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Impact of a Workplace Wellness Program on Health Literacy and Type 2 Diabetes Management Among Blue-Collar Workers in South Carolina

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2023

Abstract

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MS HEP, Walden University, 2018

BS, Siena College, 2015

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Health Education and Promotion

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Abstract

The prevalence of chronic diseases and their management is significantly different between blue- and white-collar employees. Social determinants of health are determining factors of health for blue-collar manufacturing employees in South Carolina. Type 2 Diabetes is a complex chronic condition that has been associated with serious co-morbidities, but it can be managed and/or treated. Workplace wellness programs provide an ideal setting for health education and promotion efforts targeted toward population health management. While workplace wellness programs have been proven successful, there is limited research on the relationship and impact on health literacy. This quantitative, descriptive study used secondary data to understand the relationship between health literacy-numeracy and diabetes care management because of participating in a workplace wellness program. Health-numeracy is knowing what the "health numbers" mean and understanding how and what to do when the numbers are not within range. Health-numeracy is a key component of diabetes management. The results of this study indicated that gender significantly impacted health literacy-numeracy. Males were more likely to have adequate health literacy-numeracy compared to females. The findings of this study can help expand health promotion and education efforts to provide awareness of workplace wellness programs and health literacy. Improvements in health literacy can also enhance overall chronic condition management, which can have wide reaching positive social change.

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Dedication

I would like to dedicate this to my family and friends who supported me throughout this journey, especially my husband, Stephen, and my parents. I couldn't have done it without you, Tasha, and Maggie!

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A special thank you to my chair, Dr. Summer Parrott, who helped guide and support me throughout this entire project. The timely, detailed, and thorough feedback made this process manageable. I also appreciated the support from Dr. Jason Baker, my second committee member, who provided feedback and helped me throughout this journey. You both helped me reach a goal I was not sure was possible, and I will forever be grateful to have you as mentors and colleagues.

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Chapter 1: Introduction to the Study

Type 2 Diabetes is a complex chronic condition that was first diagnosed in the 1930s (Karamanou et al., 2016; Lakhtakia, 2013; Trikkalinou et al., 2017). Diabetes is one of the most common non-communicable diseases and one of the leading causes of death worldwide (Vandenbosch et al., 2018). While it is a serious condition that has been associated with many significant co-morbidities, it can be managed and/or treated. There are numerous prevention programs and education materials available for Type 2 Diabetes; however, the incidence and prevalence of Type 2 Diabetes continue to rise (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019; Vandenbosch et al., 2018). A key reason for the continued increase comes from a lack of understanding of Type 2 Diabetes and how to manage it (Huizinga et al., 2008; Vandenbosch et al., 2018). Various studies have shown the connections between Type 2 Diabetes and the social determinants of health, such as education, income, access to care, and health literacy (Vandenbosch et al., 2018; Wolff et al., 2009).

Even though there are health education and preventive care efforts targeted toward Type 2 Diabetes, limited research has been conducted to understand the relationship and impact of health literacy on condition management (Bains & Egede, 2011; Fransen et al., 2012; Gazmararian et al., 2003; Kim et al., 2004; Schillinger et al., 2002). Studies focusing on health literacy and health management have primarily evaluated functional print literacy (Huizinga et al., 2008; Wolff et al., 2009), which is only one component of health literacy. The triad of health literacy consists of

communication, functional literacy, and numeracy (Vandenbosch et al., 2018). The background, definitions, and details of health literacy are expanded upon in Chapter 2 within the literature review. For this study, numeracy is a main focus in the evaluation of health literacy because of the impact it can have on Type 2 Diabetes management.

The target population of this study was blue-collar manufacturing employees. The gap between blue- and white-collar employees has been highlighted by researchers; there are vast differences between socioeconomic, health, and chronic disease prevalence status (Kang, 2021; Lingard & Turner, 2015). Additional risk factors that are more prominent among blue-collar workers include smoking, obesity, hypertension, and lack of physical activity (Bagwell & Bush, 2000; Gottlieb et al., 1992; Lingard & Turner, 2015; Väisänen, et al., 2020).

Worksites provide an ideal setting for health education and promotion because employees spend a significant amount of time at work (Chakkalakal et al., 2019; Cheon et al., 2020). Workplace wellness programs have been around since the 1950s, and while the methods may have changed throughout the years, the end goal remains the same: to promote workforce wellness and increase productivity. There is significant research noting the benefits of workplace wellness programs for both the employer and employees (Bagwell & Bush, 2000; Barham et al., 2011; Brown et al., 2018; Nagamine et al., 2020; Odom et al., 2019; Smith et al., 2021).

While there have been studies showing evidence that workplace wellness programs can provide positive education and support to employees dealing with Type 2 Diabetes (Barham et al., 2011; Brown et al., 2018; Cheon et al., 2020; DeJoy et al., 2013;

Giese & Cook, 2014), the measurement and impact of health literacy have not been identified as a direct result of the workplace wellness program. There is also a lack of data on this population's health, demographic, socioeconomic, and lifestyle profiles. Limited information is available about health and other disparities impacting blue-collar manufacturing employees, which makes it more difficult to plan and develop evidence-based interventions to address health issues, specifically health literacy and Type 2 Diabetes management.

Positive social change is defined as improving human and social conditions for the betterment of society. Research and social change have a direct relationship because research can provide the data and results necessary to impact policies and practices that could directly enhance society, which results in the betterment of lives. Health promotion and education is the positive promotion of health to empower people to live healthier lives; it aims to promote independence and empowerment for individuals (Whitehead, 2004). My study could lead to broad positive social change by providing awareness of health literacy and understanding its impact on Type 2 Diabetes management. In addition, my study has the potential for broader social change for those with other health conditions because improvements in health literacy could enhance overall condition management (Karamanou et al., 2016).

Within Chapter 1, I expand upon the background of Type 2 Diabetes, workplace wellness programs, and the blue-collar manufacturing employee population in South Carolina. I also present the purpose of my research and the research questions with associated hypotheses. Additionally, I discuss the theoretical framework that guides my

research and address assumptions, potential limitations, and delimitations of my study population. Finally, I convey the significance of this research and the potential impact of positive social change.

Background

There are health education and preventive care efforts targeted toward Type 2 Diabetes, but many employees continue to struggle with disease management. Blue-collar manufacturers in South Carolina are disadvantaged by various social determinants of health, which result in difficulty managing their Type 2 Diabetes (American Diabetes Association [ADA], 2021). There have been studies that produced evidence that workplace wellness programs or interventions can provide positive impacts through education and support to employees dealing with Type 2 Diabetes (Brown et al., 2018; Vandenbosch et al., 2018); however, the measurement and impact of health literacy has not been looked at as a direct result of the workplace wellness program. Further research is needed to investigate and understand the impact of a workplace wellness program on health literacy and Type 2 Diabetes management within the specific population of blue-collar manufacturing employees in South Carolina.

My study can expand upon the current research to help understand the effectiveness, impact, and relationship of workplace wellness programs on Type 2 Diabetes management and health literacy. The following data points were investigated from the workplace wellness program perspective for Type 2 Diabetes and health literacy to address the gap in the literature: age, blood pressure, Hemoglobin A1c (HbA1c), gender, race, smoking status, and weight. The literature review presents evidence to

support the positive impacts of workplace wellness programs on Type 2 Diabetes management, while also highlighting the need for additional research as it relates to the measurement and understanding of health literacy. This knowledge gap illustrates the potential risk factors of poor health literacy and Type 2 Diabetes management among blue-collar manufacture workers in South Carolina.

In this study, I investigated the impact of a workplace wellness program on health literacy and Type 2 Diabetes management among blue-collar workers in South Carolina. The concept of health literacy has been around for some time, but the evaluation and measurement tools are relatively new. Being able to evaluate the different types of health literacy will be useful in understanding the impact of the workplace wellness program. Additionally, the target population, blue-collar manufacturing employees in South Carolina, does not have research associated with it as the focus. Examining the topic and population will help provide insight and data to create evidence-based programs. Therefore, this study is needed to bridge the gap in knowledge of health literacy and Type 2 Diabetes management among blue-collar manufacturing workers in South Carolina.

Problem Statement

Researchers have studied Type 2 Diabetes for decades, including its causes, management, complications, and treatment options (Lakhtakia, 2013). The results of those studies indicate that Type 2 Diabetes can be prevented, managed, and treated if proper education is provided (Barham et al., 2011; Brown et al., 2018; Cheon et al., 2020; Chu et al., 1997; Fetherman et al., 2021; Giese & Cook, 2014). Increasing health literacy has been shown to positively impact health outcomes (American Diabetes Association

[ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019). Workplace wellness programs provide a great setting to educate and promote healthy behaviors and actions. Few studies have explored the relationship and impact of a workplace wellness program on health literacy and Type 2 Diabetes management. My study focused on exploring this relationship among blue-collar manufacturing workers in South Carolina.

My research will build upon and bridge previously conducted research. Recent research has shown the benefits of a general workplace wellness program (Fetherman et al., 2021; Väisänen et al., 2020; Van Kasteren et al., 2020). Few studies have evaluated workplace wellness programs with a specific focus on Type 2 Diabetes (Brown et al., 2018; Chakkalakal et al., 2019; Cheon et al., 2020; Smith et al., 2021). Additionally, many of the workplace wellness programs that have been studied focus on prevention of Type 2 Diabetes rather than management. A well-known example is the Diabetes Prevention Program (DPP), which was developed by the CDC (Ely et al., 2017). The DPP was used in the study by Padilla et al. (2021) where the researchers translated the DPP into a workplace wellness program. The goal of the DPP is to prevent Type 2 Diabetes, but there also needs to be a focus on condition management because the incidence and prevalence of Type 2 Diabetes continue to increase (Fransen et al., 2012; Heise et al., 2022; Smith et al., 2021).

Understanding the link between health literacy and diabetes management also needs to be explored further (Huizinga et al., 2008). Historically, health literacy has not been incorporated or evaluated from a workplace wellness program perspective. Health literacy has become a more prominent topic, but specifically connected to the provider-

patient relationship and functional print literacy, which is only one component of complete health literacy (Huizinga et al., 2008). This can be seen in the study by Finbråten et al., which evaluated the association between health literacy and health behavior and empowerment in people with Type 2 diabetes (2020). These researchers did acknowledge the importance and need for additional research to be done on the association between health literacy and health behaviors. My research will add to all three subject areas: Type 2 Diabetes management, workplace wellness programs, and health literacy – numeracy. It will also provide a new perspective by incorporating all of these in one study. My research will provide valuable information to the field of health promotion and education to be able to positively impact and empower individuals to take control of their health. The relationships between Type 2 Diabetes, workplace wellness programs, and health literacy are not clear and have not been studied in the context of the blue-collar manufacturing population, but my study will do that.

Despite health education and preventive care efforts, Type 2 Diabetes is an epidemic in South Carolina (American Diabetes Association [ADA], 2021), and is only projected to worsen from a global perspective (Lin et al., 2018). The negative impact of the social determinants of health are factors causing the situation to get worse (Golden et al., 2017; Silva-Tinoco et al., 2020; Zibran & Mohammadnezhad, 2019). South Carolina data show a lack of literacy, education, and income (2022 South Carolina state report, n.d.; Shrider, 2022). Given the prominent manufacturing industry in SC, there is a significant number of blue-collar employees who are negatively impacted by the social

determinants of health, which, in turn, impacts their ability to manage their health, specifically chronic conditions like Type 2 Diabetes.

Purpose of the Study

This study was a quantitative, descriptive study to investigate and understand the relationship between health literacy-numeracy and diabetes care management. This study utilized secondary quantitative data from employees of a blue-collar manufacturing company in South Carolina with a diagnosis of Type 2 diabetes who participated in their workplace wellness program. The data were originally used for tracking purposes of the workplace wellness program. The manufacturing company and their onsite clinic provider agreed to allow me to use this data for my study. The dependent variable being studied is health literacy-numeracy. The independent variables included the following: age, blood pressure, Hemoglobin A1c (HbA1c), gender, race, smoking status, and weight. The motivation for this study is to improve health promotion and education among blue-collar manufacturer workers in South Carolina with Type 2 diabetes so they can have better care management. This can translate into decreased health care costs for themselves, as well as from an employer's perspective, and most importantly, allow them to have better health outcomes and quality of life.

Research Questions and Hypotheses

RQ1: What is the relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina?

H_o1: There is no relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina.

H_a1: There is a relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina.

RQ2: What is the relationship between Diabetes Numeracy Test score between gender and hemoglobin A1C test results among blue-collar manufacturing employees in South Carolina?

H_{o2}: There is no relationship between Diabetes Numeracy Test score between gender and hemoglobin A1C test results among blue-collar manufacturing employees in South Carolina.

H_a2: There is a relationship between Diabetes Numeracy Test score between gender and hemoglobin A1C test results among blue-collar manufacturing employees in South Carolina.

Theoretical Framework

The social ecological model (SEM) is the theoretical framework used throughout this study, along with the multi-level concept of health literacy. The social ecological model (SEM) was developed by Urie Bronfenbrenner in the 1970s, but it was not formalized as a theory until the 1980s (McCormack et al., 2017). SEM recognizes the

importance of psychosocial factors in behavior change and the person-environment relationship (Lusmägi & Aavik, 2021). SEM addresses the complexities and interdependencies between socioeconomic, cultural, political, environmental, organizational, psychological, and biological determinants of health (Whittemore et al., 2004). Interpreting health from the SEM perspective, the individual is embedded within a larger caste where there are various levels of influences that impact and reinforce the underlying health outcomes of the individual (Golden & Earp, 2012). Ultimately, SEM illustrates how the social determinants of health impact and influence an individual's behavior and thus their health.

The health of employees is shaped by the interactions between personal, environmental, and social factors, which fit within the individual, interpersonal, and organizational levels of the SEM. As identified by McCormack et al., there are multiple factors influencing overall health, and there are potential interventions that may improve health literacy and engagement (2017). Incorporating health literacy into the social ecological model, as seen in Figure 1, can provide more sustainable changes over time by creating environments where people can access, seek, and understand health information (McCormack et al., 2017). It is important to consider that there are multiple levels of influence on individuals because of their physical and social environments. An intervention at one level influences the outcome through one or more other levels (McCormack et al., 2017). Focusing on a workplace wellness program for my study means that the most impactful and relevant levels to consider are the individual, interpersonal, and organizational levels of the SEM. The goal and intention of my study

is to build upon research that removes barriers and addresses individuals' health through employer-sponsored workplace wellness programs, to provide accessible information in the workplace setting, and ultimately drive individuals' engagement in their health.

The SEM was used as the foundation of my research questions. The individual, interpersonal, and organizational levels of the SEM are prominent components of each question. The literature review in Chapter 2 expands upon the social ecological model as the theoretical framework as a guide for my study. Within Chapter 2, I include more detail on the background and how the SEM relates to my study by expanding upon the individual (intrapersonal), interpersonal, and organizational levels. Each research question is listed below and includes the details of how the SEM underpins it.

RQ1: What is the relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina? Blue-collar workers are relevant to all three levels of the SEM: individual, interpersonal, and organizational. Health literacy-numeracy, HbA1c, gender, race, blood pressure, and body mass index (BMI) are relevant to the interpersonal and individual levels of the SEM.

RQ2: What is the relationship between Diabetes Numeracy Test score between gender and hemoglobin A1C test results among blue-collar manufacturing employees in South Carolina? The workplace wellness program is associated with the organizational level, while health literacy, hemoglobin A1c and gender are associated with the individual and interpersonal levels of the SEM.

Nature of the Study

To address the research questions in this study, I utilized secondary internal quantitative data from employees with a diagnosis of Type 2 Diabetes who are employed by a blue-collar manufacturing company in South Carolina. The employer and onsite clinic provider own the data. The data are survey-based secondary data. The surveys and questionnaires used by the original researchers were previously validated tools, including the Diabetes Numeracy Test (DNT), biometric health measurements, and demographic data. The employer has a workplace wellness program in place. At the time of this study, the measurement and impact of health literacy has not been evaluated by the workplace wellness program. I collaborated with the onsite clinic, Human Resources team, and Executive Team to obtain the secondary data and address any questions.

I examined the relationship between the independent variables: age, blood pressure, Hemoglobin A1c (HbA1c), gender, race, smoking status, weight, and the dependent variable, health literacy-numeracy. Age was evaluated and then sorted based on age brackets. Gender was defined as either male or female. For race, participants could identify as African American, American Indian, Asian, Black, Black or African American, English, Mexican American Indian, Other, White, or Decline to Answer. Weight was used in the determination of obesity or overweight status. Blood pressure uses systolic and diastolic measurements for the evaluation of heart-related issues, such as hypertension. Based on the blood pressure values, it was characterized as normal, elevated, high blood pressure stage 1-hypertension, high blood pressure stage 2-hypertensive crisis (American Heart Association [AHA], 2023). The Diabetes Numeracy

Test (DNT5) was used to assess numeracy skills essential for diabetes self-management. Income was based on a range of the compensation values received. These data points were analyzed using IBM SPSS statistics software to perform multiple quantitative statistical tests, which include descriptive statistics, and logistical regressions.

Definitions

Terms used within this study are defined below with more detailed explanations presented in Chapters 2 and 3.

Body mass index (BMI): A person's weight-to-height ratio. BMI is used as a screening tool for weight categories that may lead to health problems, like obesity, which is a major precursor to Type 2 Diabetes. A BMI over 25 is considered overweight and over 30 is obese (Centers for Disease Control and Prevention [CDC], 2022b).

Blue-collar employee: A blue-collar worker is engaged in manual work, works shifts, and whose primary goal is to produce the product of the manufacturing site. Blue-collar workers are often paid on an hourly basis and their pay is dependent upon the industry in which they work. Blue-collar workers may only require certain skills that can be obtained either on the job or by going to trade school (Alexy, 1990; Kang, 2021).

Descriptive statistics: The summary of quantitative statistics for a collection of information; this commonly includes the mean, median, mode, and standard deviation (Pallant, 2020).

Diabetes Numeracy Test (DNT): The first scale to specifically measure numeracy skills used in diabetes; this scale can be used to assess numeracy skills essential for

diabetes self-management. Performance on the DNT correlates with diabetes knowledge, self-efficacy, behaviors, and glycemic control (Huizinga et al., 2008).

Employer/workplace: An employer is considered a person or organization that provides a job paying wages or a salary to one or more people. There are rules and regulations that must be followed to ensure the proper treatment and safety of employees.

Health literacy: The concept of health literacy is the degree to which individuals can obtain, process, and understand basic health information to be able to make decisions about their health (Vandenbosch et al., 2018). Health literacy can be broken down into three different components: communication, functional literacy, and numeracy (Vandenbosch et al., 2018).

Health literacy communication: The flow of information between patients and their healthcare team to understand and make decisions about their health plan. (Vandenbosch et al., 2018).

Health literacy functional literacy: The basic ability to understand information. (Vandenbosch et al., 2018).

Health literacy numeracy: Knowing what the health "numbers" mean and understanding how and what to do when the numbers are not within range (Vandenbosch et al., 2018).

Hemoglobin A1c (HbA1c) *Test*: A blood test that measures the average blood sugar levels over the past three months. It is commonly used to diagnose prediabetes and diabetes, and as a tool to manage Type 2 Diabetes. The ranges include normal: below

5.7%; pre-diabetes: 5.7% - 6.4%; and diabetic: 6.5% and above. (Centers for Disease Control and Prevention [CDC], 2022a).

IBM SPSS: A statistical software used for data analysis that was developed by IBM. Version 28 via Walden University license was used.

Logistic regression: A model that is used to model the probability of an event taking place by having the log odds for the event be a linear combination of one or more independent variables (Pallant, 2020).

Manufacturing industry in South Carolina: Manufacturers in South Carolina account for 16.27% of the total output in the state, and they employ 12.04% of the workforce. South Carolina manufacturing sectors include a variety of industries such as motor vehicles and parts, chemicals, machinery, plastic products, and fabricated metal products (South Carolina Manufacturers Alliance, 2022).

Mean: Average of a set of values.

Median: The middle number in a sorted, ascending, or descending list of numbers (Pallant, 2020).

Mode: The value that appears most frequently in the data set (Pallant, 2020).

Obesity: Abnormal or excessive fat accumulation that poses health risks; this is often used in the classification of BMI (World Health Organization, n.d.).

Type 2 diabetes: A chronic condition that affects the way the body processes glucose (blood sugar) (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019).

Workplace wellness program: Workplace health programs are a coordinated and comprehensive set of health promotion and protection strategies implemented at the worksite that include programs, policies, benefits, environmental supports, and links to the surrounding community designed to encourage the health and safety of all employees (Centers for Disease Control and Prevention [CDC], n.d.).

Assumptions

As I used secondary data, I assumed that the information received was accurate, authentic, and truthful about the participants. I also assumed that the study participants were competent and able to understand and provide the information. These assumptions were necessary to ensure that the data collected was appropriate for the analyses performed.

Scope and Delimitations

This was a quantitative, descriptive study that utilized secondary data. The target population was employees of a manufacturer in Aiken, South Carolina, who participated in the workplace wellness program and had been diagnosed with Type 2 Diabetes. Biometric health measurements and demographic information were evaluated from 2015-2022. The Diabetes Numeracy Test was administered in February 2023 for those who self-identified as having Type 2 Diabetes. This study focused on identifying and understanding the relationship between the independent variables, age, blood pressure, Hemoglobin A1c (HbA1c), gender, race, smoking status, and weight, and the dependent variable, health literacy-numeracy. Blood pressure and body mass index (BMI)

classifications were incorporated into the data based on participant lab results. The criteria of which are determined by national health organizations.

This study has the potential for generalizability. Based on the specific demographic of blue-collar manufacturing workers, this could be translated to other blue-collar demographics such as construction workers, automotive, trade jobs, or other types of manufacturing. This could also be expanded to other locations within the United States, but going outside of the US may cause some issues because of the differences in job descriptions, companies, work environments, etc. Additionally, the variables being studied can be applied from a white-collar perspective, but the program may need to be updated to apply to the different demographics' needs.

Limitations

Identifying and addressing specific biases is important when utilizing secondary data. Participation in the workplace wellness program was voluntary, but there is the potential for self-selection bias, in that only healthy people would participate. Response bias could also occur in any study that relies on information provided by participants during data collection. Since I utilized secondary data, I did not have control over the data quality, which was something I took into consideration. I am confident that the original researchers I obtained the secondary data from had the knowledge, tools, and resources to gather good data, which in turn, provided me with good data to analyze. Additionally, I evaluated the data to ensure they were relevant and consistent with my research topic and included the necessary variables for my study.

Significance

Positive social change is defined as improving human and social conditions for the betterment of society. Research and social change have a direct relationship because research can provide the results necessary to impact policies and practices to directly impact society to enhance lives. Health promotion and education is the positive promotion of health to empower people to live healthier lives; it aims to promote independence and empowerment for individuals. Health literacy is a significant concern and a social determinant of health. My study can offer broad social change by providing awareness of the importance of understanding health literacy and Type 2 Diabetes for patients related to their health journey. In addition, my study has the potential for broader social change by not only helping those with Type 2 Diabetes, but also those with other health conditions, as improvements in health literacy could lead to better compliance with medical recommendations (Karamanou et al., 2016).

Many adults in the US have low health literacy, which impacts their ability to make medical condition-specific decisions and increases their financial burden (Rothman et al., 2005). Conducting additional research on this problem and gap is meaningful because it will add to the research addressing the multiple levels of health literacy, specifically for those managing Type 2 Diabetes. Additionally, it can provide data to support why workplace wellness programs should be considered or implemented, along with how to deal with those doing diverse types of work at various shift hours. The problem and gap in research that has been identified is meaningful because doing this research could have a significant impact on the way those who have diabetes learn about

and manage their condition in a workplace setting. As a result of effectively managing their condition, workers may experience positive physical and mental health, and a decreased financial burden (Vandenbosch et al., 2018).

This study is significant in that it will provide evidence for workplace wellness programs for the education of Type 2 Diabetes. It will provide valuable information to stakeholders in the region to create positive social change through policies to incorporate this type of workplace wellness program. It will also promote positive social change for those involved, by creating a better understanding of their health and medical condition management.

Summary

The motivation for this study is to enhance health promotion and education among blue-collar manufacturer workers with Type 2 Diabetes in South Carolina to improve self-care management, which could translate to decreased healthcare costs and increased health outcomes and quality of life. If a workplace wellness program can be identified for blue-collar manufacturing workers that has a positive impact on Type 2 Diabetes care management, it could lead to reduced comorbidities, cost impact, prevalence, and incidences of diabetes. This would be a significant impact on the research surrounding Type 2 Diabetes, health education, and care management in the workplace setting. Additionally, this could provide support and credibility for future workplace wellness programs focusing on Type 2 Diabetes.

In Chapter 2, I discuss the search strategies, theoretical framework, and key variables of my study. I expand upon the past and current literature to connect, elaborate,

and synthesize the impacts of workplace wellness programs on health literacy and Type 2 Diabetes management among blue-collar manufacturer employees in South Carolina.

Chapter 2: Literature Review

Introduction

Diabetes is a serious medical condition that is considered one of the leading causes of death globally. Diabetes is one of the most common non-communicable diseases and has been associated with significant co-morbidities, but it can be managed and/or treated (Vandenbosch et al., 2018). Health education and promotion programs are readily available for Type 2 Diabetes; however, the incidence and prevalence of Type 2 Diabetes continue to rise (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019; Vandenbosch et al., 2018). A key reason for the continued increase comes from a lack of understanding of Type 2 Diabetes and how to manage it (Huizinga et al., 2008; Vandenbosch et al., 2018). Numerous studies have shown the connections between Type 2 Diabetes and the social determinants of health, such as education, income, access to care, and health literacy (Vandenbosch et al., 2018; Wolff et al., 2009).

There are workplace wellness programs, health education, and preventive care efforts targeted toward Type 2 Diabetes, but many employees struggle with disease management. Worksites provide ideal settings to disseminate health promotion materials since employees spend more than one-third of their days at work (Cheon et al., 2020). Studies have shown evidence that workplace wellness programs can provide positive impacts through education and support to employees dealing with Type 2 Diabetes (Brown et al., 2018; Vandenbosch et al., 2018); however, the measurement and impact of health literacy has not been looked at as a direct result of the workplace wellness

program. Blue-collar manufacturers in South Carolina are disadvantaged by various social determinants of health and have difficulty managing their Type 2 Diabetes (American Diabetes Association [ADA], 2021). Further research is needed to investigate and understand the impact of a workplace wellness program on health literacy and Type 2 Diabetes management within the specific population of blue-collar manufacturing workers in South Carolina.

The motivation for this study is to promote health promotion and education among blue-collar manufacturer workers in South Carolina with Type 2 Diabetes so they may have better self-care management, which could translate into decreased healthcare costs and increased health outcomes and quality of life. If a workplace wellness program can be identified for blue-collar manufacturing workers, there would be a positive impact on Type 2 Diabetes care management, then it could lead to reduced comorbidities, cost impact, prevalence, and incidences of diabetes. This would have a significant impact on the research surrounding Type 2 Diabetes, health education, and care management in the workplace setting. Additionally, this could provide support and creditability for future workplace wellness programs focusing on Type 2 Diabetes.

This review of the literature was conducted to understand the effectiveness, impact, and relationship of workplace wellness programs on Type 2 Diabetes management and health literacy. The following data points were investigated from the workplace wellness program perspective for Type 2 Diabetes and health literacy to address the gap in the literature: age, blood pressure, Hemoglobin A1c (HbA1c), gender, race, smoking status, and weight. The literature review provided evidence to support the

positive impacts of workplace wellness programs on Type 2 Diabetes management while also highlighting the need for additional research as it relates to health literacy.

Within this Chapter, I expanded upon the search strategies, theoretical framework, and key variables of my study. This review of the past and current literature was used to connect, elaborate, and synthesize the impacts of workplace wellness programs on health literacy and Type 2 Diabetes management among blue-collar manufacturer employees in South Carolina. The purpose of this review was to emphasize the global impacts of health literacy on Type 2 Diabetes management.

Literature Search Strategy

The detailed literature search for this study included relevant, full text, peer reviewed scholarly journals and articles from 2017 to 2023. When looking for more historical or broader perspectives, the date limitations were removed. Throughout the research review, it is beneficial to understand the historical context of previous researchers and how their contributions have expanded and built upon what is known today.

The databases searched via the Walden University Library online resources included MEDLINE with Full Text/PubMed, CINAHL, PsycInfo, SocIndex, ScienceDirect, Academic Search Complete, Gale Academic OneFile Select, Directory of Open Access Journals, SAGE Knowledge, SAGE Research Methods. Google Scholar was also used to perform citation chaining. The keywords search included *diabetes, workplace wellness or occupational health or employee health, program or intervention or training or education or module, manufacturing or blue-collar, socioecological, or*

social ecological, and *health literacy or health education or health knowledge*. Multiple search combinations were utilized to ensure all relevant articles and sources were reviewed.

The initial search in the Walden Library database included the search terms *diabetes, workplace wellness or occupational health, program or intervention,* or *training or education or module* (1,399 results). Next, the search was narrowed by adding the search terms *health literacy*, *health education,* or *health knowledge* (227 results). I then used Google Scholar to perform Citation Chaining, which was using Google Scholar to look at the references of any "good" articles for any similar work, or frequently cited paper that contain turning points in the understanding of my topic. An example of this was using the Effectiveness of workplace diabetes prevention programs: A systematic review of evidence (Brown et al., 2018) is cited by 27 others, using the "cited by 27" link, I limited it by date to find the newer articles that cited this specific article.

Additional searches in the Walden Library databases were done to obtain information for the target population, which included manufacturing or blue-collar employees. The search terms included *workplace wellness* or *occupational health* or *employee health*, *program* or *intervention* or *training* or *education module*, *manufacturing,* or *blue-collar* (2,955 results). I then added filters for *socioecological* or *social ecological* (16 results) to include studies that used the theoretical framework I used.

While there was significant research on workplace wellness programs focusing on health promotion and education for those with Type 2 Diabetes, there was limited

research on how workplace wellness programs impact health literacy. The concept of health literacy has been around for some time, but the evaluation and measurement tools are relatively new. Being able to evaluate the different types of health literacy will be useful to understand the impact of the workplace wellness program. Additionally, the target population, blue-collar manufacturing employees in South Carolina has not been the target population of study. Thus, examining the topic and population will help reduce this gap in the literature.

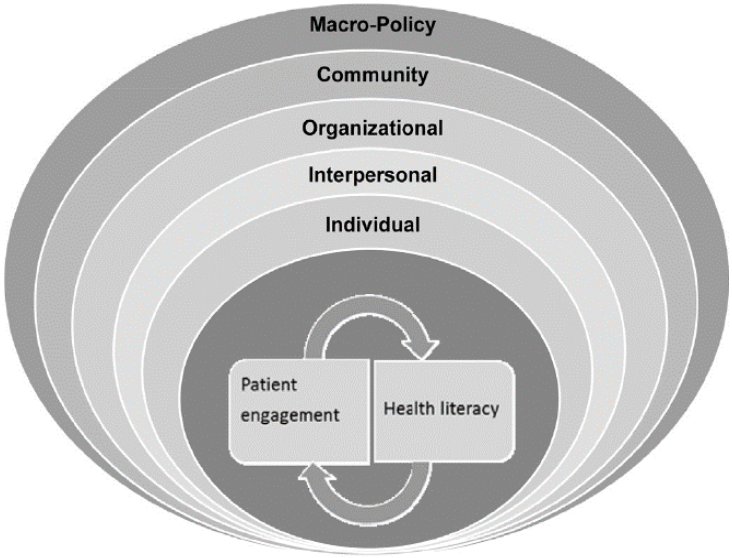
Theoretical Framework

The social ecological model (SEM) is the theoretical framework used throughout my study, along with the multi-level concept of health literacy. The social ecological model (SEM) was developed by Urie Bronfenbrenner in the 1970s, but it was not formalized as a theory until the 1980s (McCormack et al., 2017). SEM recognizes the importance of psychosocial factors in behavior change and the person-environment relationship (Lusmägi & Aavik, 2021). SEM addresses the complexities and interdependencies between socioeconomic, cultural, political, environmental, organizational, psychological, and biological determinants of health (Whittemore et al., 2004). The visual representation of the theory is nesting circles with the individual placed in the center, as shown in Figure 1, but this SEM model incorporates health literacy (McCormack et al., 2017). Interpreting health from the SEM perspective, the individual is embedded within a larger caste where there are various levels of influences that impact and reinforce the underlying health outcomes of the individual (Golden & Earp, 2012).

Ultimately, SEM illustrates how the social determinants of health impact and influence an individual's behavior and their health as a result.

Figure 1

Social Ecological Model (SEM) With Health Literacy



SEM involves five interconnected levels that influence health behaviors: individual (intrapersonal), interpersonal, organizational (institutional), community, and policy (Lusmägi & Aavik, 2021; McCormack et al., 2017).

- Individual (intrapersonal): biological, knowledge, attitudes, beliefs, self-efficacy, behavior
- Interpersonal: families, friends, co-workers, colleagues, social networks
- Organizational (institutional): workplace, formal and informal rules
- Community: neighbors, religious institutions, support groups
- Policy: legislative state laws and policies

To create the most effective positive health action and change, all levels or factors should be targeted; however, that is often unrealistic and not sustainable, so practical recommendations have been made to focus on at least two levels of influence (Golden & Earp, 2012; McCormack et al., 2017). The multi-level interventions are effective when members of the target population are motivated and have the knowledge to make healthy choices (Lusmägi & Aavik, 2021). Within my study, the individual (intrapersonal), interpersonal, and organizational levels are the main focus due to the nature of a workplace wellness program and the importance of self-care needed for Type 2 Diabetes management.

Within the health promotion field, the SEM has been used as the foundation for planning and evaluating programs to better understand determinants of behaviors, specifically in workplace wellness programs (Golden & Earp, 2012). The SEM integrates person-focused interventions to modify health behavior with environment-focused efforts to enhance physical and social surroundings (Whittemore et al., 2004). Research has shown that workplace wellness programs created using the SEM provide positive change for the employee who participates; especially in reference to Type 2 Diabetes management (Golden & Earp, 2012; Lingard & Turner, 2015; McCormack et al., 2017; Whittemore et al., 2004). Using the SEM as the theoretical framework helped my study identify possible risk factors and relationships of the workplace wellness program that impact health literacy and Type 2 Diabetes management among blue-collar workers in South Carolina.

Relation to My Study

My study utilized secondary quantitative data from employees of a blue-collar manufacturing company in South Carolina with a diagnosis of Type 2 Diabetes. The employer has a workplace wellness program in place. A descriptive study is used to understand the problem to gain knowledge concerning the relationship of the variables being studied. In my study, the relationship between health literacy and a Type 2 Diabetes focused workplace wellness program is being evaluated. At the time of this study, the measurement and impact of health literacy had not been evaluated as a direct result of a workplace wellness program. To evaluate my research questions, secondary internal quantitative data from manufacturers in South Carolina was used. The data are survey-based secondary data, which were data that has been collected by questionnaires that have already been analyzed for their original purpose. Secondary survey data are cost-effective, can be generalized, and overall versatile.

The development of chronic illnesses has been contributed to genetics, ethnicity, and the individual's lifestyle, which includes social and environmental interactions (Brown et al., 2018; Lin et al., 2018; Whittemore et al., 2004). As such, the health of employees is shaped by the interaction between personal, environmental, and social factors, which fit within the individual, interpersonal, and organizational levels of the SEM. As identified by McCormack et al., there are multiple factors influencing overall health, and there are potential interventions that may improve health literacy and engagement (2017). The health literacy Social Ecological Model (HLSEM) seeks to provide more sustainable changes over time by creating environments where people can

access, seek, and understand health information (McCormack et al., 2017). It is important to consider that there are multiple levels of influence on individuals because of their physical and social environments. An intervention at one level of the HLSEM influences the outcome through one or more levels (McCormack et al., 2017). Focusing on a workplace wellness program for my study means that the most impactful and relevant levels to consider are the individual, interpersonal, and organizational levels of the SEM. The goal and intention of my study is to build upon research to remove barriers and address individuals' health through their employers. In addition, reduce health literacy related barriers, provide accessible information in the workplace setting, and ultimately drive individuals' engagement in their health.

Individual (Intrapersonal)

Research has provided evidence that personal characteristics and behaviors are significantly associated with certain diseases, such as obesity and diabetes (American Diabetes Association [ADA], 2021; Golden & Earp, 2012; Silva-Tinoco et al., 2020.). Individuals who develop prediabetes and diabetes either have a genetic predisposition and/or health behaviors that contribute to it (American Diabetes Association [ADA], 2021; Karamanou et al., 2016; Lakhtakia, 2013). Influential factors from an individual level to consider include health related knowledge, attitudes, health beliefs, perceptions of risk, and level of engagement (Fransen et al., 2012; McCormack et al., 2017) For an individual to make changes to manage or treat their Type 2 Diabetes, they must be influenced by knowledge, skills, beliefs, attitudes, and self-efficacy (Brown et al., 2018; Lin et al., 2018; Whittemore et al., 2004).

Within the individual level, the components of health literacy are present. Particularly identifying functional literacy and numeracy as key drivers within my study, with a goal to expand upon communication to empower the individual to communicate and advocate for themselves with their healthcare team. Potential interventions to address individual health literacy limitations include using plain language, clear communication, and health education sessions, which can be facilitated while at work (McCormack et al., 2017). The biological factors, such as blood pressure, HbA1c, and weight, pertain to the individual level of the SEM, and are an important part of my study. These biological details impact the management of Type 2 Diabetes, so those with diabetes need to have a good understanding or strong health literacy relative to them. Being able to identify if participants can clearly define the importance of these biological numbers and understand them is a goal of my study.

Interpersonal

Social relationships play an influential role in the health behaviors of individuals. Family, friends, neighbors, colleagues, etc., all impact an individual's health. Type 2 Diabetes is often seen from a family history perspective (Subrata et al., 2020), meaning an individual has heard about or known someone within their family that has had Type 2 Diabetes so there could be some predispositions or biases to the condition that need to be taken into consideration from an overall health and education situation. Research has documented the importance of social support on health, from mitigating stress to promoting healthy behaviors (Subrata et al., 2020; Whittemore et al., 2004). Potential interventions to address health literacy limitations from the interpersonal perspective

include patient and family support groups, active listening, patient-centered communication, and group health visits (McCormack et al., 2017; Subrata et al., 2020).

Organizational

The organizational level is identified in this case as the workplace setting. There is a substantial amount of research to support the benefits of having health promotion and education programs at places of employment (Barham et al., 2011; Brown et al., 2018; Cheon et al., 2020; Chu et al., 1997; Fetherman et al., 2021; Giese & Cook, 2014). A significant amount of time is spent at work, and there is access to groups of people to promote positive health behaviors (Chu et al., 1997; Whittemore et al., 2004;). Potential interventions from the organizational level to address health literacy limitations include workforce initiatives or wellness programs, care coordination, and clinical champions (McCormack et al., 2017).

Additionally, the culture of the workplace is significant and can have an impact on employee health. Since such an outstanding amount of time is spent at work, relationships form that can have a negative or positive impact on health, particularly those associated with becoming diabetic or appropriately managing Type 2 Diabetes. Understanding the workforce environment and the opportunity to increase engagement in an education program will be determining factors to make positive change. Social ecological health theories propose that health promotion interventions or programs implemented in an environment that does not support healthy behaviors will produce weak or short-lived benefits (Lusmägi & Aavik, 2021; McCormack et al., 2017). As a

result, it is extremely important to have the support of the organization to drive true, lasting positive change (Lingard & Turner, 2015).

Literature Review and Key Variables

Researchers have studied Type 2 Diabetes for decades: including its causes, management, complications, and treatment of it (Lakhtakia, 2013). The results indicate that Type 2 Diabetes can be prevented, managed, and treated if proper education is provided (Barham et al., 2011; Brown et al., 2018; Cheon et al., 2020; Chu et al., 1997; Fetherman et al., 2021; Giese & Cook, 2014). Increasing health literacy has been shown to positively impact health outcomes (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019). Workplace wellness programs provide a great setting to be able to educate and promote healthy behaviors and actions, specifically related to Type 2 Diabetes. Few studies have explored the relationship and impact of a workplace wellness program on health literacy and Type 2 Diabetes management. Therefore, my study focused on exploring this relationship among blue-collar manufacturing workers in South Carolina. The key variables in my study were South Carolina, employer/workplace, employees, workplace wellness programs, health literacy, and Type 2 Diabetes.

South Carolina

South Carolina is a state in the southeastern area of the United States, on the Atlantic coast. The capital of South Carolina is Columbia. Figure 2 is a geographical representation of South Carolina.

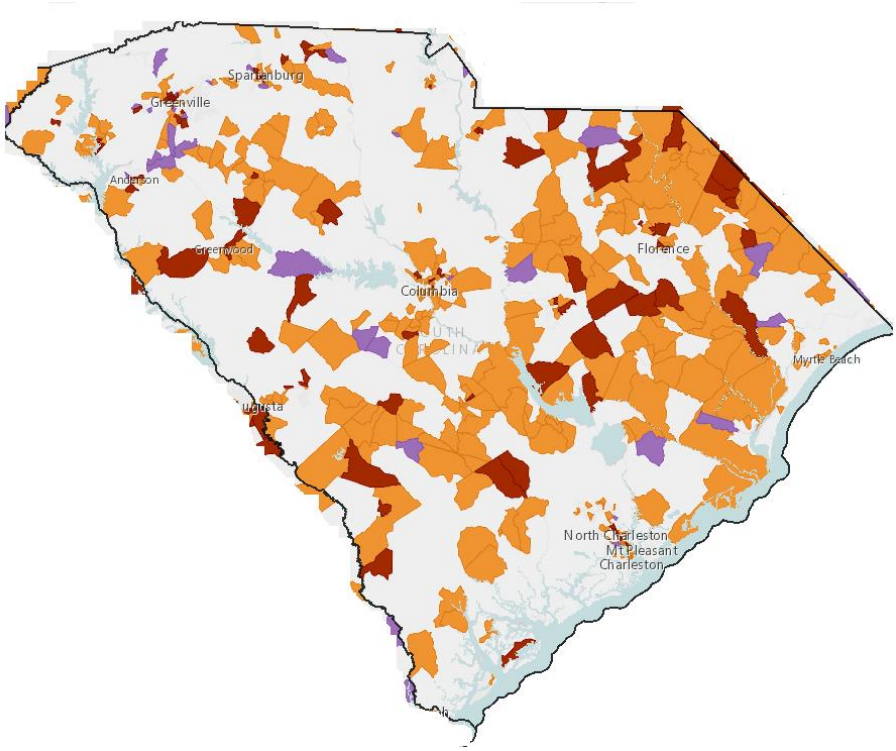
Figure 2

Map of South Carolina With Counties

As of July 2022, there were approximately 5.191 million people in the state of South Carolina (SC Map, n.d.). The state is culturally, ethnically, and religiously diverse. Compared to the rest of the United States, South Carolina is impacted more by the social determinants of health. For example, the median household income in 2021 dollars (2017 – 2021) was $58,234 whereas nationally, it was $70,784 (U.S. Census Bureau quick facts: United States, n.d.). The adult literacy rate in South Carolina is estimated to be 85.3% which ranks number 38 of the 50 states (U.S. Census Bureau quick facts: United States, n.d.). Figure 3 shows a visual representation of the vulnerable population footprint (2016 – 2020) in South Carolina (Map room, n.d.).

Figure 3

Map Room - SparkMap – Vulnerable Population Footprint (2016-2020)



Data key:

Orange: 20% of the population is below the poverty level.

Purple: 25% population less than high school education

Red: Above both thresholds

South Carolina is below average in income and literacy, which are a few of the driving factors that influence and impact health and health literacy. Culture, ethnicity, and diet are also significant drivers of health. The social determinants of health compound the health issues for individuals in the state and are a reason why 13.2% of the adult population has been diagnosed with Diabetes, and 34.9% of the adult population has pre-diabetes (American Diabetes Association [ADA], 2021). South Carolina is highly

impacted by the social determinants of health, but there has been limited research done to help find solutions. For these reasons, I chose SC as the target population of my study.

The population used in this study is from Aiken, South Carolina. Aiken is located near the mid-point of South Carolina's long border with Georgia, about fifteen miles east of Augusta. Aiken is best described as rural, country and is known for its equestrian community. In July of 2022, the population was estimated to be 31,895 (U.S. Census Bureau, n.d.). The median household income in 2021 dollars (2017 – 2021) was $58,125, which is slightly less than the average of South Carolina, but still significantly less than the national average. In Aiken, South Carolina 12.5% of the population lives below the poverty line (Data USA, n.d.). From a health outcomes perspective, which refers to length and quality of life, Aiken County ranks sixteenth in the 2022 County Health Rankings for the 46 ranked counties in South Carolina. Similarly, for health factors, which is a combination of health behaviors, clinical care, social and economic factors, and physical environment, Aiken County ranks twelfth out of 46 (2022 South Carolina State report, n.d.). From an economic and industry perspective, the largest industries in Aiken are manufacturing, health care and social assistance, and retail trade (Data USA, n.d.).

Employer/Workplace

An employer is considered a person or organization that provides a job paying wages or a salary to one or more people. There are various industries used to categorize the type of work and employers. Since most full-time employees in the US spend more than one-third of their days at work, the workplace is viewed as an ideal setting to

provide health promotion and education (Chakkalakal et al., 2019; Cheon et al., 2020; Chu et al., 1997). Employers have an obligation, under law, to ensure the safety and well-being of their employees. They also have a vested interest in their employees' well-being to reduce absenteeism, workers' compensation, and other disabilities so productivity can be running efficiently or be increased (Van Kasteren et al., 2020). Workplace wellness programs help employers address these goals and can be an effective strategy to reduce the employer's financial burden (Brown et al., 2018). However, many employers do not know or understand the positives that can come from having a workplace wellness program. There is a need for employer education regarding the benefits of this kind of support for their employees (Brown et al., 2018). The key variable, workplace wellness program, will be expanded upon further.

Manufacturers in South Carolina

Manufacturing was the target industry for my study. South Carolina has seen significant growth in the manufacturing sector over the past decade, and it is considered a driving force in the South Carolina economy. As stated in the Economic Impact of Manufacturing in South Carolina, manufacturers in South Carolina account for 16.27% of the total output in the state, and they employ 12.04% of the workforce. South Carolina manufacturing sectors include a variety of industries, for example, motor vehicles and parts, chemicals, machinery, plastic products, and fabricated metal products (2022). The economy of Aiken, SC employs approximately 13,500 people (2020). Of those 13.5k, ten percent work in Manufacturing (Data USA, n.d.). From a year-over-year growth perspective between May 2020 and May 2021, manufacturing employment grew by

6.34% (Data USA, n.d.). This increase in the workforce was driven by the need for employees. Given the challenges the world has faced with attracting, retaining, and rewarding employees, employers are modifying the way they approach their organizational strategy. A common change is implementing or enhancing employee wellness programs in an effort to get or keep their workforce healthy to reduce absenteeism, accidents, and disability.

Organizational (SEM)

Employers control the organizational culture and structure, including the nature of the work, the environment in which the work takes place, and when the work should be done. Workplace culture can have a negative or positive impact on employee health. Work schedules pose a major barrier to participating in wellness programs and can limit the ability to make healthy choices (Brown et al., 2018). Promoting healthy behaviors in the workplace removes some of the barriers that employees face. Additionally, the nature of the work or occupation determines the amount of sitting time, with sedentary time at work adding to total daily sedentary behavior. Socio-cultural support for positive health behaviors can be achieved at work through leadership and examples. These influences take into consideration the interpersonal and organizational levels of the SEM (Van Kasteren et al., 2020). The concept of workplace wellness and health promotion has changed significantly over the years because of research and advancement in understanding the determinants of employees' health (Chu et al., 1997).

Employees

An employee is an individual who works for another in return for financial or other compensation. As an employee some rules and regulations must be followed by the employer to ensure a safe environment; these laws are governed by the state and federal guidelines. The data for my study was from employees in South Carolina. The labor and employment laws in South Carolina prohibit an employer from discriminating and or retaliating against employees in protected classes.

Blue-Collar Manufacturing Employees

The target population of the study was blue-collar manufacturing employees. A blue-collar worker is engaged in manual work, works shifts, and whose primary goal is to produce the product of the manufacturing site (Alexy, 1990) Shift workers have been associated with negative health effects such as sleep disorders or negative lifestyle changes (Kang, 2021). Working the night shift impacts sleeping and eating habits, which can make it more difficult to manage a chronic condition (Kang, 2021). Blue-collar workers are often paid on an hourly basis and their pay is dependent upon the industry in which they work (Alexy, 1990). Blue-collar workers may only require certain skills that can be obtained either on the job or by going to trade school. As a result, they are not highly educated which could impact their literacy level. This combination of lower-paying positions and less education can negatively influence the way they perceive and manage their health (McCormack et al., 2017; Väisänen, et al., 2020).

Blue-collar occupations are also seen as typically being more labor intensive, meaning there is more physically demanding work as part of the job (Alexy, 1990).

Occupational physical activity is detrimental to health, whereas leisure physical activity is beneficial for health (Väisänen, et al., 2020). Occupations with a higher occupational physical activity have higher risk clusters associated with accidents and other health-related problems (Väisänen, et al., 2020). Overwork and working to death are global work-related hazards, and some studies report a positive association between overwork and chronic disease, specifically Type 2 Diabetes (Kang, 2021; Kivimäki, et al., 2015). Kang's study aimed to examine the association between working hours and shift work type in workers with hypertension, diabetes, and dyslipidemia (2021). The results showed that among workers with diabetes, the evening or night shift had a higher HbA1c level compared to the day shift. Also, the longer work weeks negatively impacted blood glucose levels. Working more than 40 hours per week had worse clinical outcomes than those working less than 40 hours (Kang, 2021).

Research has highlighted the gap between blue- and white-collar workers from socioeconomic, poor health, and high prevalence of chronic disease perspective (Kang, 2021; Lingard & Turner, 2015). The risk factors of smoking, obesity, and hypertension are more common among blue-collar occupations, while social status and benefits are lower (Väisänen, et al., 2020). Researchers have found that there is a lack of physical activity, but increased cigarette and alcohol use in blue-collar workers, and that blue-collar workers are score significantly lower in health-promoting lifestyle behaviors (Bagwell & Bush, 2000; Gottlieb et al., 1992; Väisänen, et al., 2020). Additionally, they have less knowledge about chronic conditions or the associated risk factors (Bagwell & Bush, 2000). Social and cultural determinants are relevant to the health of blue-collar

workers as well. Poor work-life balance, high stress, and work demand combined with low levels of job control or job satisfaction have been shown to be predictors of negative health outcomes for workers (Lingard & Turner, 2015).

Blue-collar workers have a greater need for health promotion programs. This is supported by limited research; further research is needed to expand upon the health promotion and education of blue-collar manufacturing employees. The health promotion, education, and engagement of this population is needed to reduce the incidence and prevalence of Type 2 Diabetes. A significant amount of time is spent at work, and employees continue to struggle to maintain a positive health status. Employers need to expand their focus and understanding of the health of their workforce, specifically those with Type 2 Diabetes, to establish a wellness program to have a positive impact on their population's health (Brown et al., 2018).

Individual (Intrapersonal) and Interpersonal (SEM)

From an employee perspective, the individual (intrapersonal) and interpersonal relationships at work are very important and relevant to health. The individual (intrapersonal) level of the Social Ecological Model (SEM) encompasses biological knowledge, attitudes, and self-efficacy, whereas the interpersonal level is the influence of friends, co-workers, and colleagues (Lusmägi & Aavik, 2021; McCormack et al., 2017). All these factors impact and influence health behaviors. When an employee comes to work, it is their whole self, meaning all the other thoughts, feelings, and situations impacting them are still there when they arrive. The employer needs to understand that many other influences are impacting their employees. An employer can help create

positive health for their employees by sharing health education and promotion materials so they can gain knowledge and interact with their co-workers about health topics. Additionally, creating a positive environment and culture around health can lead to positive attitudes and self-efficacy, which is helpful when managing health conditions (Torres et al., 2018). With a group of employees practicing these positive health behaviors, they could influence other employees to do the same. Thus, creating a healthy workplace and employees.

Self-efficacy and self-management are very important when managing a chronic condition, specifically Type 2 Diabetes (Torres et al., 2018; Wallston et al., 2007). The extent to which patients with diabetes can self-manage the condition is directly associated with the confidence they have in their ability to carry out the necessary tasks that need to be done (Wallston et al., 2007). A person's health-related choices are influenced by their self-efficacy. The greater the patient's self-efficacy, the better their health outcomes. There is support to show the positive associations between self-efficacy, self-care, and diabetes outcomes (Wallston et al., 2007). Health literacy can help promote positive self-efficacy.

Workplace Wellness/Well-Being Program

Employee health and wellness programs have been around since the 1950s. While their target audience has always been the same, the programs have changed and developed throughout the years. In the 1950s and 60s, the primary focus of workforce wellness was solving problems and increasing productivity. Workplace safety was a concern since workers were injured by accidents, noise, and asbestos (Reardon, 1998).

The Occupational Safety and Health Administration (OSHA) was established after the passage of the Occupational Safety and Health Act of 1970. The Public Health Cigarette Smoking Act was also passed in the 70s, which resulted in more impactful health warnings on cigarette packages and a ban on marketing them on TV or radio (Richmond, 1983). Financial responsibility for the cost of health care shifted from the government to the employer during the 70s, which resulted in the employer recognizing and understanding the link between an employee's unhealthy habits and the increased cost of health care.

The Employee Retirement Income Security Act (ERISA) was signed into law in 1974, which established the minimum standards for private health insurance. This law is still highly impactful and regulates insurance in today's world *(*Department of Labor, n.d.). Larger companies like Johnson and Johnson helped pave the way for onsite wellness programs. In 1979, J &J created their "Live for Life" program that included physical assessment, stress and weight management, and nutrition as topics. In the 1980s, the focus of health initiatives shifted to psychological well-being, with stress-related mental health issues being the top priority. The concept of work-life balance was born in the 80s, and corporate wellness became a regular part of the workplace. Corporate culture also became increasingly important. The 90s had several initiatives launched, the most relevant to this study being Healthy People 2000; this program primarily focused on lifestyle and behavioral change like smoking cessation.

By the early 2000s, wellness programs were established. Large technology companies entered as a new industry and the Healthy People program was updated to

Healthy People 2010. The workplace wellness journey expanded to include awareness and prevention in the 2010s, with health risk assessments and screenings for acute and chronic conditions becoming integrated into the program. Additionally, in 2010, the US Government authorized the CDC to establish the National Diabetes Prevention Program (Chakkalakal et al., 2019). Mental and emotional health are also now included in wellbeing programs to provide a more holistic approach to health. In present day, the 2020s, the overall goals of wellness programs have not changed from prior decades. Healthcare cost containment remains a high priority, along with increasing employee engagement and productivity. In today's world of 2023, the current wellness program focuses on the impact and influence from a clinical and non-clinical team perspective for individualized health and wellbeing. Utilizing a healthcare team to work in partnership with the individual to holistically approach their health is where well-being programs are going. Individuals need to take control of their health, but they need to be able to understand their health first, which is why health literacy is so important, so they can make decisions about their health.

There is a need to focus on employee health, and it can be addressed with workplace wellness programs. There is a multitude of research showing the benefits of workplace wellness programs from an employer and employee (individual) perspective. (Bagwell & Bush, 2000; Barham et al., 2011; Brown et al., 2018; Nagamine et al., 2020; Odom et al., 2019; Smith et al., 2021). Some benefits of the promotion, establishment, and participation in workplace wellness programs include reduced healthcare costs, improved health, fitness, and productivity, reduced absenteeism, increased job

satisfaction, increased employee retention, enhanced responsibility, and reduced disability and workers' compensation claims (Bagwell & Bush, 2000; Barham et al., 2011; Brown et al., 2018; Nagamine et al., 2020; Odom et al., 2019; Smith et al., 2021). Diabetes focused workplace wellness programs have been shown to have positive impacts on clinical, psychological, and behavioral outcomes, improved quality of life, and enhanced self-efficacy (Bagwell & Bush, 2000; Barham et al., 2011; Brown et al., 2018; Nagamine et al., 2020; Odom et al., 2019; Smith et al., 2021; Vandenbosch et al., 2018).

Worksites provide the ideal setting to disseminate health information and establish and implement evidence-based health promotion programs (Chakkalakal et al., 2019). When incentive, promotion, and leadership engagement are consistent, the programs with a high level of topic relevance, impact, and intensity are the most effective in improving employee health outcomes (Cheon et al., 2020). To encourage and sustain authentic engagement, the employee needs to be able to understand, use and communicate basic health information (McCormack et al., 2017).

Health Literacy

The concept of health literacy is the degree to which individuals can obtain process and understand basic health information to be able to make decisions about their health (Vandenbosch et al., 2018). Health literacy is impacted by sociodemographic characteristics, mental and physical abilities, and is a determinant of health outcomes. In the study done by Rothman et al., their results showed that increasing income, education, and literacy levels were all significantly associated with increased knowledge scores to

elevate health literacy (2005). Since health literacy is a determinant of health, it impacts a person's ability to access and use health care, interact with medical providers, and care for oneself (Hernandez, 2009; Wolff et al., 2009). The US Institute of Medicine addressed health literacy in 2004 in their report called Health Literacy: A Prescription to End Confusion (Kindig et al., 2004). The report called for more attention to increase health literacy because of the significant interaction between individuals and the health system (Kindig et al., 2004). People are expected to participate in their health decisions and to take responsibility for their health. This is more difficult when health literacy is low, there are more complicated health problems, and the United States' health system to navigate (Finbråten et al., 2020).

Health literacy can be broken down into three different components: communication, functional literacy, and numeracy (Vandenbosch et al., 2018). Communication is key for patients with their healthcare team and for navigating the healthcare system. Functional literacy is the basic ability to understand information and is needed as a framework before true health literacy can be established. Numeracy is knowing what the "health numbers" mean and understanding how and what to do when the numbers are not within range, for example: for someone with Type 2 Diabetes, when Glucose levels are not within range (Hernandez, 2009).

Recent studies focusing on health literacy and health have focused on functional print literacy with limited attention on numeracy (Huizinga et al., 2008; Wolff et al., 2009). More research is needed on numeracy because patients with adequate literacy could still have difficulty with numeracy. Sufficient numeracy skills are critical in the

management of Type 2 Diabetes because diabetic patients use numeracy skills in many of their daily self-management behaviors (Huizinga et al., 2008; Wolff et al., 2009). Insufficient numeracy skills in patients with diabetes could lead to inadequate glycemic control, which can lead to serious adverse health outcomes (Huizinga et al., 2008; Wolff et al., 2009). The Diabetes Numeracy Test (DNT) was developed to better understand numeracy in diabetes patients. The DNT15 and DNT5, which are shortened versions of the full DNT are beneficial for targeting educational needs. However, little is known about the benefits of targeting education to a patient's level of diabetes specific numeracy to improve health outcomes. More studies are needed to understand the role of specific numeracy and the potential for individualized interventions. My study used secondary data from manufacturing employees with Type 2 Diabetes in South Carolina that have completed the DNT5 to evaluate their numeracy level of health literacy.

Literacy is not consistent; it changes over time (Hernandez, 2009). Health literacy has been around for decades but often has been a misunderstood concept because there was no common definition until relatively recently. The definition used in Healthy People 2010 was adopted and accepted to be used for future improvements within society, the health system, and the education system to help expand health-literate individuals. The definition was slightly enhanced in Healthy People 2020 and is still a main topic in Healthy People 2030 (Healthy People 2030, n.d.). Additionally, the field of health literacy has had a shift from focusing on just the individual's health literacy to expanding to the broader health system perspective to bring attention to the accessibility of health materials and tools for education, engagement, and health promotion for patients and

their families (McCormack et al., 2017). In conjunction with the Social Ecological Model, it can be said that the lens of health literacy is expanded beyond the individual to look at the delivery of health information, the materials and tools provided, along with the communication skills of the public health and health care professionals (McCormack et al., 2017). Just like an individual's health is impacted by intrapersonal, interpersonal, organizational, communication, and policy, so too is their health literacy.

As history has shown, increasing health literacy has been an objective because of the positive impact it can have on health (McCormack et al., 2017). It continues to be an objective for major organizations like the Center for Disease Control and Prevention (CDC), which establishes the Healthy People initiatives. We are now on Healthy People 2030 (Hasbrouck, 2021).

Approximately 80 million US adults are said to have limited or low health literacy, which puts them at risk for poor health outcomes (Berkman et al., 2011; Rothman et al., 2005; Wolff et al., 2009). Patients with low literacy tend to have more difficulty following medical directions, understanding health information, and performing self-management tasks (Huizinga et al., 2008). Patients with low health literacy need additional support through special instructions and other accommodations to ensure they are comprehending information from their healthcare team (Huizinga et al., 2008). Those that are older, minority, low income, and with less education are at risk of having limited health literacy. Health literacy level also influences how individuals use health care services, which can have a negative financial impact. In a systematic review done by Berkman et al., nine studies focusing on emergency room usage and six on risk for

hospitalizations provided evidence that there were increased instances of both among people with lower health literacy (2011). Similarly, four studies provided evidence of lower preventive care services among those with lower health literacy (Berkman et al., 2011). Health literacy is an integral part of health and as such, improving health literacy is imperative, especially for those dealing with a chronic condition like Type 2 Diabetes.

A significant factor associated with diabetes self-management is the patient's level of health literacy because proper self-management requires patient knowledge about diabetes symptoms and associated treatments (Rothman et al., 2005; Vandenbosch et al., 2018; Wolff et al., 2009). As such, assessing a patient's knowledge and understanding of how they received the education is critical to continue to improve health education and promotion efforts (Rothman et al., 2005; Wolff et al., 2009). Low health literacy is associated with poor health outcomes for many diseases, especially Type 2 diabetes. Diabetic patients with low health literacy have poorer knowledge about their disease and its management, adopt fewer self-management behaviors, have a more difficult time managing their glucose, and have an increased risk of complications and comorbidities (Vandenbosch et al., 2018).

Type 2 Diabetes management encompasses daily individual care, lab tests, and potential visits with the healthcare team. Daily management includes medication as prescribed by the doctor, blood sugar checks, foot check, healthy eating, and physical activity. A three-month checkup requires a Hemoglobin A1c test and a doctor's visit. Then the six-month checkup includes a dental exam, potentially Hemoglobin A1c, and a doctor's visit. At least once a year, the following should occur: flu shot, kidney tests,

cholesterol test, dilated eye exam, foot check, and hearing check (Wallston et al., 2007). The guidelines are highly suggested by the Centers for Disease Control and are customized based on the patient's care plan (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019). All these healthcare-related skills are dependent upon having adequate health literacy to effectively manage Type 2 Diabetes. Without proper management, there is the possibility and likelihood of developing co-morbidities and complications that negatively impact health.

Low health literacy has been associated with poor self-management in diabetes patients (Fransen et al., 2012; Huizinga et al., 2008; Vandenbosch et al., 2018; Wolff et al., 2009). Limited research or evidence supports a significant association between health literacy and diabetes self-management. The review by Fransen et al. identified eleven studies addressing this relationship (2012). Three studies found a significant direct positive association between health literacy and self-management activities. While eight found no direct significant relationship (Fransen et al., 2012). Additional research is needed to understand if there is a link. The role of insufficient knowledge of self-management among patients with low health literacy remains unclear and needs further investigation. My study will expand upon the research that has been done and provide more insight into this important topic.

Researchers have approached the problem of health literacy from the health promotion and education perspective by evaluating Type 2 Diabetes management programs, which have shown to provide positive outcomes (Vandenbosch et al., 2018). To address the barriers to successful diabetes education, the researchers Wolff et al.,

(2009), created the Diabetes Literacy and Numeracy Toolkit (DLNET). The DLNET is designed for lower literacy and numeracy skills and provides a set of materials as a tool to facilitate diabetes education for all. There has been limited research focusing on workplace wellness programs targeting specific workforces. There needs to be further research on the impact of a workplace wellness program on health literacy and Type 2 Diabetes management.

Type 2 Diabetes

Diabetes is a chronic, long-lasting, health condition that affects how the body turns food into energy. The human body breaks down most food into glucose, also known as sugar, and releases it throughout the body via the bloodstream. When blood sugar increases, the pancreas is signaled to release insulin. Insulin lets the blood sugar into the body's cells to use as energy (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019; Karamanou et al., 2016; Lakhtakia, 2013). When an individual has diabetes, there is an issue with the way the body responds or does not respond to insulin (American Diabetes Association [ADA], 2021; Centers for Disease Control and Prevention [CDC], 2019; Karamanou et al., 2016; Lakhtakia, 2013). With Type 2 Diabetes, the body does not use insulin well and cannot keep the blood sugar levels regulated. Of those with Diabetes, about 90% of them have Type 2 (Torres et al., 2018; Vandenbosch et al., 2018). It develops over many years and is usually diagnosed in adults, but more children, teens, and young adults are being diagnosed with Type 2 Diabetes.

Genetics and Lifestyle

Diabetes is commonly caused by genetics or lifestyle implications. Racial and ethnic minorities are disproportionately impacted by Type 2 diabetes. There is an increased prevalence of diabetes among African Americans, Hispanics, and Native Americans (Brown et al., 2018). By 2060, African Americans are projected to have the highest prevalence of Type 2 Diabetes (Lin et al., 2018; Torres et al., 2018; Vandenbosch et al., 2018). Social determinants of health such as low socioeconomic status, lack of access to care, lack of education, and lack of insurance coverage have been linked to increased Type 2 Diabetes as well (Brown et al., 2018).

Obesity

The major precursor to Type 2 Diabetes is obesity (Brown et al., 2018; Lin et al., 2018; Vandenbosch et al., 2018). Even with advances in technology and medical treatments, obesity and subsequently diabetes rates continue to rise (Brown et al., 2018). By 2060, the prevalence of diagnosed Type 2 Diabetes is expected to increase to 60.6 million among American adults (Lin et al., 2018; Smith et al., 2021). This is primarily driven by the increase in obesity. This is significant because more than two-thirds of working adults are overweight or obese (Padilla et al., 2021). Obese individuals are at risk of other health complications, have a lower quality of life as a result, and have more work limitations which reduce their productivity. In most instances, obese employees also have higher healthcare costs (Padilla et al., 2021). Employers spend 37% more on health care for obese adults than normal-weight adults (Chakkalakal et al., 2019). It is

imperative to control co-morbidities and potential complications with more effective, practical, and sustainable treatment prevention strategies (Brown et al., 2018).

Economic Burden

The economic burden of Type 2 Diabetes is significant. Projections of disease burden have been used by public health professionals and researchers to predict future needs associated with diabetes (Lin et al., 2018). Projections from previous studies were lower than what has actually been observed. Diabetes is linked to higher medical costs, reduced productivity, and early mortality from associated complications (Lin et al., 2018). Between 2011 and 2015, the CDC reported that the number of people diagnosed with Diabetes increased from 21.0 to 23.1 million (Centers for Disease Control and Prevention [CDC], 2019). In 2017, the economic burden, or cost, for all those associated with a diabetes diagnosis reached nearly $404 billion. Looking at it on a per-case basis, it amounted to an average annual cost of $13,240 for diagnosed diabetes, $4,250 for undiagnosed, and $500 for prediabetes. The $404 billion represents a hidden tax of $1,240 per American in the form of higher medical costs (Dall et al., 2019). This cost is funded by employers, employees, insurance companies, and the government. With advancements in treatment, the mortality rate has decreased for those with and without diabetes. This means more people live with diabetes, and those without it, have more risk of developing diabetes at some point before they die (Lin et al., 2018). To reduce this burden, diabetes prevention and management are critical by implementing effective strategies.

Condition Management

Type 2 Diabetes can be prevented or delayed by making healthy behavior changes, such as losing weight, increasing physical activity, and eating healthy food (Lin et al., 2018; Vandenbosch et al., 2018). Diabetes management is primarily comprehensive self-care (Fransen et al., 2012; Vandenbosch et al., 2018). Once diagnosed, managing diabetes is imperative to deal with the condition and reduce comorbidities. People with Type 2 Diabetes should utilize health information in their everyday management of the disease, however, due to a lack of understanding or ignorance, they do not. Successful Diabetes management primarily relies on patients' daily self-management behaviors, which are driven by the individual's knowledge about Diabetes (Wallston et al., 2007). Studies have linked poor diabetes knowledge to low health literacy, which is associated with lower health-related quality of life (Finbråten et al., 2020). Few studies have investigated the association between health literacy and Type 2 Diabetes management as a result of a workplace wellness program. The ability to find, read, and comprehend Diabetes related information is crucial to enable people with diabetes to appropriately manage their condition (Wolff et al., 2009). Patients with Type 2 diabetes have become partners in the treatment of their disease (Fransen et al., 2012). Knowledge is power and it is positively associated with enhanced self-management behaviors, decreased disease distress, and enhanced self-efficacy (Heise et al., 2022).

In the systemic review by Brown et al., the researchers reviewed twenty-two studies to determine if workplace interventions improved diabetes-related outcomes in employees diagnosed with or at risk of Type 2 Diabetes (2018). The studies provide

evidence that workplace interventions can provide positive education and support to those dealing with Type 2 Diabetes. The interventions can help prevent diabetes and limit complications for those that already have diabetes (Brown et al., 2018). Additional studies are needed to expand employer support for these types of well-being programs.

Summary and Conclusion

Health literacy is the ability of an individual to obtain, process, and understand basic health information to make decisions about their health (Vandenbosch et al., 2018). Many adults in the US have low health literacy which impacts their ability to make condition-specific decisions and increases their financial burden (Rothman et al., 2005). Conducting additional research on this problem and gap is meaningful because it will add to the research of addressing the multiple levels of health literacy, specifically for those managing Type 2 Diabetes. Additionally, it can provide data for support as to why workplace wellness programs should be considered or implemented, and how to deal with those doing different types of work at various shift hours. The problem and gap in research that has been identified is meaningful because doing this research could have a significant impact on the way those who have diabetes learn about and manage their condition while in a workplace setting. As a result of effectively managing their condition, workers may experience positive physical and mental health, and a decreased financial burden (Vandenbosch et al., 2018).

In Chapter 3, I discuss the methodology for my study, which includes the use of secondary data. I detail the research design and rationale, identify the sample setting,

study design, and rationale. Additionally, I review the data analysis plan and address threats to validity.

Chapter 3: Research Method

This quantitative, descriptive study aimed to investigate and understand the relationship between health literacy and diabetes care management because of a workplace wellness program. This study utilized secondary data from a manufacturing company in South Carolina, specifically blue-collar employees with a diagnosis of Type 2 Diabetes. The data includes demographic information such as age, gender, race, and ethnicity, along with other characteristics relevant to employment and condition-specific biometric information. This information can be useful for employers that are interested in health promotion and education resources within their organization to not only enhance their workplace wellness program but to also better target Type 2 Diabetes management or prevention. Additionally, within the field of health promotion and education, the information gleaned from this study can be used to enhance the effectiveness of workplace wellness programs on health literacy as it relates to overall health and condition management, which could lead to positive social change. In Chapter 3, I explain the research methodology used to complete the research. Additionally, I review the research design, sample population, sampling procedures, and data analysis methods.

Research Design and Rationale

A descriptive quantitative study is used to obtain information that describes a specific phenomenon, population, or situation. It helps answer what, when, where, and how questions regarding the research problem. In my study, this relates to answering my research questions, which flesh out the association between the dependent and independent variables. The measurement and impact of health literacy have not been

evaluated as a direct result of a workplace wellness program. To evaluate my research questions, secondary internal quantitative data from a manufacturing company in South Carolina were used.

This research design was appropriate and consistent to advance knowledge in the field of health promotion and education. Since this study does not require follow-ups or an intervention, secondary data were a viable method. The data were survey-based secondary data, which were data that were collected via questionnaires that have already been analyzed for their original purpose. Secondary data are versatile overall; they are cost-effective, efficient from a time perspective, and can be generalized. Additionally, aggregate biometric data from the workplace wellness program were also used to incorporate needed data for the variables being studied. The use of secondary data reduce the time and resource constraints as the data have already been collected. This allows for less time, money, and energy to be devoted to this phase of the research and more to the analysis.

Dependent Variable

Health literacy consists of three components: functional literacy, numeracy, and communication. Numeracy is described as knowing what the "health numbers" mean and understanding how and what to do when the numbers are not within the appropriate range. Type 2 Diabetes management is heavily dependent upon numeracy. While complete health literacy is highly important, for this study, health literacy-numeracy was the dependent variable, which was evaluated using the Diabetes Numeracy Test (DNT). There is further review of the DNT in the instrumentation section.

Independent Variables

The independent variables of this study included the following: age, blood pressure classification, body mass index (BMI) classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status. For analyses, age was a continuous variable, whereas, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status were categorical variables.

Methodology

Target Population

The target population of this study was blue-collar manufacturing employees from Aiken, South Carolina with a diagnosis of Type 2 Diabetes, who participated in their workplace wellness program. The secondary data received were from 2015-2022 and consisted of males and females over the age of 18. The secondary data total population size was 515. The total target population size, which was made up of blue-collar employees with a diagnosis of Type 2 Diabetes who participated in the workplace wellness program, was 86.

Sampling and Sampling Procedure

For my study, I used secondary data from employee participants of a workplace wellness program from a manufacturer in Aiken, South Carolina from 2015-2022. A general overview of the workplace wellness program included access to an on-site clinic for healthcare support for common conditions such as colds, sore throats, and minor aches, and pains. The physician at the on-site clinic can also be used as a primary care physician. The clinic provider also manages disease management programs for Diabetes

and cardiovascular disease. If an employee has Diabetes, they are eligible to enter the voluntary Diabetes education and improvement program. A description of the workplace wellness program is depicted in Appendix A.

This study used voluntary sampling to complement the voluntary nature of the voluntary workplace wellness program. To be engaged and compliant in the workplace wellness program-disease management program, the individual must meet with the physician to evaluate their condition, establish a health action plan, and establish realistic goal(s). The provider and patient then work together to create the strategy for the patient to meet the goal(s). Frequent visits to the clinic are often integrated into the plan. These were de-identified data, but each participant was assigned a unique identifier. This is relevant because participants' data has been gathered since 2015. Thus, this allows for year-over-year comparison when applicable. Additionally, participants can have multiple visits to the clinic, which allows for unique individuals to be counted as one rather than on a per-visit basis. The data included employees who have a diagnosis of Type 2 Diabetes and was further broken down to those that participate in the workplace wellness program versus those that do not.

Sample Size

To calculate the sample size, I used G*Power version 3.1.9.7 (G*Power, n.d.). The components of the Power Analysis include the following: Alpha (err probability), effect size, and Power (1- Beta err probability). Alpha is the significance criterion. The effect size varies based on the statistical test evaluated in G*Power and is based on standard operating procedures found in the literature. Effect size tells researchers how

meaningful the relationship between different groups are for the variable(s) being studied, and how unlikely it is due to chance (Pallant, 2020). A large effect size indicates practical significance, while a small effect size indicates limited practical application. Power is the probability, given the sample size, of how often it is expected to find statistical significance; the minimum statistical effect size is 0.80.

For the G*Power calculation, Alpha = 0.05, effect size = 0.30, and Power = 0.80. The G*Power software (version 3.1.9.7) analysis for logistic regression used the z-test test family to calculate a sample size of 50, which will result in a power of 0.80 to show that this sample will be adequate to reject the null hypothesis and reduce the chance of type II error (Pallant, 2020). The covariances are expected to be moderate by previous research relative to health literacy-numeracy (Pallant, 2020). The sample size employs the statistical ratio of 10:1 for events per variable to limit the possibility of over lifting the logistic regression model (Pallant, 2020).

Instrumental and Operationalization of Constructs

Operationalization refers to the ability to translate abstract concepts into measurable observations. Operationalization outlines what will be measured, how it will be measured, and defines any rules that will be assigned to different observed values and how they will be interpreted (Pallant, 2020). The current study measures levels of the social ecological model. The three levels include the following: (1) individual or intrapersonal (age, gender, socioeconomic status), (2) interpersonal (social relationships, colleagues, family), and (3) organizational (workplace wellness program, workplace setting, employer-employee). These constructs allowed for the evaluation and

understanding of the relationship between these influences and health literacy within the target population.

This study utilized secondary data. The biometric and demographic information were collected via health assessments, preventive care, and the workplace wellness program-disease management program. The independent variables, age, gender, race, smoking status, HbA1c, BMI classification (weight), and blood pressure classification use specific measurements or are characterized into specific categories.

- Age: years
- Blood pressure: per the American Heart Association's guidelines, blood pressure is characterized as normal, elevated, high blood pressure stage 1-hypertension, high blood pressure stage 2-hypertensive crisis (American Heart Association [AHA], 2023).
- Gender: male or female
- Hemoglobin A1c: per the American Diabetes Association [ADA]'s guidelines, normal: below 5.7%, pre-diabetes: 5.7% - 6.4%, and diabetes: 6.5% and above (Centers for Disease Control and Prevention [CDC], 2022a).
- Race: African American, American Indian, Asian, Black, Black or African American, English, Mexican American Indian, Other, White, Decline to Answer.
- Smoking status: Currently every day, currently some days, formerly, never, or no answer.
- Weight: measured in pounds, a BMI over 25 is considered overweight and over 30 is obese (Centers for Disease Control and Prevention [CDC], 2022b).

The dependent variable, health literacy-numeracy, was evaluated with the Diabetes Numeracy Test (DNT) (Huizinga et al., 2008). The Diabetes Numeracy Test was developed and validated by Huizinga et al. because they recognized the importance of health literacy-numeracy and the need for an additional tool to measure it. Type 2 Diabetes management is heavily impacted by numeracy skills. The DNT was designed to address various areas that an individual with Type 2 Diabetes deals with often: nutrition, exercise, glucose monitoring, medication skills, and other daily self-management areas. "Reliability was evaluated by internal consistency and validity was assessed through correlation testing using Spearman's correlations between DNT 15 and the full DNT and comparing the DNT15 to the a priori construct validity model for both sub-samples" (Huizinga et al., 2008). The DNT is efficient, reliable, and valid, and can be used for research purposes. The responses to the DNT5 were considered correct or incorrect, and scores were reported as a percent correct with a possible range from 0% to 100%.

Data Analysis Plan

Statistical Package for the Social Sciences (SPSS v28) is the software used in the data analysis for this study. Data cleaning, cleansing, or scrubbing is the first step in data analysis. This is used to identify and fix errors, duplicates and evaluate irrelevant data in the raw data set. This is also an opportunity to ensure all variables needed for the study are found within the secondary data set. As noted in the sampling section, the secondary data are de-identified, but each participant has been assigned a unique identifier. This allows for the data to be filtered to those who did participate in the workplace wellness program. Additionally, since this data goes back to 2015, there are dates also listed to be

able to review historical participation information. Once complete, data analysis is conducted to answer the research questions. The research questions and hypotheses for this study are listed below.

RQ1: What is the relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina?

H_o1: There is no relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina.

H_a1: There is a relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina.

RQ2: What is the relationship between Diabetes Numeracy Test score between gender and Hemoglobin A1c test results among blue-collar manufacturing employees in South Carolina?

H_o2: There is no relationship between Diabetes Numeracy Test score between gender and Hemoglobin A1c test results among blue-collar manufacturing employees in South Carolina.

H_a2: There is a relationship between Diabetes Numeracy Test score between gender and hemoglobin A1C test results among blue-collar manufacturing employees in South Carolina.

To effectively answer each research question, I used different statistical tests to evaluate the data and interpret the results. The data were analyzed using SPSS v28 statistical software to perform quantitative statistical tests. First, descriptive analyses were conducted to summarize the characteristics of the sample population. The descriptive statistics include the mean, standard deviation, range of scores, skewness, and kurtosis. This initial summary of the data provides an overview of the distribution, frequencies, and tendencies within the data set. Pearson's correlation coefficient was used to test the relationship, variance, and standard deviation between the independent variables and dependent variable (Pallant, 2020). The frequency of race, ethnicity, gender, and tobacco usage was evaluated and portrayed in the descriptive statistics table, which can be found in the Appendix. Logistical regression was performed to understand the association relationship between the dependent and independent variables. Logistic regression was used because the dependent variable of interest is categorical. A significance value (p) <0.05 was considered statistically significant for all analyses.

Assumptions are taken into consideration for these statistical tests, specifically for the logistic regression model. Sample size and the number of predictors, independent variables, should be considered. The descriptive statistics for each predictor will help determine if any should be removed. Checking for high intercorrelations among the predictor variables, also known as multicollinearity, was also considered. Ideally, the

predictor variables will strongly relate to the dependent variable but not strongly relate to each other. It is also important to check for the presence of outliers, or cases not well explained by the model.

Threats to Validity

The validity of a research study refers to how well the conclusions among the study population represent accurately among similar individuals outside of the study (Pallant, 2020). Validity can be evaluated as external and internal. External validity is the extent the research can be generalized to other situations, people, settings, and measures (Pallant, 2020). The research aims to produce generalizable knowledge in the real world. Identifying and addressing specific biases are important when utilizing secondary data. Participation in the Workplace Wellness program is voluntary, which could lead to potential self-selection bias, in that only healthy people will participate. Internal validity is the degree of confidence that the causal relationship I was testing is not influenced by other factors or variables (Pallant, 2020). Statistical conclusion validity involves ensuring the use of appropriate sampling procedures, statistical tests, and reliable measurement procedures. Utilizing secondary data limits the control to validity but offers its strengths as well. I am confident that the original team that collected this now secondary data had the knowledge, tools, and resources to gather valid data.

Prior to any data evaluation, this study received Walden University's Institutional Review Board (IRB) approval (05-04-23-0674664). This study used de-identified, secondary data. All data are confidential and stored in an encrypted, password-protected,

electronic file where only I have access to it. Relevant information will be saved for five years after the completion of this study, then it will be destroyed.

Summary

Type 2 Diabetes is a significant public health issue in the US, and health literacy is an extremely important component of disease management and prevention. Studying the impact of a workplace wellness program on health literacy for Type 2 Diabetes management will bridge the gap from previous research and potentially provide results to impact positive social change. In this chapter, I discussed the methodology for my study, which included a quantitative, descriptive analysis of secondary data designed to address the research questions. I expanded upon the target population, sampling setting, study design, rationale, and data analysis plan. In Chapter 4, I report the details of data collection and an evaluation of the results.

Chapter 4: Results

This quantitative, descriptive study evaluated the relationship between health literacy-numeracy and Type 2 diabetes care management because of a workplace wellness program among blue-collar manufacturing employees in South Carolina. The social ecological model (SEM) was used as a guide to identify and interpret the factors that impact an individual's health and health behaviors. An employee's health is shaped by the interactions between personal, environmental, and social factors, which fit within the individual, interpersonal, and organizational levels of the SEM. There were two research questions assessed within this study.

RQ1: What is the relationship between adequate and inadequate health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), gender, race, and smoking status among blue-collar manufacturing employees in South Carolina?

RQ2: What is the relationship between Diabetes Numeracy Test scores between gender and Hemoglobin A1c test results among blue-collar manufacturing employees in South Carolina?

This study hypothesized that adequate health literacy-numeracy would have a positive relationship with blood pressure, Hemoglobin A1c (HbA1c), smoking status, and weight. Additionally, it was hypothesized that age, gender, and race would impact health literacy-numeracy negatively among blue-collar manufacturer employees in South Carolina.

In this chapter, I present the data collection details and results of the data analysis. Descriptive analyses were done first for the dependent and independent variables. Then, multiple logistic regression was performed to answer research question one, and correlation analysis to answer research question two. The results were shared in tables and figures.

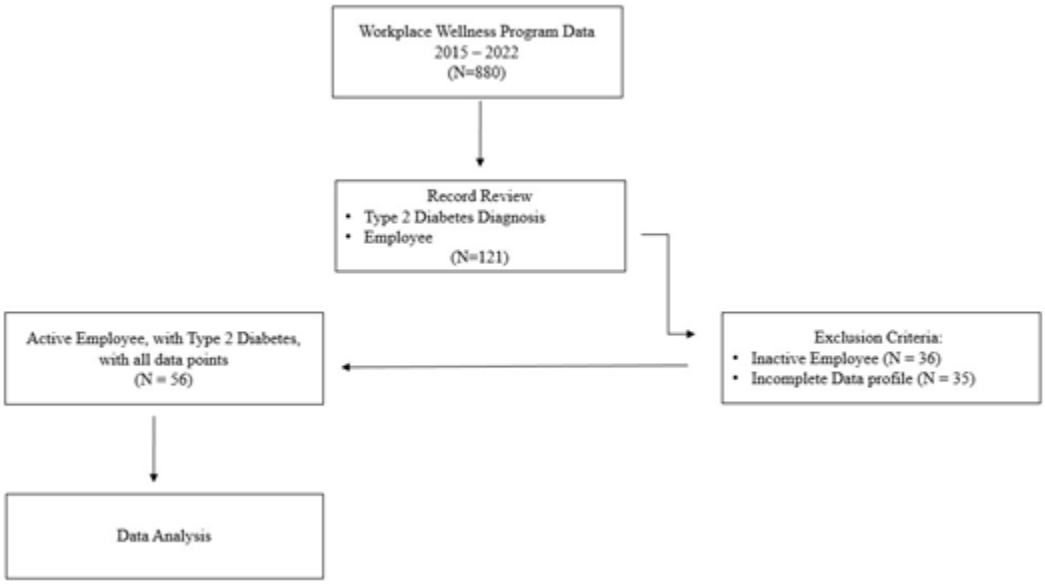
Data Collection

This study utilized secondary, quantitative data from employees of a blue-collar manufacturing company in South Carolina diagnosed with Type 2 Diabetes who participated in the workplace wellness-diabetes disease management program. The data included information from 2015 through 2022. My study aimed to build upon research that removes barriers and addresses individuals' health through employer-sponsored workplace wellness programs, while addressing health literacy and Type 2 Diabetes management. These data were used to evaluate the relationship of the independent variables age, blood pressure status, BMI classification, HbA1c, gender, race, and smoking status to the dependent variable of health literacy-numeracy.

To effectively do this, the data set had to be cleaned before the analysis was done. The original full data set included employees and spouses who were both active and inactive, terms that refer to the employment status of the participant at the company. Active employees are those that the company still employs, and thus have access to the workplace wellness program. Only active employees diagnosed with Type 2 Diabetes with complete data profiles were selected for analysis. Figure 4 illustrates the process of record review and data cleaning to show how the final data set of 56 was reached.

Figure 4

Methodological Summary of Data Evaluation



The final count satisfies the G*Power calculation sample size needed, which was 50. The sample size of 50 was calculated to show that the sample would be adequate to reject the null hypothesis and reduce the chance of type II error (Pallant, 2020). The final sample size was greater than 50, adding more support to it being representative of the population of interest and enhancing the power. The sample was larger than necessary, so it is representative of the population, thus providing adequate reasonability to infer the results regarding this population.

After cleaning, the data set included 56 participants. The data were then uploaded to SPSS v28. Before being analyzed, the categorical variables were defined and coded numerically; Table 1 displays the key to the coded variables. The data were then analyzed

using descriptive statistics, multiple logistic regression, and correlation analysis to answer the research questions.

Table 1

Variable Code Key

	0	1	2	3
Blood pressure	Normal	Pre-Hypertension	Stage 1 Hypertension	Stage 2 Hypertension
Body mass index	Healthy	Overweight	Obese	-
Diabetes Numeracy Test	Adequate	Inadequate	-	-
Gender	Male	Female	-	-
Hemoglobin A1c	In Range	Not in Range	-	-
Hypertension	No	Yes	-	-
Hyperlipidemia	No	Yes	-	-
Race	Declined	Other	Black or African American	White
Smoking Status	Never	Formerly	Currently Some Days	Currently Every Day
Type 2 Diabetes	No	Yes	-	-

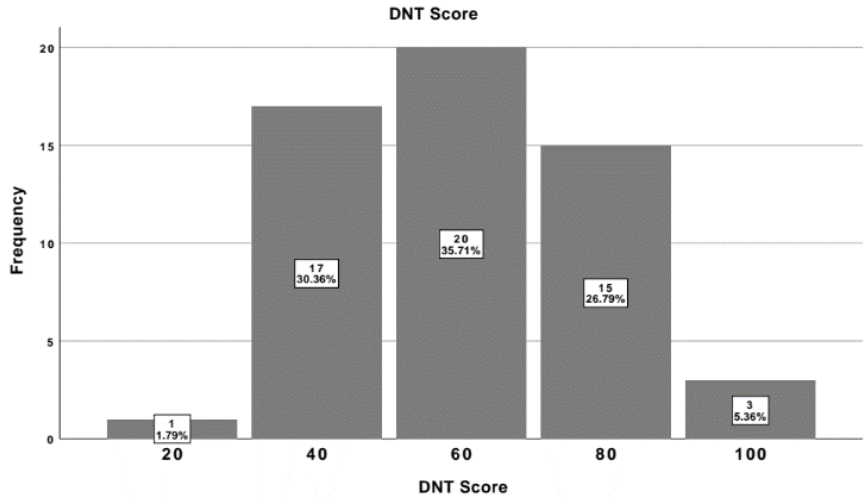
Results

A summary of the descriptive statistics for the final study participants is displayed in Appendix B. The total sample size was 56 participants, which included 42 (75%) males and 14 (25%) females. The age range was between 30 and 72 with the average age of 56. The standard deviation for age was 9.039. Race was almost equally divided between Black or African American (50%) and White (42.9%), with few participants declining to answer (5.4%), and one participant selecting Other (1.8%). Most participants had co-morbidities, as seen with hypertension (91% Yes, 8% No) and hyperlipidemia (83.9% Yes, 16.1% No) identification. Results regarding smoking status showed more than half (51.8%) never smoked, 33.9% formerly smoked, and 12.5% currently smoked some or every day. All participants had a diagnosis of Type 2 Diabetes and thus had

Hemoglobin A1c test results that were determined to be either normal, within range, or abnormal, out of range, as defined by the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention [CDC], 2022a). Of the 56 participants, five (8.9%) were normal, and 51 (91.1%) were abnormal. Data for BMI classification showed that most of the participants were obese (73.2%) or overweight (19.6%) with only four having a healthy weight (7.1%). The Diabetes Numeracy Test (DNT) was used to evaluate health literacy-numeracy and could score between 0% to 100%. Thirty-eight (68%) participants scored 60% or above, corresponding to adequate health literacy-numeracy. Eighteen (32%) scored below 60% corresponding with inadequate health literacy-numeracy. Figure 5 shows the distribution of Diabetes Numeracy Test scores. Visually, the distribution of scores is that of a bell curve, which depicts normal distribution. Of the fourteen women, eight scored below 60, while six scored a 60 or above.

Figure 5

Diabetes Numeracy Test Scores



Assumptions

Multiple assumptions were associated with multiple logistic regression analyses, and they were all evaluated. The first assumption is that the dependent variable should be measured at the nominal level, with specific category response value options. The dependent variable of this study, health literacy-numeracy, satisfies this assumption since the response categories include adequate or inadequate. The second assumption is that one or more independent variables are categorical or continuous. The independent variables for this study included age, blood pressure classification, BMI classification, HbA1c, hypertension, hyperlipidemia, race, and smoking status. All the independent variables are categorical except age, which is continuous. The third assumption is that there should be independent observations, and that the dependent variable should have mutually exclusive and exhaustive categories. This third assumption means that the response can only be in one category, which is true for the dependent variable of this study. The fourth assumption states that there should be no multicollinearity. There should not be two or more independent variables that are highly correlated with each other. The fifth assumption is that there needs to be a linear relationship between any continuous independent variable. Finally, the last assumption is that there are no outliers. These assumptions were evaluated, satisfied, and thus the analysis could be done.

Results by Research Question

For research question one, a binary logistic regression analysis was conducted to investigate the relationship between health literacy-numeracy and age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), race, and smoking status.

The independent variables were tested a priori to verify there was no violation of the assumption of the linearity of the logit. The results of the analysis in Appendix B, revealed that age, blood pressure classification, BMI classification, Hemoglobin A1c (HbA1c), race, and smoking status were not statistically significant predictors to the model ($p > .05$). The predictor variable in the logistic regression analysis (gender) was found to contribute to the model. The unstandardized Beta weight for the predictor variable: $B = 2.145$, $SE = .9802$, $Wald = 4.789$, $p<.05$. The regression coefficient ($B = 2.145$, 95% CI (.224, 4.06) $p< .05$) associated with gender suggests that adequate health literacy-numeracy is more adequate in males. It showed that males were associated with an increased likelihood of having adequate health literacy-numeracy compared to females. This is also supported by the results of the DNT, where over half of the women scored below a 60. Of the fourteen women, eight scored below 60, while six scored a 60 or above.

To approach research question two, correlation analyses were used. Table 2 displays the output of the analyses. There was a moderate negative correlation between DNT score and gender ($r = -.290$, $N=56$, $p=.03$). There was no significant correlation between Hemoglobin A1c and gender.

Table 2

Correlation Analysis

	Pearson Correlation	Sig. (2-tailed)	95% CI Lower	95% CI Upper
DNT Score – Gender	-.290	0.030	-.514	-.029
DNT Score – Hemoglobin Test	-.259	.054	-.488	.005
Hemoglobin Test – Gender	.181	.182	-.086	.424

Summary

The secondary data were analyzed based on the quantitative, secondary data of 56 participants. The answer to research question one was that health literacy-numeracy was significantly associated with gender. Males were associated with an increased likelihood of having adequate health-literacy numeracy. Similarly, research question two showed the correlation between gender and adequate health literacy-numeracy through the completed correlation analyses. In the final chapter, I interpret these results, expand upon recommendations for future research, and highlight the contributions to positive social change based on this study.

Chapter 5: Discussion, Recommendations, and Conclusions

This quantitative, descriptive research aimed to investigate the relationship between health literacy-numeracy and Type 2 diabetes care management and some socioeconomic indicators (age, gender, race, and smoking status) among blue-collar manufacturing employees in South Carolina that participated in their employer-sponsored workplace wellness program. Secondary data from a manufacturing company's workplace wellness program from 2015-2022 were used to collect the necessary data. Specifically, this study evaluated the relationship of health literacy-numeracy in a sample of 56 blue-collar manufacturing employees. The main predictor variables of age, blood pressure classification, body mass index (BMI) classification, gender, hemoglobin A1c, race, and smoking status were tested against health literacy-numeracy in a binary logistic regression model. The regression analysis showed no statistically significant association between age, blood pressure classification, BMI classification, hemoglobin A1c, race, and smoking status on adequate health literacy-numeracy. Gender was the only predictor variable statistically significant associated with adequate health literacy-numeracy. The statistically significant relationship of Gender was further supported when evaluating the correlation between Diabetes Numeracy Test (DNT) score and gender, which was shown to be significantly correlated.

Interpretation of findings

Type 2 Diabetes is a major public health issue in the United States (Huizinga et al., 2008; Vandenbosch et al., 2018; Wolff et al., 2009). The incidence and prevalence of Type 2 diabetes are projected to worsen significantly if proper education and

management are not done (Kang, 2021; Lingard & Turner, 2015). The social determinants of health such as education, income, access to care, and health literacy are key drivers of the chronic condition epidemic (Vandenbosch et al., 2018; Wolff et al., 2009). South Carolina is more impacted by the social determinants of health, drastically impacting those dealing with chronic conditions, specifically Type 2 diabetes. South Carolina has a significantly vulnerable population due to a lack of both income and education (2022 South Carolina state report, n.d.; American Diabetes Association [ADA], 2021; Golden et al., 2017; Silva-Tinoco et al., 2020; Zibran & Mohammadnezhad, 2019).

For this reason, additional research was needed to understand the link between the social determinants of health and Type 2 diabetes management. This study provides insight into the support of a workplace wellness program from a workforce perspective and includes support for the workplace wellness program being a successful, positive addition for employees and employers. The workplace provides an ideal site for health education and promotion of population health management. There are benefits seen from the perspectives of both employer and employee. To build upon the research surrounding workplace wellness programs' impacts, identifying different predictors in the population is an important part of the plan to address this ongoing issue.

The manufacturing industry has highly impacted South Carolina as a driving force of its economy. The primary workforce within manufacturing is blue-collar, which has higher health risks and needs than white-collar employees (Kang, 2021; South Carolina Manufacturers Alliance, 2022). The results of this study show that the demographic of this blue-collar manufacturer is majority male, but females are breaking biases and

joining the industry. Historically, men have dominated the blue-collar manufacturing industry, but with females entering the workforce, some changes need to be made to accommodate all employees.

A binary logistic regression model was constructed to ascertain the effects of age, blood pressure classification, BMI classification, gender, hemoglobin A1c, race, and smoking status, on the likelihood that participants will have adequate health literacy-numeracy. The model was not statistically significant, and the results did not show any effect between six out of the seven predictor variables. It did, however, identify an effect between gender and health literacy-numeracy; gender was shown to be statistically significant. The model results showed that it was more likely for males to have adequate health literacy-numeracy than females. The model results support both the null and alternative hypothesis, since only gender was found to have a statistically significant relation with health literacy-numeracy.

The results of this study are interesting because health literacy-numeracy has rarely been evaluated on a gender basis. In previous literature, studies have been conducted on health literacy in general rather than breaking health literacy down into the various components of communication, functional literacy, or numeracy. The results of this study are not consistent with other studies that evaluated health literacy between genders. In previous studies, females had better health literacy than males (Finbråten et al., 2020; Gazmararian et al., 2003). Comparatively, the results of this study could be rationalized because it focused on numeracy rather than general health literacy. Regarding science, technology, engineering, and mathematics (STEM), males tend to be

better than females (Anaya et al., 2022; Tandrayen-Ragoobur & Gokulsing, 2022). Given this result, it is important to consider the gender distribution of the participants, which was significantly more male-dominated (75% versus 25%). Additional research is needed to evaluate the health literacy-numeracy in blue-collar manufacturing employees with a more even distribution between males and females. Additionally, this would call for more research in general on understanding females in the blue-collar industries and its impact on female health. More education is needed for females, specifically those entering the manufacturing industry, to ensure their needs are met.

The social ecological model (SEM) was the theoretical foundation of this research. It recognizes the importance of psychosocial factors in behavior change and addresses the interdependencies between the socio-economic and demographic determinants of health (Lusmägi & Aavik, 2021; Whittemore et al., 2004). The SEM interprets individual health as it is influenced and impacted by the multiple nested levels (Golden & Earp, 2012). These levels include individual (intrapersonal), interpersonal, organizational, community, and policy. The findings of this study reveal that gender, which is within the individual level, had a statistically significant relationship with adequate health literacy-numeracy. Additional research should be done to explore the effects of being a female in blue-collar manufacturing to effectively provide health promotion and education.

While not directly addressed in the research questions, the organizational level, or employer, is impacted by having the workplace wellness program available to its employees. When cleaning and reviewing the data, it was very interesting to see the

progressive impact of the wellness program. It is important to understand that a wellness program does not necessarily provide immediate results; it is a long-term strategic approach to managing population risk. While participants may not have perfect lab or test results, the progression toward better health outcomes can be seen in the value of the biometric test results. Further research on the wellness program's value from the employer's viewpoint could be beneficial. These data support the positive impacts of the workplace wellness program on employee health, which translate to a better, more productive workforce. Future research should incorporate financial reviews to expand upon the impact of the workplace wellness program. Incorporating the financial review could be particularly impactful for employers to see the potential cost savings by implementing a workplace wellness program.

More research needs to be done on health literacy-numeracy and its impacts on Type 2 diabetes management. This study establishes a starting point for incorporating the evaluation of health literacy-numeracy within a workplace wellness program. There is a distinct link between numeracy and Type 2 diabetes, and research has shown its positive impact on Type 2 diabetes management (Bains & Egede, 2011; Berkman et al., 2011; Finbråten et al., 2020). Increasing health literacy-numeracy could positively impact those working to manage and treat their Type 2 diabetes.

Limitations of the study

To the best of my knowledge, this is the only study examining the relationship of health literacy-numeracy specific to Type 2 diabetes management within a workplace wellness program. The results of this study could provide useful insights into the health

of blue-collar manufacturing employees in South Carolina. Even with these insights, some limitations need to be addressed. The voluntary workplace wellness program poses the potential for self-selection bias, which could influence the overall participant pool from which data were obtained. There was a premium discount incentive for those who participated in the workplace wellness program, which could have a slight impact on the answers given. Since this program has been in place for several years, I did not see this as a significant limitation.

I used a secondary data set from a manufacturing company in South Carolina with a workplace wellness program; data were collected between 2015-2022. While there are many advantages to utilizing secondary data, there are also limitations. I did not have control over the data, how it was collected, or the quality. While I am confident that the original researchers had the appropriate knowledge and tools, there is always the possibility of error. Additionally, self-reported data from participants could impact the accuracy of the data.

Recommendations

Type 2 diabetes is a serious condition and a leading cause of death in the United States, but it can be managed and/or treated. Health literacy is a key driver of health (Kindig et al., 2004; Rothman et al., 2005; Vandenbosch et al., 2018). It is the degree to which an individual can obtain, process, and understand basic health information to make health decisions (Vandenbosch et al., 2018). Increasing health literacy has been shown to impact health outcomes positively (Fransen et al., 2012; Heise et al., 2022; Kim et al., 2004; Rothman et al., 2005) However, there is limited research on the components that

make up health literacy, which include communication, functional literacy, and numeracy. Health literacy-numeracy has been identified as a necessary skill to effectively manage Type 2 diabetes. Even though there are health education and preventive care efforts targeted toward Type 2 diabetes, it continues to get worse from a state and global perspective (American Diabetes Association [ADA], 2021; Lin et al., 2018).

Employees are a company's greatest assets, but they also pose a potentially significant financial burden. Employers should have a vested interest in their employees' health and well-being to help mitigate risk and enhance their workforce. Existing literature shows the positive impacts of a workplace wellness program, which include improved health, reduced absenteeism, and improved productivity (Bagwell & Bush, 2000; Barham et al., 2011; Brown et al., 2018; Nagamine et al., 2020; Odom et al., 2019; Smith et al., 2021). Employer education about the benefits of workplace wellness programs is needed. A more significant evaluation is needed for those with chronic conditions who do versus do not participate in a workplace wellness program. Future research should focus on the true impact of a workplace wellness program by evaluating those who do participate versus those who do not.

The target population of this study, blue-collar manufacturing employees, has limited research available. While this study provided some insights, more research needs to be done to evaluate and generalize results to strategically plan to address any gaps to enhance health outcomes. As mentioned in the interpretation of findings, women are expanding into the blue-collar industries, and as such standards need to be updated to

accommodate them. Workforce evaluations are important to understand the target audience of health education and promotion to ensure their needs are met.

Implications for Positive Social Change

Health promotion and education are the positive promotion of health to empower people to live healthier lives; it aims to promote the individual's independence. Health literacy is a significant concern and social determinant of health. This study adds to the health education and promotion field by providing awareness of the importance and connection of health literacy-numeracy and Type 2 diabetes management. Blue-collar manufacturing employees are the foundation of our society. Understanding the impacts of health literacy-numeracy on condition management will provide valuable insight into the factors that need to be addressed to control the epidemic that is Type 2 diabetes. From a broader audience perspective, this study also provides insight into health literacy regarding overall condition management. To the best of my knowledge, there is no study like this one with this population.

This study helps expand research that has been done in the field of health education and promotion. It provides valuable information on the target population to enhance health promotion and education by targeting their environment and educating them about their health. This study embodies health education and promotion goals and objectives with the hope of continuing research and building upon what is known.

Conclusion

This research aimed to study the relationship between age, blood pressure, BMI, gender, hemoglobin A1c, race, and smoking status among blue-collar manufacturing

employees who participated in their employer-sponsored workplace wellness program on health literacy-numeracy. The results only showed a significant relationship between gender and health literacy-numeracy; males were more likely to have adequate health literacy-numeracy than females.

Worksites provide an ideal location for health education and promotion and could provide financial relief. This study added to the research to support the positive impacts of a workplace wellness program on employee health. The workplace wellness program promotes positive social change for those involved by creating a better understanding of their health and condition management. The motivation for this study was to help with health education and promotion among blue-collar manufacturing employees with Type 2 diabetes in South Carolina so they can have better condition management. Without the research, knowledge, and resources to establish programs and policies, Type 2 diabetes will continue to be a global crisis. Research needs to continue until a solution can be found.

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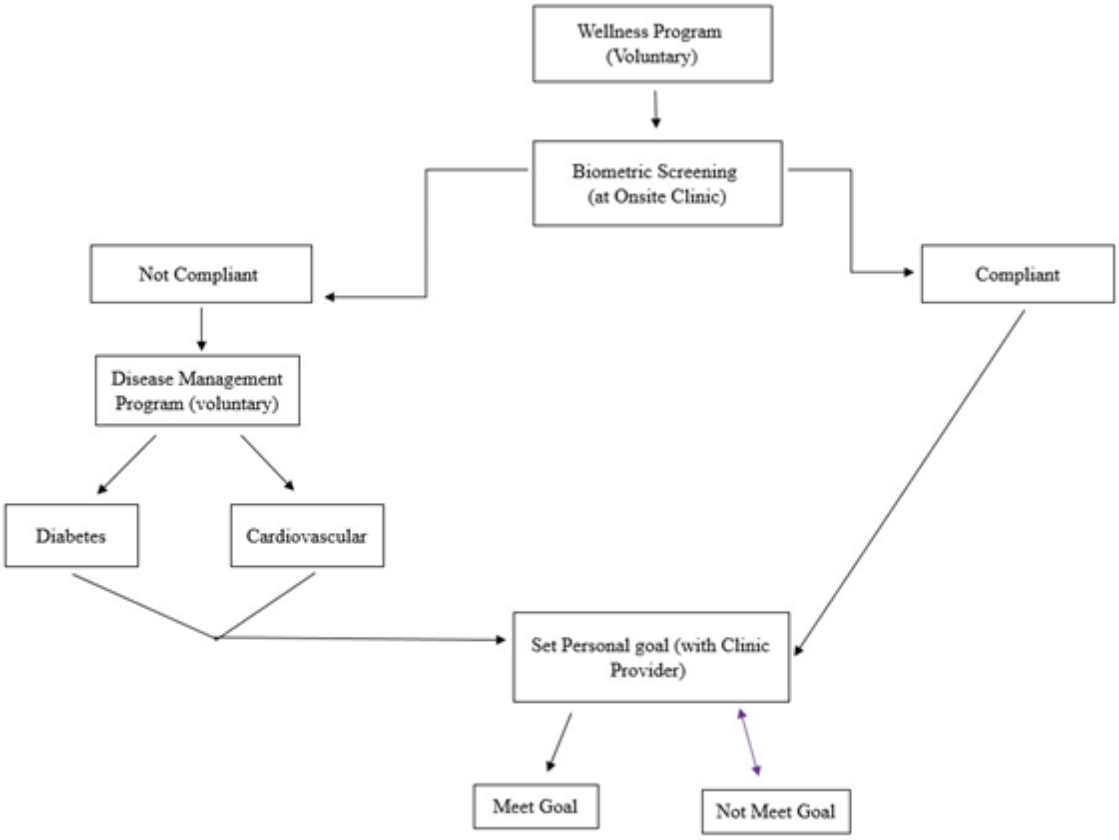
Appendix A: Workplace Wellness Program Description



Appendix B: Descriptive Analysis of Final Study

	Variable	Frequency	Percentage
Age	Age 30 to 45	10	18
	Age 46 to 60	27	48
	Age 61 to 75	19	34
Blood pressure	Normal	6	11
	Pre-hypertension	29	52
	Stage 1 hypertension	18	32
	Stage 2 hypertension	3	5
Body mass index	Healthy weight	4	7
	Overweight	11	20
	Obese	41	73
Diabetes Numeracy Test	Adequate	38	68
	Inadequate	18	32
Gender	Male	42	75
	Female	14	25
Hemoglobin A1c	In Range	5	9
	Not in Range	51	91
Hypertension	Yes	51	91
	No	5	9
Hyperlipidemia	Yes	47	84
	No	9	16
Race	Black or African America	28	50
	Other Race	1	2
	Patient Declined	3	5
	White	24	43
Smoking Status	Currently Every Day	6	11
	Currently Some Days	1	2
	Formerly	19	34
	Never	30	53
Type 2 Diabetes	Yes	56	100
	No	0	0

Appendix C: Regression Analysis

						95% CI	
	B	S.E.	Df	Sig.	Exp(B)	Lower	Upper
Age	.062	.0447	1	.168	1.064	.974	1.161
Blood Pressure							
Normal	0[b]	.	1	.	.	.	.
Pre-hypertension	.078	1.2499	1	.950	1.081	.093	12.521
Stage 1 hypertension	.087	1.2357	1	.944	1.091	.097	12.298
Stage 2 hypertension	-27.387	43634.0236	1	1.000	<.001	.000	.
BMI							
Healthy weight	0[b]	.	.	.	1	.	.
Overweight	21.546	38573.7023	1	1.000	2276329860	.000	.
Obese	22.828	38573.7023	1	1.000	8203747041	.000	.
Gender							
Female	2.145	.9802	1	.029	8.543	1.251	58.340
Male	0[b]	.	.	.	.	.	.
Hemoglobin A1c							
In Range	0[b]	.	.	.	1	.	.
Not in Range	-1.750	1.3460	1	.193	.174	.012	2.430
Race							
Black or African American	0[b]	.	.	.	1	.	.
Other	-20.445	79462.0050	1	1.000	<.001	.000	.
Patient Declined	-.329	1.8304	1	.857	.719	.020	26.005
White	.525	.9007	1	.560	1.691	.289	9.879
Smoking Status							
Currently Every Day	1.110	1.3284	1	.403	3.035	.225	41.008
Currently Some Days	24.307	79461.9931	1	1.000	3.602E+10	.000	.
Formerly	.962	.8431	1	.254	2.617	.501	13.662
Never	0[b]	.	.	.	1	.	.

Note: Regression Predicting Likelihood of Adequate Health Literacy-Numeracy Based on Age, Blood Pressure, Body Mass Index, Gender, Hemoglobin A1c, Race, and Smoking Status. The procedure models Inadequate as response, treating Adequate as the reference category.