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Connections Between Household Socioeconomic Status, Modifiable Risk Factors, and Diabetes Status Among Adults in Jamaica

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This is to certify that the doctoral dissertation by

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and that any and all revisions required by
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Walden University
2024

Abstract

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MPH, Northern Caribbean University, 2014

B. Tech, Nova Scotia Agricultural College/ College of Arts, Science and Education, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Globally, diabetes is one of the most prevalent and challenging disorders. In Jamaica, the prevalence of the disease has increased by 42% since 2001. This study explored the connection between household socioeconomic status, modifiable risk factors, and diabetes status among adults in Jamaica using the social-ecological model. The study explored whether household socioeconomic status and modifiable risk factors were associated with diabetes and whether they predicted diabetes among Jamaican adults. A quantitative cross-sectional design was used to analyze data with 11,206 respondents from the Jamaica Survey of Living Conditions 2019 dataset. Binary logistic regression analysis revealed statistically significant associations between the modifiable risk factor hypertension ($p < .001$) and the household socioeconomic factors of location ($p < .001$), health insurance coverage ($p < .05$), and social welfare/financial support ($p < .001$). The odds of a diagnosis of diabetes were associated with hypertension (OR=3.729), location (OR=0.324), social welfare/financial support (OR=0.572), and health insurance (OR=0.763) after controlling for age, gender, education, and employment. The findings suggest that individuals with hypertension were three times more likely to be diagnosed with diabetes. Participants on social welfare/financial support, those living in urban areas, and those with health insurance are less likely to have diabetes, at 43%, 68%, and 24% respectively. These findings highlight the need for evidence-based interventions, including public education, lifestyle changes, early screening, and dietary policies, to address diabetes prevalence in Jamaica.

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Dedication

With deepest gratitude, I dedicate this study to Mr. Delroy. Blackwood. Your unwavering encouragement, wisdom, and support have been my constant companions throughout this journey. You were my sounding board in moments of doubt, constantly reminding me of the bigger picture, my source of strength in times of challenge, and my greatest supporter throughout this journey. This achievement would not have been possible without your patience, understanding, and belief in me.

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Thank God for love, life, and the incredible opportunity to reach thus far.

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Chapter 1: Introduction to the Study

In the last few decades, a notable increase in diabetes rates has been recorded globally, posing a public health challenge across developed and developing nations. According to the World Health Organization (WHO, 2023a), diabetes may be described as a chronic metabolic disease characterized by elevated blood glucose levels in the body. With over 537 million individuals affected globally, the majority residing in low- and middle-income nations (WHO, 2023a), the continued increase in prevalence may amplify associated complications, adding to the economic strain on healthcare systems. Additionally, individuals affected by Type 2 diabetes, the most common type that usually affects adults, can develop complications leading to decreased quality of life and or increased mortality (Duncan et al., 2020). In the long term, diabetes can lead to health issues such as heart disease, blindness, and nerve and kidney damage (Duncan et al., 2020). Moreover, the presence of complications may affect mobility, individuals' quality of life, and life expectancy (Duncan et al., 2020; Kolarić et al., 2022). To this end, there is now a global thrust to halt its prevalence by 2025 (Lin et al., 2020).

Duncan et al. (2020) mentioned that the prevalence rate for diabetes in the Caribbean is 9%, and countries such as Jamaica have embarked on increased health education to promote health behaviors. Several studies on diabetes have been published over the years; however, studies conducted within the Caribbean, especially in Jamaica, are limited. Additionally, studies done in developed countries have explored the association of modifiable risk factors such as alcohol use and smoking with diabetes to help improve health outcomes within their population (Song & Lin, 2023). However, in

Jamaica, currently, there is limited research on the different factors (i.e., modifiable risk factors, social welfare, etc.), and none have explored a possible connection between household socioeconomic status, modifiable risk factors, and diabetes at a national level. Thus, a study looking at the areas mentioned earlier could prove beneficial in providing evidence to support strategies to improve the health outcome of the population.

Education can potentially influence a change in attitude and behavior overall (Khargekar et al., 2024). This research also can potentially affect positive social change at the national level. The results could provide evidence-based information that could be used to inform policies in the future and guide interventions if required. Additionally, the experience of COVID-19 and its negative impact on diabetics' access to medication could lead to innovative measures to protect the affected population and reduce the associated healthcare costs in a developing country like Jamaica (WHO, 2022).

In this chapter, I provide an overview of diabetes and the importance of accessing care to assist in managing the prevalence of the disease. Understanding the variables under study facilitated defining the research problem, research questions, and the purpose of the study. Also, in addition to providing the theoretical framework for this study, I provide definitions of key terms and explain the study's rationale and significance, the study, the nature of the study, scope assumptions, and limitations. I conclude the chapter with a summary and transition to other components that are included in the study.

Background

Diabetes is one of the fastest-growing and most common diseases worldwide (Cole & Florez, 2020). Type 2 diabetes mellitus (T2DM), the most common type and the

one that mostly affects adults, is one of the leading preventable chronic diseases with high rates of morbidity and mortality. It is multifactorial, polygenic, and characterized by chronic hyperglycemia, and the burden of diabetes is seen in individuals, families, communities, and countries globally (Waqar et al., 2023). In 2019, the annual global medical expenditure for diabetes was U.S. $760 billion (Zhang et al., 2022). Therefore, in addition to adversely affecting the quality of life, diabetes places a huge economic burden on affected individuals seeking treatment (Zhang et al., 2022). Moreover, according to Aburto et al. (2020), life expectancy has been increasing worldwide. Thus, an increase in the number of individuals living longer with diabetes may pose an increased risk of developing diabetes-related complications in the long term.

Identifying risk factors is crucial in determining the occurrence of diseases. Identifying specific risk factors for a particular disease, particularly within a particular age group or population, aids in more effective disease management. According to Gulbahar Eren et al. (2023), a major concern of individuals diagnosed with diabetes is managing the disease to prevent diabetes-related complications. The authors mentioned that some patients have trouble performing daily activities, to the extent that some experience anxiety, depression, stress, and a loss of social support that gives rise to negative consequences of diabetes, exacerbating the condition and increasing the burden of the disease on the individual. Thus, the findings of this research could assist in developing evidence-management strategies to aid in effective diabetes management.

The precise origin of T2DM is multifaceted; however, risk factors such as age, sex, race, family history, smoking, overweight, obesity, physical inactivity, and other

lifestyle choices are believed to be associated with the prevalence of the disease (Kovácset al., 2024; Tao et al., 2020). Hence, it is important to examine the risk and modifiable risk factors of diabetes independently and collectively, as the information garnered could provide vital information for diabetes management. Moreover, identifying the risk factors of diabetes can provide direction for screening and preventative measures for diabetes and diabetes-related complications going forward.

According to the International Diabetes Federation (IDF, 2021), up to 2021, Jamaica had an adult population of approximately 1,991,400 and 231,000, or approximately 11.6% of them, who had been diagnosed with diabetes. In 2008, the Jamaican government introduced free access to health care for all citizens and legal residents at all public hospitals and clinics nationwide (Campbell et al., 2022). The government aimed to promote more accessible access to services such as preventing, diagnosing, treating, and managing diseases, illnesses, disorders, and other health-impacting conditions. Cunningham Myrie et al. (2013) conducted a study using the 2008 Jamaica Health and Lifestyle Survey to provide valid estimates of the burden and risk factors of diabetes mellitus by sex in Jamaica. The study found that the prevalence rate of diabetes in Jamaica was 7.9%. Chambers et al. (2023) revealed that there was a 42% increase in the prevalence of diabetes since 2001 and that 80% of all deaths in the country are due to noncommunicable diseases (NCDs).

Additionally, obesity and, especially, childhood obesity, is a significant health concern in Jamaica. The Pan American Health Organization (2022) reported that over 54% of Jamaicans are overweight or obese, while one in three live with hypertension,

which means a potential increase in health complications such as diabetes. As such, there is no doubt that more factors need to be considered and explored to guide intervention measures as we proceed. The literature provided evidence that researchers have conducted various studies on diabetes over the years. Moreover, the diversity in research designs and related findings highlights the importance of this current study and its potential to add to the existing body of knowledge concerning diabetes in a developing country.

Brown et al. (2022) suggested that the WHO found an association between the prevalence of diabetes and income in Caribbean countries. In the case of Jamaica, however, while the data for other markers of socioeconomic status is present, the proportion of missing data for income is very high (Cunningham Myrie, 2013; Planning Institute of Jamaica, 2022). Cunningham Myrie (2013) stated that new markers may need to be explored in future studies due to the poor response to the income question. Elgart et al. (2022) posited that an association exists between low economic status and increased risk for diabetes. Elgart and colleagues indicated that, while studies had found an association in developed countries, there was a paucity of information for developing countries. Thus, I addressed the income gap by using household assets to develop a wealth index of socioeconomic status to measure the household socioeconomic status of the target population. Furthermore, a combination of diverse economic statuses and other factors such as social welfare and external financial support, health insurance, and location provided data to contribute to the body of knowledge about diabetes risk factors in a developing country like Jamaica.

Problem Statement

The issue that prompted me to search the literature is that globally, diabetes, and especially T2DM, has become a public health problem of epidemic proportions (see WHO, 2023a). In the last few years, diabetes has been recorded as one of the leading causes of mortality in the region; however, there is limited information available on evidence-based intervention strategies. As such, the ability to effectively manage this disease is also unknown, leading to potentially adverse health outcomes for at-risk residents. Diabetes is also highly ranked on the international health agenda as a serious threat to human health (Williams et al., 2020). According to the WHO (2022), diabetes affects over 500 million people worldwide, and most affected individuals live in low-and middle-income countries. Additionally, 1.5 million deaths are directly attributed to diabetes annually, and the numbers continue to increase steadily.

The recent COVID-19 pandemic and accompanying supply chain issues created increased challenges for diabetics as many experienced difficulties in accessing much-needed medication, which can lead to serious health consequences (WHO, 2022). In Jamaica, a middle-income developing country, the estimated 9%prevalence of diabetes mellitus (DM) has also been increasing steadily over the last few decades, with the potential to burden the economy significantly (Duncan et al., 2020). As a result, interventions for diabetes treatment and care must be incorporated into national response and preparedness strategies. Additionally, interventions for prevention strategies, where possible, must be explored a nd communicated to the general public.

Several types of research focusing on diabetes have been published over the years; however, studies conducted within the Caribbean and especially Jamaica are limited. Carranza et al. (2022) stated that only a few studies have explored socioeconomic factors and diabetes among older adults. Glover et al. (2023) conducted a study to determine the association between cumulative socioeconomic status and incident type 2 diabetes. They found that the combined effects of socioeconomic factors may affect the downstream risk of T2DM among African American adults. Cunningham-Myrie et al. (2013) conducted the only study that looked at some risk factors associated with diabetes nationally in Jamaica. Cunningham-Myrie and colleagues indicated that few studies from developing countries have explored the risk factors associated with diabetes.

Although Jamaica has a relatively small population of just under 3 million people, the incomes, educational levels, support systems, risk factors, and the socioeconomic statuses are diverse (Bryan et al., 2012). As a result of this diversity, more information is needed to explore the topic and answer the research questions. The subject has been researched, but no study has yet attempted to analyze a possible link between household socioeconomic variables and diabetes in Jamaica. Few research studies have investigated modifiable risk factors. As a result, there is little research into a possible link between household socioeconomic status, modifiable risk factors, and diabetes in Jamaica.

Purpose of the Study

The purpose of this study was to explore the relationship between household socioeconomic status, modifiable risk factors, and diabetes among adults in Jamaica. To

address this research inquiry, I conducted quantitative research using a cross-sectional study design.

Research Question(s) and Hypotheses

The following research questions were addressed in this study:

RQ1: Is there a statistically significant relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment?

$H_0$1: There is no statistically significant relationship between household socioeconomic status and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

$H_1$1: There is a significant relationship between household socioeconomic status and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

RQ2: Is there a statistically significant relationship between the modifiable risk factors (alcohol, smoking, hypertension) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment?

$H_0$2: No statistically significant relationship exists between modifiable risk factors and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

$H_1$2: A statistically significant relationship exists between diabetes-modifiable risk factors and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

RQ3: To what extent do household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) predict diabetes while controlling for age, gender, education, and employment?

$H_0$3: household socioeconomic status and the modifiable risk factors do not predict a statistically significant relationship with diabetes while controlling for age, gender, education, and employment.

$H_1$3: Household socioeconomic status and the modifiable risk factors do predict a statistically significant relationship with diabetes while controlling for age, gender, education, and employment.

Theoretical Framework for the Study

The theoretical framework that grounded this study was the social-ecological model (SEM). The SEM was initially conceived as a framework for comprehending human development in 1970 by Bronfenbrenner and transitioned into a formalized theory during the 1980s (Bronfenbrenner, 1977, 1986, 1989). Bronfenbrenner posited that the different environments that people are associated with influence their behavior; therefore, to grasp human development comprehensively, it's crucial to consider the entirety of the ecological environment within which the growth occurs (Bronfenbrenner, 1977). The five levels of the model, namely intrapersonal, interpersonal, organizational, community, and

public policy, work together to influence and determine the factors that impact health status and human behavior (Golden & Earp, 2012). Therefore, I used the SEM constructs to explain the relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance), modifiable risk factors (alcohol, smoking, hypertension), and diabetes among adults in Jamaica for Research Questions 1, 2, and 3 while controlling for age, gender, education, and employment.

The application of the factors to the different levels of the model allowed me to examine how these factors influence diabetes among adults in Jamaica. The first level, the intrapersonal level, assesses personal factors associated with the individual (Bronfenbrenner, 1977). Thus, demographic information such as age, gender, and knowledge about diabetes were considered at this level. The next level is the interpersonal level, which assesses the formal and informal social network systems such as family, colleagues at work, and friends. The third level is the organizational level, which refers to the institutions, organizations, and groups that directly influence an individual's behaviors, beliefs, and experiences. As such, I looked at the informal and informal policies, procedures, and norms that shape the behavior and experiences of individuals. Understanding the organization's influence on beliefs and behaviors relating to diabetes prevention or general management could help guide the development of intervention strategies where necessary.

At the fourth level, the community-level emphasis is placed on understanding the broader context in which individuals live and how a range of factors within a community interact to influence behaviors and outcomes (Bronfenbrenner, 1977). At the final level,

the policy level of the SEM, policies can be enacted to achieve a particular goal (Huet al., 2021). Therefore, the connection between the framework presented and my study was that the ecological model helped me explain how the different environments the participants live in and operate in affect their behaviors and health outcomes. It also helped me to understand how the risk and modifiable factors impact the diabetes status of individuals. The information garnered can help improve diabetes-related health outcomes and potentially reduce diabetes-related complications. Additional details relating to the theoretical framework used in this study are provided in Chapter 2.

Nature of the Study

For this research, the target population included adults 18 years and older who reported being diagnosed with diabetes. To address the research questions in this quantitative study, a cross-sectional design was employed to identify any relationship between the independent variables' household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and modifiable risk factors (alcohol, smoking, hypertension) and the dependent variable diabetes. A quantitative approach was chosen as it facilitates the analysis of numeric data to explain a phenomenon of interest with a view to determining if associations exist between independent and dependent variables (Frankfort-Nachmias et al., 2020). I also used secondary data from the Jamaica Survey of Living Conditions 2019 dataset. A cross-sectional study design was appropriate for population-based surveys because it facilitates testing of the assumptions regarding potential relationships as outlined in the research questions (Taris et al., 2021).

The Jamaica Survey of Living Conditions 2019 dataset contains data on all the variables required to conduct this study. This includes the independent variables such as wealth index, wherein household assets ownership was converted to low, medium/ high economic status, social welfare and external financial support, location, and health insurance, and the modifiable risk factors alcohol, smoking, and hypertension. The dataset also had information on the controlling variables: age, gender, level of education, employment, and the dependent variable, diabetes.

For the first research question, the dependent variable was diabetes, which is dichotomous (i.e., no = 0, yes = 1), while the independent variables were household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) age, gender, education, and employment were applied as covariates. To determine whether a relationship exists between these variables, an inferential statistical analysis in the form of a logistic regression analysis was done.

In the second research question, the dependent variable was diabetes, and the independent variables were the modifiable risk factors of smoking, hypertension, and alcohol use. The covariates were age, gender, education, and employment, and a logistic regression analysis was performed to determine if an association exists between the independent and dependent variables.

For the third research question, the dependent variable was diabetes, while the independent variables were household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and modifiable risk factors (alcohol, smoking, hypertension). The covariates age, gender, education, and

employment were used, and a logistic regression analysis was employed to determine if independent variables predict the probability of the dependent variable. The coding used for the variables is further explained in Chapter 3.

The data contained in the Jamaica Survey of Living Conditions 2019 dataset were analyzed using the Statistical Package for the Social Sciences (SPSS) version 29, and the logistic regression model was used to quantify any identified relationship between the variables. The dataset presently resides with both the University of the West Indies, Mona, and the Planning Institute of Jamaica. As such, once Walden University granted ethical approval and permission to conduct the study, I submitted the requisite application to access the dataset.

Definitions

Alcohol use: Refers to whether the respondents consumed alcohol or not.

*Diabete*s/Type 2 diabetes refers to and describes the state wherein the body develops resistance to insulin or fails to produce an adequate amount of insulin (WHO, 2022).

Health insurance Refers to the attainment of additional support to improve access to healthcare services (Al-Sanaani et al., 2022; McElfish et al., 2021).

Household socioeconomic status: For this research household socioeconomic status included a wealth index (low, medium/high economic status). The index was calculated using a method known as principal component analysis (PCA), which uses household assets owned by individuals in the target population. These encompassed household assets such as car//bicycle ownership, internet, and television as well as

housing characteristics such as the source of drinking water, type of toilet facilities, electricity, types of dwelling, and ownership of dwellings. Additionally, location, health insurance, and social welfare were included as variables of household socioeconomic status.

Hypertension: Refers to whether the participants had been diagnosed with hypertension.

Location: Refers to the geographic residence of the respondents and will seek to determine if they reside in rural or urban areas.

Modifiable risk factors: Refers to the factors that a person can control to reduce the negative impact on health. For the purposes of this research, modifiable risk factors will include hypertension, smoking, and alcohol use.

Smoking: Refers to whether the respondents smoked and the frequency for those who did.

Social welfare/ external financial support: Refers to any financial support received either from the government or other sources that could supplement the financial resources of the households.

Assumptions

Several assumptions were made for this study. My first assumption was that there was no selection bias at the point of data collection. The second assumption was that the participants understood each survey question and provided accurate responses to the interviewees. The accuracy of gathered data holds immense importance, as it directly affects the validity of the outcomes obtained. Furthermore, research is considered

internally valid when its conclusions accurately reflect the reality of the participants studied, indicating that the reported results are not influenced by chance or bias (Burkholder et al., 2020). My third assumption was that the data contained in the Jamaica Survey of Living Conditions 2019 dataset is reliable and valid because the survey was administered by the Statistical Institute of Jamaica (STATIN), a team of highly trained individuals. Finally, the Jamaica Survey of Living Conditions is a national survey; hence, a fourth assumption was that the sample size was large enough to generate results representative of Jamaica's adult population.

Scope and Delimitations

The focus of the study was to determine the relationship between household socioeconomic status, modifiable risk factors, and diabetes from a national dataset and to explore how this relationship is mediated by four covariates. The scope of the study was limited to adults aged 18 years and older who met the inclusion criteria and, therefore, participated in the national survey, Jamaica Survey of Living Conditions (JSLC) 2019 survey. A perusal of the data dictionary supplied by the University of the West Indies, Mona, revealed that the information contained in the JSLC dataset is appropriate to facilitate this research in that information relating to the dependent variable diabetes, the independent variables (wealth index, social welfare/external financial support, health insurance, and geographic location, smoking, alcohol use, hypertension) and covariates (age, gender, education, and employment) under study is included in the dataset. As such, analysis of the dataset should allow for the determination of a relationship between the variables.

Delimitations can impact the external validity of a study (Hodson, G2022). Delimitation also helps to manage the study effectively, ensuring that it remains relevant and feasible. In this study, I explored the population parameters of the JSLC dataset. The dataset is the result of a national survey, and as such, the results of the analysis may be generalizable.

Limitations

The JSLC is a survey in which the data was collected at a single point in time, indicating that a cross-sectional design was used. Similarly, I used a cross-sectional design for data analysis, which means that the results obtained can only establish whether a relationship exists between the variables and not causation (Burkholder et al., 2020; Wang & Cheng, 2020). A limitation of this study was that secondary data was used and may consist of recall bias and some data was also missing. Another limitation of this study was that the information was collected through self-reporting and not subjected to evidence for diabetes diagnosis. Thus, the potential exists that some level of bias was included in the responses reported.

Significance

I sought to determine the relationship between household socioeconomic status, modifiable risk factors, and diabetes among Adults in Jamaica. Therefore, since no prior study has looked at the variables under study at a national level, the findings could contribute evidence-based information to Jamaica's public health facilities and the general public concerning the risk factors of diabetes. Similarly, the study's findings can also help to ensure that the relevant organizations and the at-risk and affected diabetic individuals

are better equipped to practice effective preventative and control measures. Additionally, the results reported could serve to strengthen the need for increased awareness of the impact of non-communicable diseases on the population. It could also lend itself to further research to investigate other issues that may be contributing to the increased prevalence of the disease.

The literature provided evidence of potential diabetes-related health complications. Thus, this study could provide an understanding regarding the potential adverse health impact on quality of life and health outcomes if diabetes is improperly managed. Additionally, this study has the potential to influence positive social change. The research findings could provide vital information to increase the knowledge of individuals who do not have the disease, thereby leading to behavior change to prevent the occurrence. For those already diagnosed, the information could provide the necessary information to encourage behavior change, leading to improved management strategies as we advance.

Summary

In this study, I aimed to evaluate seven risk factors for diabetes among Jamaican adults. Using a quantitative approach and secondary data from the JSLC 2019, I explored the relationship between the dependent variable, diabetes, and the independent variables, household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and modifiable risk factors (alcohol, smoking, hypertension), and the confounding variables age, gender, education, and employment. The findings from this study may add to the existing body of knowledge and help identify intervention

strategies to aid in the prevention and management of diabetes among the Jamaican population. In Chapter 2, I provide a more in-depth review of the literature related to the variables and concepts mentioned in this study to demonstrate the importance of research on a public health issue such as diabetes.

Chapter 2: Literature Review

In the last few decades, diabetes has become a public health problem of epidemic proportions and is listed among the major causes of mortality and morbidity (Maiti et al., 2023; WHO, 2022). The International Diabetes Federation (IDF; 2021) estimated that approximately 537 million people worldwide were living with diabetes in 2021, with a projected increase to 643 million by 2030 if no effective preventive measures are implemented. Additionally, over 1 million deaths are directly attributed to diabetes annually, and the numbers continue to increase steadily (Moien Abdul et al., 2020). Diabetes is recorded as one of the leading causes of mortality in the region; however, the recommended intervention strategies have not succeeded in reducing the burden of illness on the population (Guariguata et al., 2022; Ogurtsova et al., 2022). In Jamaica, a middle-income developing country, the estimated 9%prevalence of DM has also been increasing steadily over the last few decades, with the potential to burden the economy significantly and lead to serious health consequences for the population (Duncan et al., 2020).

Glover et al. (2023) conducted a study to determine the association between cumulative socioeconomic status and incident type 2 diabetes. The study found that the combined effects of socioeconomic factors may affect the risk of type 2 diabetes among African American adults. Previous research has been done on risk factors and the prevalence of diabetes (e.g., Bidulescu et al., 2017; Bryan et al., 2012; Cunningham-Myrie et al., 2013); however, researchers have not sought to explore a potential connection between the household socioeconomic variables and diabetes in Jamaica. Also, very few have looked at the modifiable risk factors. Hence, there is limited research

to investigate a possible connection between household socioeconomic status, modifiable risk factors, and diabetes. This chapter is divided into five sections: introduction, literature review strategies, the theoretical foundation that grounds the study, a description of the key variables of the study, and a summary of the information that is presented.

Literature Search Strategy

Walden University library was used as a search tool for relevant articles on diabetes, modifiable risk factors, and household socioeconomic status. I reviewed peer-reviewed journal articles that were published between 2019 and 2024. Also, a few seminal articles and textbook information are included in the research. The databases used in the literature search included ProQuest Nursing Academic Search Complete, Allied Health Source, CINAHL, ProQuest Central, Public Health, PubMed, ScienceDirect, Medline, and Google Scholar. Additionally, data was collected from websites of state governmental agencies and international public health organizations such as the WHO and the Centers for Disease Prevention and Control (CDC). Furthermore, key words were searched individually and in combination with each other, and each database was used to find literature that was related to diabetes, alcohol consumption, smoking, DM, socioeconomic status. Search words include *diabetes, diabetes mellitus, Type 2 diabetes mellitus in Jamaica, obesity, prevalence, gender, household socioeconomic status, socioeconomic status, social determinants of health,* and *risk factors of diabetes.*

Theoretical Foundation

The theoretical model used to ground this research was SEM. SEM is a comprehensive framework for understanding the many factors that affect development (Bronfenbrenner, 1977). Bronfenbrenner (1977) claimed that the different environments, such as community, workplace, family, and friends that people are associated with influence their lifestyle. As such, if one aims to understand human development, then the entire ecological system in which growth occurs should be considered (Bronfenbrenner, 1977). Thus, SEM embraces the theory that an individual's behavior is influenced by a variety of factors to which they are exposed at different levels (Golden & Earp, 2012). This could, therefore, explain the emphasis placed on intervention strategies that included lifestyle changes. The model is a framework that is widely utilized in various fields, including public health, to understand and analyze the different levels of influence on human behaviors and health outcomes (Golden & Earp, 2012; Sagi et al., 2022).

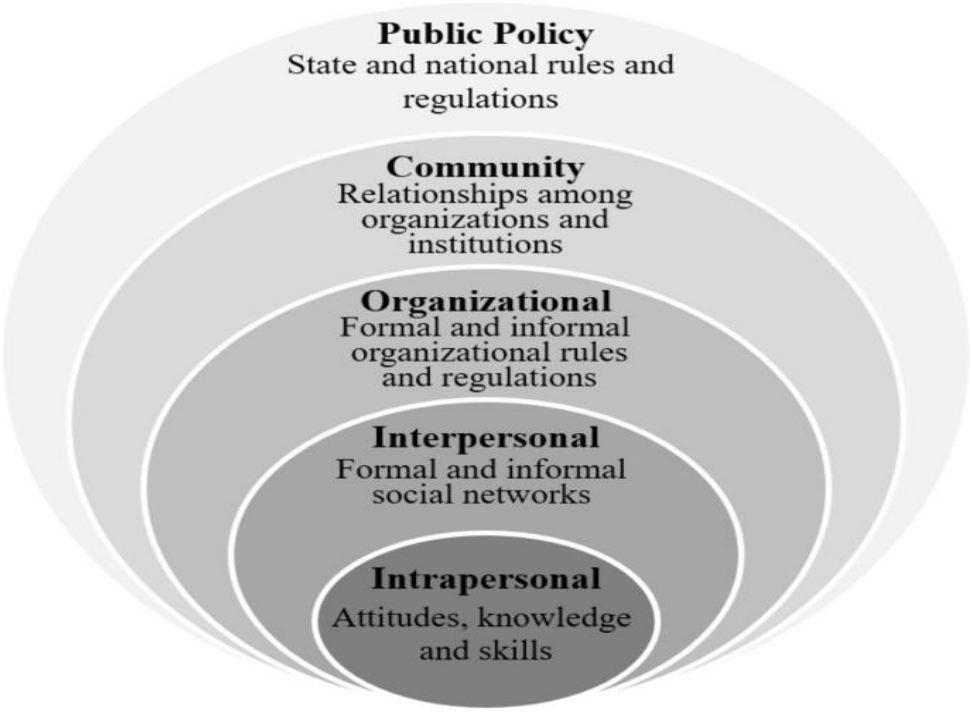
The SEM was first established as a conceptual model for understanding human development in 1970 by Bronfenbrenner, and in the 1980s, it was formalized as a theory (Bronfenbrenner, 1977, 1986, 1989). McLeroy et al. (1988) expanded on the existing four-level framework, and today, the model assumes that the five levels, namely intrapersonal, interpersonal, organizational, community, and public policy, work together to influence and determine the factors that impact health status and human behavior (Golden & Earp, 2012). According to Guariguata et al. (2022), the environment in which people live and operate is multilayered, and as such, the physical, social, and cultural aspects may influence individuals' health differently depending on their beliefs and

practices. Also, the various levels of influence facilitate collaboration and support to enhance the model's effectiveness (Golden & Earp, 2012). Therefore, the SEM is focused on highlighting how the associations and relationships among health behaviors, and the environment impact the health of a population.

Organizations such as the CDC and the WHO have embraced the utilization of ecological models. The WHO embraces the broad approach to thinking of health as evidenced by its inclusion of physical, mental, and social wellbeing in its definition of health, as advanced in the 1947 Constitution of the WHO (Glanz et al., 2015). Additionally, the CDC also encourages the adoption of the SEM in the design of health models based on its effectiveness in various health promotion programs (Glanz et al., 2015). As such, health professionals and researchers can use this model to identify factors at multiple levels that contribute to ill health and to use the data as the evidence to plan and implement strategies aimed at disease prevention. The application of the model could provide health professionals with an opportunity to determine their beliefs, attitudes, and practices as well as the physical and social environment in which they occur to identify opportunities to promote healthy behaviors. Figure 1 represents a visual display of the five levels of SEM.

Figure 1

Social Ecological Model



Note. A depiction of the factors that influence behaviors, health, and outcomes at the five levels of influence of the Social Ecological Model. Adopted from "*An ecological perspective on health promotion programs"* by McLeroy K. R., Bibeau D., Steckler A., & Glanz, K. (1988). *Health Education & Behavior*, *15*(4), 351-377. https://doi.org/10.1177/109019818801500401

Ingram et al. (2021) stated that the SEM is an approach to health promotion that acknowledges that individual health is a product of the multiple influences of family, work, community, and the broader political environment. Additionally, Sagi et al. (2022) posited that the SEM considers the interplay of factors at different levels and their impact

on health. Thus, since my aim was to explore the connection between household socioeconomic status, modifiable risk factors and diabetes, then the application of the factors to the different levels of the model could examine how these factors influence diabetes among adults in Jamaica. Furthermore, some of the variables to be considered in the research were socioeconomic factors, social protection, and modifiable risk factors such as smoking, hypertension, and alcohol consumption. Hence, a knowledge of the relationship between these variables and diabetes prevalence could provide the framework for evidence -based management and prevention strategies that will help to reduce the negative impact on health and health disparities.

Glanz et al. (2015) indicated that the most successful public health programs are those that place emphasis on health behaviors and the context in which they occur. Thus, the SEM was appropriate for my research on a global public health issue of concern in that it can illustrate how the embedded levels of influence, interpersonal, intrapersonal, organizational, community, and public policy, interact to impact health outcomes such as the noncommunicable disease diabetes. In addition, Ingram et al. (2021) proposed that social and economic factors play a role in creating and perpetuating health disparities. With this research, I assessed the relationship between household socioeconomic status and modifiable risk factors with diabetes. Thus, the SEM could help to unearth vital information that not only improve upon the existing body of knowledge regarding factors influencing diabetes in Jamaica, but also identify opportunities to design health promotion strategies aimed at ameliorating the health outcomes of the population.

Literature Review Related to Key Variables/Concepts

Household Socioeconomic Status and Diabetes

Research suggests that individuals in developed countries have an increased risk of developing diabetes if they are of a low socioeconomic status (Elgart et al., 2022). Elgart et al. (2022) revealed that while this is the case in developed countries, limited information was available to determine if similar findings would exist in developing countries. Therefore, this study by Elgart et al. (2022) provided evidence to support the decision to conduct research to evaluate the association between socioeconomic status and diabetes in a developing country such as Jamaica. Be-Ikuuet al. (2021) argued that diabetes management over the years has been focused on medication intake, adherence to dietary recommendations, regular physical activities, and monitoring of blood glucose levels. Be-Ikuuand et al. also stated that even though the recommendations have proven to be very effective in diabetes management, diabetes continues to be a public health concern worldwide. Therefore, the findings suggest that other factors need to be considered and included in the intervention programs.

In my research, I used wealth index as one of the variables associated with the household socioeconomic status of the population due to a paucity of information on household incomes. Seminal work has demonstrated that socioeconomic status (SES) is a pivotal factor affecting health and individuals with a low SES; however, these individuals receive less treatment and have less control over diabetes (Hunt, 2021; Maiti et al., 2023). Studies also show that an association exists between socioeconomic status and diabetes (Elgart et al., 2022; Kang et al., 2021). Elgart and colleagues (2022) conducted a cross-

sectional study to verify the relationship between the risk-frequency of developing Type 2 diabetes and SES in a local population of Argentina. The SES indicators were education and monthly household income, and a survey instrument was used to collect data from 150 people aged 45–64 years. Fifty-six percent of the participants were females with an average low education and income level. The findings revealed that 40% of the female population had a moderate to very high risk, and 60% presented a low (24.7%) or slightly high (35.3%) risk for developing Type 2 diabetes. Furthermore, the risk score increased significantly with lower SES. Hence, the authors concluded that an inverse association exists between SES and the risk of developing Type 2 diabetes.

Kang et al. (2021) sought to assess the health- related quality of life of (HRQoL) diabetics in the countryside and explore its influencing factors. A cross-sectional study design was used to assess data on 23,053 participants from the Henan Rural Cohort Study. The findings show that old age, poverty, low physical activity, and existing comorbidities were negatively related to HRQoL of diabetics, while high educational level was positively related to HRQoL. As such, the authors concluded that more attention should be given to diabetics with poor socioeconomic status in rural areas.

Similar findings of the association between socioeconomic status and diabetes were unearthed by systematic and narrative reviews (Kyrou et al., 2020; Lago-Peñas et al., 2021). Both studies conducted a comprehensive search of the existing literature on Type 2 diabetes. Kyrou et al. (2020) sought to assess the role of Type 2 diabetes risk factors and on identifying vulnerable groups for Type 2 diabetes in the general European population. The results revealed that age, ethnicity, family history, low socioeconomic

status, obesity, metabolic syndrome, and some unhealthy lifestyle behaviors are related to high type 2 diabetes risk. Also, Lago-Peñas et al. (2021) sought to determine the effect of socioeconomic position on the incidence and prevalence of NCD in organization for economic cooperation and development (OECD) countries. The findings show that a low socioeconomic position increases the risk of developing cardiovascular diseases, lung and breast cancer, and Type 2 diabetes and has a significant consistent effect on mortality and morbidity caused by said non-communicable diseases.

In the case of income, the data for Jamaica and other countries reveal mixed results. Park et al. (2023) examined the relationship between income variation and risk of Type 2 diabetes. They found that individuals who experienced sustained low-income status or an income decrease had increased Type2 diabetes risk, while those who had continual high-income status or an income increase had lower Type 2 diabetes risk. Data from the WHO has demonstrated an association between the prevalence of diabetes and income in Caribbean countries, such as Jamaica (Brown et al., 2022). The findings of research by Cao et al. (2020) also show an association between the prevalence of diabetes and individuals of disadvantaged socioeconomic positions in developing and developed countries.

Cao et al. (2020) conducted a quantitative study using secondary data from the China Health and Retirement Longitudinal Study. The authors sought to assess income-related health inequalities among middle-aged and elderly diabetes patients in China between 2011 and 2015, and to explore the factors that may contribute to these disparities. Principal component analysis was used to assess asset-based economic status,

while the concentration index was used to evaluate income-related inequality, and a generalized linear model was used to identify factors that explained wealth-related inequality in the target population. The findings revealed the existence of health inequality in favor of the wealthy members of the population. Thus, an individual's financial capability can directly impact their ability to adhere to the recommended diabetes management regime and health outcomes (Be-Ikuuet al., 2021). The concentration index also revealed that place of residence, region, body mass index (BMI), and education contributed positively to the measured inequality; however, age had a negative contribution (Cao et al., 2020). The research by Cao et al. and Be-Ikuuet al. (2021) is related to my current study, where I sought to determine if a relationship exists between diabetes and socioeconomic status in a developing country. Conversely, the WHO data digresses from other research findings in that it indicates that diabetes is more prevalent among higher-income groups in Jamaica (Brown et al., 2022).

In my research, I used the population's wealth index to measure household socioeconomic status due to a paucity of information on household incomes. Cao et al. (2020) mentioned that household assets and housing characteristics have been used to construct a proxy index to measure living standards and inequalities in the chronic disease prevalence among people with unique standards of living. In this study, land, home, motor vehicle ownership, internet, water source, electricity, excreta disposal facility, type of housing structure, and car/bicycle ownership were combined into a wealth index of SES to measure the household socioeconomic status of the target

population. Additional socioeconomic factors to be considered were social welfare/ external financial support, health insurance, and location.

Wealth Index and Diabetes

The social gradient of health proposes that inequalities in a population's health status result from the inherent inequalities in the social status of individuals; hence, the lower an individual's socioeconomic status, the worse their health (WHO, 2023a). Verna et al. (2021) also mentioned that individuals in economically vulnerable households may unconsciously disregard signs of illnesses and, therefore, miss the opportunity for early intervention. The missed opportunity for early intervention could impact health outcomes. Other research has found a link between socioeconomic status and health (Wei et al., 2021). Shirin Sara et al. (2023) concurs with this hypothesis and posits that wealth status has been recognized as a significant predictor of type 2 diabetes.

Cerpa-Arana et al. (2022) conducted research using secondary data from the National Demographic and Family Health Survey from 2018 to 2020. The study aimed to determine the association between socioeconomic status and the prevalence of obesity, hypertension, and type 2 diabetes mellitus. The findings revealed that those with a high wealth index had a higher prevalence of type 2 diabetes mellitus. Hence, the authors concluded that a positive association exists between wealth index and type 2 diabetes mellitus. This research is fundamental to my study as it facilitates a comparative analysis of my findings. I will also use secondary data from a national survey to assess a possible relationship between the wealth index of households and diabetes in the population.

Household Assets and Diabetes

Konkor et al. (2023) opine that the responses to the management and control of the global epidemic of diabetes, has for the most part, emphasized individualistic risk factors of the disease while neglecting similar important determinants such as the living environment. Uddin et al. (2023) posit that where individuals live may influence their health and well-being even after accounting for differences in individual-level socioeconomic status. Hence, people living in disadvantaged environments are at increased risk of type 2 diabetes. Kundu and Chakraborty (2023) used data from the Longitudinal Ageing Study in India and a sample size of 65562 participants to determine socioeconomic inequality on the burden of communicable and non-communicable diseases among older adults in India. The findings revealed that the prevalence of NCDs was concentrated among rich older adults. Also, economic status and rural residence are common factors contributing to inequality. Additionally, the results revealed that the living environment (house type, toilet facilities, and drinking water) has a unique contribution to explaining inequality in NCD diseases.

Social Welfare/External Financial Support and Diabetes

In terms of social protection, the Jamaican government offers some level of social protection through the Program of Advancement through Health and Education (PATH) (Bose-Duker et al., 2021). PATH is a conditional cash transfer system of social assistance that provides a cash benefit to vulnerable groups and households living in the country (Bose-Duker et al., 2021). Also, remittances are a large and important source of external financial assistance to Jamaicans. Das et al. (2019) posit that remittances are broadly seen

as beneficial because they are used for expenditures on goods and services, provide a source of funds for the accumulation of capital, and, ultimately, are another source from which poverty can be alleviated. Therefore, the literature suggests that both cash transfers and remittances contribute to household income.

Shahidi et al. (2019) conducted a systematic review to examine the health impact of social assistance programs in high-income countries. The findings revealed that social assistance is associated with poor health outcomes and that social assistance recipients exhibit worse health outcomes compared to non-recipients. As such, the authors concluded that social assistance programs in high-income countries are failing to maintain the health of socioeconomically disadvantaged populations. This review is very important to my study as it facilitates a comparative analysis with the findings of my study. Thus, by using a different methodology, I will be able to determine if a relationship exists between social protection and diabetes using a quantitative cross-sectional design in the developing country of Jamaica.

Health Insurance and Diabetes

In low-and middle-income countries (LMICs), the burden of non-communicable diseases (NCDs) challenges the ability of the health systems to adequately offer financial protection to all its citizens (Oyando et al., 2023). Financial protection can be measured by determining whether a household has experienced "catastrophic health expenditure" (CHE), which is health expenditure that exceeds a selected income threshold. Thus, health insurance coverage may be one measure used to enhance social protection. Research has shown that access to health insurance has been recognized as a critical

factor in managing and preventing chronic conditions (Al-Sanaani et al., 2022; McElfish et al., 2021). McElfish et al. examined the associations between undiagnosed hypertension and undiagnosed T2D and age group, sex, health care access (defined by cost and health insurance status), and body mass index (BMI). The study found that undiagnosed T2D was significantly associated with age group and health insurance status. Oyando et al. (2023) posit that non-communicable diseases (NCDs) can impose a substantial financial burden on households lacking adequate financial risk protection. Giang et al. (2020) concurred and mentioned that the rise in non-communicable diseases has resulted in increased out-of-pocket (OOP) health-related spending in many households, thereby resulting in catastrophic health expenditure (CHE).

In their study, Giang et al. conducted a cross-sectional household survey on a sample size of 2,038 individuals over 18 years of age with reported communicable disease (NCD). The study examined the association between health insurance (HI) on healthcare utilization and the burden of out-of-pocket expenditure among people with reported NCDs and their households in Vietnam. The results showed that individuals with reported non-communicable diseases (NCDs) who had health insurance were twice as likely to utilize outpatient care compared to those without insurance. Also, households in the three lowest wealth quartiles were more likely to encounter CHE and financial distress than economically better-off households. As such, the study concluded that HI did not provide a protective effect to households, as there was no evidence of a

significant association between the HI status of household members and reported NCD and CHE or financial distress.

Similar results were reported by Oyando et al. (2023). Oyando et al. conducted a prospective cohort study that included 888 households that had at least one individual living with hypertension and/or diabetes for 12 months. The study evaluated the effectiveness of the National Health Insurance Fund (NHIF) in providing financial risk protection to households with persons diagnosed with hypertension and/or diabetes in Kenya. The findings revealed substantial evidence that households that were enrolled in NHIF spent a lower portion (12.4%) of their household budget on healthcare compared with unenrolled households (23.2%) (*p=0.004*). Meanwhile, households enrolled in NHIF were less likely to incur CHE. Likewise, there was no strong evidence that they are better protected from CHE than households without NHIF (*OR=0.67; p=0.47*).

Location and Diabetes

Studies have shown that community settings, such as where individuals live or work, may influence health and well-being (Thorpe et al., 2022; Uddin et al., 2023). Uddin et al. (2023) conducted a harmonized analysis using the data from three independent longitudinal study samples in the US. The authors aimed to investigate the association between the neighborhood socioeconomic environment and T2D incidents in three large studies from the Diabetes LEAD Network. Uddin et al. also examined whether any identified association differed by sex and age within the four community types. The findings revealed that a worse neighborhood socioeconomic environment may contribute to an increased risk of type 2 diabetes. The study also found larger and

stronger associations between worse NSEE and diabetes risk among women than men and among those less than age 45 in the VADR cohort. Uddin et al. concluded that the impact of neighborhood socioeconomic environment on T2D risk may differ for males and females and by age group within different community types.

Studies also assessed and found an association between rural-urban residential location and diabetes (Bujawati et al., 2021; Issaka et al., 2023). Conversely, research has also indicated a non-statistical significance regarding location and diabetes (Ponomarev et al., 2022). The research by Bujawati et al. was conducted in an area with the highest prevalence of type 2 diabetes mellitus. Using a quantitative approach and a cross-sectional design, the authors conducted purposive sampling on 210 respondents. The results found differences in the consumption of sugar-sweetened beverages ($p < 0.032$), fast food consumption ($p < 0.044$), physical activity ($p < 0.001$), and economic status ($p<0.04$) of people diagnosed with type 2 diabetes in urban and rural areas.

Similarly, Molina et al. (2022) also conducted a study to analyze the associations between the risk of developing T2D and setting on the Colombian north coast. The authors used a cross-sectional design and interviewed 1005 members of an urban community and a rural indigenous population. The results indicated that urban communities are more likely to have T2D than rural-indigenous populations. On the contrary, Ponomarev et al. (2022) carried out a retrospective analysis of health indicators among patients with type 1 and type 2 diabetes mellitus residing in both urban and rural areas of the Saratov region. The study utilized data from the Federal Register of Patients with Diabetes, which contained information on the urban and rural population of

the study population. The results revealed high levels of disability, morbidity, and mortality in patients with type 1 and 2 diabetes living in rural areas.

Additionally, no evidence of a statistically significant relationship between morbidity, mortality, disability levels, the incidence of complications, and the residential location of patients with type 1 and type 2 diabetes was found. This research on location is essential to my study as I will also be assessing the relationship between rural-urban location and diabetes using national data. Hence, the results of previous studies can inform my results and discussion.

Modifiable Risk Factors and Diabetes

Smoking and Diabetes

Smoking is a risk factor for diabetes among adults (Wu et al., 2022). Smoking accounts for 6.3% of the burden of diseases worldwide and is linked to cancer in many organs, cardiovascular diseases, respiratory diseases, reproductive effects, and many more harmful effects. In Jamaica, tobacco use has been an ongoing public health concern as Jamaicans spend over 40% of their yearly income on tobacco-related products (McLeary et al., 2022). According to the World Health Organization (WHO) (2023a), a healthy diet, regular physical activity, a normal body weight, and avoiding tobacco use can help in the prevention or delay of the onset of type 2 diabetes. Multiple studies have provided evidence that smoking is linked to ill-health (Hashemi-Aghdam et al., 2022; Mukong, 2020). Mukong asserted that smoking harms almost all organs in the body and contributes to the increase in the burden of non-communicable diseases globally. Hashemi-Aghdam et al. (2022) conducted a cross-sectional study to evaluate the trend of

passive smoking and related determinants during the three phases of a school-based surveillance program. The results of the study supported other findings that passive smokers, like active smokers, are at increased risk of developing non-communicable diseases.

Sia et al. (2022) conducted a retrospective cohort study among 3044 eligible men who had been newly diagnosed with type 2 diabetes. The study sought to examine the extent of the association between smoking and glycemic control. The findings revealed that smoking was independently associated with unfavorable glycemic control among men with newly diagnosed T2D. A study by Kessler et al. (2020) also found an association between smoking and diabetes. Kessler et al. sought to evaluate 9-year all-cause mortality risk attributable to modifiable risk factors among older English and Brazilian adults using the English Longitudinal Study of Ageing and the Bagé Cohort Study of Ageing. The five modifiable risk factors that were assessed are smoking, hypertension, diabetes, obesity, and physical inactivity. The results showed more similarities than differences, with physical inactivity and current smoking having the strongest association. The study is related to my current study because it assessed the association of smoking as a modifiable risk factor for diabetes. As such, it will facilitate the comparison of the findings with my study.

Alcohol Use and Diabetes

The World Health Organization (2023b) posits that alcohol is a toxic, psychoactive, and dependence-producing substance, and there is no safe amount that does not affect health. The WHO further stated that the risks of alcohol consumption start with

the first drop, and no studies have yet shown that the potential benefits of light to moderate drinking for cardiovascular diseases and type 2 diabetes outweigh the increased cancer risk associated with these consumption levels for individuals. Oshi et al. (2021) stated that limited information is available on alcohol use among the elderly in Jamaica; however, the available evidence suggests that alcohol is the most frequently used substance across all age groups. Moreover, in Jamaica, the mean age of initiation of alcohol consumption is 12.6 years, and the prevalence peaks between 25 and 34 years, while elderly persons aged 65–74 years have the lowest prevalence (Oshi et al., 2021).

Song and Lin (2023) mentioned that alcohol consumption is said to be associated with the incidence of type 2 diabetes. The researchers further stated that their study was done to address the gap of inconsistent results across different studies. Hence, Song and Lin conducted a study using secondary data from a retrospective Japanese cohort. The study utilized 15,464 participants to examine the relationship between alcohol consumption and the incidence of T2DM among Japanese men who attended regular medical examinations at a hospital. The study found that heavy alcohol consumption was independently associated with an increased risk of new-onset T2DM. This study is important to my research in that my research also aims to determine if a relationship exists between alcohol consumption and diabetes. My research will also be using secondary data from a national dataset.

Other studies have found that the frequency of alcohol consumption plays a major role in influencing an association between alcohol consumption and diabetes (Wu et al., 2021). The research by Wu et al. (2021) used the Henan Rural Cohort study. It aimed to

identify the prevalence of alcohol consumption and further explore the relationship between alcohol consumption and type 2 diabetes mellitus. The study included 39,259 participants aged 18 to 79 years. The findings show that among men, alcohol abstinence was associated with an increased risk of T2DM; however, current drinkers were not associated with T2DM. Also, further analysis of alcohol drinkers revealed that only high-risk drinkers were at increased risk of T2DM compared to those who were never drinkers. Similar results have been found in other research wherein the risks of diabetes were significantly higher for non-drinkers compared to social drinkers (Lai et al. 2019). Also, individuals who consumed one drink per day had a lower risk for type 2 diabetes (Hinkle et al., 2021).

Hypertension and Diabetes

In the year 2000, there were 972 million hypertensive adults globally, with a projected 60% increase to 1.56 billion by 2025 (Alsaadon et al., 2022). The prevalence of hypertension among people with diabetes is estimated to be around 70% in the United States (Sethi et al., 2023). According to the Ministry of Health and Wellness, Jamaica (2019), 1 in 3 Jamaicans are hypertensive, and four out of every 10 Jamaicans with hypertension are unaware of their status. The report from the Ministry also mentioned that the country had seen a notable increase in the prevalence as the number of individuals diagnosed with high blood pressure in the 15-74 age group grew from 20.9% in 2001 to 31.5% in 2017. There is a paucity of information on hypertension as a modifiable risk factor for diabetes, as most studies posit that both diseases coexist and synergistically increase cardiovascular morbidity and mortality (Sethi et al., 2023). The

author also mentioned that most patients with Type 2 diabetes reported having hypertension at diagnosis (Sethi et al., 2023).

Diabetes

Diabetes is deemed a global epidemic of public health concern (Urrutia et al., 2021). The WHO defines diabetes as a chronic disorder resulting from either inadequate insulin production or the inability of the body to use the insulin produced (World Health Organization, 2023a). The disease frequency has been gradually increasing over the last decade and is thought to be associated with an aging population and lifestyle changes promoting obesity (Urrutia et al., 2021). Formerly, diabetes 1 was associated with illness among children, and type 2 was only associated with adults; however, in recent times, the incidence of type 2 diabetes among children has increased frequently (World Health Organization, 2023a). The number of people diagnosed with diabetes increased from 108 million in 1980 to 422 million in 2014 (World Health Organization, 2023a).

In 2019, diabetes was the cause of 1.5 million deaths, and 48% of deaths due to diabetes occurred before the age of 70. In 2021, approximately 537 million people worldwide were living with diabetes, and this figure is expected to increase to 643 million by 2030 and to 783 million by 2045 (International Diabetes Federation (IDF), 2023). The increasing prevalence of diabetes can give rise to a subsequent increase in the social and economic impact resulting from the complications associated with the disease (Urrutia et al., 2021). The incidence and prevalence of the disease and the effect on health outcomes occur across diverse populations irrespective of their demographic profiles.

Hence, the World Health Organization advanced that diabetes has become a global priority health problem requiring urgent interventions (Urrutia et al., 2021).

The increased prevalence of diabetes has been recorded mainly among low- and middle-income countries (International Diabetes Federation (IDF), 2023). According to the literature, Type 2 diabetes is mostly preventable; however, more than 90% of people with diabetes have type 2 diabetes (International Diabetes Federation (IDF), (2023). Gallardo-Rincón et al. (2021) advance that prevention is possible if attention is given to the risk factors, early diagnosis, and adequate treatment that prevent long-term complications of the disease. According to Gallardo-Rincón et al. (2021), the national prevalence of diabetes in Jamaica stood at 11.3%, and the comorbidity rates across the Caribbean suggest that the incidence and prevalence of type 2 diabetes may continue increasing. Jamaica's population has approximately 2.7 million people and over 200,000 cases of Type 2 Diabetes Mellitus within the population (Adeniyi, 2021). Furthermore, this number is projected to increase by an additional 33,000 by 2030 (Adeniyi, 2021). Hence, it is evident that an effective intervention is needed to manage the potential social and economic impact on a developing country such as Jamaica.

Covariates

Research has shown that factors such as age, gender, education, marital and unemployment status may increase the risk of morbidity and mortality associated with diabetes mellitus (Pinchevsky et al., 2020). Shirin Sara et al. (2023) conducted a study to analyze the prevalence of type 2 diabetes and the risk factors using the Bangladesh Demographic and Health Surveys (BDHS) dataset. The study used data from

the BDHS 2011 and the BDHS 2017-18 survey, which had a population of 7565 (50.6% female) and 12,299 respondents (56.9% female), respectively. The findings revealed a significant correlation between diabetes status and gender, age, wealth status, physical activity, BMI, and caffeinated beverage consumption. The authors also concluded that older people and individuals with lower education are more likely to develop diabetes.

Age and Diabetes

The prevalence of younger-onset type 2 diabetes has seen an increase over the years and is no longer seen as a disease affecting only middle-aged and older adults (Hao et al., 2022). This has resulted in individuals with type 2 diabetes having the illness for a longer period (Morton et al., 2022). These individuals will also be at risk for several major diabetes-related complications and a possible increased burden of non-communicable disease management on the health system (Morton et al., 2022). Consequently, understanding the risk factors of diabetes can form the platform for much-needed interventions. Studies have shown an association between age and the risk of developing diabetes (Ge et al., 2022; Waqar et al., 2023). Ge et al. (2022) stated that an association exists between obesity and type 2 diabetes mellitus (T2DM). Yoo et al. (2023) conducted a study using secondary data and over 4.1 million people without diabetes from the Korean National Health Insurance Service data. The study evaluated and assessed the impact of obesity on the development of DM for two age groups (40 and 66-year-olds). The findings showed that the impact of general and abdominal obesity on the development of diabetes mellitus (DM) varied by age. Among older adults, abdominal obesity had a stronger association with DM development than general obesity.

Gender and Diabetes

According to Muilwijk et al. (2022), men and women have a different risk of diabetes; however, limited research has been done on gender and type 2 diabetes. Thus, the authors conducted a study to explore the association of six gender-related characteristics with incident T2DM over three years and the mediation by known risk factors for T2DM. The study utilized a multi-ethnic population and a sample size of 9605 women and 7080 men of the multi-ethnic HELIUS study. The results showed that 198 (2.1%) women and 137 (1.9%) men developed T2DM; individuals who were not primary earners were at lower risk of type 2 diabetes but had more significant need for social support. Additionally, the type of employment and male- or female-dominated occupation were not associated with T2DM incidence. No evidence was found for effect modification by biological sex or ethnicity. The authors, therefore, concluded that gender-related characteristics, such as not being the primary earner and having a higher desired social support system, were associated with reduced T2DM risk, and known risk factors did not mediate this for T2DM.

Hao et al. (2022) posit that early-onset T2DM is a clinical condition affected by genetic and environmental factors. Hao et al. also mentioned that the age of diagnosis of T2DM has changed, wherein a trend toward a younger age is noticeable. Thus, the authors conducted a study investigating the association between diabetic family history and gender with the diagnosed age of T2DM. The survey consisted of 3,725 patients who were registered at a diabetes center in China. The findings revealed that when the male parent has diabetes, then the male patients are diagnosed with T2DM earlier.

Education and Diabetes

According to Oshio and Kan (2019), there is documented evidence that health outcomes are closely related to the level of education and incidences of non-communicable diseases (NCDs). Likewise, research has proven that lower levels of education are related to higher incidence and prevalence of non-communicable diseases (Oshio & Kan, 2019). More specifically, studies have also shown that an association exists between individuals' educational level and the incidence of type 2 diabetes (Hawkins et al., 2022; Urrutia et al., 2021). Mathisen et al. (2020) conducted a longitudinal cohort study to investigate the contribution of differential exposure and differential susceptibility to being overweight/obese to educational inequality in type 2 diabetes incidence. The study population included 53,159 Danish men and women aged 50-64 years who were followed for 14.7 years. The results revealed that a low and medium education level was associated with additional cases of type 2 diabetes when compared to individuals with a high level of education. A study by Hawkins et al. (2022) revealed similar findings as their research revealed an incidence rate of 9.8/1000 person-years of T2D in the elderly population and concluded that the risk of T2D was associated with a lower income and educational level.

Employment Status and Diabetes

It is well-established that an association exists between individuals' socioeconomic status and health (Lago-Peñas et al., 2021). Safieddine et al. (2020) mentioned that the indicators of education, occupation, and income are often used interchangeably to reflect the socioeconomic status of individuals when investigating

social inequalities in health. However, evidence suggests that each indicator measures different aspects of life and influences health differently. As such, Safieddine et al. conducted a study to examine the prevalence of T2D in three population subgroups: employed individuals, nonworking spouses, and pensioners from 2013 to 2017. The findings revealed that T2D prevalence was four times higher in male nonworking spouses (24.2%) and 2.6 times higher in female nonworking spouses (12.7%) compared to employed men (6.4%) and women (4.7%), respectively. In comparison, it accounted for 40% of men and 36% of women who were pensioners.

Critique of Research Methods

Different researchers utilized various study designs, and the approaches used were consistent throughout and clearly outlined, which could, therefore, facilitate the replication of the research methods. The dominant methodology used was the quantitative approach, which was considered appropriate as the researchers sought to collect numerical data to examine and assess the relationships between the variables under study. Most of the studies utilized cross-sectional designs; however, systematic reviews, longitudinal, retrospective, and prospective designs were evident. Likewise, the studies used various types of regression and multivariate analysis to determine the association between the variables. It was also observed that quite a bit of the research looking at diabetes and its risk factors utilized secondary data taken from available national health survey databases. As such, in most cases, the sample sizes were large, represented the population under study, and therefore facilitated the generalization of the findings.

One weakness in some methodologies was that in some cases where archival data was utilized, areas such as the procedure used to gain access to the dataset and recruitment procedures for the main study were inadequate (Kang et al., 2021; Wu et al., 2022). There were also instances where the study design was mentioned; however, no information was provided on the appropriateness of the design for the research (Takahashi et al., 2022; Elgart et al., 2022).

Summary and Conclusions

Non-communicable diseases (NCDs) are major contributors to global morbidity and mortality. The four primary categories of NCDs include cardiovascular diseases, cancers, respiratory diseases, and diabetes. Based on the literature presented, there is no doubt that diabetes remains a public health issue with the potential to become a significant socioeconomic problem globally and in developing countries such as Jamaica. Type 2 diabetes prevalence has been steadily increasing in the Caribbean for the past three decades and stood at 15% in 2019, thereby causing it to become one of the most urgent public health problems to undertake in the region (Gallardo-Rincón et al., 2021). Thus, the focus of this study will be diabetes (type 2), as the literature suggests that the increased risk of early death for adults with diabetes is 60% higher than for adults without diabetes due to a higher risk of severe health complications.

In Jamaica, the prevalence rate for diabetes in 2019 was 11.3%, and based on the projections across the Caribbean, there is a strong need to create evidence-based solutions aimed at preventing and managing type 2 diabetes and its potential complications (Gallardo-Rincón et al., 2021). To date, no study in Jamaica has examined the

relationships among household socioeconomic variables and Type 2 diabetes. Also, only a few studies have examined the modifiable diabetes risk factors in Jamaica. Therefore, this study aims to bridge this gap by adding to the body of knowledge and providing information that can be used to plan evidence-based interventions as we advance.

Chapter 3 will include the proposed research design and rationale, methodology, population, sampling, sampling procedures, instrumentation, and data analysis plan I will use. In addition, the chapter will include threats to validity and ethical guidelines to be followed.

Chapter 3: Research Method

Diabetes is a global public health epidemic with the potential to impact the health outcomes of individuals and cause economic crisis in a country. The purpose of this quantitative study was to determine the relationship between household socioeconomic status, modifiable risk factors, and diabetes among adults in Jamaica. The variables and related questions from the JSLC 2019 dataset are presented. In this chapter, I provide an overview of this quantitative cross-sectional study. I present information on the research design and rationale for its selection, the sampling strategy, and target populations. It also explains the methodology, threats to validity, and ethical approach to be used to examine the relationship between the dependent and independent variables.

Research Design and Rationale

I aimed to explore the relationship between household socioeconomic status, modifiable risk factors, and diabetes status. I used the following research questions to guide my study.

RQ1: Is there a statistically significant relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment?

RQ2: Is there a statistically significant relationship between the modifiable risk factors (alcohol, smoking, hypertension) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment?

RQ3: To what extent do household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) predict diabetes while controlling for age, gender, education, and employment?

I used a quantitative method as it allowed for the collection and analysis of numeric data to explain a phenomenon of interest. The quantitative approach is appropriate for this study because it can be used to test hypotheses, generalize the results to the population, and examine the relationships between independent and dependent variables (Burkholder et al., 2020). As observed, a vast majority of the literature I found used a cross-sectional design to determine associations between the variables. Cross-sectional designs are a form of observational study in which the researcher simultaneously measures both the outcomes and exposures of the study participants (Wang & Cheng., 2020). Furthermore, cross-sectional designs facilitate data collection at a single point in time and are inexpensive and easy to conduct to attain results and make conclusions (Wang & Cheng., 2020). Additionally, a cross-sectional design is appropriate if used to test assumptions regarding potential relationships outlined in the research questions (Taris et al., 2021). Therefore, this design facilitated answering the research questions outlined in my study.

Of note, however, is that cross-sectional designs also have some disadvantages. One such disadvantage is that cross-sectional designs are prone to sampling bias because the targeted sample population is usually chosen from a larger heterogenous population (Wang & Cheng., 2020). Furthermore, cross-sectional designs do not facilitate

assessment of the incidence of a disease, nor does it allow researchers to make a causal inference (Wang & Cheng., 2020). Hence, only correlational associations can be inferred. Therefore, because I aimed to explore the relationship between the above-mentioned independent variables of interest and diabetes, a cross-sectional study design facilitated acquiring the required responses to answer the research questions. Also, a cross-sectional study design was appropriate for use in the evaluation of population-based surveys such as the dataset that I will be using. As such, the information garnered could advance knowledge by providing evidence-based information to inform population-based strategies and policies going forward.

Methodology

Population

The study population for this study was adults 18 years and older who participated in the 2019 JSLC survey. Based on the information in the data dictionary, the sample size is estimated to be approximately 13,109 participants, 561 of which reported having diabetes.

Sampling and Sampling Procedures

The study sample consists of secondary data that was obtained from the JSLC 2019 dataset. The use of secondary data for this study was beneficial because it facilitated the use of a large population-based survey to conduct research. Additionally, an advantage of using secondary data for this study was that it saved time on data collection, was easily accessible to the public, and was economical. The sample dwellings included in the JSLC were a random subset of approximately one-third of the preceding Labour

Force Survey. They were used to facilitate the linkage of the data from both surveys. The survey used a two-stage stratified random sample as the sampling methodology, with the first stage being the selection of enumeration districts (ED) and the second stage involving a selection of dwellings. In the first stage, the selection of the EDs were grouped into sampling regions (SR) of approximately equal size in terms of the number of dwellings. Then, two EDs were selected from each sampling region with probability proportionate to size. Additionally, in each ED, a list of dwellings was prepared, which became the framework for the selection of the master sample of dwellings for the labor force.

The target population for the survey was all adult residents of Jamaica. The sample size was 4,547 households and 13,109 individuals, and each questionnaire was administered at each household to the household head or a representative. For my research, the target population included adults 18 years and older who reported being diagnosed with diabetes, as well as a control group of those who did not report having diabetes. Only data from the JSLC 2019 dataset was included in the study. Additionally, only data concerning the topic of interest was made available to the researcher. The use of similar data collected and stored in other databases was excluded from the study. Data collected in previous years was also excluded from the study.

The dataset used for this study is the most recent publication in 2019 for Jamaica. While the number of respondents in the dataset was 13,109, only about 560 reported they had been diagnosed with diabetes. The sample size was calculated using G*Power 3.1.9.7 (Kang, 2021). This software was chosen because it is free statistical power analysis

software that is available online and easy to use. The G*Power 3.1.9.7 facilitated the calculation of sample size based on a statistical test. Thus, using G*Power, the two-group independent means statistical *z* test, the parameters of a significance level of α=0.05, an effect size of 0.15, power ($1 - \beta$) of 0.95, and a two-tailed test were entered into the calculator parameters. This resulted in a sample size showing that the minimum number of responses should be 1,188. Since the data set had at least 500 participants with the disease and thousands without the disease, it exceeded the minimum requirements, and all respondents with complete information were included in the study.

Procedures for Recruitment, Participation, and Data Collection

The STATIN was the organization responsible for the surveys, and the data was collected face-to-face at the individual dwellings across all fourteen parishes of Jamaica (Planning Institute of Jamaica, 2022). To create awareness and increase participation, prior to visits by STATIN, a national sensitization is normally conducted via the different media houses to inform the population of the impending visits by the team from STATIN (Planning Institute of Jamaica, 2022). Following this, the employees of STATIN are deployed to enter each community within the respective parishes and conduct interviews at each household. The head of each household was targeted, and where such individuals were absent, another member of the household who met the inclusion criteria was interviewed. The interviewers requested and encouraged consent; however, signed consent was not required to participate. The questionnaire data is the source of self-reported data collected face-to-face.

Archival Data Use

The JSLC is a series of the JSLC and is a living standards measurement survey that monitors the social conditions of the Jamaican populace and tracks the effects of social and economic programs and policies (Planning Institute of Jamaica, 2021). The first survey was conducted in 1988 jointly between the STATIN and the Planning Institute of Jamaica (2021). The data retrieved continues to play a vital role in advising policies and programs and measuring the living standards of Jamaican households (Planning Institute of Jamaica, 2021). The JSLC is an interviewer-administered survey that collects data from all 14 parishes throughout Jamaica. Concerning diseases, the survey captures data on thirteen chronic illnesses or diseases that are among the leading causes of death and or disability within the populace. The data garnered from the survey facilitates evidence-based policy analysis and guidance for the allocation of government resources and services (Planning Institute of Jamaica, 2021).

Access to the Dataset

The required dataset was not readily available to the public; hence, permission was sought to access it via an online application. There were no constraints experienced in accessing the dataset as an initial contact was made, and the requirements for access were clearly outlined and followed. Access entailed signing an agreement form that covered areas such as confidentiality, copyright, access to others, errors, liability, and the like. The dataset was provided at no cost; however, one of the conditions is that the user acknowledges the source of the data. In addition, the following criteria were required, and consent submitted prior to the release of the dataset:

- applicant submits an abstract or a detailed description of the research project that will be using the data
- applicant must complete, sign, and submit the data application form to the relevant unit
- data sets obtained from the Databank must only be used for academic research or teaching
- the user informs the Databank of any errors in the data set
- the user does not pass the data set to other researchers without written permission from the Databank
- the user is to provide the Databank with at least one copy of any publication, paper, or report produced based on the data set
- the user should cite the data set in all reports emanating from the use of the data set
- Only questions or variables pertinent to the area of interest will be provided (especially for large surveys with multiple records like the JSLC).

Instrumentation and Operationalization of Constructs

The operationalization of constructs for this study includes household SES, modifiable risk factors, and diabetes. A total of seven independent variables, one dependent variable, and four covariates were used in the study. Each variable, the name and type of variable, the level of measurement, and response options within this study are presented in Table 1. The first independent variable associated with household SES is the wealth index. This variable is used as the data set had a paucity of information related to

income. As such, household assets ownership and housing characteristics such as land, home, motor vehicle ownership, internet, water source, electricity, excreta disposal facility, type of housing structure, car//bicycle ownership were used to form a wealth index (low and medium/high economic status) using a method known as PCA. According to Cao et al. (2020), PCA is a standard factor analysis method used to describe variation in a set of variables as linear combinations of the original variables to explain variation in the original data while being uncorrelated with other linear combinations. To perform PCA on the variables, the qualitative categorical variables were recoded as binary variables. Then, all the variables were entered into SPSS and calculated.

The second independent variable was social welfare/ external financial support. For this study, social protection referred to any financial support received either from the government or other sources that could supplement the financial resources of the households. The independent variable location referred to the geographic residence of the respondents and seeks to determine if they reside in rural or urban areas. The fourth independent variable was health insurance, and referred to the attainment of additional support to improve access to health care services. As such, I used it to determine if the respondents had health insurance.

Hypertension referred to the health status of the respondents and whether they have been diagnosed with hypertension. Smoking referred to smoking habits and seeks to determine whether the respondents smoked and the frequency of those who smoked. Alcohol use referred to the consumption habits regarding alcohol. This variable was also re-coded to yes or no for alcohol use within the last 7 days.

Four covariates were used. They were age, gender, level of education and employment. Age referred to the actual age of the respondents. This variable was re-coded to five intervals with the age groups 18-28, 29-39, 40-50. 51-61 and 62+. Gender referred to respondents who are of the male and female sex. Level of education referred to the highest level of education that the respondent attained. Employment referred to whether the respondents were employed at the time of data collection. This variable was re-coded as a binary variable to use yes or no options.

The dependent variable was diabetes, which is referred to as Type 2 diabetes, which is the most common type and the type that affects adults (Duncan et al., 2020). Also, I used data on individuals who reported that they had been diagnosed with the disease at the time of data collection. It is a categorical variable.

Table 1

Study Variables, Variable Name, and Measurement Scale

Research question	Variable name	Level of measurement	Variable type	Response options
RQ 1, 2, &3	Diabetes status	Categorical	Dependent	Yes/No
RQ1	Wealth index	Ordinal	Independent	Low, medium/high economic status 1st quartile - low 2nd quartile – medium/ high
Social Welfare External / Financial Support		Categorical	Independent	Received assistance from PATH? Yes/No
Health Insurance		Categorical	Independent	Are you covered by any health insurance? Yes/ No
Location				Rural____Urban
RQ2	Smoking	Categorical	Independent	Smoke any of the following products: a. Cigarettes b. Ganja/ Marijuana c. electronic cigarettes d. Hookahs (water pipes) e. Cigars yes, daily. yes, but not every day. no, no longer smoke, no, I have never smoked. no response
	Alcohol use	Categorical	Independent	During the past 7 days, has this household spent money on or

Research question	Variable name	Level of measurement	Variable type	Response options
				received as a gift any of the following items? a. Alcoholic beverages (beer) b. Alcoholic beverages (rum, whisky, wine, sherry.)
RQ2	Hypertension	Categorical	Independent	Yes No
RQ1,2, & 3	Age	Interval	Covariate	18-28, 29-39,40-50. 51-61 62+____
	Employment	Categorical	Covariate	1. Employee of Central or Local Govt. 2. Employee of Other Govt Agencies.. 3. Employee of Private Sector.... 4. Unpaid family worker.. 5.Employer..
	Education	Ordinal	Covariate	1.Junior High School Certificate 2. Grade Nine Achievement Test 3. CSEC Basic/JSC 5/SSC.3rd JL 4.CSEC General/GCE O Level 5. Associate degree/NVQJ Level 4 Undergraduate degree/NVQJ Level 5

Research question	Variable name	Level of measurement	Variable type	Response options
				Higher degrees and professional qualification
	Gender	Categorical	Covariate	1. Male 2. Female

Data Analysis Plan

Statistical Analyses

For this study, I conducted a predictive analysis using secondary data collected from the state-based dataset known as “The Jamaica Survey of living conditions.” The Statistical Package for the Social Sciences (SPSS) version 29 was used to conduct the descriptive and inferential statistical analysis.

Data Cleaning and Screening

Data cleaning and screening were done to remove incomplete and erroneous data within the dataset. Ayilara et al. (2019) mentioned that conducting an analysis with missing data negatively impacts precision and increases bias in the study. Hence, a missing value analysis was done to identify and remove all missing data within the data set. Additionally, since the choice of methodology for handling missing data might impact conclusions drawn from a regression model that includes the use of categorical data, the multiple imputation method was employed to handle the missing data found in the data set (Stavseth et al., 2019). This was done by importing the dataset into SPSS, selecting multiple imputations, imputing missing data values, and then selecting all variables that have missing values, selecting the monotone method, and performing five

imputations in sequence. The pooled data set from the imputation models was then used to create a new data set that was used for the data analysis.

Data screening seeks to evaluate data properties and data quality to protect the integrity of the analysis and interpretation of the data (Huebner et al., 2020). Therefore, after importing the dataset into SPSS, the data view was checked to ensure that the information presented in the SPSS data view reflected the information of the original data. In the data view of SPSS, I selected analyze, then descriptive statistics, then frequencies, highlight and sent over variables of interest, and selected ok. A review of the frequency tables did not reveal any errors in the dataset. Hence, I proceeded to analyze the new dataset.

Research Questions and Hypotheses

The following research questions were addressed in this study:

RQ1: Is there a statistically significant relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and diabetes status among adults in Jamaica while controlling for age, gender, education, and employment?

Ho1: There is no statistically significant relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and diabetes status among adults in Jamaica while controlling for age, gender, education, and employment.

$H_1 1$: There is a significant relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and

diabetes status among adults in Jamaica while controlling for age, gender, education, and employment.

RQ2: Is there a statistically significant relationship between the modifiable risk factors (alcohol, smoking, hypertension) and diabetes status among adults in Jamaica while controlling for age, gender, education, and employment?

$H_0$2: No statistically significant relationship exists between modifiable risk factors (alcohol, smoking, hypertension) and diabetes status among adults in Jamaica while controlling for age, gender, education, and employment.

$H_1$2: A statistically significant relationship exists between diabetes modifiable risk factors (alcohol, smoking, hypertension) and diabetes status among adults in Jamaica while controlling for age, gender, education, and employment.

RQ3: To what extent do household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) predict diabetes status while controlling for age, gender, education, and employment?

Ho3: household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) do not predict a statistically significant relationship with diabetes status while controlling for age, gender, education, and employment.

$H_1$3: household Socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol,

smoking, hypertension) do predict a statistically significant relationship with diabetes status while controlling for age, gender, education, and employment.

Analysis Plan

Descriptive statistics were used to depict the characteristics of the study sample, and inferential statistics were used for the hypothesis testing analyses. The inferential statistics used was a logistic regression analysis to investigate the relationship between the independent and dependent variables for research questions 1 and 2. Logistic regression was also used to determine if the independent variables would predict a diabetes outcome for research question 3. The descriptive analysis included calculations of the frequency, count, and percentage distribution of all the variables. Inferential statistical analysis was also used to test the hypotheses associated with all three research questions.

Table 2

Description of Research Questions and Variables

Research questions	Independent variables (IV) and measurement	Dependent variables (DV) and measurement	Statistical analysis
RQ1	Wealth Index (Ordinal) Social welfare/ external financial support (Categorical) Health insurance (Categorical) Location (Categorical) Age, gender, employment, educational level (Categorical)	Diabetes status (Categorical)	Descriptive (frequency distribution) logistic regression (binary logistic regression)
RQ2	Smoking (Categorical) Alcohol use (Categorical) Hypertension (Categorical) Age, gender, employment, educational level (Categorical)	Diabetes status (Categorical)	Descriptive (frequency distribution) logistic regression (binary logistic regression)
RQ3	Wealth index, social welfare, health insurance, location, hypertension, alcohol use, smoking; (categorical) Age, gender, employment, educational level (categorical)	Diabetes status (Categorical)	Descriptive (frequency distribution) Multivariate logistic regression (binary logistic regression)

Note. The statistical significance level is set at $p < .05$

To perform the logistic regression analysis, SPSS Version 29 was opened, then data view, select binary logistic, select the dependent variable, the independent variables, including the covariates, as well as the options of statistics and plots. The covariates were also included in the analysis to facilitate an explanation regarding the strength of the relationship between the variables being assessed and to determine if there were other variables influencing the dependent variable. The Cox and Snell R Square and Nagelkerke R Square were included to explain the variation in diabetes diagnosis, while the Wald test was performed to help determine the statistical significance of each independent variable.

The significance of the study was based on the *p*-value estimates derived from the results of the statistical tests. As such, where the *p*-value is less than the predetermined alpha value of 0.05 ($p < 0.05$), the finding is statistically significant, and in that case, the null hypothesis will be rejected. On the other hand, if the *p*-value is greater than the predetermined alpha value of 0.05 ($p > 0.05$), then the *p*-value for the study finding is insignificant, and therefore, the null hypothesis will be accepted. Also, I used the level of confidence for all the estimated p-values as 95%, which means that the findings will not occur at random. The logistic regression Coefficient (*B*) will be interpreted as the change in the "log odds" associated with a one-unit change in the independent variable and expressed as Exp(B). When Exp(B) is 1.0 or higher, Exp(B) can be expressed as the percentage of the odds increase with a one-unit increase in the IV. As such, calculating Exp(B) will help determine the odds of having diabetes based on the associated independent variables.

Threats to Validity

The concept of validity refers to the accuracy of inferences according to the results and instruments (Dobakhti, 2020). Internal validity refers to the degree of confidence that the observed results are trustworthy and not influenced by potential confounding factors (Lin et al., 2023). External validity refers to the extent to which results from a study can be generalized to different situations, persons, settings, and measures (Hodson, 2022). Hence, it is important to examine the threats to the validity of this research to ensure that the requisite control measures are included. Construct validity examines the extent to which a given measurement scale measures the theoretical construct that it is expected to measure. The questionnaire regarding the Jamaica Survey of Living Conditions (JSLC) was developed and pre-tested by the Statistical Institute of Jamaica (STATIN). For this study, construct validity was addressed by ensuring that the measurements used were developed based on existing knowledge derived from the literature reviews and other resource materials.

The potential threats to the external validity of this study include interviewer and sampling bias. The data was collected by trained individuals from a wide variety of individuals across the entire country, and such data is deemed to have broader generalizability. Furthermore, the instrument used is available and can be used again to collect data and ensure the reproducibility of the study. Additionally, the inclusion criteria used would have ensured that the information related to the target population was the ones captured in the dataset. For this study, I minimized the threats to external validity by ensuring that the target population is clearly defined, an appropriate sampling

method is utilized, the methodology is clearly outlined to facilitate replication, confounding variables are controlled, and any limitations encountered are reported.

The possible threats to the internal validity of this study include instrumentation and selection bias. Instrumentation bias can refer to issues such as a change in the instrument used to collect the data. Only one data collection tool was utilized, and the data was collected by trained and experienced individuals at the Statistical Institute of Jamaica. Selection bias occurs when participants included in a study do not represent the target population of interest. Hence, selection bias was minimized in this study because the Jamaica Survey of Living Conditions (JSLC) is a cross-sectional survey that included adults across the fourteen parishes of Jamaica. Additionally, all homes were visited, and participants were selected and interviewed based on the established inclusion-exclusion criteria and consent to participate.

Ethical Procedures

Participation in the Jamaica Survey of Living Conditions (JSLC) is voluntary, and informed consent was obtained from every participant. The Jamaica Survey of Living Conditions does not provide personally identifiable information, and as such, the confidentiality of the participant's answers will be protected. Also, the data for this study was obtained from the University of the West Indies, and the information was coded to ensure the confidentiality of the participants' answers. Additionally, all answers to the survey questions are coded to ensure that the data cannot be traced back to a specific individual. Furthermore, all documents and data received and reviewed were saved in a password-protected server. Prior to accessing the dataset, Institutional Review approval

was sought from Walden University. Approval was granted by Walden University Institutional Review Board (IRB) with approval number 07-09-24-1018971.

Summary

The purpose of this study was to examine the connection between household Socioeconomic Status (wealth index, social welfare/ external financial support, location, health insurance), modifiable risk factors (alcohol, smoking, hypertension), and Diabetes status among Adults in Jamaica. In Chapter 3, I outlined the research design, approach, study methodology, data analysis plan, threats to validity, and their relationship with the research questions. I also outlined the ethical procedures that were used to determine the connection between the independent and dependent variables. In Chapter 4, I will explain the data collection method, data management, and the descriptive and inferential results of the study.

Chapter 4: Results

In this chapter, I will discuss the data collection process and present the data analysis associated with each research question. This quantitative study aimed to explore the connection between household socioeconomic status, modifiable risk factors, and diabetes status among adults in Jamaica. Three research questions were developed to explore the connection between the independent and the dependent variables.

The following research questions and hypotheses were addressed in this study:

RQ1: Is there a statistically significant relationship between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment?

$H_0$1: There is no statistically significant relationship between household socioeconomic status and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

$H_1$1: There is a significant relationship between household socioeconomic status and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

RQ2: Is there a statistically significant relationship between the modifiable risk factors (alcohol, smoking, hypertension) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment?

$H_0$2: No statistically significant relationship exists between modifiable risk factors and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

$H_1$2: A statistically significant relationship exists between diabetes-modifiable risk factors and diabetes among adults in Jamaica while controlling for age, gender, education, and employment.

RQ3: To what extent do household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) predict diabetes while controlling for age, gender, education, and employment?

$H_0$3: household socioeconomic status and the modifiable risk factors do not predict a statistically significant relationship with diabetes while controlling for age, gender, education, and employment.

$H_1$3: Household socioeconomic status and the modifiable risk factors do predict a statistically significant relationship with diabetes while controlling for age, gender, education, and employment.

Data Collection

After receiving the Walden University IRB approval to proceed to data collection (approval number 07-09-24-1018971) in July 2024, I contacted the University of the West Indies, Mona, one of the repositories of the dataset. Thereafter, I applied for the dataset and provided the requested materials, such as the abstract, application form, and a

signed agreement relating to the use of the dataset, confidentiality, copyright, access to others, errors, liability, and the like. I received the dataset electronically on July 15, 2024.

The data used in this study was initially collected by the STATIN during the JSLC 2018 survey. The data was collected face to face as a national survey that facilitates monitoring of the social conditions of the Jamaican populace and tracking the effects of social and economic programs and policies. While the survey targeted heads of household, one adult from the household who was 18 years or older and who was willing was interviewed in their absence. The dataset contained responses from approximately 13,109 individuals across the fourteen parishes in the country and is, therefore, representative of the general population.

The dataset was received as an SPS S data file. I then opened SPSS version 29 and cleaned the dataset to remove missing data, thereby reducing the number of responses for analysis to 11,206. As mentioned in Chapter 3, a few variables were re-coded. The independent variable alcohol was re-coded to yes or no. Additionally, three covariates were also re-coded. Age was re-coded to a categorical variable using five intervals with the age groups 18-28, 29-39, 40-50, 51-61, and 62+. Employment was re-coded to yes or no. Also, education was coded with the number 1 representing individuals whose highest academic examination was below that of the junior high level. Number 2 represents individuals whose highest academic examination included junior high school, an associate degree, and individuals who achieved higher degrees or professional qualifications.

The wealth index was then computed using SPSS. Before computing the new variable wealth index, a reliability analysis was conducted on the variables to ascertain Cronbach's Alpha value. A Cronbach's Alpha of .802 was achieved for the wealth index, which is a positive indicator of internal consistency and suggests that household items effectively form a coherent measure of wealth. The next step was to compute the variable using the method known as principal component analysis. To create the wealth index variable, I went to Transform > Compute Variable; in the dialogue box, the name of the target variable was inserted as well as the label. All the variables were then entered in parenthesis with an addition sign (+) after each variable; after all the variables were entered in the parenthesis, a division sign (/) was then placed outside the parenthesis, followed by the number of variables entered in the parenthesis. OK was then selected, and the wealth index variable was formed in the data set. The wealth index variable was then categorized using percentiles, and finally, the labels were added to classify the variable as low and medium/high. Thereafter, after reviewing to ensure that the information presented in SPSS data view reflected the information of the original data and all variables were accounted for, I then proceeded to the analysis with the new dataset consisting of seven independent variables, namely, household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension), four covariates (age, gender, education, and employment) and the dependent variable (diabetes; see Table 3).

Table 3

Study Variables and Variable Types

Study variables (household socioeconomic status)	Variable type
Wealth index	Independent
Social welfare/financial assistance	Independent
Geographic location	Independent
Health insurance	Independent
Modifiable risk factors	
Smoking	Independent
Alcohol use	Independent
Hypertension	Independent
Diabetes	Dependent
Age group	Covariate
Gender	Covariate
Education	Covariate
Employment	Covariate

Results

The descriptive statistics and frequency for the analyzed data are displayed in Tables 4 and 5. The final dataset used in the analysis represents 11,206 respondents. Table 4 shows the frequency and percentages of the variables used in the study. Concerning the demographic data, most of the respondents (28%) and (26%) fell in the age group 29 to 39 and 40 to 50, respectively. The data for gender revealed that there were more females (57%) than males (43%). Also, approximately 71% of the study population did not receive a junior high school certificate, and 93% were employed. (see Table 4).

Table 4

Demographic Characteristics of the Sample

Variables	Subcategories	Frequencies	Percentages
Age Group	18 To 28	2,025	18.0
	29 To 39	3,125	28.0
	40 To 50	2,886	26.0
	51 To 61	1,875	7.0
	62 and older	1,295	11.0
Education	None	7,926	71.0
	Secondary/Postsecondary	3,280	29.0
Employment status	Yes	10,413	93.0
	No	793	7.0
Gender	Male	4,778	43.0
	Female	6,428	57.0

Descriptive Statistics of Key Variables in the Study

A descriptive analysis of the key variables in the study revealed that most of the respondents (95%) did not report having diabetes. Approximately 56% of the sample population were in the category of medium/high economic status, and 44% fell in the low economic status category. The data also revealed that 49% of the sample population resided in rural areas, with 29% receiving social welfare and or external financial support. Also, 35% of the population reported that they had health insurance. The hypertension data shows that only about 15% of the population was so affected. In addition, most of the population did not report being smokers (91%) or alcohol users (83%; see Table 5).

Table 5

Descriptive Statistics of Key Variables

Variables	Subcategories	Frequency	Percentage
Diabetes	Yes	561	5.0
	No	10,645	95.0
Wealth index	Low	4,955	44.2
	Medium/high	6,251	55.8
Social welfare/	Yes	3,199	29.0
financial support	No	8,007	71.0
Health insurance	Yes	3,880	35.0
coverage	No	7,326	65.0
Hypertension	Yes	1661	15.0
	No	9545	85.0
Alcohol use	Yes	1904	17.0
	No	9302	83.0

Variables	Subcategories	Frequency	Percentage
Smoking	Yes	1009	9.0
	No	10197	91.0
Geographic	Urban areas	5683	51.0
location	Rural areas	5523	49.0

Statistical Assumptions

Logistic regression was used to explore the connection between household socioeconomic status, modifiable risk factors, and diabetes status among adults in Jamaica. Assumption testing is very important when conducting a logistic regression in that it ensures that the collected data can be analyzed using the method and, most importantly, that a valid result can be ascertained (Laerd statistics, n.d.). The first assumption for a logistic regression is that the dependent variable is dichotomous. This assumption was met as the dependent variable diabetes had two categories (yes or no). The second assumption is that the data to be analyzed should have one or more independent variables, which can either be categorical or continuous. This assumption was met as all independent studies used in the analysis were nominal variables. The third assumption requires independence of observations. This assumption was met as there was no evidence of duplication of responses from the respondents. The fourth assumption refers to linearity between any continuous independent variables and the log odds; however, no continuous variable was used in this analysis. Finally, a fifth assumption relates to the absence of multicollinearity among the independent and confounding variables. This assumption was met as the tolerance values and the variance inflation

factor (VIF) for the independent variables and covariates were well within the acceptable ranges, that is, closer to 1 and below 5, respectively (see Tables 6 and 7). This means that the logistic regression model used in the analysis is considered reliable to produce constant estimates.

Table 6

Collinearity Results for RQ1

	Unstandardized coefficients		Standardized coefficients			Collinearity statistics	
Model	B	*SE*	Beta	*t*	Sig.	Tolerance	VIF
1 (constant)	2.113	.021		99.841	<.001		
Location	-.048	.004	-.111	-11.765	<.001	.959	1.043
Employment status	.039	.008	.046	4.751	<.001	.894	1.119
Health insurance coverage	-.015	.005	-.032	-3.255	.001	.862	1.160
Gender	-.020	.004	-.046	-4.909	<.001	.986	1.014
Wealth index	.004	.004	.009	.953	.340	.952	1.051
Age group	-.026	.002	-.158	-16.258	<.001	.974	1.027
Social welfare/financial support	-.022	.005	-.045	-4.645	<.001	.928	1.078
Education	.021	.005	.043	4.580	<.001	.925	1.081

Table 7

Collinearity Results for RQ2

Coefficients							
	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	B	*SE*	Beta	*t*	Sig.	Tolerance	VIF
1 (Constant)	1.778	.024		74.372	<.001		
Employment status	.035	.008	.041	4.484	<.001	.997	1.003
Education	-.018	.004	-.037	3.947	<.001	.975	1.026
Hypertension	.104	.006	.170	17.708	<.001	.911	1.098
Gender	-.009	.004	-.020	-2.091	.037	.897	1.114
Smoking	-.002	.007	-.002	-.212	.832	.917	1.090
Alcohol use	-.005	.005	-.009	-.973	.331	.971	1.029
Age group	-.020	.002	-.114	-11.747	<.001	.894	1.118

No collinearity results for RQ3 are presented, as RQ3 was a combination of the variables for RQ1 and 2, which were used to conduct the predictive analysis. Thus, it would only be a replica of the figures presented in RQ1 and 2.

Research Question Results

Three research questions were addressed in the analysis. A binary logistic regression was used to test the research questions and hypotheses. RQ1 was designed to determine if a statistically significant relationship existed between household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment. The results show that the Omnibus Chi-square test for the model was significant ($p < .001$), suggesting that the overall model is statistically significant, thereby implying that a statistically significant relation existed between at least one of the predictors and diabetes. The Cox & Snell R^2 (.049) and Nagelkerke R^2

(.149) values indicate that the model explains approximately 4.9% to 14.9% of the variance in diabetes status. This is a modest effect size, meaning the predictors explain a small portion of the variation.

Table 8 shows the results for the variables in the equation and shows that the p-values for wealth index are not significant ($p > .05$), thereby suggesting that wealth index does not have a significant effect on diabetes. Social welfare/financial support was significant ($p < .001$), with an Exp(B) of 0.550, indicating that those receiving social welfare/financial support are 45% less likely to have diabetes than those not receiving social welfare/financial support. Location was significant ($p < .001$), with an Exp(B) of 0.319, suggesting that the specific location significantly reduces the likelihood of having diabetes. In this case, individuals living in urban areas are 68% less likely to have diabetes than individuals living in rural areas. Health insurance coverage was also significant ($p = .004$), with an Exp(B) of 0.734, implying that having health insurance coverage is associated with a lower likelihood of having diabetes. Therefore, individuals with health insurance are 27% less likely to have diabetes than those without health insurance coverage.

Education level was significant, with those having academic qualifications below the level of junior high having a p-value of <.001, and (Exp(B) = 1.584). This suggests that individuals with educational achievements below the secondary education category are about 1.584 times more likely to have diabetes when compared to those with secondary or higher education and higher degrees. Therefore, individuals with educational achievement below the level of secondary education have a 58% higher

chance of diabetes compared to individuals with a secondary and higher level of education. Employment was a significant variable with a *p*-value (<.001), indicating that employment status affects the likelihood of diabetes. The odds ratio of 3.536, (Exp(B) = 3.536) suggests that unemployed individuals are about 253% more likely to have diabetes compared to those who are employed. This finding implies that being employed significantly reduces the likelihood of diabetes when compared to those who are unemployed.

Gender was also a significant variable with a *p*-value (<.001), an Exp(B) of 0.623, indicating that the gender variable significantly affects the likelihood of diabetes. This indicates that males are about 0.623 times less likely to have diabetes compared to females. Additionally, there is a 38% reduced risk of diabetes in males when compared to females. All age groups are significant. Age Group 1 (18-28 years): *p*-value <.001 and Exp(B) = 0.173, Age Group 2 (29-39 years): *p*-value <.001 and Exp(B) = 0.163. Age Group 3 (40-50 years): *p*-value <.001 and Exp(B) = 0.088, Age Group 4 (51-61 years): *p*-value <.001 and Exp(B) = 0.046. This indicates that Individuals aged 18-28 have approximately an 83% lower chance of having diabetes compared to the reference age group 62 years and older. Individuals aged 29-39 have approximately an 82% lower chance of having diabetes compared to the reference age group of 62 years and older. Individuals aged 40-50 have approximately a 91% lower chance of having diabetes compared to the age group 62 years and older. Individuals aged 51-61 have approximately a 95% lower chance of having diabetes compared to the age group 62 years and older. These percentages show that younger age groups (18-28, 29-39, 40-50,

and 51-61) have a lower likelihood of having diabetes compared to the oldest age group 62 and older.

In summary, given the significant relationships identified for social welfare/financial support, location, health insurance, education, gender, and age, the null hypothesis (Ho1) was rejected as the data reveals that there is a statistically significant relationship between household socioeconomic status and diabetes status among adults in Jamaica while controlling for age, gender, education, and employment.

Table 8

RQ1 Variables in the Equation

Variables in the Equation

							95% CI for EXP(B)	
		B	*SE*	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step1[a]	Location (1)	-1.143	.100	129.548	1	<.001	.319	.262	.388
	Employment status (1)	1.263	.307	16.924	1	<.001	3.536	1.937	6.453
	Education	.460	.115	16.137	1	<.001	1.584	1.266	1.983
	Health insurance coverage (1)	-.310	.106	8.514	1	.004	.734	.596	.903
	Wealth index	.096	.093	1.066	1	.302	1.100	.918	1.319
	Gender (1)	-.473	.095	24.790	1	<.001	.623	.517	.751
	Social welfare/financial support (1)	-.598	.117	26.122	1	<.001	.550	.437	.692
	Age group			207.473	4	<.001			
	Age group (1)	-1.753	.298	34.522	1	<.001	.173	.097	.311
	Age group (2)	-1.815	.294	38.184	1	<.001	.163	.092	.290
	Age group (3)	-2.435	.293	69.147	1	<.001	.088	.049	.155
	Age group (4)	-3.073	.292	111.007	1	<.001	.046	.026	.082
	Constant	5.864	.385	232.279	1	<.001	352.127		

a. Variable(s) entered on step 1: Location, EMPLOYMENT STATUS, Education, Health Insurance Coverage, Wealth Index, Gender, Social Welfare/Financial Support, Age Group.

RQ2 was designed to explore if there is a statistically significant relationship between the modifiable risk factors (alcohol, smoking, hypertension) and type 2 diabetes status among adults in Jamaica while controlling for age, gender, education, and employment. A binary logistic regression was used to test research questions and hypotheses. The results revealed that the Omnibus Chi-square test for the model was significant ($p < .001$), suggesting that the overall model is statistically significant, thereby implying that a statistically significant relationship existed between at least one of the predictors and diabetes. The Cox & Snell R Square *(.049*) and Nagelkerke R Square (*.148*) values indicate that the model explains approximately 4.9% to 14.8% of the variance in diabetes status.

Table 9 reflects the results for the variables in the equation and shows that alcohol use had a B value of $B = -0.115$ and a p-value of $p = .395$. This suggests that there is no significant relationship between alcohol use and diabetes status when controlling for age, gender, education, and employment. Smoking had a B value of $B = -0.118$ and a p-value $> .05$ (p-value = *0.524*). This indicates that there is no significant relationship between smoking and diabetes status when controlling for age, gender, education, and employment. Hypertension had a B value of $B = 1.348$ and a p-value $< .05$ ($p < .001$). This indicates that there is a significant positive relationship between hypertension and diabetes status when controlling for the other variables. The odds ratio of ($Exp(B) = 3.851$) indicates that individuals with hypertension are approximately 3.851 times or 285% more likely to have diabetes compared to individuals without hypertension. Hence, based on the results, the null hypothesis was rejected because one of the modifiable risk

factors was statistically significant. Hypertension **s**howed a statistically significant relationship with diabetes status. However, alcohol use and smoking did not show a statistically significant relationship with diabetes status. Therefore, the data suggests that hypertension is a significant modifiable risk factor for diabetes among adults in Jamaica, while alcohol use and smoking are not significant predictors.

Table 9

RQ2 Variables in the Equation

Variables in the Equation

							95% CI for EXP(B)	
		B	*SE*	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Employment status (1)	1.300	.299	18.930	1	<.001	3.670	2.043	6.593
	Education	.375	.112	11.146	1	<.001	1.456	1.168	1.814
	Gender (1)	-.207	.100	4.289	1	.038	.813	.669	.989
	Age group			106.636	4	<.001			
	Age group (1)	-1.720	.298	33.288	1	<.001	.179	.100	.321
	Age group (2)	-1.803	.294	37.530	1	<.001	.165	.093	.294
	Age group (3)	-2.322	.294	62.148	1	<.001	.098	.055	.175
	Age group (4)	-2.569	.296	75.518	1	<.001	.077	.043	.137
	Smoking (1)	-.118	.185	.407	1	.524	.889	.618	1.278
	Alcohol use (1)	-.115	.136	.724	1	.395	.891	.683	1.162
	Hypertension (1)	1.348	.099	187.288	1	<.001	3.851	3.175	4.672
	Constant	3.675	.379	93.892	1	<.001	39.438		

a. Variable(s) entered step 1: EMPLOYMENT STATUS, Education, Gender, Age Group, Smoking, Alcohol Use, Hypertension.

RQ3 was designed to explore the extent to which household socioeconomic status (wealth index, social welfare/ external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) predict diabetes while

controlling age, gender, education, and employment. A binary logistic regression was used to test research questions and hypotheses. The results revealed that the Omnibus Chi-square test for the model was significant ($p < .001$), an indication that the overall model was statistically significant and thereby supporting the results from research questions I and 2 that at least one of the predictors significantly contributed to predicting diabetes status. The Cox & Snell R Square *(.063*) and Nagelkerke R Square (*.191*) values indicated that the model explained approximately 6.3% to 19.1% of the variance in diabetes status.

Table 10 offers a visualization of the results for the variables in the equation and shows that the p-value for the Wealth Index (Low) was not significant with $B = 0.085$ and p-value ($p=.369$), with an Exp(B) of *1.089,* suggesting that the wealth index does not have a significant effect on diabetes status. Social Welfare/Financial Support was significant with B = *-0.559* and p-value ($p < .001$), with an Exp(B) of *0.572*, indicating that those receiving social welfare/financial support are 42.8% less likely to have diabetes than those not receiving social welfare/financial support.

Location was significant with $B = -1.126$ and p-value ($p < .001$), with an *Exp(B)* of *0.324*, suggesting that the residential location reduces the likelihood of diabetes. Thus, in this case, individuals living in urban areas are 68% less likely to have diabetes than individuals living in rural areas. Health Insurance Coverage was also significant with $B = -0.270$ and p-value ($p < .012$), with an Exp(B) of *0.763*, implying that having health insurance coverage is associated with a lower likelihood of having diabetes. Therefore,

individuals who have health insurance are 23.7% less likely to have diabetes than those without insurance coverage.

Alcohol use had a B value of $B = -0.112$ and a p-value of $p = .419$. This suggests that there is no significant relationship between alcohol use and diabetes status when controlling for the other variables. Smoking had a B value of $B = -0.020$ and a p-value > .05 ($p = 0.917$). This indicates that there was no significant relationship between smoking and diabetes status when controlling for the other variables. Hypertension had a B value of $B = 1.316$ and a p-value < .05 ($p < .001$). This indicates that there is a significant positive relationship between hypertension and diabetes status when controlling for the other variables. The odds ratio of ($Exp(B) = 3.729$) indicates that individuals with hypertension are approximately three times or 273% more likely to have diabetes compared to individuals without hypertension.

Based on the results, the null hypothesis was rejected as the data revealed statistically significant relationships between hypertension, location, health insurance coverage, and social welfare/financial support, and diabetes status among adults in Jamaica. The percentages shown in the results indicate the strength and direction of the relationship between these predictor variables and diabetes status, with hypertension being a very strong positive predictor and the other significant variables (location, health insurance coverage, social welfare/financial support) being protective factors against diabetes. The variables alcohol use, smoking, and wealth index did not show statistically significant relationships with diabetes status. In summary, hypertension and several socioeconomic factors (location, health insurance coverage, social welfare/financial

support) are significant predictors of diabetes status, while alcohol use, smoking, and wealth index are not significant predictors of diabetes status.

Table 10

Variables in the Equations for RQ3

								95% C.I.for EXP(B)	
		B	*SE*	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Location (1)	-1.126	.102	122.188	1	<.001	.324	.266	.396
	Employment Status (1)	1.289	.308	17.553	1	<.001	3.631	1.986	6.636
	Education	.552	.117	22.084	1	<.001	1.737	1.380	2.187
	Health insurance Coverage (1)	-.270	.108	6.267	1	.012	.763	.618	.943
	Hypertension (1)	1.316	.100	172.025	1	<.001	3.729	3.063	4.540
	Gender (1)	-.276	.102	7.262	1	.007	.759	.621	.928
	Wealth index	.085	.095	.806	1	.369	1.089	.904	1.311
	Smoking (1)	-.020	.188	.011	1	.917	.980	.678	1.419
	Alcohol use (1)	-.112	.138	.654	1	.419	.894	.683	1.172
	Age group			91.824	4	<.001			
	Age group (1)	-1.726	.300	33.209	1	<.001	.178	.099	.320
	Age group (2)	-1.696	.295	33.044	1	<.001	.183	.103	.327
	Age group (3)	-2.154	.296	53.136	1	<.001	.116	.065	.207
	Age group (4)	-2.479	.297	69.513	1	<.001	.084	.047	.150
	Social welfare/ Financial support (1)	-.559	.119	22.119	1	<.001	.572	.453	.722
	Constant	4.514	.445	102.658	1	<.001	91.268		

a. Variable(s) entered step 1: Location, EMPLOYMENT STATUS, Education, Health Insurance Coverage, Hypertension, Gender, Wealth Index, Smoking, Alcohol Use, Age Group, Social Welfare/Financial Support.

Summary

In this chapter, I presented the results of the research questions and hypothesis under study. A logistic regression was conducted to analyze data on approximately 11,206 respondents from the Jamaica Survey of Living conditions 2019 dataset. Three research questions and the associated hypotheses were used to explore the connection between household socioeconomic status, modifiable risk factors, and diabetes status Among Adults in Jamaica. The connection between the independent and the dependent variables was reported. On the one hand, the null hypothesis was rejected for hypertension, location, health insurance coverage, and social welfare/financial support, as the results revealed a statistically significant relationship with diabetes status. On the other hand, it must be noted that variables such as alcohol use, smoking, and wealth index, as the results did not show a statistically significant relationship with diabetes status.

In chapter 5, I will present the interpretation of the findings, limitations, and recommendations for future research in the area. I will also interpret the context of the theoretical concept that grounded this research, the social-ecological model, the implications of the study findings, and the impact of the findings on positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this quantitative study was to explore the connection between household SES, modifiable risk factors, and diabetes status among adults in Jamaica. I used a national dataset, the JSLC 2019. SPSS version 29 was used to conduct descriptive and inferential analysis. In this chapter, I focus on interpreting and discussing the study findings as well as the implications of the findings. For each of the three research questions, I also compare the findings with the information from the literature review presented in Chapter 2.

Additionally, I also interpret the findings relative to the theoretical framework that grounds this study, the SEM. Thereafter, I discuss the limitations of the study and make recommendations for future research. Finally, I discuss the implications for social change before presenting my concluding remarks regarding the overall study.

Interpretation of the Findings

With RQ1, I sought to determine if there was a statistically significant relationship between household SES (wealth index, social welfare/ external financial support, location, health insurance) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment. The findings of the binary logistic regression revealed a statistically significant relationship between household SES and diabetes by way of social welfare/financial support, location, and health insurance. The findings did not reveal a statistically significant relationship between wealth index and diabetes. The literature review revealed mixed findings for socioeconomic status/ wealth index and diabetes. On the one hand, various studies revealed that a

low socioeconomic position increases the risk of developing Type 2 diabetes (e.g., Lago-Peñas et al., 2021; Park et al., 2023; Shirin Sara et al., 2023; Wei et al., 2021). However, a study done by Cerpa-Arana et al. (2022) revealed that individuals with a high wealth index had a higher prevalence of Type 2 diabetes. The literature, therefore, suggests that a positive relationship exists between one's economic status and diabetes. However, the findings from my research digressed as the results did not show a statistically significant relationship between wealth index and diabetes status at any of the two levels (low and medium/high economic status).

According to the results, 44.2% of individuals were in the low SES category, while 55.8% were in the medium/high socioeconomic status category. A possible explanation for this finding is that the data revealed that 29% of the study population received social welfare benefits and or were receiving financial assistance from friends and families both locally and or oversees. As such, the assistance received would have contributed to household income and would, therefore, have helped to offset the expenses associated with acquiring needed resources. In addition, with free health care being available at all government facilities island-wide and 35% of the study population also having access to insurance coverage, their economic status may not be a significant predictor of their diabetes status. This may be an indication that the prevention and control strategies should be widespread across the population and not just target individuals of low economic status.

My findings were inconsistent with those of Shahidi et al. (2019), who stated that an association exists between social welfare and poor health outcomes. Shahidi et al. also

revealed that social assistance recipients exhibit worse health outcomes than nonrecipients in high-income countries. In my study, financial assistance was combined with social welfare. According to Das et al. (2019), remittances are used for expenditures on goods and services, to provide a source of funds for the accumulation of capital, and, ultimately, to help alleviate poverty. Therefore, since social welfare in Jamaica involves a monetary benefit, then, when both are combined, it would increase household income and could possibly explain the differing results for Jamaica, a middle-income country. The results differed in that the results show that those receiving social welfare/financial support are 45% less likely to have diabetes than those not receiving social welfare/financial support. This suggests that financial support may provide access to resources or lifestyle benefits that aid in diabetes prevention or management, thereby reducing the likelihood of diabetes. The findings for geographic location were consistent with other studies that show an association between rural-urban residencies and diabetes (Bujawati et al., 2021; Issaka et al., 2023). The findings from my research diverge from the findings of Molina et al. (2022) in that it revealed that individuals living in urban areas are less likely to have diabetes than individuals living in rural areas. Urban residents are 68% less likely to have diabetes compared to those in rural areas, possibly due to better access to healthcare services, healthier food options, and more active lifestyles in urban settings. Therefore, with the data also showing that 49% of the study population lives in rural areas, it would suggest a need for more targeted intervention strategies. Research has shown an association with health insurance and diabetes (Giang et al., 2020). My research also found an association between health insurance and

diabetes and revealed that having health insurance coverage is associated with a lower likelihood of having diabetes. However, only 35% of the population had access. This underscores the role of health insurance in facilitating access to preventative care and early treatment. Therefore, if access to health insurance has been recognized as a key factor in managing and preventing chronic conditions (Al-Sanaani et al., 2022), then encouraging increased enrolment in health insurance programs could help in the management and control.

With RQ2, I sought to determine if there was a statistically significant relationship between the modifiable risk factors (alcohol, smoking, hypertension) and diabetes among adults in Jamaica while controlling for age, gender, education, and employment. The logistic regression findings revealed a statistically significant relationship between modifiable risk factors and diabetes as the Chi-square test for the model was significant, $p < .001$, thereby suggesting that the overall model is statistically significant and that at least one of the predictors significantly contributed to predicting diabetes status. My findings did not reveal a statistically significant relationship between alcohol and diabetes or smoking and diabetes. Regarding smoking, the findings of my study differed from previous studies that found an association with diabetes (see Hashemi-Aghdam et al., 2022; Kessler et al., 2020). Kessler et al. (2020) revealed a stronger association among individuals who were active smokers. The fact that only 9% of the population under study smoked and that said data included those who smoked infrequently could explain why I found no association.

While the reports on alcohol use and the association with diabetes tend to be inconsistent for the most part, Song and Lin (2023) found an association between alcohol use and diabetes. The results of my study deviated in that it found no association with alcohol use and diabetes. Oshi et al. (2021) mentioned that alcohol is the most frequently used substance across all age groups in Jamaica. Additionally, some studies suggest that heavy and frequent alcohol consumption, as well as high-risk drinkers, were at increased risk of diabetes (Song & Lin., 2023; Wu et al., 2021). Therefore, even though I found that 17% of the population consumed alcohol, if the consumption was infrequent, then the same could explain the deviation in the results of the analysis.

My data revealed a significant positive relationship between hypertension and diabetes status while controlling for age, gender, education, and employment. The results coincide with those of Meshram et al. (2024), who also found an association between hypertension and diabetes. The data for Jamaica shows that individuals with hypertension are approximately three times (or 285%) more likely to have diabetes compared to those without hypertension. This highlights the importance of managing blood pressure to reduce diabetes risk. According to the Ministry of Health and Wellness, Jamaica (2019), Jamaica has seen a notable increase in the prevalence of the number of individuals diagnosed with high blood pressure, and one in three Jamaicans are diagnosed as hypertensive. This, therefore, could be a possible reason for the results seen.

With RQ3, I sought to determine the extent to which household SES (wealth index, social welfare/external financial support, location, health insurance) and the modifiable risk factors (alcohol, smoking, hypertension) predict diabetes after controlling

for age, gender, education, and employment. On the one hand, the data revealed did not show a statistically significant relationship between wealth index, alcohol and smoking, and diabetes status, and, as such, they are not predictors of diabetes. On the other hand, the data found statistically significant relationships between hypertension and the household socioeconomic factors of location, health insurance coverage, and social welfare/financial support, thereby suggesting that they are significant predictors of diabetes status. The data for the odds of hypertension in Jamaica coincides with that found by Meshram et al. (2024), which reported 2.9 times higher odds of diabetes compared to non-hypertensive individuals. According to the data, Jamaicans with hypertension are 285% or three times more likely to have diabetes than those without hypertension. This highlights hypertension as a major modifiable risk factor for diabetes. Sethi et al. (2023) mentioned a paucity of information on hypertension as a modifiable risk factor for diabetes, as most studies found that both diseases coexist. Therefore, this finding will add to the body of knowledge and guide interventions in Jamaica as we advance.

For household socioeconomic factors, my data correlated with that of Kamin Mukaz et al. (2022), who posited that individuals in rural areas have higher odds of diabetes. Disparities in healthcare access are known to be major barriers to healthcare access for individuals in rural areas (Venkatesh et al., 2021). Forty-nine percent of my study population resided in rural areas, and as such, challenges to healthcare access could be a contributing factor to increased odds of having diabetes.

Regarding health insurance coverage and social welfare/financial support, my findings showed that having health insurance coverage and social welfare/financial assistance is associated with a lower likelihood of having diabetes. According to the data, individuals with health insurance are 24% less likely to have diabetes, and those receiving social welfare/financial support are 43% less likely to have diabetes. This finding highlights the protective role of health insurance and social welfare/financial assistance in managing diabetes risk. Access to health insurance has been proven to be effective in managing and preventing chronic illnesses and would therefore support the findings of this research (Al-Sanaani et al., 2022). Bose-Duker et al. (2021) suggested that the government of Jamaica should offer social protection in the form of cash benefits to its residents. In addition, financial support from friends and families, along with health insurance coverage and free health care access at all government facilities, can help to improve residents' ability to access goods and services aimed at preventing and managing health conditions (Campbell et al., 2022; Das et al., 2019). This, therefore, could possibly be a contributing factor to the decreased likelihood of diabetes among individuals with health insurance coverage and social/financial assistance.

Interpretation of Findings to the Theoretical Framework

The theoretical framework I used in this study was the SEM. The SEM advances the idea that the different environments that people are associated with influence their behavior (Golden & Earp, 2012). As such, the five levels of the model, namely, intrapersonal, interpersonal, organizational, community, and public policy, work together to influence and determine the factors that impact health status and human behavior.

Glanz et al. (2015) posited that successful public health programs target health behaviors. Therefore, the application of the findings to this framework could help to determine more targeted interventions at each level.

I explored the relationship between household SES, modifiable risk factors, and diabetes among adults in Jamaica. Demographic information such as age, gender, and knowledge about diabetes was considered at the intrapersonal level. The data revealed statistical significance for all age groups, gender, employment, and education. The conclusion drawn from the findings is that younger age groups (18-28, 29-39, 40-50, and 51-61) have a significantly lower likelihood of having diabetes compared to the oldest age group 62 and older. Also, males have a 36% reduced risk of diabetes when compared to females.

For education, it was also revealed that individuals with low educational achievement (below the junior high) were at a 58% increased risk of diabetes. The findings are consistent with that of Shirin Sara et al. (2023), who also found a significant correlation between diabetes status and gender and age and concluded that older people and individuals with lower education were more likely to develop diabetes. Pinchevsky et al. (2020) postulated that factors such as age, gender, education, and unemployment status may increase the risk of morbidity and mortality associated with Diabetes; hence, interventions at this level should include health education to target behavior changes (Glanz et al., 2015). Also, with lower educational levels being at increased risk of diabetes, then innovative means of communication will need to be considered to enhance behavior change (Lai Meng& Ling Wan., 2021; Lohr et al., 2022).

The second and third levels of SEM, interpersonal and organizational levels, consider the social network systems and organizations that directly influence an individual's behaviors, beliefs, and experiences (Golden & Earp, 2012). The data revealed a significant correlation between social welfare and hypertension. Overwijk et al. (2021) proposed the effective use of support professionals to encourage healthy lifestyle behavior change. This could, therefore, assist in hypertension prevention and management to reduce the risk levels. Additionally, by defining how and when family or friends affect an individual's ability to adjust their health behaviors, public health professionals can provide recommendations that can better inform more effective intervention strategies (Rothman et al., 2020). The fourth and fifth levels are focused on understanding the broader context in which individuals live and how the factors within a community interact to influence behaviors and outcomes, as well as policies that can be enacted to achieve set goals. A significant correlation was revealed between location and diabetes, as individuals living in rural areas were at higher risk of diabetes. According to Nagy et al. (2023), rural areas often lack hospitals or specialized care, thereby negatively impacting healthcare access and, subsequently, leading to poor health outcomes.

Talukder et al. (2024) used secondary data to estimate the prevalence of Type 2 diabetes in urban and rural settings and identify the specific risk factors for each location. They recommended tailored awareness campaigns, improving healthcare access in rural areas, increased physical activity, and community involvement as strategies that could be used at this level to aid in the prevention and management of diabetes. Policy advocacy, such as sugary drink taxation, has been introduced as an intervention strategy to manage

diabetes (Talukder et al., 2024). Regulatory policies have also been explored as a means of diabetes management. Government policies aimed at increasing the population's level of physical activity, improving the quality and quantity of dietary intake, and increasing early screening uptake have been used as a strategy for diabetes management (Lai Meng & Ling Wan., 2021). The plan also included using intersectoral and community collaboration that fostered a sense of unity, resulting in greater public awareness of the need to combat diabetes (Lai Meng & Ling Wan., 2021). As such, analyzing the findings and subsequent evidence-based planning and intervention strategies at the different levels of the social-ecological model could help improve diabetes outcomes and potentially reduce diabetes prevalence in Jamaica.

Limitations of the Study

I used data from the JSLC 2019 dataset. The data was collected through interviewer-administered questionnaires and administered to one individual in each household who was at least 18 years old. This means that the information collected was self-reported. As such, a limitation associated with this study is related to response or recall bias and selection bias. Selection bias could have occurred wherein more than one person who met the inclusion criteria was at home at the data collection point, leaving the interviewer to select one individual who they believed would have been better able to answer the questions.

Also, response bias was seen in that questions relating to income and education were not answered by many and, therefore, impacted the dataset in the form of missing data (Burkholder et al., 2020). In addition, various factors, such as mistrust of

government agencies, fear of a breach of confidentiality, and embarrassment, could have resulted in individuals providing incorrect information. Furthermore, some of the survey questions required information within the last year, and as such, the inability to recall some of the information could have impacted the data collected. Finally, the data collected for the JSLC 2019 used a cross-sectional design. Likewise, I also used a cross-sectional design. Therefore, this design's limitation is that the reported results can only depict a correlational association and not a causative relationship between household socioeconomic status, modifiable risk factors, and diabetes among adults in Jamaica (Burkholder et al., 2020).

Recommendations

I analyzed data from the data collected during the JSLC 2019 survey. The survey collected data from all the parishes across the country and is, therefore, a representative sample. Moreover, the results generated vital information that can be used to develop evidence-based intervention strategies and add to the body of literature regarding the connection between household socioeconomic status, modifiable risk factors, and diabetes status in Jamaica. However, further studies could be done in the form of trend analysis to detect patterns, lifestyle practices, and factors that influence these practices over time. Trend analysis could also help to provide a better understanding of how the factors associated with diabetes evolve over time, thereby providing critical insights that researchers can use to guide decision-making and planning or inform policies or strategies.

One of the advantages of this study is that it used secondary data and, therefore, eliminated the resource and time constraints associated with primary data collection (Schneider et al., 2023). However, a challenge with using secondary data is the potential for error or bias in the original data, lack of alignment with the research questions, inaccuracies, missing data, and data compatibility (Schneider et al., 2023). Thus, the researcher recommends that future research explore the collection of primary data to ensure that all the necessary data is collected and that precautions are taken to reduce potential challenges. Additionally, the initial survey used a cross-sectional design during data collection. Most of the literature reviewed also used a cross-sectional design to determine the association between the independent and dependent factors under study. However, a limitation of this study is the inability of a cross-sectional design to determine causality (Burkholder et al., 2020). Therefore, future studies could explore the use of prospective longitudinal cohort studies to track individuals over time and thereby determine causality rather than associations.

This study used three modifiable risk factors (smoking, alcohol use, hypertension) to determine the association with diabetes; however, behavioral and lifestyle factors were not included in the study. The results revealed no significant association between smoking and alcohol use and diabetes. Thus, they were not significant predictors of diabetes status. However, hypertension was recorded as a significant predictor of diabetes status. This finding is consistent with that of Meshram et al. (2024). The study by Meshram et al. sought to explore the factors of overweight/obesity, pre-diabetes, diabetes, and its association with hypertension and other factors among rural adults in

India. The findings revealed the odds of diabetes were 3 to 4 times higher among overweight and obese, 1.3 times higher among higher socio-economic groups and 2.9 times higher odds of diabetes for hypertensive individuals. The researcher, therefore, recommends future research to determine if lifestyle factors, such as diet, physical activity, and stress, could be predictors of diabetes status. In addition, the fact that hypertension was revealed as a significant predictor of diabetes, then further research could be considered to explore how hypertension mediates the relationship between household socioeconomic factors and diabetes. This could then provide some insight regarding the lifestyle habits linking socioeconomic factors to diabetes development.

The independent variable household economic status included wealth index, social welfare/ external financial support, location, and health insurance. The findings revealed a statistically significant association between location and diabetes status and that those in urban areas were less likely to be diagnosed with diabetes than those living in rural areas. While the findings are consistent with existing literature (Bujawati et al., 2021; Issaka et al., 2023; Kamin Mukaz et al., 2022), future research could focus on doing research at the parish levels across the country to determine prevalence and access to health care and thereby determine if certain locations have higher or lower risks. The results also revealed that health insurance was a significant predictor for diabetes. As such, future research could examine if the quality of health insurance coverage influences diabetes management and prevention.

Implications

This study has several implications for social change. This study revealed that hypertension and the household socioeconomic factors of geographic location, health insurance coverage, and social welfare/financial support are significant predictors of diabetes status. Knowledge of the predictors influencing diabetes can form the foundation for targeted intervention strategies. Therefore, a focus on ensuring that hypertension management strategies such as routine blood pressure checks, regular health screenings, and lifestyle behavior counseling could be prioritized. Also, improving the provisions for access to healthcare services and ensuring that needed healthcare resources reach areas, especially rural areas with increased vulnerabilities, could help in the prevention and management of diabetes.

The significant relationship between health insurance coverage and diabetes status suggests that expanding access to affordable healthcare plays an important role in the management of diabetes. Also, the statistical relationship between location and diabetes suggests geographical inequalities. In addition, a significant association with social welfare and financial support indicates that economic security is vital to preventing or managing diseases like diabetes. While Jamaica presently has a policy for free healthcare services at all government facilities across the country, issues such as long waiting times and availability of some services, unavailability of some medications, and the quality of care have negatively impacted the management of some illnesses (Campbell et al., 2022). Consequently, healthcare policies that seek to strengthen the social safety net, provide insurance, or improve access to underserved communities could help reduce diabetes

prevalence by improving early diagnosis, management, and prevention of hypertension and, ultimately, diabetes.

The study findings revealed statistically significant associations between household socioeconomic factors, modifiable risk factors, and diabetes. This, therefore, suggests the need for a more holistic approach to diabetes prevention and management. Such an approach could include policy advocacy, intersectoral collaboration, and health education programs that are community-driven and widespread. By improving access to healthcare, encouraging increased support systems, and making the intervention strategies more inclusive, efforts to reduce the burden of diabetes could be more effective, thereby leading to broader societal benefits and healthier populations.

Conclusion

Diabetes continues to be a global health challenge of epidemic proportions with rising rates and substantial socio-economic impacts on the population. A notable gap identified in the literature was the limited understanding of diabetes risk factors in developing countries. This study sought to address this gap by examining the connection between household socioeconomic status, modifiable risk factors, and diabetes among adults in Jamaica. Therefore, this research can add to the body of knowledge and bridge the gap of limited information on household socio-economic status and modifiable risk factors and diabetes in a developing country. The findings reveal that commonly considered modifiable risk factors such as wealth index, alcohol consumption, and smoking habits do not significantly predict diabetes in this context, suggesting that these factors may not have a direct impact on diabetes status in Jamaica. As such, the findings

can serve as cues to guide health service providers regarding the issues and populations of greatest priority.

The findings revealed that established modifiable risk factors such as wealth index, alcohol consumption, and smoking habits were not statistically significant predictors of diabetes, thereby suggesting that these factors do not play a direct role in influencing diabetes status in this context. Conversely, the study found that hypertension and the household socioeconomic factors of location, health insurance coverage, and social welfare/financial support are significant predictors of diabetes status. The findings emphasize the importance of addressing broader socioeconomic factors and ensuring that equitable access to healthcare, targeted preventative strategies and support systems are included in all efforts to prevent and manage diabetes. Also, a focus on improving early diagnosis of diabetes collaboration between researchers, healthcare providers, policymakers, and the public is essential for reducing the global burden of diabetes. Finally, further research is needed to explore the identified associations such as hypertension, location, social welfare assistance, and access to health insurance in greater detail and to guide more targeted interventions for diabetes prevention and management going forward.

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