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Association Between Marital Status, Family Size, and Diabetes Among Asian-American Women

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Walden University
2024

Abstract

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MPBA, Polytechnic University of the Philippines, 2000

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Dissertation Submitted in Partial Fulfillment

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Abstract

Diabetes is a condition in which the levels of sugar in the blood are consistently elevated and can lead to damage of various parts of the body. The risks of developing type 2 diabetes increase or decrease depending on how a people live. The incidence of type 2 diabetes in the United States has significantly increased. This quantitative cross-sectional study was used to explore the relationship between marital status and family size and type 2 diabetes among adult Asian-American women, as well as to investigate whether any relationship between marital status and type 2 diabetes was moderated by family size in this group of women. The NHANES data set were used, and the study was guided by social ecological model, wherein I investigated if the interactions between individuals and their environment are reciprocal. The results of the complex samples logistic regression showed that the association between marital status and type 2 diabetes was not significant (p = .163); the association between family size and type 2 diabetes was not significant; (p = .980) and family size did not statistically moderate the relationship between marital status and type 2 diabetes (p = .367). However, after controlling for age, obesity, smoking and education, the association of both age and smoking to type 2 diabetes were statistically significant. The findings of this study could raise awareness among adult Asian-American women that as they grow older, their chances of developing type 2 diabetes increase and avoiding smoking can help lessen the likelihood of having type 2 diabetes. This awareness may lead to early prevention of type 2 diabetes that can potentially avoid not only the numerous serious complications and untimely death, but also the burden it places on the affected person, family, community, and society.

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Dedication

I dedicate this dissertation to my father and mother. Both of them died while I was doing this dissertation. I am forever grateful for all their sacrifices and hard work to ensure that my brother and I will have a better life.

Acknowledgments

The completion of this study had been a combined effort of several people whom I wish to recognize. First and foremost, I would like to thank my husband and son. This academic journey became possible because of the love, patience and understanding of these two very important individuals in my life. Deep appreciation and gratitude are due to my committee members, Dr. Srikanta Banerjee (committee chair), Dr. Peter Anderson (second committee member), and Dr. Chinaro Kennedy (University Reviewer during the proposal stage), for providing me with unwavering support, encouragement, and guidance during this entire process. The late Dr. Ernest Ekong is also acknowledged for his valuable comments and suggestions during the premise and prospectus stages. The staff of Walden University's Office of Research and Doctoral Services, particularly Dr. Sunny Liu and Dr. Arfe Ozcan, has been instrumental for providing me with SPSS support as well as for assisting me when I was doing the quantitative data analysis. In addition, the useful feedback from Dr. Rose Gold (dissertation form & style editor), greatly helped improve the quality of my final product. Lastly, special thanks go to my friends and colleagues who inspired and motivated me to go above and beyond to get things done.

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Chapter 1: Introduction to the Study

Diabetes is a major health problem that cause burden to people in both rich and poor countries. It is projected that the global diabetes-related deaths in adults will rise from 3.1 million in 2015 to 4.2 million in 2030 (Bommer et al., 2018). Diabetes is a chronic disease characterized by elevated levels of sugar in the blood, either because the pancreas is no longer able to make insulin, a hormone which helps glucose get into the cells to produce energy, or because the body cannot use the insulin it produces, resulting in damage to the body and eventually failure of various organs and tissues (International Diabetes Federation, 2020).

Chronic diseases, also known as noncommunicable diseases, present significant impact in both public health and the medical community. Chronic diseases are widely described as illnesses that are not passed from person to person, progress gradually, persist over a long period of time, require continuing medical attention, or limit activities of daily living or both (Center for Disease Control and Prevention, 2019a). The World Health Organization (2019b) reported that 41 million people die annually due to chronic diseases which is equivalent to 71% of all deaths worldwide. Accordingly, the four main types of chronic diseases causing premature deaths globally are cardiovascular diseases (17.9 million), cancers (9 million), respiratory diseases (3.9 million), and diabetes (1.6 million).

In the United States, many Americans suffer from chronic diseases, requiring the healthcare system as well as individuals to spend enormous amounts of money. Data from the Center for Disease Control and Prevention (2019b) showed that six in 10 adult

Americans have one chronic disease, while four in 10 have two or more chronic diseases. The U.S. government spends more than 3 trillion dollars on healthcare each and every year, 75% of which is used for fighting and treating chronic diseases nationwide (Center for Disease Control and Prevention, 2019b). A study showed that American households with chronic health conditions are likely to have financial burden due to out-of-pocket costs and medical debt (Richard et al., 2018). Of all common health conditions in 2013, the highest government expenditure was on diabetes ($101.4 billion), followed by ischemic heart disease ($88.1 billion; Dieleman et al., 2016)

Diabetes is not restricted to a specific age group. Type 1 diabetes, however, typically develops in children, teens, and young adults and happens when the body stops making insulin; type 2 diabetes, on the other hand, is usually diagnosed in adults and occurs when the body is not using insulin well and cannot keep normal blood sugar levels, while gestational diabetes happens during pregnancy, and it usually goes away when the baby is born (Center for Disease Control and Prevention, 2017a).

Type 2 diabetes has the highest incidence among the different types of diabetes and accounts for around 90% of all diabetes cases worldwide (World Health Organization, 2019a). It has been described as a lifestyle disease because the risks of developing it increases or decreases depending on how a person lives (i.e., whether they engage in regular physical activities, eat healthy foods). As people transition to various stages over their life span, such as entering marriage, the situation that they are in prompts them to change their lifestyle so they can perform their duties in the family (Lavner et al., 2018). The purpose of this study was to explore the relationship between marital status and type 2 diabetes among adult Asian-American women using secondary data from the National Health and Nutrition Examination Survey (NHANES). I also investigated the relationship between family size and marital status and type 2 diabetes in this group of women. No study has been conducted to determine the relationship between marital status, family size, and type 2 diabetes among adult Asian-American women, this study therefore filled the gap noted by Golden et al. (2019), who stated that there is inadequate research conducted on the variation of type 2 diabetes prevalence based on race/ethnic differences. The potential positive social change implication of this study is it may be able to help health professionals in the formulation of programs and strategies to aid in the prevention of type 2 diabetes among Asian-American women. Anything that helps to lower the incidence of type 2 diabetes is apt to affect health care programs. This may take the form of lower health care costs to individuals and society. This study can impact the individual health of Asian-American women through the awareness of how their marital status and family size can affect their chances of developing type 2 diabetes. Awareness can motivate individuals to change their lifestyles to live healthier to lessen their risks of having type 2 diabetes. By following a healthy lifestyle, Asian-American women can influence their family members and the people in their communities to do the same, which in the long run can lead to lower incidence of type 2 diabetes in the general population. Ultimately, the outcome of this study could contribute new information to the existing body of knowledge about the association of marital status and type 2 diabetes.

I discussed in this chapter are the following sections: background of the study, problem statement, purpose of the study, research questions and hypotheses, theoretical framework, nature of the study, definition of terms, assumptions, scope and delimitations, limitations, significance of the study and summary.

Background of the Study

There are studies that have described the association of marital status and type 2 diabetes. Being married is a factor that increases the risk of diabetes and prediabetes among males in Saudi Arabia as well as having older age, obesity and overweight, being a smoker, and having a civilian job and less education (Aldossari et al., 2018). A study that used a cohort database called Tehran Lipid and Glucose Study showed that relationships between marital status and health outcomes vary by gender (Ramezankhani et al., 2019). The results of this study suggested that for women, lower risk of type 2 diabetes is associated with widowed status than married, never married, or divorced.

The factors that are causing the high prevalence of diabetes became an interesting topic to several researchers. Another study conducted in Jeddah, Saudi Arabia revealed the higher prevalence of diabetes not only among married but also among divorced adult (Murad et al., 2014). Additionally, the results of this study suggested that male gender, age >40 years, low educational attainment (illiterate or having completed primary school), salaries <7000 Saudi Riyals, and smoking status (current smoker) were risk factors associated with diabetes mellitus type 2. Escolar-Pujolar et al. (2018), on the other hand, studied mortality caused by diabetes mellitus of both men and women in Andalusia, Spain. Accordingly, widowed women, single men, and separated or divorced persons had the highest mortality risk. An evaluation to determine whether poor marital quality was associated with the prevalence of diabetes among Americans who are above

50 years old showed that poorer marital quality was associated with higher prevalence of diabetes among men but not in women (Whisman et al., 2014). Researchers have shown that daily marital interactions have implication on individual's health. Martire et al. (2018) found that physical symptoms experienced by type 2 diabetes patients exacerbated on days when these patients and their spouses faced more marital tension. Further, data collected across the United States from individuals who are in marriage or marriage-like relationships connected marital risk to an 18% greater likelihood of having diabetes as well as connected marital strain to a 56% greater likelihood of having diabetes (Roberson & Fincham, 2018). Results of a prospective cohort study participated by 15,792 men and women from North Carolina, Mississippi, Minnesota, and Maryland showed that adults who are married to diabetic spouse had increased risk of developing diabetes compared to those without a spouse diagnosed with diabetes (Appiah et al., 2019).

Type 2 diabetes is a disabling, deadly, and costly chronic disease that has long term consequences not only on individuals but also on families and national health care systems (Silva-Tinoco et al., 2020). In this study, I explored the relationship between marital status and type 2 diabetes among adult Asian-American women using secondary data from the NHANES. I also investigated the relationship between family size and marital status and type 2 diabetes in this group of women. There is an increasing public health attention on the elevated risk of type 2 diabetes among Asian American population (Tung et al., 2017). However, no study has been conducted to determine the relationship between marital status, family size and type 2 diabetes specifically among adult Asian-American women, this study therefore filled the gap. This study is needed because its result provided awareness to Asian-American women on the association of type 2 diabetes to their marital status and family size that would eventually lead to prevention and reduction of type 2 diabetes incidence.

Problem Statement

Diabetes is a condition in which the levels of sugar in the blood are very high causing health issues overtime such as heart disease, stroke, kidney disease, eye problems, dental disease, damage on the nerves, and foot problems that could lead to leg amputation (National Institute of Diabetes and Digestive and Kidney Disease, 2016). The World Health Organization (2018) estimated that 1.6 million people died in 2016 directly due to diabetes. Type 2 diabetes has the highest incidence among the different types of diabetes and accounts for around 90% of all diabetes cases worldwide (World Health Organization, 2019a). In 2015, there were 30.3 million diabetic individuals in the United States and 84.1 million have prediabetes which is a condition that if left untreated will result to type 2 diabetes within a period of 5 years (Center for Disease Control and Prevention, 2017c).

There is an association between ethnicity and diabetes status. For instance, belonging to Asian-American race/ethnicity is one of the risk factors of developing type 2 diabetes (American Heart Association, 2019). Among Asian-Americans the three groups with high rates of diagnosed diabetes in adults are Asian Indians (11.2%), Filipino (8.9%) and Chinese (4.3%; American Diabetes Association, 2019).

Type 2 diabetes has been described as a lifestyle disease because the risks of developing it increases or decreases depending on how a people live (i.e., whether they engage in regular physical activities, eat healthy foods). As people transition to various stages over their life span, such as entering marriage, the situation that they are in prompts them to change their lifestyle so they can perform their duties in the family. Marriage is a social contract which include set of rules, expectations, and boundaries along with rights and responsibilities (Pascale & Primavera, 2016). Asia is one of the cultures in the world wherein societal norms govern the performance of domestic tasks, giving wives more responsibilities to handle because husbands do not participate in doing house chores and childcare (Luke et al., 2014). In comparison, among husbands in advanced industrialized countries, Japanese husbands spend the least time doing house chores (Nakamura & Akiyoshi, 2015). The study by Luke et al. (2014) showed that the increasing number of women entering the paid labor force in India did not change the amount of work men do at home because they continue to perceive them as feminine tasks. By placing the numerous needs of family members on top of their daily priorities, women often end up overlooking their own needs (Craig & Brown, 2017). In doing so, the high levels of physical, psychological, and emotional burden of women for carrying many responsibilities at home, negatively affects their health and well-being (Eek & Axmon, 2015).

Diabetes is one of the widely studied health-related topics. I found some studies that associated marital quality to various diseases, including type 2 diabetes. Marital quality is an indicator to assess the positive or negative quality of the marriage that includes marital satisfaction, marital conflict, and marital positivity (Proulx et al., 2017). This study however is not about marital quality but about marital status and its relationship to type 2 diabetes. Marital status is the state of being married or unmarried. When I searched for studies that focused specifically on the association of marital status to type 2 diabetes, the number was scanty, and majority of these studies were conducted over 5 years ago. After a thorough search, the most recent studies I found were conducted by de Oliveira et al. (2020), who used a rural population in Brazil and showed that those who remained married during the 5-year study period were significantly less likely to develop diabetes than their divorced counterparts and another study by Mirzaei et al., (2020) who used Iranian population, but no study was conducted using data collected in the United States within the past 5 years. In an older study conducted by Cornelis et al. (2014), the authors mentioned that so far only four studies investigated the role of marital status in the development of type 2 diabetes. These studies were conducted among Finnish (men and women), Iranian (men and women), Australian (men) and the population of Pomerania, Germany (men and women). In the study of Mirzaei et al., the result showed that being female as well as being widow/divorced puts an individual at high risk of developing diabetes. In contrast, Ramezankhani et al. (2019) stated that there was a significantly lower risk of diabetes for widowed women compared to married women. Evidently, the results of previous studies on the relationship of marital status and type 2 diabetes were not consistent. De Oliveira et al. (2020) argued that marital status seemed to be a predictor of the occurrence of type 2 diabetes, and he suggested further investigation of this association for they may provide vital information that will help improve the design and implementation of preventive programs. The number of type 2 diabetes cases in the United States is alarming and this chronic disease has become a growing epidemic among the Asian American population (Li-Geng et al., 2020). However, no study has been conducted to determine the relationship between marital status, family size and type 2 diabetes specifically among adult Asian-American women, this study therefore filled the gap. Golden et al. (2019) stated that there is inadequate research conducted on the variation of type 2 diabetes prevalence based on race/ethnic differences. Accordingly, having a deeper understanding on this matter can lead to enhanced prevention and treatment of type 2 diabetes.

Purpose of the Study

The purpose of this quantitative and cross-sectional study is to explore the relationship between marital status and type 2 diabetes among adult Asian-American women using secondary data from the NHANES. This survey assesses the health and nutritional status of nationally represented sample in the United States through interviews as well as physical examinations (Center for Disease Control and Prevention, 2017b). In addition, I also investigated the relationship between family size and marital status and type 2 diabetes in this group of women.

Research Questions and Hypotheses

The following questions were addressed in this study:

RQ1: Is there an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

$H_0$1: There is no association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

$H_1$1: There is an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

RQ2: Is there a relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

$H_0$2: There is no relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

$H_1$2: There is relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

RQ3: Does family size moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

$H_0$3: Family size does not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

$H_1$3: Family size moderates any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

Theoretical Framework

This study was guided by social ecological model (SEM), wherein I investigated if the interactions between individuals and their environment are reciprocal, as argued by Salihu et al. (2015), that an individual is influenced by his/her environment and the environment is influenced by the individual. In SEM, the person sits in the center and is enveloped by four concentric layers of environmental influences: (1) the microsystem that contains elements in the external environment with which one interacts directly on an ongoing basis (e.g., regular activities, roles, and relationships with others at home, at work, in their neighborhood, and in other social settings of personal importance), (2) the mesosystem consists of interactions between the elements of the microsystem, such as organization and work setting, which affect the individual's ability to function effectively in each part of the microsystem (e.g. the interaction of work and home microsystems, and the difficulties of balancing the two), (3) the exosystem that includes interactions and influencers in the extra-organizational, such as one's industry or profession, and (4) the macrosystem which refers to the societal context or environment (Lyons et al., 2019). Similarly, Harper et al. (2018) emphasized that this model conceptualizes individuals as nested within multiple levels of influence that are organized hierarchically by which relationships are most proximal to individuals, followed by community/organizations and then society more broadly. According to the U.S. Department of Health and Human

Services & U.S. Department of Agriculture (2015), the SEM can help health professionals recognize how layers of influence intersect to shape a person's food and physical activity choices. In this study, SEM was the framework I used in determining whether marital status and family size are risk factors for type 2 diabetes among Asian-American women.

Nature of the Study

Through this quantitative and cross-sectional study, I investigated the association of the prevalence of type 2 diabetes and marital status by using a secondary dataset. Quantitative approach is commonly used when a study involves large samples size and statistics are used in order to summarize numbers across a wide range of variables (Ruane, 2016). Cross-sectional research design can be employed when investigating associations between risk factors and the outcome of interest for a given population at one time point or short period of time (Levin, 2006). The dependent variable is type 2 diabetes, and the independent variable is marital status. The effect-modifying variable is the family size which may cause the increase or decrease the risk of type 2 diabetes. A quantitative approach is suitable to use because I statistically analyzed data to investigate the association of marital status and type 2 diabetes which involves randomly selected sample from a large population and will be using the statistical software SPSS (Rahman, 2017). In collecting and analyzing data for quantitative research, the investigator puts emphasis on numbers and figures (Eyisi, 2016).

In the approved proposal, I was originally planning to use logistic regression for statistically analyzing the data. However, after thorough consideration, I ascertained that complex samples logistic regression is more appropriate to use for NHANES data set, which was obtained through a complex, multistage, probability sampling design. I discussed this change with the chair and second committee member; they both agreed with it. A detailed explanation of the change is on page 54-55. It is a minor change, since I only changed the statistical technique, the same dataset was used. Hence, IRB revision is not required.

Definition of Terms

The following definition of the key terms used in this study are mostly derived from MedlinePlus, a website produced by the United States National Library of Medicine, which is the world's largest medical library that provide information about health conditions, medical tests, medications, dietary supplements and healthy recipes (MedlinePlus, 2019), as well as from Merriam-Webster Online Dictionary.

Asian-American: A group of people having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent (Office of Minority Health, 2019).

Chronic disease: A persistent noninfectious disease that requires long term care (Bookey et al., 2017).

Diabetes: A condition caused by high levels of blood glucose or blood sugar (Diabetes, 2019). There are different kinds of diabetes; in this study, the term diabetes will pertain to type 2 diabetes.

Education: The process of gaining knowledge through continuous learning experiences, e.g. from people, from success and failures, from leaders (Bhardwaj, 2016).

Although education is not limited to school and academic institutions, education in this study will refer to formal education pertaining to elementary, high school, college, master, and doctoral degree.

Family size: The total number of individuals comprising a family unit (Treas, 1981). In this study, the individuals in the family include the father, mother, and all children regardless whether they are biological, adopted, or from previous marriages.

Hemoglobin A1C (HbA1C) Test: A blood test to diagnose diabetes by measuring the average amount of glucose attached to hemoglobin over the past 3 months. The normal HbA1C level is below 5.7%; between 5.7 and 6.4% means prediabetes, and above 6.5% is diabetes (Hemoglobin A1C [HbA1c] Test, 2019).

Marital status: A state of being married by law or unmarried, for example being single, separated, divorced, or domestic partner (Hinyard et al., 2017).

Obesity: Abnormal accumulation of excessive bodily fat that can damage health (Müller & Geisler, 2017).

Older age: Human age starting 65 years old and beyond (Merkt et al., 2020).

Prediabetes: A condition indicated by blood glucose levels above normal but below diabetes threshold, with plasma glucose of 100–125 mg/dL and diagnostic criterion 5.7–6.4% of HbA1c (Pazmino et al., 2021).

Smoking: The smoke inhalation of burning tobacco of either cigarettes, pipes, or cigars (Leone et al., 2010).

Women: Humans born female (Watson, 2016). In this study, women refer to 18-65 years old Asian-American females.

Assumptions

I made the assumption that the participants of the survey voluntarily provided truthful responses during the interview and did not cause bias to this study. Another assumption I made is that the persons who conducted the physical examination portion of the survey consistently used calibrated medical instruments.

Scope and Delimitations

The delimitations of the study are the following:

1. Although NHANES has participants from different racial backgrounds, this study only included Asian-Americans.
2. I only looked at women who are aged 18-65 years old. Males are excluded as well as those females who are either younger than 18 years old or older than 65 years old.
3. I did not look at whether the children in the family are biological, adopted or from previous marriages.

Limitations

The first limitation of this study concerns the use of secondary data. Since the secondary data are collected for a different purpose, it may be incomplete due to missing data and variables that were not properly measured (Dunn et al., 2015). The second limitation is the use of cross-sectional design. You cannot derive causal relationships from cross-sectional analysis because this is a one-time measurement of exposure and outcome (Setia, 2016).

Significance

Type 2 diabetes and its comorbidities are escalating burdens that have affected people not only on personal level but also at the societal level. Seib et al. (2018) argued that the burden carried by diabetic individuals is also carried by their family members and the wider community in relation to rising healthcare costs, lost productivity, and adverse social and economic outcomes for families. Although type 2 is largely a preventable disease, lowering its incidence however requires the combined action of families, schools, worksites, healthcare providers, communities, media, the food industry, and government (Harvard University School of Public Health, 2020). The social change implication is that using the results may be able to help health professionals in the formulation of programs and strategies to aid in the prevention of type 2 diabetes among Asian-American women. Anything that helps to lower the incidence of type 2 diabetes is apt to affect health care programs. This may take the form of lower health care costs to individuals and society. This study will impact the individual health of Asian-American women through the awareness of how their marital status and family size can affect their chances of developing type 2 diabetes. Awareness can motivate individuals to change their lifestyles to live healthier to lessen their risks of having type 2 diabetes. By following a healthy lifestyle, Asian-American women can influence their family members and the people in their communities to do the same which in the long run can lead to lower incidence of type 2 diabetes in the general population. Ultimately, the outcome of this study could contribute new information to the existing body of knowledge about the association of marital status and type 2 diabetes.

Summary

In this chapter, I discussed chronic disease, diabetes, risk of Asians for diabetes and the effects of marital status on women’s health. I outlined the purpose, theoretical framework, research questions, hypotheses, assumptions, limitations, significance, and implication for social change.

In Chapter 2, I review existing body of literature that is pertinent to this study.

Chapter 2: Literature Review

Introduction

The World Health Organization (2018) estimated that 1.6 million people died in 2016 directly due to diabetes. Type 2 diabetes has the highest incidence among the different types of diabetes and accounts for around 90% of all diabetes cases worldwide (World Health Organization, 2019a). Type 2 diabetes has been described as a lifestyle disease because the risks of developing it increases or decreases depending on how a people live (i.e. whether they engage in regular physical activities and eat healthy foods). As people transition to various stages over their life span, such as entering marriage, the situation that they are in prompts them to change their lifestyle so they can perform their duties in the family (Lavner et al., 2018). The purpose of this study was to explore the relationship between marital status and type 2 diabetes among adult Asian-American women using secondary data from the NHANES. It also investigated the relationship between family size and marital status and type 2 diabetes in this group of women. Although diabetes is a widely studied subject for the past several decades, no study has been conducted on the relationship of marital status and type 2 diabetes specifically among Asian-American women (Haines et al., 2018).

An in-depth literature review was conducted for this study. The chapter begins with the first subsection that discusses the literature search strategy and then in the second subsection, I discuss the theoretical foundation. In the third subsection, I address marital status and marital status-related health outcomes, while family size and family size-related health outcomes are explored in the fourth subsection. The fifth subsection includes detailed information regarding diabetes and then the sixth subsection is a discussion of Asian Americans and the prevalence of diabetes in this ethnic group. Lastly, I provide a summary.

Literature Search Strategy

Walden University library was used to access several databases for peer-reviewed articles including Cumulative Index of Nursing and Allied Health (CINAHL), EBSCO Academic Health Premier, MEDLINE, PubMed, Science Direct, SocINDEX and Google Scholar. I used the following keywords and phrases for the search: *social ecological model, marital status, relationship status, family characteristics, family size, household size*, *diabetes*, *Asian-Americans*, and *ethnic group*. In this literature search, I only considered peer-reviewed articles written in English from the past 5 years.

Theoretical Foundation

Humans are social beings. They develop social attachment through social ties, which include emotional, social, and economic support (Wright & Brown, 2017). Evidence has shown that social connections are very crucial because they affect health, longevity and risk factors that could lead to early death (Holt-Lunstad, 2018). For more than three decades, many studies have established the link between close relationships and health (Farrell & Stanton, 2019). Cornelius et al. (2016) observed that health behaviors seem to cluster within social groups and extend through social contacts.

There are various ways wherein close relationships can protect and promote health (Pietromonaco & Collins, 2017). It appeared that when a person aspires to achieve something (e.g. improved health), it becomes more achievable if there is a supportive social environment (Wold & Mittelmark, 2018). To better understand the factors that influence health, Early (2016) recommended the application of SEM, which illustrates the different kinds of environment that humans interact with as well as the interdependence of humans to each of these environments.

The SEM is based on the ecological framework for understanding human development which was first introduced by Urie Bronfenbrenner in the 1970s. According to the World Health Organization (2020), the ecological framework treats with equal importance the interaction of the various factors at four levels: individual level (for example, a woman), personal relationship (including family, friends, intimate partners, and peers), community (schools, neighborhoods, and workplaces) and society (for example, culture). When the SEM was formalized in the 1980s, it emphasized that health is influenced by the interplay between the characteristics of the individual, the community, as well as the environment that includes the physical, social, and political components (Kilanowski, 2017). Schölmerich and Kawachi (2016) stated that organizations can freely customize the number of SEM levels to be combined depending on situations.

The concept of SEM has been widely used in public health studies and health promotion programs (Wold & Mittelmark, 2018). McCormack et al. (2017) argued that in order to promote and support healthful action and change, health interventions must address two or more levels of SEM. A randomized control trial conducted among 360 women showed significant increase in physical activity when intervention according to socioecological model was received (Tehrani et al., 2016). The SEM principle is helpful and effective in understanding how food and physical activity choices are shaped by the layers of influence intersection (Desalvo, 2016). Interventions that target various levels of influence reinforce each other and consequently yields greater and more sustainable effects compared to interventions which target only one level of influence (McCormack et al., 2017).

Type 2 diabetes has been described as a lifestyle disease because the risks of developing it increases or decreases depending on how a people live (i.e., whether they engage in regular physical activities, eat healthy foods). The first level of SEM is individual; in this study, the individual refers to the Asian-American women which is the target study group. Both variables, marital status and family size, are part of the second level of SEM. As people transition to various stages over their life span, such as entering marriage, the situation that they are in prompts them to change their lifestyle so they can perform their duties in the family. The physical activity of a woman can be influenced by the community she is part of, which is the third level of SEM, for example she lives in a location where there are many opportunities to do outdoor activities like hiking and playing sports. The eating habits of a woman can be influenced by the fourth level of SEM, for example the culture of the society she belongs to may prefer eating fast foods rather than preparing home cooked meals. Consequently, women's risk on developing type 2 diabetes has interdependence on the various SEM levels.

Marital Status and Marital Status-Related Health Outcomes

Humans undergo various stages during their life span, and one of them is when they decide to be in a marital relationship. Traditionally, marriage is described as a union of man and woman for various reasons including companionship, procreation, legal sex, enculturation, training of children, and for financial and emotional supports (Onuorah, 2018). Married people are often viewed to be healthier and live longer than unmarried people due to having lesser health problems and lower psychological distress and depression (Kalmijn, 2017; Lawrence et al., 2019). Contrastingly, the paper of Ramezankhani et al. (2019) presented that widowed women have diabetes controlled better than married women. Decades of studies have shown the protective impact on physical and mental health by the conditions for social support that are created in marital relationships (Gerull et al., 2017). In the study conducted by Wright and Brown (2017) on the role of partnership among older adults indicated that the highest well-being was reported by married individuals, followed by cohabitors, daters, and lastly unpartnered persons. Umberson et al. (2018) explained that in the process of imposing demands, threats, requests, or rewards to each other, the spouses somehow influence each other's health behavior such as performing exercise, eating healthier foods and drinking alcohol in moderation. Similarly, Kiecolt-Glaser and Wilson (2017) stated that health protection and promotion are demonstrated among married people by buffering stress reactivity and encouraging healthy behavior. A study conducted among 393,470 males and 389,697 female cancer patients living in California indicated that unmarried patients experience a higher risk of all-cause mortality than married patients (Martínez et al., 2016). French and Meltzer (2019) compared the negative effects of having poor marital relationship as equivalent to smoking cigarette or drinking alcohol, and worse than the effects of living a sedentary lifestyle or being obese.

The association of marital status and type 2 diabetes was presented in several studies. Aldossari et al. (2018) revealed that being married is a factor that increases the risk of diabetes and prediabetes among males in Saudi Arabia as well as having older age, obesity and overweight, being smoker, and having a civilian job and less education. Using a cohort database called Tehran Lipid and Glucose Study, Ramezankhani et al. (2019) concluded that for women, lower risk of type 2 diabetes is associated with widowed status than married, never married, or divorced. Escolar-Pujolar et al. (2018) studied mortality caused by diabetes mellitus of both men and women in Andalusia, Spain. Results indicated that widowed women, single men and separated or divorced persons have the highest mortality risk.

Results of previous studies are conflicting. Some researchers state that married individuals are at higher risk of certain diseases, while other researchers argue that unmarried individuals are more at risk to various diseases. In analyzing this literature, I observed that participants of these studies included both men and women without distinction of their race. Considering that people's gender and race can affect their risk of developing diseases, I investigated the relationship of marital status and type 2 diabetes specifically among Asian-American women from 18-65 years old. The result of this study gave Asian-American women a better understanding of how their marital status affects their development of type 2 diabetes.

Family Size and Family Size-Related Health Outcomes

Every person belongs to a family regardless of its size or number of members. Family is described by United States Health Resources & Services Administration (2017) as “a group of two or more persons related by birth, marriage, or adoption who live together; all such related persons are considered as members of one family.” The count of family members differ from the count of family household members because the latter include non-relative individuals living in the same house (United States Census Bureau, 2019). Although there have been remarkable changes since the 1960s, as seen in the reduction of marriage and increase of cohabitation, the official definition of family does not take into account two adults cohabiting (Winkler, 2018).

It is observable that the terms family size and household size are used interchangeably in multiple literature. The United Nations (2019) exclusively categorized households into seven types: one-person households (comprised of only one member); couple only households (comprised of a married or in-partnership couple and no one else); couple with children households (comprised of a married or in-partnership couple and their children regardless whether they are biological, step, and adopted/foster children, irrespective of children’s ages, and no one else); single parent with children households (comprised of a single parent and his or her children regardless whether they are biological, step, and adopted/foster children), irrespective of children’s ages, and no one else); extended family households (include one or more members outside of the nuclear family unit and no members who are not related to each other); non-relative households (include two or members who are not related to each other; unknown households (include one or more members whose relationship to the head is unknown or not reported). In this study, the term family size is equivalent to the “couple with children household” of the United Nations.

The health promoting effect of family has been long cited (You et al., 2018). There are however limited studies about the relationship between family size and health (Datar, 2017). It was discussed in previous studies that having larger family size has health benefits to family members. A comprehensive empirical analysis on the effects of family size on child health revealed that the 4% decline in the likelihood of being overweight and 5% reduction in the probability of illness are associated to the birth of younger siblings (Dasgupta & Solomon, 2018). Results of another study showed that children with more siblings have significant lower body mass index (BMI) and lower likelihood of being obese (Datar, 2017).

Results of some studies presented the relationship of certain health conditions to being part of a family with more members. For instance, the ecological study that used data from 178 countries showed that there is lesser risk for cancer in both males and females, more pronounced on males, in countries where there is bigger family size (You et al., 2018). The study of Mengistu et al. (2019) on iron deficiency anemia among in-school adolescent girls revealed that the study participants who belong to household family size of > 5 were 3.2 times more likely to be anemic, compared with those who belong to household family size of ≤5. A study involving 463,347 Chinese participants who have children, presented the association of 3–4% increased risk for developing diabetes in both women and men for each additional child (Peters et al., 2016).

Every day, women perform multiple duties and responsibilities for their family members. Many women give everything they have when they perform their significant role of raising children and managing a household (Lantara, 2015). Researchers suggested that increase in family members leads to increase in the amount of workload at home for women since they are the ones who are expected to take care of children's physical needs and listen to children's problems, in addition to performing female-typed chores such as cooking, cleaning, laundry, and grocery shopping (Doan & Quadlin, 2019). Performing endless tasks have shown that it can lead to women's poor health (Eek & Axmon, 2015). I investigated the relationship of family size to type 2 diabetes among Asian-American adult women. Having a better understanding on this relationship could help women protect themselves from developing type 2 diabetes.

Definition and Epidemiology of Diabetes

Diabetes is described by the National Institute of Diabetes and Digestive and Kidney Diseases (2016) as a condition in which the levels of sugar in the blood are very high causing health issues overtime such as heart disease, stroke, kidney disease, eye problems, dental disease, damage on the nerves and foot problems that could lead to leg amputation. Varsha et al. (2018) explained that these complications happen because there is an interruption or disturbance in the regulatory systems for the storage and mobilization of metabolic macro-molecules.

Approximately 1.6 million people died globally in 2016 directly due to diabetes (World Health Organization, 2018) and according to the reports of the Centers for Disease Control and Prevention (2017c), the mortality rate of diabetes in the United States was 83,564 in 2017. In 2015, there were 30.3 million diabetic individuals in the United States, and 84.1 million have prediabetes, which is a condition that if left untreated will result to type 2 diabetes within a period of 5 years (Center for Disease

Control and Prevention, 2017c). Diabetes is one of the economic burdens of the United States. It is estimated that in 2017, diabetes cost the nation $327 billion, which includes $237 billion in direct medical costs and $90 billion in lost productivity (American Diabetes Association, 2018b).

Some of the symptoms that diabetic individuals experience include excessive thirst, polyuria, feeling tired and lethargic, polyphagia, slow wound healing, skin infections, blurred vision, weight loss, mood swings, headaches, etc. (Varsha et al., 2018). To avoid complications in different parts of the body, doctors need to know the levels of sugar in the blood of the patient. Pippitt et al. (2016) suggest that the following laboratory test results will help to diagnose diabetes: fasting plasma glucose level of 126 mg per dL or greater; an A1C level of 6.5% or greater; a random plasma glucose level of 200 mg per dL or greater; or a 75-g two-hour oral glucose tolerance test with a plasma glucose level of 200 mg per dL or greater. It is however recommended to repeat testing on a subsequent day to confirm the diagnosis, but it should be noted that a single random plasma glucose level of 200 mg per dL or greater with typical signs and symptoms of hyperglycemia possibly implies diabetes (Pippitt et al., 2016) .

The human body needs glucose as a source of energy of the cells. When a person is healthy, the pancreas produce sufficient amount hormone called insulin which allows the glucose to move out from the blood into the cells, and is responsible in regulating the blood glucose level. Alam et al. (2016) discussed that in normal physiology, when insulin binds on the cell surface insulin receptor, glucose transporter type 4 (GLUT4) which is an insulin-regulated membrane protein translocate from intracellular environment to the cell surface, it docks and then merges with the membrane in order to facilitate glucose transport into the cell.

Elevated blood glucose level happens when glucose does not enter into the cell. Consequently, the cells will be deprived of energy while glucose retains in the blood unconsumed which eventually cause the damage of different organs of the body. Diabetes is generally classified as type 1 diabetes is caused by the autoimmune destruction of the β-cell that typically leads to absolute insulin deficiency; type 2 diabetes which is caused by the continuing loss of β-cell insulin secretion usually on the background of insulin resistance; gestational diabetes mellitus which is detected among pregnant women in their second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation; specific types of diabetes which happens because of other reason such as having certain disease/condition or taking medications/treatments that induce diabetes (American Diabetes Association, 2018a). Interestingly, a study conducted by Sankar et al. (2018) in South India showed high prevalence of diabetes risk among the 326 employed women who participated in the study.

Among the classes of diabetes mentioned above, type 2 diabetes has the highest incidence and accounts for around 90% of all diabetes cases worldwide (World Health Organization, 2019a). Unnikrishnan et al. (2017) claimed that type 2 diabetes is now considered a global pandemic affecting every corner of the world but the two countries with the largest number of people with diabetes are China (109.6 million) and India (69.2 million). According to the authors, economic development and the subsequent changes in lifestyle that promote an obesogenic environment are linked to the increase in prevalence of type 2 diabetes (Unnikrishnan et al., 2017).

The management of type 2 diabetes is usually a combination of lifestyle modification and taking metformin which is the first choice of treatment of most patients, but doctors can offer alternative or second-line treatment options such as sulfonylureas, meglitinides, insulin, TZD, alpha-glucosidase inhibitors, RA-GLP1 receptor agonists, iDPP4 and iSGLT2 which are prescribed individually depending on the patient characteristics (i.e. degree of hyperglycemia, presence of comorbidities, patient preference, ability to access treatments) and properties of the treatment (i.e. effectiveness and durability of lowering blood glucose, risk of hypoglycemia, effectiveness in reducing diabetes complications, effect on body weight, side effects and contraindications; Marín-Peñalver et al., 2016)

Asian-Americans and the Prevalence of Diabetes

Asian-Americans are individuals who originated from Far East, Southeast Asia, or the Indian subcontinent (United States Department of Health and Human Services, 2019). Among the Asians immigrants in the United States, the first ones who arrived in large numbers in the mid-nineteenth century were the Chinese and then followed by Japanese, Filipino, Koreans, Indians, etc. (Kim & Lewis, 2018). There has been a steady increase in their number that more than 20.4 million individuals in the United States identify themselves as being of Asian descent (Lee, 2019). The United States Department of Health and Human Services (2019) reported that the states with the largest Asian American population are California, New York, Texas, New Jersey, Illinois, Washington, Florida, Virginia, Hawaii, Massachusetts. The following is the prevalence of diagnosed type 2 diabetes by racial/ethnic group in the U.S.: Asians 9.0%, African Americans 13.2%, Hispanic 12.8%, and non-Hispanic whites 7.6% (Rodríguez & Campbell, 2017).

Belonging to Asian-American race/ethnicity is one of the risk factors of developing type 2 diabetes (American Heart Association, 2019). The three groups among Asian Americans with high rate of diagnosed diabetes in adults are Asian Indians (11.2%), Filipino (8.9%) and Chinese (4.3%; American Diabetes Association, 2019). There is a public health attention given on the elevated risk of Asian Americans on type 2 diabetes (Tung et al., 2016). Using the 2012-2014 Behavioral Risk Factor Surveillance System from 45 U.S. states and territories, Tung et al. reported that although Asian Americans have high risk of diabetes, they were the least likely racial and ethnic group to receive the recommended diabetes screening. Based on the National Health Interview Survey which provides data on the health status, health care access, and health behavior of the non- institutionalized civilian population in the U.S, Lee and Yeh (2018) asserted that number of type 2 diabetes among Asian Americans have increased over time, from 8.1% in 2000−2002 to 9.6% in 2012–2014. Compared to non-Hispanic white women, the Office of Minority Health (2019) reported that Asian-American women were almost 3 times more likely to be diagnosed with diabetes during the years 2013-2015.

Multiple studies have linked type 2 diabetes to high BMI. Kobayashi et al. (2017) however revealed that one in every five Asian-Americans with diabetes is in the low normal BMI category (18.5 to < = 23) compared to 1 in 12 Whites with diabetes and the authors were surprised to find out that the higher odds of diabetes found among Asians did not decrease by known risk factors for diabetes including socioeconomic status, fruit and vegetable consumption, ever smoking, and level of physical exercise. They further suggested that there must be other important environmental or genetic factors at play.

Numerous studies have shown the high prevalence of diabetes in Asia. One factor that was looked at by some researchers which lead to the increase of diabetes cases is the influence of western lifestyle and health behavior to the people living in Asia. Considering that there many Asians who have migrated in the US and then adapted the western lifestyle even though they continue to follow the culture of the country where they originated, no study has been conducted to determine the relationship between marital status, family size and type 2 diabetes among adult Asian-American women. This study filled the gap.

Summary

The focus of this chapter was the literature review regarding SEM, marital status and marital status-related health outcome, family size and family size-related health outcome, diabetes as well as Asian-Americans and the prevalence of diabetes in this ethnic group.

Diabetes is a chronic condition caused by elevated amount of sugar in the blood. Early diagnosis and management are important to avoid the complications in different parts of the body. There are several classes of diabetes, but the most common worldwide is type 2 diabetes. In the United States, diabetes is one of the economic burdens due to high medical costs and lost productivity. Type 2 diabetes is a public health concern in the

United States, and Asian-Americans are one of the races/ethnicities in the country who have high risk of this condition.

Studies have shown the positive health effects of being in a marital relationship, but other studies presented that married people have higher risk for diabetes. The health promoting effects of having larger family size were discussed in various studies, but in contrast, Peters et al. (2016) found that each additional child in the family leads to 3-4% increased risk of developing diabetes in both women and men.

The number of type 2 diabetes cases in the United States is alarming, and this chronic disease has become a growing epidemic among the Asian-American population (Li-Geng et al., 2020). However, no study has been conducted to determine the relationship between marital status, family size and type 2 diabetes specifically among adult Asian-American women, this study therefore filled the gap. Golden et al. (2019) stated that there is inadequate research conducted on the variation of type 2 diabetes prevalence based on race/ethnic differences. Accordingly, having a deeper understanding on this matter can lead to enhanced prevention and treatment of type 2 diabetes.

In Chapter 3 of this study, I discuss the research design and methodology.

Chapter 3: Research Method

Introduction

The purpose of this study was to explore the relationship between marital status and type 2 diabetes among adult Asian-American women. In addition, it also investigated the relationship between family size and marital status and type 2 diabetes in this group of women. I discuss in this chapter the following: research design and rationale, methodology, participants and dataset, threats to validity, ethical considerations, and finally, the summary.

Research Design and Rationale

This cross-sectional quantitative study used secondary data to answer three research questions and in testing the corresponding hypothesis. Cross-sectional study is conducted to evaluate the outcome and the exposures in the participants of the study at the same time (Setia, 2016). Some reasons that this study is preferred by researchers include: it is easy to conduct, less expensive, allows the examination of the associations between multiple exposures and outcomes, as well as allows the estimation of the burden of the disease, making it useful for health care service planning (Pandis, 2014).

The dependent variable of this study was type 2 diabetes, the two independent variables were marital status and family size, and the four covariates were older age, obesity, smoking, and education.

Research Questions and Hypotheses

The research questions and hypotheses were as follows:

RQ1: Is there an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

$H_0$1: There is no association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

$H_1$1: There is an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

RQ2: Is there a relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

$H_0$2: There is no relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

$H_1$2: There is relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

RQ3*:* Does family size moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

*H_0*3: Family size does not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

*H_1*3: Family size moderates any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

Time and Resource Constraints

In this study, I used secondary data to answer the research questions. Secondary data are previously gathered data intended to be used for different purpose and in different research (Ellram & Tate, 2016). One important benefit of using secondary data is that they provide large sample sizes and a variety of data on multiple topics (Renbarger et al., 2019). By using secondary data, I saved money, time, manpower used to collect the data, and other resources previously needed by the primary researcher. Since the data that I used had been collected and available online to the public for free, time and resource therefore will not constraints for this study.

Methodology

Population

The target population for this study were Asian-American women whose age ranges from 18 to 65 years who were diagnosed with type 2 diabetes. Statistically, population refers to an entire group who possess the information required to be ascertained while the target population refers to the group who have the characteristics from which the sample can be drawn (Banerjee & Chaudhury, 2010). In this study, the population pertained to the Asian-American women, while the target population specifically pertained to 18-65 year old Asian-American women who were diagnosed with type 2 diabetes, or whose blood sugar test results indicate that they have diabetes. Comparisons was made by also including individuals of similar age, gender and race who are non-diabetic. Asiamah et al. (2017) emphasized the importance of proper definition or specification of the population because it guides the readers in appraising the credibility of the sample, sampling technique(s) and outcomes of the research.

Sampling and Sampling Procedures

The U.S. population is large and studying the entire population will be impractical considering the amount of resources required to accomplish it. Elfil and Negida (2017) argued that locating the whole population everywhere, and having access to all the population are both difficult. Hence, sampling is applied by selecting certain number of individuals who have the characteristics that represents the target population.

The nationally representative sample of 5,000 NHANES participants was determined by computer algorithm that selected some, all, or none of the household members. Stookey (2019) described this process as stratified multi-stage, unequal probability cluster sampling wherein every participant is assigned with a numerical sample weight that reflects the number of people in the population represented by that specific person and then the sample weights are calculated to account for survey non-response, over-sampling, post-stratification, and sampling error. Elfil and Negida (2017) suggested the use multi-stage sampling when generating a sampling frame is nearly impossible due to the large size of the population. In this study, the sample frame was the list of female NHANES participants aged 18-65 who identified themselves in the questionnaire as Asian and met all the inclusion criteria set in this study.

To determine the effect that I was looking for, I performed a power analysis. Guetterman (2020) broadly referred power as the ability to identify a statistical significance of a specified effect size when an effect indeed exists. In order to calculate the statistical power, I used G*Power 3.1.9.7 software. This program is widely used in power and sample size calculations because it can be used for free, and its simple interface is easy to use (Kent State University, 2020).

I conducted complex samples logistic regression since NHANES data was obtained through a complex, multistage, probability sampling design to guarantee the participant's representative of the civilian, non-institutionalized U.S. population (Centers for Disease Control and Prevention, 2013). Complex survey data are collected by means other than simple random samples, and complex sampling designs typically include stratified multistage cluster sampling that makes nonindependence among units along with disproportionate sampling where some groups may be oversampled or probability proportional to size sampling has been applied (Hahs-Vaughn et al., 2011).

To control Type I and Type II errors, an a priori power analysis was performed which is an ideal method of sample size and power calculation (Kang, 2021). Type I error or α (alpha) occurs when the researcher rejects the null hypothesis when it is actually true, while type II error or β (beta) occurs when the researcher fails to reject the null hypothesis when it is actually false (Banerjee et al., 2009). The input parameters used in the power analysis include an effect size of 0.15, alpha level of 0.05, power of 0.80 and two predictors. Based on these parameters, the power of the study was 0.9519 and the determined sample size is 107. Serdar et al. (2021) argued that 0.05 is the most frequently chosen alpha level which means the researcher is willing to take a 5% chance that a result supporting the hypothesis will be false in the full population.

Inclusion Criteria

The inclusion criteria for this study included the following: (a) female gender, (b) stated race was Asian, (c) 18-65 years old, and (d) has diabetes. Comparisons were made by also including individuals of similar age, gender and race who are non-diabetic. There are four laboratory tests that determine the blood sugar of an individual: A1C test, fasting plasma glucose (FPG) test, oral glucose tolerance test (OGTT), random plasma glucose (RPG) test and in order to confirm the diagnosis, the same test is done in two different days or by using two different tests, e.g. FBG and A1C (National Institute of Diabetes and Digestive and Kidney Diseases, 2014). In NHANES 2017-2018, three blood tests were performed to determine the participants' blood sugar levels. These blood tests are glucose, fasting glucose and glycohemoglobin.

Exclusion Criteria

The exclusion criteria for this study included the following: a) male gender, (b) the race stated was other than Asian, and (c) the age was either less than 18 years old or more than 65 years old. In this study, the Asian-American women pertained to female individuals who were born in any country of Asia from Asian parent(s) and have migrated to any parts of the United States or female individuals who were born in any of the 50 states of USA and prefer to be identified as Asian because their ancestors (either paternally, maternally, or both) came from Asia. Geographically, Asia is the biggest continent occupying 44,568,500 sq km landmass and the most populous, consisting of about 60% of the world's population (Central Intelligence Agency, 2015). Asians are individuals who originated from Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei, Cambodia, China, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Laos, Lebanon, Malaysia, Maldives, Mongolia, Myanmar (Burma), Nepal, North Korea, Oman, Pakistan, Philippines, Qatar, Russia, Saudi Arabia, Singapore, South Korea, Sri Lanka, Syria, Tajikistan, Thailand, Timor-Leste (East Timor), Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam, and Yemen (National Geographic Society, 2020).

Recruitment, Participation, and Data Collection

Recruitment

The secondary data that was used for this study is the NHANES. It is a major program of the National Center of Health Statistics (NCHS) and is funded by US Centers for Disease Control and Prevention (CDC). When NHANES was first conducted in the early 1960s, it was originally intended to be done on periodic basis as a series of surveys focusing on different groups or health topics in the United States, but since 1999, the program has been conducted annually focusing on a variety of health and nutrition measurements to meet emerging needs (Centers for Disease Control and Prevention, 2017).

NHANES is a cross-sectional survey conducted every year in 15 counties nationwide. It targets civilian, non-institutionalized individuals of the U.S. population.

Researchers sample 5,000 individuals a year. The government provides $300 compensation for each participant and transportation if necessary (U.S. Department of Veterans Affairs, 2018). To disseminate the information regarding the in-person recruitment, the NCHS Director sends notification to the local health and government officials of each location, mails letter to households to introduce the survey, and uses local media to feature stories about the survey (Centers for Disease Control and Prevention, 2017). NHANES results are published biennially.

Participation

The eligibility to participate in the NHANES starts by completing the questionnaire at home with the NHANES interviewer. The questionnaire obtains family information (e.g., occupation, smoking, demographics and food consumption) and sample person information (e.g., health insurance, medical history, dietary behavior and weight history). The next step is the free health examination in the local mobile examination center (MEC), which is a group of trailers set up at a specific location accessible to all participants. The following are performed in the MEC: blood pressure testing, height and weight measurements, oral health screening with dentist, and collection and laboratory testing of blood and urine.

Data Collection

NHANES data were collected through interviews in the participants' home and health measurements that were performed by a team composed of physicians, dentists, health and medical technicians, and dietary and dietary interviewers in a specially designed MEC equipped to travel throughout the country (Centers for Disease Control and Prevention, 2017). The electronic gadgets and systems used during data collection include: touch-sensitive computers wherein respondents enter their responses to certain sensitive questions, tablet computers with electronic pens that are used by the interviewers, digital scales and stadiometers that automatically transmit data into a database making survey information available to NCHS staff within 24 hours of collection (Centers for Disease Control and Prevention, 2017).

NCHS shares to the public the results of the NHANES on its website, which can be downloaded for free. With regards to the use of more detailed dataset for research purposes, it is available upon request. I sent an email including my research proposal to the NCHS Research Data Center to obtain permission to access the more detailed NHANES data set.

Instrumentation and Operationalization of Constructs

NHANES is conducted and developed by NCHS. The NHANES data is released in two-year cycles, and it is openly available to the public on the CDC website, hence no need to ask permission to use it. It can be downloaded and accessed using IBM SPSS. I used the 2017-2018 NHANES in this study. I selected this cycle because it was the most recent full 2-year data collection cycle that was completed prior to the start of COVID-19 pandemic. The NCHS announced that due to the COVID-19 pandemic, the data collection for the 2019-2020 cycle was suspended in March 2020, which resulted to the creation of a “special pre-pandemic dataset” that consisted of the combined completed data from 2017-2018 cycle and the partial data collected for 2019-2020 cycle prior to the March 2020 suspension (Centers for Disease Control and Prevention, 2021). This secondary quantitative data that I used was a nationally representative study of the health of noninstitutionalized Americans which included a questionnaire which asked about the participants' health status, comorbidities, demographic information, and social determinants of health such as education; a physical exam to measure blood pressure, height and weight; and selected laboratory studies such as the determination of glucose, fasting glucose and glycohemoglobin levels (Seligman et al., 2021).

Operationalization

I selected the variables based on research interest available in NHANES 2017-2018. Table 1 lists the dependent, independent variables and covariates included in this study.

Table 1

Dependent, Independent and Covariates Used in This Study

Dependent variable	Independent variable	Covariates
Type 2 diabetes	Marital status	Older age
	Family size	Obesity
		Smoking
		Education

Definitions of Variables

The type 2 diabetes status was defined based on fasting glucose level, glycohemoglobin (HbA1c) level which is the average blood sugar level for the past 2-3 months, and participants' responses to the questionnaires. Participants who have type 2 diabetes mellitus will both have above 126mg/dl fasting glucose and 6.5% glycohemoglobin (HbA1c) levels. Positive responses to questions ''Have you ever been told by a doctor that you have diabetes?'' and ''Are you now taking diabetic pills to lower your blood sugar?'' will define if the participant has been diagnosed diabetes (Zhang et al., 2017)

Demographic information of NHANES were collected during the interview. The marital status variable had the following codes and descriptions: 1 = married, 2 = widowed, 3 = divorced, 4 = separated, 5 = never married, 6 = living with partner, 77 = refused, and 99 = don't know. Only participants 14 years old and older were asked for their marital status in the NHANES interview. The variable family size was the number of people in the participant's family. The values for this variable ranged from 1 to 7. Due to disclosure concerns, families that comprised of 7 or more people were included in the category that was labeled "7 or more" (Center for Disease Control and Prevention, 2020). NHANES define family as a group of people related by birth, marriage, or adoption and residing together.

For variable older age, the age in years at the time of the screening interview was reported for survey participants between the ages of 1 and 79 years of age. All responses of participants aged 80 years and older were coded as '80.' The education variable referred to highest grade or level of education completed by adults 20 years and older. The response categories included: less than 9th grade education, 9-11th grade education (includes 12th grade and no diploma), high school graduate/GED, some college or associates (AA) degree, and college graduate or higher. For participants 6-19 years of age, the responses were re-coded as follows: single years of education (grades 1-12), high school graduate/GED, and post-high school. Codes “55” (less than 5th grade) and “66” (less than 9th grade) were used to categorize older youth who had very low education levels (Center for Disease Control and Prevention, 2020). Asian American women age 18-65 years old were included in this study.

Data Analysis Plan

Data analysis was completed using a software developed by IBM, called Statistical Package for Social Sciences (SPSS). Abbott (2017) described SPSS as a “large spreadsheet that allows the evaluator to enter, manipulate, and analyze data of various types through a series of drop-down menus”. This effort and time saving tool is the most widely used software in analyzing large amounts of quantitative data (Masood & Lodhi, 2016).

The purpose of this study was to test the relationship between marital status, family size, and type 2 diabetes among adult Asian-American women. The dependent variable was type 2 diabetes, the independent variables were marital status and family size, and the confounding variables were older age, obesity, smoking and education. The research questions were as follow: (1) Is there an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education? (2) Is there a relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education? (3) Does family size moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education? Below were the three null and alternative hypotheses for this study.

$H_0$1: There is no association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

$H_1$1: There is an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

$H_0$2: There is no relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

$H_1$2: There is relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

$H_0$3: Family size does not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

$H_1$3: Family size moderates any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

I performed descriptive statistics as part of the data analysis procedure. In the presentation of descriptive statistics, few words are used to describe the basic features of the data in a study such as the mean and standard deviation (Mishra et al., 2019). I used SPSS 27 to conduct a complex samples logistic regression analysis to test the hypotheses. SPSS was also used to assess the frequency, measures of central tendency (e.g. means, median, mode) and dispersion of scores (e.g. variance and standard deviations). Complex samples logistic regression is the suitable statistical technique to use since NHANES data was obtained through a complex, multistage, probability sampling design to guarantee the participant's representative of the civilian, non-institutionalized U.S. population (Centers for Disease Control and Prevention, 2013).

Older age was one of the covariates because it is a significant risk factor for type 2 diabetes (Dunning et al., 2014). Abdullah et al. (2010) revealed that obese persons have 7-fold relative risk of developing type 2 diabetes compared to those with normal weight, for this reason I included obesity as a covariate because it is strongly related to type 2 diabetes. Smoking was another covariate because numerous evidence showed that smoking increases the risk of diabetes (Chang, 2012). In addition, education was chosen as covariate because in the U.S. population, educational attainment has been associated with the prevalence of diabetes (Borrell et al., 2006).

I used inferential statistical methods to answer the research questions. Gerstman (2008) argued that inferential statistics draws conclusions about the population from the sample statistics. The data was analyzed using complex samples logistic regression analyses. IBM (2017) maintained that when investigators are using complex samples logistic regression, the procedure executes logistic regression either on a binary or multinomial dependent variable for samples obtained by complex sampling method. Generally, logistic regression is used to analyze the relationship between several independent variables and a categorical dependent variable, and then estimate the probability of occurrence of an event by fitting data to a logistic curve (Park, 2013). Osborne (2015) claimed that effect sizes for logistic regression produces odds ratios which represent the change in odds for every 1.0 increase in the independent variable. Odds ratio is a measure of association between an exposure and an outcome, and it signifies the odds that an outcome will arise given a particular exposure, compared to the odds of the outcome happening in the absence of that exposure (Szumilas, 2010). For each odds ratio, a 95% confidence interval was computed to indicate statistical significance. The 95% confidence interval meant that if the same population is sampled on multiple occasions and interval estimates are made on each occasion, the resulting intervals would support the true population parameter in approximately 95 % of the cases (National Institute of Standards and Technology, 2013). Researchers described confidence interval as a range around a measurement that suggests how accurate the measurement is (New York State Department of Health, 1999). In this study, confidence intervals that included 1.00 was not be statistically significant.

Construct validity is one of the measures to validate tests. Cohen et al. (1996) described construct validity as the extent to which a construct measures the construct it is supposed to measure. Frankfort-Nachmias and Nachmias (2008) emphasized the use of previously tested survey because it ensured construct validity by yielding similar results as previously published studies. NHANES is a very comprehensive and time-tested survey which started in the 1960s. Various strategies were employed to ensure construct validity and it has been established through numerous research efforts confirming validity of national estimates by comparison to other national surveys.

Threats to Validity

Through this study, I explore the relationship between marital status and family size and type 2 diabetes among adult Asian-American women, and at the same time investigate whether family size moderates any relationship between marital status and type 2 diabetes among adult Asian-American women.

As a researcher, I wanted to produce a result that is accurate as possible. Internal validity refers to the researcher's ability to demonstrate cause and effect between at least two variables, while external validity relates to how the results can be generalized to describe contexts and/or populations outside of the sample (Urban & van Eeden-Moorefield, 2018). There are various threats to internal and external validity.

Instrumentation becomes a threat to internal validity when measurements do not work equally well each time they are used, so researcher must select measures carefully, test physical measurement devices (e.g., stopwatch, scales) consistently over the course of a study and to use the same measures at each administration (Urban & van Eeden-

Moorefield, 2018). The NHANES data that I used consisted of information gathered from the laboratory tests, health examinations performed by health professional and survey questionnaires answered by the participants. There were environmental factors that can affect the accuracy of the data collection. These can be the noise level, lighting condition, temperature, or the location (considering that some places in the United States have 4 seasons while others do not). To address these concerns, the following tests were performed in the controlled environment of MEC where instruments were regularly checked and calibrated: blood pressure testing, height and weight measurements, oral health screening with dentist; collection and laboratory testing of blood and urine. There were standard procedures that staff needs to consistently follow to maintain the accuracy of data collection. To avoid errors and to make sure that the staff can resolve errors that may arise, annual staff trainings as well as random visits by the NCHS personnel or contracted consultants were conducted.

This study focused on relationships between type 2 diabetes, marital status and family size among Asian American women. The threat to external validity in this study was minimal since I used NHANES dataset, which is a complex, multistage, stratified, cluster sample design survey that was collected from a nationally representative sample of United States civilians and noninstitutionalized population (Yang et al., 2021). Paulose-Ram et al. (2017) asserted that in the NHANES 2011–2014 and 2015–2018, the inclusion of the oversample of Asian-Americans produced the first national estimates for Asian-Americans on numerous health conditions and risk factors of public health significance that could not be found in other surveys. The use of secondary data, as opposed to primary data, in a way good for external validity because I had no impact on any bias or factors that would risk external validity. Since the data has been previously collected, I only conducted a secondary data analysis.

Ethical Procedures

This study used the data from the NHANES. In using secondary data, ethical rules and guidelines were considered to protect the participants and researchers from possible damage (Shirmohammadi et al., 2018). It is my duty to maintain privacy and confidentiality by protecting the personal information of the participants of the study and any identifying characteristics that would compromise anonymity (Clark-Kazak, 2017).

To ensure that I adhered to ethical standards, I sought first the approval of Walden University IRB to conduct this study. I then obtained approval of the NCHS to access the NHANES dataset and follow its policy in using their data. Privacy and confidentiality were maintained since the dataset does not indicate name of the participants nor identifiable information. The laptop computer used for the entire study has a password that only the researcher knows. In compliance to the federal regulation requiring the retention of research records for at least three years, I will destroy the data from the laptop computer three years after the completion of this study (U.S. Department of Health and Human Services, 2021).

Summary

This chapter described the research design associated with my study, sampling, data collection, analysis of data and ethical considerations. With this cross-sectional quantitative study, I used secondary data from the NHANES to explore the relationship between marital status and family size and type 2 diabetes among adult Asian-American women, as well as to investigate whether family size moderates any relationship between marital status and type 2 diabetes in this group of women. SPSS software was used in performing the data analysis.

In chapter 4, I present the results and findings from the study.

Chapter 4: Results

Introduction

The purpose of this quantitative study was to explore the relationship between marital status and family size and type 2 diabetes among adult Asian-American women using secondary data from the NHANES, as well as to investigate whether family size moderates any relationship between marital status and type 2 diabetes in this group of women. NHANES is a widely used data by research organizations, government agencies, universities, health care providers, and educators to assist in developing public health policy, directing and designing health programs and services, as well as expanding the health knowledge for the nation (Paulose-Ram et al., 2017). This useful program, which was launched in the early 1960s, was originally intended to be done on periodic basis as a series of surveys focusing on different groups or health topics in the United States starting 1999; however, it has been conducted annually focusing on a variety of health and nutrition measurements to meet emerging needs (Centers for Disease Control and Prevention, 2017).

The first research question was: Is there an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education? The null hypothesis for the first question was: There is no association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education. The alternative hypothesis for the first research question was: There is an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

The second research question was: Is there a relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education? The null hypothesis for the second research question was: There is no relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education. The alternative hypothesis for the second research question was: There is relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

The third research question was: Does family size moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education? The null hypothesis for the third research question was: Family size does not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education. The alternative hypothesis for the third research question was: Family size moderates any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

I discuss in this chapter the results of the descriptive and statistical analyses that I conducted to address the three research questions. I present a summary of the characteristics of the study population, baseline demographics, and descriptive statistics of the study sample. I end this chapter with summarized answers to the research questions, and then transition to the final chapter.

Data Collection of Secondary Data Set

The secondary data used for this study were derived from the NHANES, which is conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention to provide information on health and nutritional status, as well as to track changes over time among adults and children in the 50 states of the United States and the District of Columbia. Specifically, the four goals of gathering NHANES data include: to provide prevalence data on selected diseases and risk factors for the U.S. population; to monitor trends in selected diseases, behaviors, and environmental exposures; to explore emerging public health needs; and to maintain a national probability sample of baseline information on health and nutritional status (Paulose-Ram et al., 2017). To ensure national representativeness, the samples in NHANES are identified through a complex, stratified, multistage probability sampling design which consists of a four-stage sample: counties, segments, households, and individuals (Rana et al., 2020). The NHANES participants are recruited to represent all ages of the U.S. population. Approximately 5,000 individuals are examined every year, the inclusion however of the oversample of Asian-Americans in NHANES 2011–2014 and 2015–2018, allowed the first national estimates for Asian Americans on numerous health conditions and risk factors of public health significance that are not obtained through other surveys (Paulose-Ram et al., 2017). The purpose of NHANES for oversampling different sub-populations is to improve estimate accuracy (Eke et al., 2015). NHANES survey materials were translated into Mandarin Chinese, both traditional and simplified, Korean, and Vietnamese to facilitate the oversampling of the Asian population.

The NHANES data set consisted of information gathered from laboratory tests, health examinations and survey questionnaires answered by the participants. The interviews of the participants were conducted in their homes to ascertain demographic characteristics such as age, gender, level of education, ethnicity, marital status, place of birth, health insurance, and smoking status using a Computer-Assisted Personal Interviewing system (Chobufo et al., 2021). Informed consent is obtained from all participants and NHANES protocol is approved by the National Center for Health Statistics Research Ethics Review Board (Deng et al., 2021). Permission was given by the parent or guardian of minor participants, and documented assent is provided to those 7-17 years old (Stierman et al., 2021). The health examination component consists of medical, dental, physiological measurements (e.g. height, weight, blood pressure), and laboratory tests (e.g. blood and urine specimens testing) are administered by trained medical personnel (Heredia et al., 2022). When the medical examination was performed for NHANES 2017-2018, there were two categories in 6-month time period: November 1 through April 30, and May 1 through October 31.

I used the NHANES 2017-2018 cycle because it is the most recent full 2-year data collection cycle that was completed prior to the start of COVID-19 pandemic. The NCHS announced that due to the COVID-19 pandemic, the data collection for the 2019-2020 cycle was suspended in March 2020, which resulted to the creation of a “special pre-pandemic dataset” that consisted of the combined completed data from 2017-2018 cycle and the partial data collected for 2019-2020 cycle prior to the March 2020 suspension (Centers for Disease Control and Prevention, 2021). There were 16,211 total individuals from 30 different survey locations were selected in the NHANES 2017-2018 cycle, whereby 9,254 of these participants were able to complete the interview portion, and 8,704 underwent medical examination at the MEC (Centers for Disease Control and Prevention, 2021).

After receiving an IRB approval number 01-26-22-0446555 from Walden University (Appendix A), I downloaded the free NHANES 2017-2018 data set from the website of the Centers for Disease Control and Prevention. Specifically, I downloaded the Demographics Data (for the gender - RIAGENDR, age in years at screening - RIAAGEYR, race - RIDRETH3, education level – DMDEDUC2, marital status - DMDMARTL, total number of people in the family - DMDFMSIZ), body measures under Examination Data (for the BMI - BMXBMI), diabetes – DIQ010, and smoking – cigarette use – SMQ020 under Questionnaire Data (for the questions, “Have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?” and “Have you smoked at least 100 cigarettes in your entire life?”, respectively). Initially, I encountered an issue with two variables that prompted me to send an email to CDC for assistance. I conveyed that in the NHANES 2017-2018 codebook the variables RIDRETH3 (Race/Hispanic origin w/NH Asian) and DMDFMSIZ (Total number of people in the family) are shown, but when I downloaded the above-mentioned data, I do not see these two variables in the variable view of SPSS. The CDC forwarded my email to the NCHS. I received two email replies from NCHS. The first reply mentioned that the

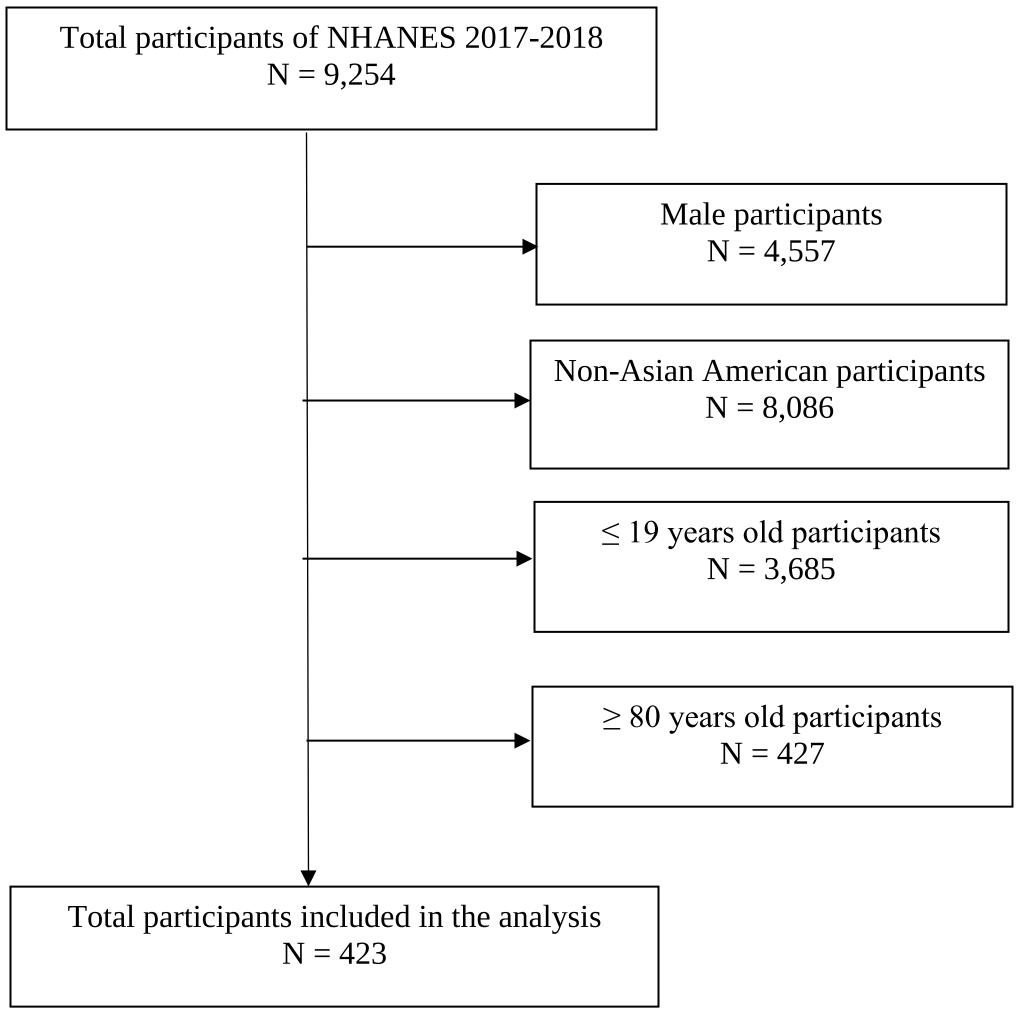
NHANES data are saved in a SAS transport (.XPT) file, and software packages such as SPSS is used to extract, as well as to analyze this complex data. The issue was finally resolved when I received the second NCHS reply after 6 days, whereby the Demographics file in CSV format was attached. I extracted the new Demographics Data and then merged it to the data I previously downloaded from the CDC website.

A discrepancy in data collection from the plan that I presented in Chapter 3 is with regards to the age of participants to be included in this study. In Chapter 3, I stated that the age of the participants will be from 18-65 years old. I changed the age of the participants for this study to 20-79 years old after reading the descriptions of the different variables in the CDC website. According to CDC (2020), it only released the marital status for participants who are 20 years old and older due to potential disclosure risks. Additionally, CDC has determined that it is a disclosure risk to report age in single years for adults 80 years and older. The last reason for the change of age is that there are two education level variables in the Demographics data. First is the DMDEDUC3, which pertains to the highest grade or level of education completed by participants 6-19 years of age. Second is DMDEDUC2 which pertains to highest grade or level of education completed by adults 20 years and older. For this study, I used DMDEDUC2. Appendix B lists the variables that are used in this study, as well as their corresponding question to the participants and the numeric code of each answer choices in the questionnaires of the NHANES 2017-2018.

Figure 1 shows the flow chart on how participants were selected for this study. I excluded from this study those participants who are 19 years old and younger, and those who are 80 years old and older. The total number of individuals who are 20-79 years old is 5,142. Males, as well as non-Asian participants, are also excluded. This resulted in a final study sample size of 423 who are female, Asian American and 20-79 years old.

Figure 1

Flowchart of the Study Sample Inclusion



All 9,254 participants of NHANES 2017-2018 with corresponding frequency and percentage per singular age are shown in Appendix C.

Among the 423 female Asian-American participants aged 20-79 years old who were included in this study, the singular age that comprised the most are the 55 years old. Hence, it is the mode of this data set, representing N = 20 or 4.7%. In contrast, 69 years old (N = 1 or 0.2%) had the least number of participants.

As previously mentioned, I excluded from this study the participants whose gender is male. Appendix D shows the gender distribution among the 9,254 participants of NHANES 2017-2018 with their corresponding frequency and percentage. There were more females (N = 4,697) in the NHANES 2017-2018, comprising 50.8% of the total participants. Among the total 4,697 female participants, 423 were included in this study based both on their age (20-79 years old) and self-reported race (Non-Hispanic Asian).

In the NHANES 2017-2018, there were two variables that pertain to race. Firstly, is the RIDRETH1 - Race/Hispanic origin, which has five categories to choose from and there was no category specifically for Asians: (1) Mexican American, (2) Other Hispanic, (3) Non-Hispanic White, (4) Non-Hispanic Black, and (5) Other Race – Including Multi-Racial. Secondly, is the RIDRETH3 - Race/Hispanic origin w/ NH Asian, which gave participants six categories to choose from. They can either select (1) Mexican American, (2) Other Hispanic, (3) Non-Hispanic White, (4) Non-Hispanic Black, (6) Non-Hispanic Asian, or (7) Other Race – Including Multi-Racial. The variable, RIDRETH3 - Race/Hispanic origin w/ NH Asian, was used in this study because it has the Non-Hispanic Asian category. Appendix E shows the frequency and percentage of each of the six categories in the variable, RIDRETH3 - Race/Hispanic origin w/ NH Asian. Between the six categories mentioned above, majority of the participants self-reported Non-

Hispanic White (N = 3,150 or 34%), followed by Non-Hispanic Black (N = 2,115 or 22.9%). The category, Other Race – Includes Multi-Racial, has the least number (N = 634 or 6.9%).

Among the 9,254 NHANES 2017-2018 participants, there were 1,168 who self-reported that their race is Non-Hispanic Asian. In this study, I included the 423 Non-Hispanic Asians whose gender is female and whose age belongs to 20-79 years old range.

In the variable, total number of people in the family, the families that are comprised of seven or more people were included in the category that is labeled "7 or more" due to disclosure concerns (Center for Disease Control and Prevention, 2020). In this study however, I only included the family size of the 423 Non-Hispanic Asian female participants who were 20-79 years.

Most participants of this study have two family members (N = 111 or 26.2%), followed by three family members (N = 97 or 22.9%), as seen in Table 2. The least number of participants are those in the Category 7 or more people in the family which comprise 4.3% (N = 18).

I presented in Table 2 the demographic characteristics of the sample study population. I recoded the age variable into six categories: 20-29, 30-39, 40-49, 50-59, 60-69, and 70-79. The BMI variable is also recoded based on the standard weight status categories recommended by CDC (2022): underweight (below 18.5, healthy weight (18.5-24.9), overweight (25.0-29.9), and obese (30.0 and above). BMI is an inexpensive tool to determine obesity through calculation using the formula BMI = kg / m^2 in metric system, where kg is the individual's weight in kilograms and m^2 is the height in meter squared. In the United States of America, where the English system of measurement is used, the formula BMI = lb (pounds) / in^2 (inches^2) x 703 (conversion factor) is used. The BMI has been valuable in population-based studies because it is the representation of an individual's fatness, which is a widely used risk factor for the development as well as the prevalence of various health issues (Nuttall, 2015).

Table 2

Demographic Characteristics of the Sample Study Population

Variable	Sample Study Population *n* = 423 (%)
Gender – Female (RAGENDR)	423 (100)
Race – Non-Hispanic Asian (RIDRETH3)	423 (100)
Marital status (DMDMARTL)	
Married	296 (70.0)
Widowed	22 (5.2)
Divorced	27 (6.4)
Separated	7 (1.7)
Never married	56 (13.2)
Living with partner	14 (3.3)
Refused	1 (.2)
Total number of people in the family (DMDFMSIZ)	
1	42 (9.9)
2	111 (26.2)
3	97 (22.9)
4	68 (16.1)
5	60 (14.2)
6	27 (6.4)
7 or more people in the family	18 (4.3)
Age in years at screening (RIDAGEYR)	
20-29	58 (13.7)
30-39	86 (20.3)
40-49	74 (17.5)
50-59	93 (22.0)
60-69	70 (16.5)
70-79	42 (9.9)

Body mass index (BMXBMI)	
Underweight	12 (3.0)
Healthy weight	194 (48.7)
Overweight	126 (31.7)
Obesity	66 (16.6)
Smoked at least 100 cigarettes in life (SMQ020)	
Yes	35 (8.3)
No	388 (91.7)
Education level – Adults 20+ (DMDEDUC2)	
Less than 9th grade	35 (8.3)
9-11th grade (Includes 12th grade with no diploma)	27 (6.4)
High school graduate / GED or equivalent)	61 (14.4)
Some college or AA degree	74 (17.5)
College graduate or above	225 (53.2)
Refused	1 (.2)
Don't know	
Doctor told you have diabetes (DIQ010)	
Yes	45 (11.4)
No	351 (88.6)

There are participant responses that are not specific. In this regard, I treated the responses "refused" and "don't know" as missing data. For the question: "Doctor told you have diabetes?", I only included the "yes" and "no" responses. The "borderline" responses were added to the missing data. Borderline, also called prediabetes, means the blood glucose of the participant is above normal levels but it is lower than the diabetes thresholds (Tabak et al., 2012). Authors Wu et al. (2021) claimed that there is a persistent controversy with regards to the cut-off points for diagnosing prediabetes utilizing the fasting plasma glucose and HbA1c concentrations. The contrast between the demographic characteristics of the sample study population and total study population is presented in Appendix F.

Results

I used IBM SPSS Statistics version 27 to perform statistical analyses. I initially conducted the logistic regression analysis. However, after thorough consideration, I ascertained that it is more rational to conduct the SPSS complex samples logistic regression analysis considering the comprehensiveness and the intricacy of the NHANES sampling method. Workie et al. (2017) asserted that conducting the logistic regression is suitable if the data collection used simple random sampling wherein each sampling unit has the same probability of being chosen from the population, but it becomes unsuitable if the data collection used complex survey sampling designs which can lead to biased estimates of parameters as well as incorrect variance estimates. Complex survey data is described by Hahs-Vaughn et al. (2011) as data that are collected by means other than simple random samples, and complex sampling designs typically include stratified multistage cluster sampling that makes nonindependence among units along with disproportionate sampling where some groups may be oversampled or probability proportional to size sampling has been applied. According to the Centers for Disease Control and Prevention (2013), NHANES data was not obtained via simple random sampling but rather through a complex, multistage, probability sampling design to guarantee the participant’s representative of the civilian, non-institutionalized U.S. population.

Research Question 1

Research Question 1: Is there an association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

Null Hypothesis 1: There is no association between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

I tested Research Question 1 using complex samples logistic regression to ascertain the effect of marital status, older age, obesity, smoking, and education on the likelihood of exhibiting type 2 diabetes. The model was not statistically significant, X^2 (5) = 423, *p* = .163, hence the null hypothesis could not be rejected. The model explained 22% (Nagelkerke R^2) of the variance in type 2 diabetes. Table 3 shows that covariates age (*p* = < .001) and smoking (*p* = .012) were statistically significant. This means that the odds of exhibiting type 2 diabetes increased by 7.2% for every one unit increase in age. While the odds of exhibiting type 2 diabetes increased by 287.6% for smoking versus non-smoking.

Table 3

Complex Samples Logistic Regression for Research Question 1

			95% CI for OR	
Variable	*p*	*OR*	Lower	Upper
Marital status	.163	1.443	.846	2.463
Age	<.001	1.072	1.048	1.095
Obesity	.116	1.441	.903	2.301
Smoking	.012	3.876	1.422	10.526
Education	.344	1.115	.879	1.414

Research Question 2

Research Question 2: Is there a relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

Null Hypothesis 2: There is no relationship between family size and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking and education.

I tested Research Question 2 using complex samples logistic regression to ascertain the effect of family size, older age, obesity, smoking, and education on the likelihood of exhibiting type 2 diabetes. The model was not statistically significant, X^2 (5) = 423, *p* = .980, hence the null hypothesis could not be rejected. The model explained 22% (Nagelkerke R^2) of the variance in type 2 diabetes. Table 4 shows that covariates age (*p* = <.001) and smoking (*p* = .008) were statistically significant. This means that the odds of exhibiting type 2 diabetes increased by 7.1% for every unit increase in age. While the odds of exhibiting type 2 diabetes increased by 263.6 % for smoking versus non-smoking.

Table 4

Complex Samples Logistic Regression for Research Question 2

Variable	*p*	*OR*	95% CI for OR Lower	95% CI for OR Upper
Family size	.980	1.012	.354	2.895
Age	<.001	1.071	1.049	1.093
Obesity	.115	1.432	.905	2.267
Smoking	.008	3.636	1.494	8.850
Education	.247	1.131	.909	1.408

Research Question 3

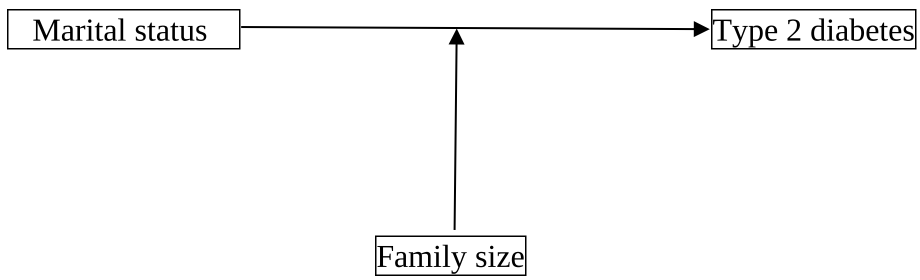
Research Question 3: Does family size moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education?

Null Hypothesis 3: Family size does not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

I tested Research Question 3 using complex samples logistic regression to ascertain whether family size moderates the effect of marital status, older age, obesity, smoking, and education on the likelihood of exhibiting type 2 diabetes. In analyzing moderation, the focus is on factors that influence the strength and/or direction of the relationship between the independent variable and the dependent variable (Muller et al., 2005). Figure 2 illustrates that family size is the moderator variable in this study.

Figure 2

Moderator Variable



To determine whether family size strengthens, weakens, or reverses the nature of a relationship between marital status and type 2 diabetes, I recoded the family size variable with only two categories: low family size (the family has 1-3 members), and high family size (the family has 4 or more members). I also recoded the marital status variable with only two categories: with partner (those who are married, or living with partner), and no partner (those who are widowed, divorced, separated, and never married). Table 5 shows the values I assigned for each category when I transformed in SPSS the variables family size and marital status, and it also shows the interaction between the recoded family size and recoded marital status.

Table 5

Interaction Between the Recoded Family Size and the Recoded Marital Status

Recoded Marital Status	Recoded Family Size	Interaction
1 = with partner	3 = low family size	3 = with partner and low family size
2 = no partner	4 = high family size	4 = with partner and high family size
		6 = no partner and low family size
		8 = no partner and high family size

The model was not statistically significant, X^2 (7) = 423, p = .367, hence the null hypothesis could not be rejected. The model explained 23% (Nagelkerke R^2) of the variance in type 2 diabetes. Table 6 shows that covariates age (p = <.001) and smoking (p = .006) were statistically significant. This means that the odds of exhibiting type 2 diabetes increased by 7.2% for every one unit increase in age. While the odds of exhibiting type 2 diabetes increased by 259.7% for smoking versus non-smoking.

Table 6

Complex Samples Logistic Regression for Research Question 3

Variable	*p*	*OR*	95% CI for OR Lower	Upper
Recoded marital status	.137	2.935	.680	12.678
Recoded family size	.444	2.251	.247	20.502
Interaction	.367			
With partner & low family size (3) vs. No partner & high family size (8)		.394	.046	3.361
With partner & high family size (4) vs. No partner & high family size (8)		1.000	1.000	1.000
No partner & low family size (6) vs. No partner & high family size (8)		1.000	1.000	1.000
Age	<.001	1.072	1.050	1.095
Obesity	.099	1.457	.923	2.299
Smoking	.006	3.579	1.524	8.474
Education	.324	1.094	.906	1.322

Summary

In this chapter I described the data collection and the results of study using secondary data from the NHANES to explore the relationship between marital status and family size and type 2 diabetes among adult Asian-American women, as well as to investigate whether family size moderates any relationship between marital status and type 2 diabetes in this group of women. The results showed that marital status is not a statistically significant predictor of type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education. Similarly, family size is also not a statistically significant predictor of type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education. Finally, it showed that family size does not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women after controlling for older age, obesity, smoking, and education.

In chapter 5, I present the interpretation of findings, limitations of the study, recommendations, implications, and conclusion.

Chapter 5: Summary, Conclusion and Recommendation

Introduction

Using secondary data from the NHANES, this quantitative cross-sectional study was used to explore the relationship between marital status and family size and type 2 diabetes among adult Asian-American women, as well as to investigate whether any relationship between marital status and type 2 diabetes was moderated by family size in this group of women.

The results showed that marital status was not statistically significantly related to type 2 diabetes among adult Asian-American women. Family size was also not statistically significantly related to type 2 diabetes among adult Asian-American women. Family size did not moderate any relationship between marital status and type 2 diabetes among adult Asian-American women. However, while controlling for age, obesity, smoking, and education, both age and smoking showed statistically significant relationships in all three models.

Interpretation of the Findings

Type 2 diabetes is a widely studied disease. However, no study has been conducted that specifically used Asian American women to explore the relationship to type 2 diabetes of marital status and family size. The study conducted by Aldossari et al. (2018) revealed that being married is a factor that increased the risk of diabetes and prediabetes among males in Saudi Arabia as well as having older age, obesity and being overweight, being a smoker, and having a civilian job and less education. This study, however, has a different result and did not support previous findings. The result of this study showed that the association between marital status and type 2 diabetes among Asian American women was not significant. The difference in the results of the two studies could be due to the difference in the gender of the respondents. Aldossari et al. used male respondents, while female respondents were used in this study. Peters et al. (2016) studied 463,347 Chinese participants who have children and presented an association of 3–4% increased risk for developing diabetes in both women and men for each additional child. Whereas the results of this study showed no significant association between family size and type 2 diabetes among Asian American women. The difference in the results of the two studies could be because Peters et al. only considered the number of biological children of the participants. In my study, the respondents were asked about the number of people in the family. The answer options were (1), (2), (3), (4), (5), (6) and (7 or more) which means the respondents may have children or childless. For instance, if the respondent answered that there are (2) members in his/her family, the (2) response could mean that the family of the respondent is composed only of husband and wife without children, or it could mean that the family of the respondent includes a single parent and one child. The child or children in this study could be either biological, adopted, foster, step or from previous marriage(s). As suggested by Early (2016), it is imperative that when employing the SEM, the different kinds of environment that humans interact with, as well as the interdependence of humans to each of these environments are given emphasis. The family is one of those environments wherein individuals create frequent and close interactions.

The result of the complex samples logistic regression for Research Question 1 showed that the covariates age and smoking were both statistically associated to type 2 diabetes. The result of the complex samples logistic regression for Research Question 2 implied that the covariates age and smoking were both statistically associated to type 2 diabetes. The result of the complex samples logistic regression for Research Question 3 indicated that the covariates age and smoking were both statistically associated to type 2 diabetes. These three results support the multiple studies conducted which revealed that increasing human age and frequent smoking are risk factors for developing type 2 diabetes.

The SEM served as the framework of this study in testing whether marital status and family size are risk factors for type 2 diabetes among Asian-American women. Individuals are conceptualized in SEM as nested within multiple levels of influence that are organized hierarchically by which relationships are most proximal to individuals, followed by community/organizations and then society more broadly (Harper et al., 2018). The results of this study indicated that although marital status and family size are both very proximal to the respondents, these two variables however were not statistically associated to type 2 diabetes.

Limitations of the Study

The Centers for Disease Control and Prevention's NCHS conducts the NHANES to assess the health and nutritional status of noninstitutionalized U.S. civilian population of all ages residing in all 50 states and Washington D.C. (Centers for Medicare & Medicaid Services, 2022). The NHANES data is a widely used research resource to explore prevalent health problems as well as their risk factors in the population because it combines many publicly accessible variables that are available for analysis (Koru-Sengul et al., 2011). However, since data from non-civilian or institutionalized populations were not collected for the NHANES, a limitation of this study is that it cannot be generalized to the entire U.S. population.

In cross-sectional studies, researchers analyze data that is collected at a single point in time to measure the prevalence of health outcomes, test determinants of health, and describe features of a population (Wang & Cheng, 2020). Since the NHANES is not a longitudinal study, it only measures the current exposures and health status of the participants. Another limitation therefore of this study is that establishing the temporal relationship between exposures and diseases cannot be clearly made, because both are determined at the same time. Distinguishing cause and effect from simple association is the most important drawback with cross-sectional studies (Mann, 2003).

I only used BMI as measure of obesity for this study; the results indicated that obesity is not significantly associated to type 2 diabetes, which does not support previous researches identifying obesity as a risk factor for type 2 diabetes. Although most investigators relied solely on BMI to define obesity, there are other methods of determining obesity that were used in various studies such as dual-energy x-ray absorptiometry (DEXA) that directly measures body fat; waist circumference measurement; as well as waist-hip ratio (Ghesmaty Sangachin et al., 2018). Rothman (2008) argued that reliance only on BMI could introduce misclassification problems, especially among muscular individuals, because it does not differentiate between fat, muscle or bone mass; which may result in important bias in estimating the effects related to obesity.

Recommendations

Type 2 diabetes is a preventable lifestyle disease. Overwhelming evidence show that the lifestyle of an individuals can either increase or decrease their risk of developing type 2 diabetes (van Dam, 2003). The results of this study revealed that marital status is not a statistically significant risk factor of developing type 2 diabetes among Asian American adult women. It was not identified whether members of this study sample were residing in a rural or urban environment. There are various environmental factors such as the level of nutrition education, access to sports facilities, and eating habits that are known to affect the lifestyle of individuals (Suliburska et al., 2012). Further researchers should attempt to investigate the difference in the risk of developing type 2 diabetes specifically among Asian American women between those who live in rural and urban areas.

Longitudinal study is also recommended to evaluate the association between risk factors and the development of type 2 diabetes among Asian American adult women. The ability to assess the associations between exposures and outcomes by limiting the influence of sample selection bias is one of the major benefits of conducting this kind of research (McLeod et al., 2022). Since conducting longitudinal studies allow researchers to follow individuals continuously over prolonged period of time, it may provide a more comprehensive understanding about type 2 diabetes, specifically in evaluating the relationships between the risk factors and the development of this disease, as well as the effects of treatments over different lengths of time (Caruana et al., 2015).

Implications

Type 2 diabetes is a noncommunicable disease that typically affects adult population. In contrast to infectious disease, its cause cannot be easily identified because these are various factors that affects an individual's risk of developing type 2 diabetes. Early prevention, diagnosis, and treatment of this chronic disease is crucial to avoid not only the numerous serious complications and early death, but also the burden it gives to the affected person, family, community, and society. Unfortunately, the number of people with type 2 diabetes has significantly increased through the years in both rich and poor countries that it is now a global public health crisis (Khan et al., 2020).

The results of this study showed that both marital status and family size were not statistically associated to type 2 diabetes, while increasing age and smoking were both statistically associated to type 2 diabetes. This study has potential impact for positive social change by raising awareness among Asian American women that as they grow older, their chances of developing type 2 diabetes increase and avoiding smoking can help lessen the likelihood of having type 2 diabetes. Since the SEM emphasizes that an individual is influenced by their environment and the environment is influenced by the individual (Salihu et al., 2015), it is important to consider that the scope of the word environment is broad. In the individual level, adult married women will be motivated to follow a healthy lifestyle. Observably, the family is the closest environment of every individual. The cooperation of the family members when they participate in spending more time for physical activities and making better food choices is the influence of this particular environment. Since the 50 U.S. states have different climatic conditions, organizations could show support by building both indoor and outdoor facilities that will encourage people to perform physical activities all year round. Policies can be created that will ensure the availability of nutritious foods in every supermarket and restaurant, as well as limiting the exposure to unhealthy foods thru stricter advertisement guidelines. Society in general could benefit from these efforts because type 2 diabetes cases might eventually decline, and its related medical expenditures may also reduce. In effect, the money saved can be used to improve the people's quality of life.

Conclusions

The U.S. economy is burdened in the form of higher medical cost and reduced productivity due to the continued growth in the number of people diagnosed with type 2 diabetes (American Diabetes Association, 2018a). To solve this health problem, various treatments/diagnostic procedures have been developed for this disease and it has been widely studied. In spite of all the efforts that were made, this epidemic still exists, and it is getting worse annually (Khan et al., 2020).

Numerous studies have been conducted about type 2 diabetes that identified its risk factors. In this study, I did not find a significant association between marital status, and family size, and type 2 diabetes among adult Asian-American women. The results manifested that marital status is not a statistically significant predictor of type 2 diabetes, X^2 (5) = 423, p = .163; family size is not a statistically significant predictor of type 2 diabetes, X^2 (5) = 423, p = .980; and family size does not statistically moderate the relationship between marital status and type 2 diabetes, X^2 (7) = 423, p = .367. However, while controlling for age, obesity, smoking, and education, both age and smoking showed statistically significant relationships in all three models. The findings of this study depicted the adult Asian-American women only, not the entire population, which indicates that more research is needed to determine what contributes to the continuously rising incidence of type 2 diabetes among people residing in the United States. Considering that the U.S. population consists of immigrants from different countries and observably individuals' lifestyle differ based on their cultural backgrounds, researchers need to refrain from viewing the people of this nation collectively. Type 2 diabetes is a lifestyle disease, each ethnicity therefore should be studied separately to determine what specific risk factors contribute to their development of type 2 diabetes. That way, this epidemic will be addressed appropriately.

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Appendix A: IRB Approval from Walden University

IRB Materials Approved - RheaAnn McBride
IRB <irb@mail.waldenu.edu>
1/26/2022 4:06 PM
To: Rheaann Mcbride Cc: IRB; Banerjee, Sri
Dear RheaAnn McBride,

This email is to notify you that the Institutional Review Board (IRB) confirms that your doctoral capstone entitled, "Association Between Marital Status, Family Size, and Diabetes Among Asian-American Women," meets Walden University's ethical standards. Since this project will serve as a Walden doctoral capstone, the Walden IRB will oversee your capstone data analysis and results reporting. Your IRB approval number is 01-26-22-0446555, which expires when your student status ends.

This confirmation is contingent upon your adherence to the exact procedures described in the final version of the documents that have been submitted to IRB@mail.waldenu.edu as of this date. This includes maintaining your current status with the university and the oversight relationship is only valid while you are an actively enrolled student at Walden University. If you need to take a leave of absence or are otherwise unable to remain actively enrolled, this is suspended.

If you need to make any changes to the project staff or procedures, you must obtain IRB approval by submitting the IRB Request for Change in Procedures Form. You will receive confirmation with a status update of the request within 10 business days of submitting the change request form and are not permitted to implement changes prior to receiving approval. Please note that Walden University does not accept responsibility or liability for research activities conducted without the IRB's approval, and the University will not accept or grant credit for student work that fails to comply with the policies and procedures related to ethical standards in research.

When you submitted your IRB materials, you made a commitment to communicate both discrete adverse events and general problems to the IRB within 1 week of their occurrence/realization. Failure to do so may result in invalidation of data, loss of academic credit, and/or loss of legal protections otherwise available to the researcher.

Both the Adverse Event Reporting form and Request for Change in Procedures form can be obtained on the Tools and Guides page of the Walden website:
https://academicguides.waldenu.edu/research-center/research-ethics/tools-guides

Doctoral researchers are required to fulfill all of the Student Handbook's Doctoral Student Responsibilities Regarding Research Data regarding raw data retention and dataset confidentiality, as well as logging of all recruitment, data collection, and data management steps. If, in the future, you require copies of the originally submitted IRB materials, you may request them from Institutional Review Board.

Both students and faculty are invited to provide feedback on this IRB experience at the link below:

http://www.surveymonkey.com/s.aspx?sm=qHBJzkJMUx43pZegKlmdiQ_3d_3d

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Information about the Walden University Institutional Review Board, including instructions for application, may be found at this link:
http://academicguides.waldenu.edu/researchcenter/orec

Appendix B: Variables, Questions, and Numeric Code of Each Answer Choices

Dependent Variable: Type 2 Diabetes

Variable Name: DIQ010
SAS Label: Doctor told you have diabetes
English Text: The next questions are about specific medical conditions. {Other than during pregnancy, {have you/has SP}/{Have you/Has SP}} ever been told by a doctor or health professional that {you have/{he/she/SP} has} diabetes or sugar diabetes?

Code or value	Value description
1	Yes
2	No
3	Borderline
7	Refused
9	Don't know
.	Missing

Independent Variables: Marital Status, Family Size
1) Marital Status
Variable Name: DMDMARTL
SAS Label: Marital status
English Text: Marital status

Code or value	Value description
1	Married
2	Widowed
3	Divorced
4	Separated
5	Never married

6	Living with partner
77	Refused
99	Don't Know
.	Missing

2) Family Size
Variable Name: DMDFMSIZ
SAS Label: Total number of people in the family
English Text: Total number of people in the family

Code or value	Value description
1	1
2	2
3	3
4	4
5	5
6	6
7	7 or more people in the family
.	Missing

Covariates: Older age, Obesity, Smoking, Education
1) Older age
Variable Name: RIDAGEYRSAS
Label: Age in years at screening
English Text: Age in years of the participant at the time of screening. Individuals 80 and over are top-coded at 80 years of age.

Code or value	Value description
0 to 79	Range of Values

80	80 years of age and over
.	Missing

2) Obesity
Variable Name: BMXBMI
SAS Label: Body Mass Index (kg/m**2)
English Text: Body Mass Index (kg/m**2)

Code or value	Value description
12.3 to 86.2	Range of Values
.	Missing

3) Smoking
Variable Name: SMQ020
SAS Label: Smoked at least 100 cigarettes in life
English Text: These next questions are about cigarette smoking and other tobacco use. {Have you/Has SP} smoked at least 100 cigarettes in {your/his/her} entire life?

Code or value	Value description
1	Yes
2	No
7	Refused
9	Don't know
.	Missing

4) Education
Variable Name: DMDEDUC2
SAS Label: Education level - Adults 20+
English Text: What is the highest grade or level of school {you have/SP has} completed or the highest degree {you have/s/he has} received?

Code or value	Value description

1	Less than 9th grade
2	9-11th grade (Includes 12th grade with no diploma)
3	High school graduate/GED or equivalent
4	Some college or AA degree
5	College graduate or above
7	Refused
9	Don't Know
.	Missing

Appendix C: Frequency and Percentage for Age of All NHANES 2017-2018 Participants

Frequency Distribution of Response Variable: Age in years at screening

	Frequency	Percent
0	357	3.9
1	234	2.5
2	242	2.6
3	185	2.0
4	180	1.9
5	178	1.9
6	165	1.8
7	168	1.8
8	195	2.1
9	199	2.2
10	199	2.2
11	189	2.0
12	156	1.7
13	152	1.6
14	159	1.7
15	135	1.5
16	157	1.7
17	148	1.6

18	144	1.6
19	143	1.5
20	76	0.8
21	67	0.7
22	90	1.0
23	80	0.9
24	92	1.0
25	77	0.8
26	89	1.0
27	77	0.8
28	85	0.9
29	95	1.0
30	85	0.9
31	79	0.9
32	92	1.0
33	104	1.1
34	82	0.9
35	81	0.9
36	88	1.0
37	81	0.9
38	82	0.9
39	85	0.9

40	76	0.8
41	96	1.0
42	85	0.9
43	72	0.8
44	79	0.9
45	85	0.9
46	86	0.9
47	85	0.9
48	82	0.9
49	67	0.7
50	80	0.9
51	73	0.8
52	99	1.1
53	79	0.9
54	99	1.1
55	121	1.3
56	104	1.1
57	97	1.0
58	77	0.8
59	90	1.0
60	141	1.5
61	145	1.6

62	123	1.3
63	129	1.4
64	112	1.2
65	93	1.0
66	103	1.1
67	91	1.0
68	82	0.9
69	85	0.9
70	83	0.9
71	89	1.0
72	61	0.7
73	61	0.7
74	71	0.8
75	60	0.6
76	49	0.5
77	53	0.6
78	47	0.5
79	45	0.5
80	427	4.6
Total	9,254	100.0

Appendix D: Frequency and Percentage for Gender of All NHANES 2017-2018 Participants

Frequency Distribution of Response Variable: Gender

	Frequency	Percent
Male	4,557	49.2
Female	4,697	50.8
Total	9,254	100.0

Appendix E: Frequency and Percentage for Race of All NHANES 2017-2018 Participants

Frequency Distribution of Response Variable: Race

	Frequency	Percent
Mexican American	1,367	14.8
Other Hispanic	820	8.9
Non-Hispanic White	3,150	34.0
Non-Hispanic Black	2,115	22.9
Non-Hispanic Asian	1,168	12.6
Other Race – Includes multi-racial	634	6.9
Total	9,254	100.0

Appendix F: Contrast Between the Demographic Characteristics of the Sample Study Population and the Total Study Population

Variable	**Sample study population** ***n*** **= 423 (%)**	**Total study population** ***n*** **= 9,254 (%)**
Gender – Female (RAGENDR)	423 (100)	4697 (50.8)
Race – Non-Hispanic Asian (RIDRETH3)	423 (100)	1168 (12.6)
Marital status (DMDMARTL)		
Married	296 (70)	2737 (49.1)
Widowed	22 (5.2)	462 (8.3)
Divorced	27 (6.4)	641 (11.5)
Separated	7 (1.7)	202 (3.6)
Never married	56 (13.2)	1006 (18.1)
Living with partner	14 (3.3)	515 (9.2)
Refused	1 (.2)	6 (.1)
Total number of people in the family (DMDFMSIZ)		
1	42 (9.9)	1250 (13.5)
2	111 (26.2)	1717 (18.6)
3	97 (22.9)	1556 (16.8)
4	68 (16.1)	1861 (20.1)
5	60 (14.2)	1423 (15.4)
6	27 (6.4)	794 (8.6)
7 or more people in the family	18 (4.3)	653 (7.1)
Age in years at screening (RIDAGEYR)		
20-29	58 (13.7)	828 (16.1)
30-39	86 (20.3)	859 (16.7)
40-49	74 (17.5)	813 (15.8)
50-59	93 (22.0)	919 (17.9)
60-69	70 (16.5)	1104 (21.5)
70-79	42 (9.9)	619 (12.0)
Body mass index (BMXBMI)		
Underweight	12 (3.0)	1449 (18.1)
Healthy weight	194 (48.7)	2191 (27.4)
Overweight	126 (31.7)	1957 (24.4)
Obesity	66 (16.6)	2408 (30.1)
Smoked at least 100 cigarettes in life (SMQ020)		

Yes	35 (8.3)	2359 (40.3)
No	388 (91.7)	3497 (59.7)
Education level – Adults 20+ (DMDEDUC2)		
Less than 9th grade	35 (8.3)	479 (8.6)
9-11th grade (Includes 12th grade with no diploma)	27 (6.4)	638 (11.5)
High school graduate / GED or equivalent)	61 (14.4)	1325 (23.8)
Some college or AA degree	74 (17.5)	1778 (31.9)
College graduate or above	225 (53.2)	1336 (24.0)
Refused	1 (.2)	2 (.0)
Don't know		11 (.2)
Doctor told you have diabetes (DIQ010)		
Yes	45 (11.4)	893 (10.3)
No	351 (88.6)	7816 (89.7)