at 0.72 to 0.90.</p>	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2517872/pdf/11606_2008_Article_613.pdf">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2517872/pdf/11606_2008_Article_613.pdf</a>
Communication	<p>Perceived provider communication was measured using the Patient Centered Care scaled from the Medical Expenditure Panel Survey (MEPS), 2010. This scale assesses patient centeredness through perceived communication from the patient standpoint across 7-items. These include questions such as "Are you involved in decisions about your care as much as you want?" or "Does your physician take enough time to answer your questions?" Responses range from "Always" to "Never".</p>	<a href="http://meps.ahrq.gov/mepsweb/survey_comp/survey_questionnaires.jsp">http://meps.ahrq.gov/mepsweb/survey_comp/survey_questionnaires.jsp</a>

	Medical Expenditure Panel Survey (2010). Survey Questionnaire, Medical Expenditure Panel Survey. <i>Agency for Healthcare Research and Quality.</i>	
Cultural Competence	<p>Perceived provider cultural competence was measured using a single item from the NHIS 2017 Adult Access to Healthcare and Utilization questionnaire that asked participants how important it was that providers were similar to and understood race, religion, gender, or beliefs.</p> <p>Centers for Disease Control and Prevention. (2018). National health interview survey. 2017. <i>National center for health statistics, health data interactive from www. cdc. gov/nchs/hdi. html.</i></p> <p>Reliability and Validity: “The content of the NHIS questionnaire is revised periodically, with the last major revisions occurring in 1982 and 1997. The redesigned NHIS questionnaire introduced in 1997 consists of a Core that remains largely unchanged from year to year, plus an assortment of Supplements that may be sponsored by agencies other than NCHS, with the assortment varying from year to year. The Core consists of four main components: the Household Composition section, the Family Core, the Sample Child Core, and the Sample Adult Core”. (CDC, 2018)</p>	<a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/</a>
<b>Cost</b>		

<p>Cost of Medications</p>	<p>Cost of medications was measured using the following question from the BRFSS 2014 questionnaire: was there a time in the past 12 months when you did not take your medications as prescribed because of cost?</p> <p>Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2014</p> <p>Reliability and Validity: "The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based, CDC-assisted health- data collection project and partnership of state health departments, CDC's Division of Population Health, and other CDC programs and offices. It comprises telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Puerto Rico, and Guam." Summary data quality report can be found here: <a href="https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf">https://www.cdc.gov/brfss/annual_data/2014/pdf/2014_dqr.pdf</a></p>	<p><a href="ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/">ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/</a></p>
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## **CURRICULUM VITAE**

**Jennifer A. Campbell, M.P.H.**

**Doctoral Candidate**

**University of Wisconsin, Milwaukee, Joseph Zilber School of Public Health**

### **EDUCATION:**

01/2006 – 08/2008 A.A., Trident Technical College, North Charleston, SC

08/2008 – 12/2012 B.S., College of Charleston, Charleston, SC

08/2015 – 05/2017 M.P.H., California State University Long Beach, Long Beach, CA

09/2017 – 05/2020 Ph.D., University of Wisconsin, Milwaukee, Milwaukee, WI

### **DISSERTATION TITLE:**

Contribution of Individual, Community, and Health System Factors to Health Outcomes in Inner-City African Americans with Type 2 Diabetes

### **POSTGRADUATE TRAINING AND FELLOWSHIP APPOINTMENTS:**

01/2012 – 08/2012 Research Design and Methodology for Health Services Research,

Medical University of South Carolina, 171 Ashley Ave, Charleston, SC 29425

01/2012 – 08/2012 Foundations in Global Health,

Medical University of South Carolina, 171 Ashley Ave, Charleston, SC 29425

11/2014 – 12/2014 Data Management for Clinical Trials,

Vanderbilt University Verified Coursera, 2201 West End Ave, Nashville, TN 37235

### **RESEARCH ADMINISTRATIVE APPOINTMENTS:**

09/2010 – 12/2012 Data Coordinator, Department of Medicine, Center for Health Disparities Research, Medical University of South Carolina, 171 Ashley Ave, Charleston, SC 29425

09/2010 – 08/2015 Data Coordinator

Ralph H. Johnson VA Medical Center, Charleston Health Equity and Rural Outreach Innovation Center (COIN)

12/2012 – 12/2016 Program Assistant, Department of Medicine, Center for Health Disparities Research, Medical University of South Carolina, 171 Ashley Ave, Charleston, SC 29425

12/2016 – Present Program Manager, Department of Medicine, Center for Advancing Population Science, Medical College of Wisconsin, 8701 Watertown Plank Rd, Milwaukee, WI 53228

### **AWARDS AND HONORS:**

01/2016 Marion Pollack Endowed Scholarship, California State University Long Beach, California

01/2016 Jo Gaines Scholarship, California State University Long Beach, California

05/2017 Outstanding Thesis Award, California State University Long Beach, California

03/2019 1<sup>st</sup> place Best Poster Award in the Research Staff Category, MCW Department of Medicine Research Retreat

03/2020 1<sup>st</sup> place Best Poster Award in the Research Staff Category, MCW Department of Medicine Research Retreat

### **MEMBERSHIPS IN HONORARY AND PROFESSIONAL SOCIETIES:**

01/2015 – Present American Diabetes Association

01/2018 – Present Society of General Internal Medicine

### **EDITORSHIPS/EDITORIAL BOARDS/JOURNAL REVIEWS:**

MEDLINE Journal Review

06/2019 – present Preventing Chronic Disease, ad hoc

08/2019 – present Substance Use and Misuse, ad hoc

10/2019 – present Journal of Psychosomatic Research, ad hoc

10/2019 – present Preventive Medicine, ad hoc

## PEER REVIEWED WORKSHOPS/PRESENTATIONS:

### **International**

Dawson AZ, Walker RJ, **Campbell JA**, Smalls BL, Egede LE. Incorporating Social Determinants of Health in Diabetes Intervention Development for Indigenous People of Panamá. International Diabetes Federation, Abu Dhabi, UAE.

12/04/2017 – 12/10/2017

Walker RJ, Dawson AZ, **Campbell JA**, Smalls BL, Egede LE. Prevalence of Diabetes and Cardiovascular Risk Factors in Indigenous Populations. International Diabetes Federation, Abu Dhabi, UAE.

12/04/2017 – 12/10/2017

Walker RJ, Dawson AZ, **Campbell JA**, Smalls BL, Egede LE. Diet and Physical Activity in an Indigenous Population in Panama. International Diabetes Federation, Abu Dhabi, UAE.

12/04/2017 – 12/10/2017

**Campbell JA**, Walker RJ, Dawson AZ, Williams, JS, Egede LE. Prevalence of diabetes across 6 sub-Saharan African countries. International Diabetes Federation, Busan, Korea.

12/02/2019-12/06/2019

### **National**

Egede LE, Williams JS, Voronca DC, **Campbell JA**, Gebregziabher M, Lynch CP. Telephone-delivered Behavioral Skills Intervention for African Americans with Type 2 Diabetes. 76TH Scientific Sessions, American Diabetes Association, New Orleans, Louisiana.

09/2014

Ozieh MN, Bishu KG, Walker RJ, **Campbell JA**, Egede LE. Geographic variation in access among adults with kidney disease: evidence from Medical Expenditure Panel Survey, 2002-2011. CKD: Health Services, Disparities, Prevention, American Society of Nephrology Kidney Week 2016, Chicago, Illinois.

06/2016

**Campbell JA**, Farmer G, Nguyen-Rodriguez S, Egede LE. Evaluation of the pathway between adverse childhood experiences and type 2 diabetes in

adulthood. 77TH Scientific Sessions, American Diabetes Association, San Diego, California.

11/2016

**Campbell JA**, Walker RJ, Garacci E, Egede LE. Effect Modification of Early and Late Life Social Support on the Development of Chronic Illness among Adults with Adverse Childhood Experiences. Society for General Internal Medicine Annual Meeting, Denver, Colorado.

06/2017

**Campbell JA**, Walker RJ, Eiler C, Egede LE. Impact of Diabetes on Colorectal Cancer Screening Rates in US adults. 78TH Scientific Sessions, American Diabetes Association, Orlando, Florida.

04/2018

**Campbell JA**, Garacci E, Egede LE. Source of diabetes knowledge information and its impact on self-management behavior among older US adults. Society for General Internal Medicine Annual Meeting, Washington, DC.

06/2018

**Campbell JA**, Garacci E, Egede LE. Impact of Diabetes Related Family and Social Discomfort on Diabetes Self-Management (DSM). 79TH Scientific Sessions, American Diabetes Association, Orlando, Florida.

04/2019

## **Regional**

Smalls B, Walker R, Hernandez-Tejada MA, **Campbell JA**, Davis KS, & Egede LE. Associations between Coping Styles, Diabetes Knowledge, Medication Adherence, & Self-Care Behaviors in Adults with Type 2 Diabetes. 17th Annual Diabetes Fall Symposium for Primary Health Care Professionals, Charleston, South Carolina.

09/2011

Walker R, Smalls B, Hernandez-Tejada MA, **Campbell JA**, Davis KS, & Egede LE. Association between Fatalism, Medication Adherence and Self-Care Behaviors in Adults with Type 2 Diabetes. 17th Annual Diabetes Fall Symposium for Primary Health Care Professionals, Charleston, South Carolina.

09/2011



Reynolds B, Walker RJ, **Campbell JA**, Egede LE. Differential Effect of Race, Education, Gender and Language Discrimination on Glycemic Control in Adults with Type 2 Diabetes. 20TH Annual Diabetes Fall Symposium for Primary Care Health Professionals, Charleston, South Carolina.

09/2014

Dawson AZ, Walker RJ, **Campbell JA**, Egede LE. Effect of Perceived Racial Discrimination on Self-Care Behaviors, Glycemic Control, and Quality of Life in Adults with Type 2 Diabetes. 20TH Annual Diabetes Fall Symposium for Primary Care Health Professionals, Charleston, South Carolina.

09/2014

Ozieh MN, Bishu KG, Walker RJ, **Campbell JA**, Egede LE. Geographic Variation in Access Among Adults with Kidney Disease: Evidence from Medical Expenditure Panel Survey, 2002-2011. 22nd Annual Diabetes Fall Symposium for Primary Health Care Professionals, Charleston, South Carolina.

09/2016

Egede LE, Williams JS, Voronca DC, **Campbell JA**, Gebregziabher M, Lynch CP. Telephone-delivered Behavioral Skills Intervention for African Americans with Type 2 Diabetes. 22nd Annual Diabetes Fall Symposium for Primary Health Care Professionals, Charleston, South Carolina.

09/2016

## **Local**

Hernandez-Tejada MA, **Campbell JA**, Davis KS, Smalls B, Walker R, & Egede LE. Diabetes Empowerment, Medication Adherence, and Self-Care Behaviors in Adults with Type 2 Diabetes. 46th Annual Perry V. Halushka MUSC Student Research Day, Charleston, South Carolina.

11/2011

Smalls BL, Walker RJ, Hernandez-Tejada MA, **Campbell JA**, Davis KS, Egede LE. Associations between Coping Styles, Diabetes Knowledge, Medication Adherence, and Self-Care Behaviors in Adults with Type 2 Diabetes. 46th Annual Perry V. Halushka MUSC Student Research Day, Charleston, South Carolina.

11/2011

Walker RJ, Smalls BL, Hernandez-Tejada MA, **Campbell JA**, Davis KS, Egede LE. Association between Fatalism, Medication Adherence and Self-Care Behaviors in Adults with Type 2 Diabetes. 46th Annual Perry V. Halushka MUSC Student Research Day, Charleston, South Carolina.

11/2011

Smalls BL, Walker RJ, Hernandez-Tejada MA, **Campbell JA**, Davis KS, Egede LE. Associations between Coping Styles, Diabetes Knowledge, Medication Adherence, and Self-Care Behaviors in Adults with Type 2 Diabetes. 6th Annual Department of Medicine Research Day, Medical University of South Carolina, Charleston, South Carolina.

01/2012

Walker RJ, Smalls BL, Hernandez-Tejada MA, **Campbell JA**, Davis KS, Egede LE. Association between Fatalism, Medication Adherence and Self-Care Behaviors in Adults with Type 2 Diabetes. 6th Annual Department of Medicine Research Day, Medical University of South Carolina, Charleston, South Carolina.

01/2012

**Campbell JA**, Mosley-Johnson E, Garacci E, Walker RJ, Egede, LE. Examination of the Co-occurrence of Diabetes and Adverse Childhood Experiences on Mortality in US Adults. Medical College of Wisconsin, Department of Medicine Research Day, Milwaukee, WI.

03/2018

**Campbell JA**, Walker RJ, Dawson AZ, Egede LE. Prevalence of Diabetes, Prediabetes, and Obesity in the Indigenous Kuna Population of Panamá. Medical College of Wisconsin, Department of Medicine Research Day, Milwaukee, WI.

03/2019

## **PROGRAMMATIC DEVELOPMENTS**

### **Community Programs**

04/2013 Community workshop - Community Compass, Trident Technical College, North Charleston, South Carolina

04/2013 Community workshop - Fun and Fitness Day, West Ashley Middle School, Charleston, South Carolina

06/2013 Community workshop - Health Education Day John's Island Rural Housing, John's Island, South Carolina

06/2016 Community workshop - Strong Men Strong Communities - Community Health Screening, Charleston, South Carolina, June 4, 2016

## **REFEREED JOURNAL PUBLICATIONS/ORIGINAL PAPERS**

(\* indicates with mentee)

1. Smalls BL, Walker RJ, Hernandez-Tejada MA, **Campbell JA**, Davis KD, Egede LE. Associations between Coping, Diabetes Knowledge, Medication Adherence, and Self-Care Behaviors in Adults with Type 2 Diabetes. *General Hospital Psychiatry*. 2012, 34(4):385-9.
2. Hernandez-Tejada MA, **Campbell JA**, Walker RJ, Smalls BS, Davis KD, Egede LE. Diabetes Empowerment, Medication Adherence and Self-Care Behaviors in Adults with Type 2 Diabetes. *Diabetes Technology and Therapeutics*. 2012, 14(7): 630-634. Epub 2012 Apr 23.
3. **Campbell JA**, Walker RJ, Smalls BS, Egede LE. Glucose control in diabetes: the impact of racial differences on monitoring and outcomes. *Endocrine*. 2012 Dec;42(3):471-82.
4. Walker RJ, Smalls BL, Hernandez-Tejada MA, **Campbell JA**, Davis KD, Egede LE. Effect of Diabetes Fatalism on Medication Adherence and Self-Care Behaviors in Adults with Diabetes. *General Hospital Psychiatry*. 2012 Nov-Dec; 34(6): 589-603. Epub 2012 Aug 13.
5. Walker RJ, Smalls BL, Bonilha HS, **Campbell JA**, Egede LE. Behavioral interventions to improve glycemic control in African Americans with type 2 diabetes: a systematic review. *Ethnicity and Disease*. 2013; Autumn;23(4):401-8.
6. Walker RJ, Smalls BL, Hernandez-Tejada MA, **Campbell JA**, Egede LE. Effect of diabetes self-efficacy on glycemic control, medication adherence, self-care behaviors, and quality of life in a predominantly low-income, minority population. *Ethnicity and Disease*. 2014; 24: 349-355.
7. Walker RJ, Smalls BL, **Campbell JA**, Strom Williams JL, Egede LE. Impact of social determinants of health on outcomes for type 2 diabetes: a systematic review. *Endocrine*. 2014 Feb 15.
8. Strom Williams J, Walker RJ, Smalls BL, **Campbell JA**, Egede LE. Effective interventions to improve medication adherence in type 2 diabetes: a systematic review. *Diabetes Management*. 2014; 4(1): 29-48.
9. Smith JA, Frueh BC, **Campbell JA**, Egede LE. Racial Differences in Diabetes Among Union Forces During the U.S. Civil War. *Ethnicity and Disease*. 2015;25(1):104-7.
10. Walker RJ, **Campbell JA**, Egede LE. Effective strategies for global health research, training and clinical care: A narrative review. *Global Journal of Health Science*. 2015; 7(2): 119-138.
11. Dawson AZ, Walker RJ, **Campbell JA**, Egede LE. Effect of Perceived Racial Discrimination on Self-Care Behaviors, Glycemic Control, and Quality of Life in Adults with Type 2 Diabetes. *Endocrine*. 2014. doi: 0.1007/s12020-014-0482-9
12. Reynolds B, Walker RJ, **Campbell JA**, Egede LE. Differential Effect of Race, Education, Gender and Language Discrimination on Glycemic Control in Adults with Type 2 Diabetes. *Diabetes Technol Ther*. 2014. doi:10.1089/dia.2014.0285

13. Smalls BL, Walker RJ, Bonilha HS, **Campbell JA**, Egede LE. Community Interventions to Improve Glycemic Control in African Americans with Type 2 Diabetes: A Systemic Review. *Global Journal of Health Science*, 7(5), 2015
14. **Campbell JA**, Walker RJ, Egede LE. Association between Adverse Childhood Experiences, High Risk Behaviors, and Morbidity in Adulthood. *American Journal of Preventative Medicine*. 2016; 50(3):344-52.
15. Achuko O, Walker RJ, **Campbell JA**, Dawson AZ, Egede LE. Pathways between Discrimination and Quality of Life in Patients with Type 2 Diabetes. *Diabetes Technology and Therapeutics*, 2016;18(3), DOI: 10.1089/dia.2015.0305.
16. Hurt K, Walker RJ, **Campbell JA**, Egede LE. mHealth interventions in low and middle income countries: A systematic review. *Global Journal of Health Science*, 2016; 8(9), 183-193.
17. Dawson AZ, Walker RJ, **Campbell JA**, Egede LE. Effective Strategies for Global Health Training Programs: A Systematic Review of Training Outcomes in Low and Middle Income Countries. *Global Journal of Health Science*. 2016 In press
18. Dawson AZ, Walker RJ, **Campbell JA**, Egede LE. Validation of Theoretical Pathways between Discrimination, Diabetes Self-Care and Glycemic Control. *Journal of Diabetes Complications*. 2016, 30(5):858-63.
19. Ozieh MN, Bishu KG, Walker RJ, **Campbell JA**, Egede LE. Geographic variation in access among adults with kidney disease: evidence from Medical Expenditure Panel Survey, 2002-2011. *BMC Health Services Research*. 2016;16:585.
20. **Campbell JA**, Bishu KG, Walker RJ, Egede LE. Trends of Medical Expenditures and Quality of Life in US Adults with Diabetes: The Medical Expenditure Panel Survey, 2002-2011. *Health and Quality of Life Outcomes*. 2017,13;15(1):70. doi: 10.1186/s12955-017-0651-7
21. **Campbell JA**, Walker RJ, Smalls BL, Egede LE. Social adaptability index in self-care and diabetes outcomes. *BMC Endocrine Disorders*. 2017, 20;17(1):34. doi: 10.1186/s12902-017-0185-3
22. **Campbell JA**, Farmer G, Nguyen-Rodriguez S, Walker RJ, Egede LE. Relationship Between Individual Categories of Adverse Childhood Experience and Diabetes in Adulthood in a Sample of US Adults: Does it Differ by Gender? *Journal of Diabetes and its Complications*. 2018, 32(2):139-143. doi: 10.1016/j.jdiacomp.2017.11.005
23. **Campbell JA**, Farmer G, Nguyen-Rodriguez S, Walker RJ, Egede LE. Using Path Analysis to Examine the Relationship Between Sexual Abuse in Childhood and Diabetes in Adulthood in a Sample of US Adults. *Preventive Medicine*. 2018, 108:1-7. doi: 10.1016/j.ypmed.2017.12.013.
24. **Campbell JA**, Mendez CE, Garacci E, Walker RJ, Wagner N, Egede LE. The Differential Impact of Adverse Childhood Experiences in the Development of Pre-Diabetes in a Longitudinal Cohort of US Adults. *Journal of Diabetes and Its Complications*. 2018, 32(11):1018-1024. doi: 10.1016/j.jdiacomp.2018.09.006.

25. **Campbell JA**, Mosley-Johnson E, Garacci E, Walker RJ, Egede, LE. The Co-occurrence of Diabetes and Adverse Childhood Experiences on Mortality in US Adults. *Journal of Affective Disorders*. 2019, 15;249:20-25. doi: 10.1016/j.jad.2019.02.016.
26. **Campbell JA**, Walker RJ, Dawson AZ, Egede LE. Prevalence of Diabetes and Obesity in the Indigenous Kuna Population of Panamá. *Journal of Racial and Ethnic Health Disparities*. 2019, 6(4):743-751. doi: 10.1007/s40615-019-00573-0.
27. Walker RJ, **Campbell JA**, Dawson AZ, Egede LE. Prevalence of Psychological Distress, Depression and Suicidal Ideation in an Indigenous Population in Panamá. *Social Psychiatry and Psychiatric Epidemiology*. 2019, 54(10):1199-1207. doi: 10.1007/s00127-019-01719-5.
28. \*Hanna DR, Walker RJ, Smalls BL, **Campbell JA**, Dawson AZ, Egede LE. Correlates of Hypertension in the Indigenous Kuna Population of Panamá. *BMC Public Health*. 2019, 28;19(1):843. doi: 10.1186/s12889-019-7211-5.
29. \*Neitzel AL, Smalls BL, Walker RJ, Dawson AZ, **Campbell JA**, Egede LE. Examination of Dietary Habits Among the Indigenous Kuna Indians of Panama. *Nutritional Journal*. 2019, 18(44). doi:10.1186/s12937-019-0469-8
30. Walker RJ, **Campbell JA**, Egede LE. Differential Impact of Food Insecurity, Distress, and Stress on Self-care Behaviors and Glycemic Control using Path Analysis. *Journal of General Internal Medicine*. 2019, 16. doi: 10.1007/s11606-019-05427-3.
31. Walker RJ, Garacci E, **Campbell JA**, Egede LE. The Influence of Daily Stress on Glycemic Control and Mortality in Adults with Diabetes. *Journal of Behavioral Medicine*. 2019, 15:1-9. doi: 10.1007/s10865-019-00109-1.
32. **Campbell JA**, Egede LE. Individual, Community, and Health System Level Barriers to Optimal Type 2 Diabetes Care for Inner-City African Americans: An Integrative Review and Model Development. *The Diabetes Educator*. 2019, 5:0145721719889338.
33. Dawson AZ, Walker RJ, **Campbell JA**, Davidson TM, Egede LE. Telehealth and Indigenous Populations around the World: A Systematic Review on Current Modalities for Physical and Mental Health. *mHealth*. 2019, *in press*.
34. Walker RJ, Garacci E, **Campbell JA**, Harris M, Mosley-Johnson E, Egede LE. Relationship between Multiple Measures of Financial Hardship and Glycemic Control in Older Adults with Diabetes. *Journal of Applied Gerontology*. 2020, <https://doi.org/10.1177/0733464820911545>.