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Predictors of Complementary Alternative Medicine Usage Among Diabetic Adults in the United States

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Walden University

College of Health Sciences and Public Policy

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Erlina Lewis

has been found to be complete and satisfactory in all respects,
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the review committee have been made.

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Walden University

2024

Abstract

Predictors of Complementary Alternative Medicine Usage

Among Diabetic Adults in the United States

by

Erlina Kearsse-Lewis

MSN, Walden University, 2015

BSN, Winston Salem State University, 2005

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

Walden University

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Abstract

Available data for the last two decades have shown that the use of complementary and alternative medicine (CAM) is increasing, with users including adult diabetics around the world. There is not a strong consensus concerning the influence of socioeconomic factors on the use of CAM by adult diabetics. The purpose of this retrospective cross-sectional study was to examine the use of CAM among U.S. adults 21 years and older diagnosed with diabetes and whether income influences the use of CAM among adult diabetics after adjusting for age, gender, and location. Cross-sectional data from the 2017 National Health Interview Survey represented noninstitutionalized U.S. adults with diabetes ($n = 26,728$). Multivariate logistic regression was used to examine the odds of CAM use among diabetics and whether income level influences CAM use. Results showed that females had lower adjusted odds ratio (AOR) of using CAM (AOR: 0.386; $p = 0.654$) compared to males (AOR: 1.472; $p = 0.654$). After adjusting for age, gender, and location, participants with higher education levels of master's and above (AOR: 4.214; $p = 0.103$) had higher odds of CAM usage compared to participants with lower education levels of high school/GED (AOR: 0.468; $p = 0.626$). The AOR for the association between income level and CAM use after controlling for confounders such as age, gender, and location was 0.491 ($p = 0.213$). Implications for positive social change include having practitioners regularly inquire on CAM use and medication adherence among diabetic patients, which may reduced mortality resulting from harmful side effects.

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Dedication

I want to dedicate this effort to my grandmother and my mother. I still remember my grandmother telling the kids, “You’ll have time to sleep when you're dead.” I am grateful that my mother listened to my grandmother when becoming a single mother. She set a strong and resilient example to my sisters and myself as she finished her education at night and worked her way through nursing school.

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Section 1: Foundation of the Study and Literature Review

Introduction

Diabetes mellitus (DM) type 1 and type 2 have become a global public health problem, with the prevalence of DM increasing, doubling in some areas of the world. This increase in DM has caused a public health concern or emergency for both developed and developing countries across the world (Al-Lawati, 2017; Devi et al., 2015; NCD Risk Factor Collaboration, 2016). The National Diabetes Statistical Report, from the Centers for Disease Control and Prevention (CDC), estimated in 2017 that over 34 million people had a diagnosis of diabetes. This number increased to 100 million people with the addition of people living with prediabetes. The incidence for DM was estimated to be over 1.5 million people in that same year. On a global scale, in 2015, the prevalence of DM was reported to affect over 400 million people. DM is not limited to developed countries like the United States but also affects developing countries such as India and Brazil (Bommer et al., 2018; Devi et al., 2013; NCD Risk Factor Collaboration, 2016; Rhee et al., 2018).

The comorbidities commonly related to DM include conditions such as heart disease, blindness, kidney failure, lower limb amputations, depression, and premature death (Hoffstad et al., 2015; Manzella, 2020). All of the associated conditions can affect the individual, their community, and their nation's economy (Bommer et al., 2018). The exact cost is a point of controversy based on research by Rodriguez et al. (2019) that suggested that mortality rates related to DM are being underestimated. These researchers were suggesting that the formal analysis of DM and its associated complications are being miscalculated, causing an underestimation of DM prevalence. The World Health Organization (WHO) estimated DM to be the seventh leading cause of death in 2016 and a major contributor to conditions such as kidney

failure, blindness, stroke, and heart disease (International Diabetes Federation Atlas of 2019, 2020; WHO, 2019).

The mortality rates and complications associated with DM can be more difficult to calculate in developing countries for many reasons, with economics and poor infrastructure leading the list of barriers to accurate calculations (NCD Risk Factor Collaboration, 2016). Globally the International Diabetes Federation Atlas of 2019 estimated the global mortality rate of DM to be over 4 million people. In 2019, the WHO reported an increasing rate for complications associated with DM.

The actual financial burden of DM can only be estimated with the combination of the direct and indirect costs related to this chronic disorder. In 2014, the cost to the U.S. economy as it related to DM was estimated to be over 300 billion dollars by Willey et al. (2018). On the global level, estimates were as high as 1.3 trillion dollars by Bommer et al. (2018). Similar analysis has projected that by the year 2030, DM will affect the global economy to the sum of 2.2 trillion dollars (Willey et al., 2018). The collaborating research of Willey et al. also shows that the financial burden associated with DM is high for economies like the United States but overwhelming for developing economies such as Brazil and Indonesia.

The projected 2.2 trillion-dollar expense that is related to DM indicates the need for social change by addressing the approaches being used by many countries in their efforts to resolve the public health emergency of chronic illness, including DM (Al-Lawati, 2017). These changes have included more international collaborations, focused goals, and increased monitoring. To complement these and future initiatives, the money spent by complementary and alternative medicine (CAM) users should indicate the existing demand for more options that

include local CAM applications (Davis, 2008; Krug et al., 2016; NCD Risk Factor Collaboration, 2016; Raghupathi & Raghupathi, 2018; Ventola, 2010).

The National Center for Complementary and Integrative Health (2018) defined CAM as a health practice or product that is unconventional by traditional medical standards. Although researchers have investigated monitoring and the application of CAM, there is very little or no literature on the influence of CAM usage on the likelihood of a DM diagnosis and how income may influence this relationship. The purpose of this quantitative study was to examine whether CAM usage influences DM status and if income influences the relationship between CAM usage and DM status among noninstitutionalized adults over the age of 20 after adjusting for age, gender, location, and ethnicity.

Study Background

Traditional care for DM requires many different considerations, including the individuals' choice of treatments. The cost in lives and the financial impact are big contributing factors to the growing public health emergency surrounding chronic diseases such as DM and their related complications (Ward et al., 2014). This public health emergency is not limited to DM but includes other chronic diseases like heart disease, liver disease, and kidney failure (Hoffstad et al., 2015; Manzella, 2020). Ward et al. (2014) established the need for CAM therapy due to the financial burden of diabetes. The cost of one chronic disease like DM for the U.S. economy was estimated in the trillions for 2015 and projected to almost double by 2030. These costs indicate the need for innovative solutions that include CAM targeted research (Bommer et al., 2018; NCD Risk Factor Collaboration, 2016).

The National Center for Complementary and Integrative Health (2018) reported that in 2017, an estimated 33% of the U.S. population had used some form of CAM. This study will attempt to better establish how the high usage of CAM indicates the need for better understanding of CAM usage in specific populations such as adult diabetics in the United States. A report in 2018 from The National Center for Complementary and Integrative Health found that CAM usage was on the rise, indicating the need for more targeted CAM research for its continued safe use and clarification of benefits. Coughlan et al. (2014) and Mbizo et al. (2018) found that CAM has many applications in the chronically ill population, including individuals with DM, liver failure, kidney disease, and mental health issues. CAM usage should be further examined as it relates to DM and other chronic diseases. More CAM research could indicate whether the global rise in usage is by local tradition or by necessity and what the related outcomes of CAM usage are. Shahid et al. (2016) found that *Ficus religiosa* had similar antimicrobial effects as some of the more expensive pharmaceuticals being used for related complications such as DM wound care.

Many chronic illnesses such as DM currently use drug-resistant microbes as a part of their treatment. The increasing number of drug-resistant microbes poses yet another present and growing threat to chronic DM, suggesting the urgent need for less expensive, alternative therapies for chronic illnesses such as diabetic wounds (Puca et al. 2021). This would indicate that the inclusion of potentially less expensive CAM in the treatment of chronic diseases such as DM could have the added benefit of reducing healthcare costs for many overwhelmed economies such as Indonesia, and to a degree the U.S. economy (Anderson, 2014; Ho et al., 2014; Hoerster et al., 2014). Another example of the increasing healthcare cost for diabetics was examined by

Rosenfeld (2019). The author found that the cost of insulin had tripled in price since 2002. This type of increase is forcing some policymakers to refocus their efforts and develop alternative strategies of obtaining insulin in their communities. Ventola (2010) suggested that the response to the growing demands of CAM users is seen in some traditional providers such as Columbia University College of Physicians and Surgeons, Harvard Medical School, and Thomas Jefferson University establishing CAM or integrative medicine centers. The NHIS data showed the increased usage of CAM in responses to annual questionnaires, indicating the need for more focused research to guide the safe practice of these users (CDC, 2012, 2017).

Problem Statement

Despite years of research on CAM usage among diabetic patients, there is a lack of consensus regarding the influence among American adults who have been diagnosed with diabetes. Despite the growing body of available data on this topic, its use largely remains undocumented (Chan et al., 2020; Liu et al., 2021; Sheikhrabari et al., 2017). A review of past studies offers conflicting insights on the topic related to the potential impact of gender, age, location, socioeconomic factors, and ethnicity influences on CAM use (Handley et al., 2017). By undertaking this study, I sought to fill the existing data gap in the available literature and help policymakers and health care providers have a better understanding of the potential roles of CAM usage among adults diagnosed with DM.

Over the years, researchers have attempted to examine potential motivators and identify sociodemographic factors and some of the major determinants of CAM use (Chan et al., 2020; Liu et al., 2021; Owusu et al., 2020; Sheikhrabari et al., 2017). There are conflicting findings on how socioeconomic and sociodemographic factors influence CAM usage among diabetic patients (Chan et al., 2020; Ilhan et al., 2017). Abdullah et al. (2018) examined factors of CAM use

among diabetic adults. Results from the cross-sectional study with adults aged 35 years to 65 years showed that persons with high education levels, females, urban residents, and older people are more likely to use CAM than younger and less educated people.

Rezaei et al. (2020) conducted a cross-sectional study on 38,859 participants in a 2018 Household Income and Expenditure Survey. Researchers examined how gender, age, household income, education, and place of residence influence CAM usage. Correlational analysis of the survey responses showed that diabetic adults from households with high socioeconomic levels were more likely to use CAM (Rezaei et al., 2020). There was a statistically significant difference in the disparity of CAM use by age, gender, geographic location, and level of education (Rezaei et al., 2020). The findings confirm observations by Abdullah et al. (2018) regarding the influence of socioeconomic and demographic factors on CAM use.

Despite the potential impact of socioeconomic and sociodemographic factors on CAM use, critics note that such factors do not necessarily influence its use among diabetic adults. Misawa et al. (2020) examined social determinants of CAM use among diabetic patients and found that disease severity, comorbidities, health anxiety, and disease progression influenced CAM use. The study found that gender, age, and family income did not influence individual use of CAM among adults with diabetes. Similar observations have been found by Kwak et al. (2021), Nuño-Solínis et al. (2021), and Owusu et al. (2020), in that there are varied findings related to how income level, gender, education level, and birthplace influence CAM usage among adults with DM. Researchers including Alzahrani et al. (2021) and Salah et al. (2020) further reported that CAM usage may be more attributed to disease outcome, the severity of the diabetes, complications, and cost of medication than the individual factors of age, gender, and level of education.

Perricone et al. (2020) added that the severity of disease, progression, and complications developed from clinical management may influence diabetic patients to use CAM. By contrast, the authors added that criteria such as gender, age of patients, and educational level are less relevant to the use of CAM among patients with diabetes. These findings further show a lack of consensus on the topic regarding how income level, gender, age, place of residence, and level of education influence CAM usage among adults with DM (Chan et al., 2020; Handley et al., 2017; Liu et al., 2021; Sheikhrabari et al., 2017). Through this study, I attempted to add the available data on whether CAM usage influences DM status and if income influences the relationship between CAM usage and DM status among adults in the United States.

Research Questions

Through this study, the following answers to the stated research questions were sought to further understand the relationship of the variables:

RQ1: Is there a statistically significant association between complementary and alternative medicine usage and DM diagnosis in adults, controlled for age, gender, location, and ethnicity?

H_01 : Complementary and alternative medicine usage is not statistically significantly associated with a diagnosis of DM in adults.

H_A1 : Complementary and alternative medicine usage is statistically significantly associated with a diagnosis of DM in adults.

RQ2: Does income level significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM after controlling for age, gender, location, and ethnicity?

H_02 : Income level does not significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM.

H_A2 : Income level does significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM.

The Cost of Diabetes Mellitus

Many articles have been published examining the cost of DM to economies around the world, including the United States. One of those articles was published by Riddle and Herman (2018). The authors found that one in four of American healthcare dollars goes to the cost of DM. Wiley et al. (2018) went further to suggest in their article that the calculations are incorrect and underestimate the true prevalence in country. The author's findings could indicate that the cost projections have been underestimated for DM and the emergency itself is being underprioritized by public health officials (Bommer et al., 2018).

Term Definitions

Alternative medicine: Xia et al. (2019) defined alternative medicines as those medications used in place of recommended conventional therapies. Singh et al. (2020) noted that alternative medicines are traditional therapies largely considered to be unorthodox in the medical profession, including crystal healing, naturopathy, and herbalism.

Barriers: The perceived or actual hindrance of access to or delivery of healthcare among patients (Huot et al., 2019).

Complementary and alternative medicine (CAM): Health practices and products that are unconventional by traditional medical standards (National Center for Complementary and Integrative Health, 2018).

Comorbidities: The simultaneous existence of different health conditions such as diabetes and chronic heart diseases (O'Hara et al., 2017).

Type 1 diabetes mellitus: A disorder that causes the immune response system to destroy the body's insulin production, causing unstable blood glucose levels (Brutsaert, 2020).

Type 2 diabetes mellitus: A disorder that causes the body to develop a resistance to insulin, producing unstable blood glucose levels (Brutsaert, 2020).

Heart disease: An umbrella term used to reference many different ailments of the heart to include coronary artery disease (CDC, 2019).

Holistic: Relating to the whole, the complete system, rather than a dissection of parts (Merriam-Webster, 2021).

Infrastructure: A term used to reference the basic framework of needed components required to facilitate effective operations ("Oxford," 2020).

Integrative medicine: Rejeski and Fanning (2019) defined integrative medicine as an approach representing a combination of conventional medicine, CAM, and evidence-based medicine in disease treatment and management.

Naturopathy: Health practices that avoid surgery and drugs. Natural remedies are used as primary (National Cancer Institute [NCI] Dictionary of Cancer Terms, 2015).

Prediabetes: A term used to indicate blood sugars that are not high enough to be diagnosed as diabetes (American Diabetes Association, 2020).

Assumptions

One author suggested that an assumption is a self-determined truth that a researcher holds about a study without proof (Beiske, 2017). The first assumption made was that CAM usage among adults over the age of 20 is widespread enough to make significant analysis and inferences to the greater U.S. population. The second assumption was that the responses given by participants during the interview process were truthful. The third assumption was that the participants felt safe and comfortable during the 2017 NHIS interview process. The last assumption was that during the interviews of the 2017 NHIS, recordings of interviews were complete as spoken by participants.

Scope and Delimitation

A definition of delimitation used by Bryman (2017) as characteristics that limit the scope of the study and serve to define the boundaries of the research. Delimitations of this study are focused on the dependent and independent variables, the research questions, the study population, and the chosen theoretical framework. The scope of this study is delimited by two research questions examining the potential association of CAM usage and a DM diagnosis in adults, and if income level significantly influences the usage of CAM among adults over 20 years with a diagnosed of DM after controlling for age, gender, location, and ethnicity. The data used focuses on adults from across the United States with and without a diagnosis of DM and who participated in the 2017 National Health Interview Survey (NHIS).

Since this is a comparative quantitative study that uses data from U.S. residents that met the qualifier of responding to the NHIS of 2017. Another delimitation was the additional qualifier of being an adult male or adult female, diagnosed with diabetes, heart

disease, asthma, COPD, using CAM, able to express answers related to employment status, and education level.

Limitations

Some potential limitations in a study are inherent to the method and design were suggested by Cohen et al. (2018). One example of inherent limitation of a study could be bias. The limitations of this study include a minimum age limit, ability to comprehend questionnaires, ability to communicate answers, and resides in the US. The limitation of being a resident could prevent the results from being generalized to other countries. The data is received from participants across the US, indicating that geographical locations should not be a limitation to generalizing to the greater U.S. population.

Significance

This study is significant in that it shows that there is a lack of consensus among the available data on the influence of CAM usage in adult diabetics and that the influence of income is limited (Goldman et al., 2020; Nuño-Solínis et al., 2021). The significance of this study is that it may also provide a better understanding of the CAM usage among adults with DM and the effect on their health status. This study may contribute to public health by providing evidence on the factors that may contribute to DM and highlight CAM disparities among adults with and without DM in the United States. Findings from this study may foster the development of interventions that consider alternative modalities of DM treatments. Through increased knowledge about variables associated with DM, strategies could be identified to reduce the risk of DM and other comorbidities. A benefit of more CAM research into the safe CAM usage by

diabetics would provide more evidence-based data for the development of new public health policies, clinical practice guidelines, and social recommendations.

As facilities respond to the public demand of more CAM therapies and to help reduce their legal burden, a larger body of CAM research will be needed (Goldman et al., 2020; Karaman et al., 2020). Social change implications of this study for health educators and providers may include collaborating with community organizations in the development of DM prevention interventions that prioritize CAM usage (Goldman et al., 2020; Karaman et al., 2020). Focused CAM research could reveal if the usage of CAM among adults diagnosed with DM is a positive social change or a dangerous trend. The interventions could consist of the support of family and friends and the use of the internet to sustain accountability of healthy weight maintenance among adults with DM and increased activity (Karaman et al., 2020; Perricone et al., 2020). Health policy planners may also utilize the study findings to conduct health promotion campaigns that include complementary medicine usage, which may assist with improving diabetic-related health outcomes.

Definition of Complementary and Alternative Medicine

Researchers have attempted to define, examine, and categorize the concept of complementary and alternative medicine for decades. For many areas of the world, there is no consensus on a specific definition of CAM. According to Rejeski and Fanning (2019), CAM includes a wide range of medical therapies that are outside of the proven conventional or traditional treatments. Xia et al. (2019) defined complementarily as therapies that are used together with clinical therapies. By contrast, alternative refers to medicines used in place of conventional therapies. In other DM management therapies, integrative medicine may be used

where a combination of CAM, conventional medicine, and evidence-based medicine are used to achieve optimal patient outcomes (Rejeski & Fanning, 2019).

Wang et al. (2018) defined alternative medicine as therapies that are outside of mainstream medical practice. The National Center for Complementary and Alternative Medicine groups CAM into five domains outside of conventional medicine. These domains include whole-medical systems, energy medicine, body-based manipulation or practices, mind-body medicine, and biological practices (Vishnu et al., 2017). For patients with diabetes, mind-body medicine and biological based practices are the most common CAM modalities studied and applied in the United States (Selçuk et al., 2019; Sheikhrabori et al., 2017). Salah et al. (2020) added that CAM constitutes health care systems, products, and practices that may not be clinically prescribed but are widely used among patients.

Some available research indicates that CAM is commonly used together with conventional therapies (Philips et al., 2019; Rhee et al., 2018). In contrast, many alternative therapies are used in place of evidence-based medicine or conventional therapies (Rhee et al., 2018). The available data shows an increase in the use of CAM, in many regions. One possible cause of increased CAM use could be the perceived safety and limited adverse reactions compared to pharmaceutical based therapies (Rhee et al., 2018). Radwan et al. (2020) suggested that CAM is considered a natural approach to DM management which includes music therapy, hypnosis therapy, massage therapy, faith healing, and acupuncture. These literature findings show diverse descriptions of CAM across academic literature, for many there is a consensus that they include unorthodox or nonconventional treatments.

Despite the diversity and range of definitions for CAM, their use has been in place since 1994 following the approval of the Dietary Supplement Health and Education Act (DSHEA) by

the US Congress (U.S. Food and Drug Administration, 2022). Under the DSHEA Act, CAM is defined as products taken by mouth and containing herbs, minerals, vitamins, and other botanicals. For many people, the definition of CAM could include any products containing substances such as metabolites, glandular substances, organ tissues, and enzymes (Misawa et al., 2020; Naja et al., 2017). Critics note that the DSHEA Act has a narrow definition of CAM since it limits the scope to biological formulations and fails to recognize systems such as body-based practices and mind-body modalities (Mekuria et al., 2018; Mbizo et al., 2018). Kwak et al. (2021) recently reported that under the DSHEA, CAM is largely defined as a dietary supplement and a type of food or spices rather than a drug. As a result of being categorized as a dietary supplement, CAM does not require approval from the Food and Drug Administration (FDA) before marketing. Often, manufacturers do not have a mandate establishing the safety, efficacy, or quality of their CAM products (Kwak et al., 2021). Lack of FDA approval, therefore, means that CAM manufacturers cannot make any claims about their clinical efficacy or whether they cure DM (Jafari et al., 2021).

Regulatory restrictions prevent some claims by CAM manufactures, but general statements are allowed during marketing including terms like “enhances”, “promotes”, or “supports” specific organ systems (Jafari et al., 2021). For example, Alzahrani et al. (2021) added that manufacturers may not state that herbs reduce blood glucose among DM patients but may state that its’ product supports glucose tolerance. Based on the current definition of CAM products, it may be noted that a specific or universal definition of CAM is still elusive in the available literature.

Complementary and Alternative Medicine Used by Adult Diabetics

The available literature presents various CAM products in use by adult diabetics around the world. Most CAM products come under three common categories including herbs or botanical products, dietary supplements, and mind-body medicine. Botanical products commonly used among diabetic patients include garlic, aloe vera, ivy gourd, *Gymnema*, bitter melon, prickly pear cactus, ginseng, and fenugreek (Al-Garni et al., 2017; Amaeze et al., 2018; Azizi-Fini et al., 2018). When researching garlic use, much of the available data was focused on treating cardiovascular conditions, Kamel et al. (2017) noted that its application has also been used among diabetic patients. Findings from clinical trials found that garlic supplementation among patients with dyslipidemia created a modest reduction in total cholesterol (Shaikh et al., 2019). Data from clinical studies found that patients taking garlic showed a decrease in diastolic (7.3 ± 1.5 mmHg) and systolic (8.4 ± 2.8 mmHg) blood pressures (Shaban et al., 2019). However, the change in blood pressures did not cause a significant decrease in high-density and low-density lipoproteins (Al-Garni et al., 2017).

There are many foods around the world that are known to affect DM. One of these studies was conducted by Wang et al. (2017) where they examined the efficacy of garlic use among patients with DM. The researchers explored past randomized controlled trials (RCTs) on garlic use from the Cochrane Library, EMBASE, and PubMed for studies published in the last three decades until the year 2017. Subgroup analysis found a significant reduction in fasting blood glucose after the group with garlic use was compared to the control group. The study also found that there was a significant decrease in glycated hemoglobin and fructosamine. Patients who used garlic showed improved total cholesterol, low-density lipoprotein, and high-density lipoprotein. The results found that the potential impact garlic use may have a positive and sustained roles of

regulating low and high-density lipoproteins, total cholesterol, and blood glucose levels (Wang et al., 2017). However, Shaikh et al. (2019) noted that considering the limited number of studies on the efficacy of garlic use among diabetic patients, further clinical trials are indicated.

Aloe vera has also been widely used over the years for a variety of skin ailments. Shakib et al. (2019) conducted a systematic study on aloe vera use among diabetic patients. Data from 53 peer-reviewed articles indicated that the increased use of aloe vera was due to its antidiabetic, antihypertensive, lipid-lowering, and cardioprotective effect. Kaur et al. (2017) also reported the potential positive effect of aloe vera use among diabetic patients related to hypoglycemic effects through the stimulation of β -cells. Besides garlic and aloe vera, the literature has also reported ivy gourd, *Gymnema*, and bitter melon as major herbs used as CAM by diabetic patients across the globe. When used as CAM, these herbs produce hypoglycemia in a mechanism similar to insulin (Ota & Ulrich, 2017). Past findings from randomized clinical trials (Al-Garni et al., 2017; Amaeze et al., 2018) and a nonrandomized trial (Kamel et al., 2017) indicated that ivy gourd, *Gymnema*, and bitter melon affect fasting blood glucose without adverse effect among diabetic patients. Further, patients receiving these herbs in addition to garlic, aloe vera, ginseng, or bitter lemon reported between 11% and 24% decrease in fasting blood glucose (Al-Garni et al., 2017; Amaeze et al., 2018; Kamel et al., 2017).

Gymnema, cinnamon, bitter lemon, ginseng, and prickly pear cactus have also been used as CAMs among diabetic patients with varied effects on blood sugar levels. Laha and Paul (2019) reported that *Gymnema* has demonstrated hypoglycemic effects in human and animal studies, possibly acting as an insulin secretagogue. A review of past studies shows that *Gymnema* has been used as adjuvant therapy in both type 1 and type 2 diabetes. Randomized trials found a significant before-to-after improvement in A1C and blood glucose levels among diabetic patients

receiving *Gymnema* herbal leaves (Laha & Paul, 2019). Similar effects have been reported for bitter melon resulting in decreased production of glucose, improved insulin activity, and glycogen synthesis (Soo et al., 2018).

Dietary supplements have also been examined in the literature as potential CAM products among patients with DM. Some of these common supplements include alpha-lipoic acid, chromium, coenzyme Q10, magnesium, omega-3 fatty acids, and vanadium. Genazzani et al. (2018) reported that alpha-lipoic acid is commonly found in food such as tomatoes, broccoli, and spinach. As an antioxidant, alpha-lipoic acid relieves oxidative stress which contributes to insulin resistance among diabetic patients (Genazzani et al., 2018). According to Tibullo et al. (2017), an increased uptake of alpha-lipoic acid improves insulin sensitivity. Results from randomized, placebo-controlled trials found that when used as CAM, alpha-lipoic acid contributes close to a 25% increase in insulin sensitivity per 600-1,800 mg of the supplement. It should be mentioned that the long-term effects of alpha-lipoic acid are yet to be determined among diabetic patients (Dworacka et al., 2018).

The available data of diabetics using CAM comes from researchers like Wanchai & Phrompayak (2016). Their study found that in Thailand the most common form of CAM used was Mind and Body modalities, Tai Chi, prayers, and meditation. The researchers also found that the more recent a diagnosis of DM, the higher the probability of CAM use. As opposed to adults with long term diagnosis of diabetes. Ben-Ayers et al. (2010) found in their study similar results for Mind and Body therapies being the most common form of CAM used by adults diagnosed with DM living in Israel. Increasing levels of available data supports the idea that CAM use is becoming common for many diabetics around the globe and expressing the cultural differences as seen in the different Mind and Body therapies (Alrowais & Alyousefi, 2017; Wang et al., 2018).

Diabetic Preventive Programs

In efforts to address the rising cases of DM, many programs have been developed by both private and governmental sources. The increasing numbers of adult diabetics indicated that the private sector needed to work more with government departments for better outcomes. Many of these programs come under the title of Diabetic Preventive Programs. In 2010, the CDC received funding and support for the National Diabetic Preventive Programs (NDPP) to address the rising prevalence of DM and to help coordinate efforts. Evaluations and follow up data found that the benefits of these programs are effective over many years for diabetics and delaying the onset of the disease (CDC, 2019).

The NDPP model was based on good research and evaluations of earlier programs. Adapting for cultural differences across the globe has made programs like the NDPP effective in countries like India. In Kerala India a similar program was developed and implemented. A study by Mathew et al. (2017) found that the Kerala Diabetic Preventive Program was culturally adapted well from the NDPP with good results. Indicating the importance of regional and global input to addressing the global DM emergency (CDC, 2019).

Section 2: Research Design and Data Collection

Framework

Over the last four decades, behavioral scientists have developed many different models and theories to help understand influences on individuals' actions towards health (Rejeski & Fanning, 2019). Some of the key theories that have been used to evaluate health-related behaviors include social cognitive theory, relapse prevention, self-determination theory, and the health belief model (HBM; Rejeski & Fanning, 2019). The HBM proposed in the 1950s has proven useful in understanding the use of CAM among adults with DM (Goering & Matthias 2020; Rosenstock, 2018).

How individuals engage in health-related activities has been increasingly explained using the HBM over recent decades. The HBM holds that a person's health belief determines whether they engage or participate in healthy activities. Some researchers have suggested that the HBM derives from behavioral and psychological theories with two founding tenets: (a) individual desire to avoid illness or get well if already ill and (b) a belief that a certain health action will cure or prevent an illness (Glanz et al., 2015; Naja et al., 2017; Shabibi et al., 2017). Kamel et al. (2017) suggested that a person's actions are influenced by their perceptions of the barriers or benefits related to such actions.

The HBM was used to guide the study with its six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and self-efficacy. In Construct 1, perceived susceptibility, a person becomes worried about the risk of acquiring a disease or an illness. Individuals have diverse feelings related to their potential vulnerability to an illness (Obirikorang et al., 2018). Construct 2 relates to the perceived severity of an illness, and it relates to the feeling a person has about the seriousness of contracting an illness. Some key

concerns that relate to the severity of an illness include permanent disability, quality of life, cost, and death (Obirikorang et al., 2018). Construct 3 relates to the perceived benefits of taking relevant action to reduce the potential threat of illness, such as finding a cure for the illness. This indicates that if a recommended action is considered beneficial, a person will accept the health action (Obirikorang et al., 2018).

Construct 4 of the HBM is popular among researchers and relates to perceived barriers. If a person has feelings about possible obstacles to performing a recommended action, these feelings affect potential benefits such as pain relief, decreased cost, or recovery from the illness. Patients are more likely to leave costly and painful experiences when making health decisions (Obirikorang et al., 2018). For example, patients may be likely to reduce clinical therapies if they consider them to cause adverse effects and have increased cost compared to cost-effective CAM, if they perceive CAM to be more beneficial.

Construct 5 of the HBM relates to cues to action where stimuli motivate an individual to take action (Obirikorang et al., 2018). Relating this construct to diabetes, the potential cue to action may include internal factors such as pain, slow-healing wounds, numbness of feet, and skin problems (Oriot & Hermans, 2020). This construct could be external factors such as internet postings, television or radio advertisements about CAM, illness of a family member, or advice from a person with DM (Oriot & Hermans, 2020). Construct 6 of the HBM relates to self-efficacy, which aligns with the level of individual confidence or ability to successfully execute a behavior. Relating this construct to a diabetic patient, self-efficacy indicates whether the patient performs the desired behavior of accessing, preparing, formulating, and consuming CAM.

Over the years, HBM has been used in various academic studies to examine self-care performance, disease control, and preventive measures that individuals embrace against illness.

The HBM, as suggested by Rosenstock (1974), works on the premise that understanding a person's belief of a threat from an illness and their perceived belief in the effectiveness of the treatment could help indicate possible cues to action. Jones et al. (2015) also suggested that the adaptability of the HBM could be used effectively to target beliefs and perceived threats of people. The use of HBM could also help indicate if a CAM user would perceive benefits from its use and needed cue to action.

A diagnosis of DM could be the cue to action of incorporating CAM safely into the treatment of DM (Glanz et al., 2015). Shabibi et al. (2017) explored the use of the HBM with education in the diabetic person. The authors found the use of the HBM helped to increase self-care around insulin use but also found areas where the use of the HBM did not have the same improvements. Specifically, the HBM applied to the research question in that individual behavior governs the decision to use CAM. The HBM could be used to address how the CAM usage decision is made by the individual with DM versus the individual without DM. For example, the perceived benefits may be greater among individuals with DM versus those without the diagnosis of DM (Alqathama et al., 2020). Furthermore, the potential effect of income status can be further studied to see if this influences the decision to use CAM.

Over the years, a growing body of literature on CAM has used the HBM to examine possible influencers of its usage among patients with diabetes. Naja et al. (2017) used the HBM to assess the use of herbal medicine among patients with chronic conditions including lung cancer and diabetes. The authors found that the health-seeking behavior among patients is influenced by the individuals' self-perception about their susceptibility to illness, the severity of their disease, and the assessment of potential benefits or barriers to using CAM. Owusu et al. (2020) also used the HBM to assess the usage of CAM among patients with DM and suggested that different

factors influence health behavior, including demographic characteristics such as gender, age, socioeconomic status, and various cues to action such as interpersonal interactions and social influences.

Philips et al. (2019) researched patients using alternative medicine. Their use of the HBM revealed that psychological factors are potential determinants of using CAM. The authors indicated that psychological influences could determine self-efficacy and initiate perceived control over behavior, thereby influencing the patient in their health-seeking behavior through CAM. Wang et al. (2018) noted that since its inception in the 1950s, the HBM has been fundamental in helping providers understand the problem encountered among patients when failing to adapt recommended preventive measures or treatment programs.

It should be noted that personal threats of poor treatment outcome and disease progression could predict the likelihood that a diabetic will adapt behavior (such as using CAM) to achieve a desired outcome. For example, some patients will consider using CAM to alleviate the comorbidities of DM that traditional therapies are unable to resolve. With increasing use and uptake of the HBM in the literature to study patient behavior, the choice of this model was considered relevant to the study. Specifically, the model was considered key to assessing how perceived susceptibility, perceived severity, perceived barriers, cue to action, and self-efficacy may help understand why adults with DM in the United States use CAM.

Literature Search

To provide answers to the research questions, a literature search was conducted to determine available data, identify trends, indicate gaps in the available data, and indicate possible inconsistencies in the available data. This literature search was conducted primarily over the years 2017–2022, using the following online databases: CINAHL, CINAHL PLUS, MEDLINE,

Walden Library database, MEDLINE, PubMed, EBSCOHOST, Data.gov, and Google Scholar. Most studies referenced for this study were published between 2014 and 2022.

Older articles are used to demonstrate availability of data and trends. The keywords and terms used in the search included *diabetic, diabetes, diabetes mellitus, public health epidemic, global rate of diabetes, public health finance, healthcare costs, indirect cost of diabetes, cost of diabetes, complementary alternative medicine, alternative therapies, holistic medicine, nonconventional medicine, Mind and Body, natural remedies, conventional medicine, use of complementary alternative medicine, heart disease, chronic diseases, kidney disease, kidney failure, liver disease, and CAM*. The literature search also used relevant data from the American Diabetic Association, CDC, WHO, and Department of Health and Human Services. The DATA.gov website also provided relevant links for statistical data.

Garg et al. (2021) examined CAM use among diabetic patients using data from case studies, hospital archive data, and peer-reviewed articles. Akhter (2021) conducted a literature review on the use of low-cost CAM remedies among patients with diabetes. The researchers obtained secondary data from academic databases such as Google Scholar, Web of Science, EBSCO, and PubMed (Akhter, 2021). Secondary studies have also been used in other studies to collect data on CAM usage among diabetic patients, including Johnson et al. (2018), Kaur et al. (2017), Kooshki et al. (2021), Lago et al. (2018), and Oriot and Hermans (2020).

Using the Walden University library and PubMed database, articles such as Forouzanfar and Hosseinzadeh (2018) were found to support this study. These authors explored in detail the availability of CAM for diabetic nerve pain in their study. The authors suggested that more research is being conducted in efforts to discover more medications leading to more CAM research. The Google Scholar database made available articles like Riddle and Herman (2018)

used to support the study. In this article, the authors explored the high cost of DM to the U.S. economy. The cost is projected to increase, affecting the U.S. economy more as the incidence of DM increases. This indicates the necessity of more innovative research and the increased use of CAM in the treatment of DM in this global emergency.

Using the CINAHL and CINAHL PLUS databases, articles such as Baker et al. (2010) were found to support the study and provide example of the available data regarding behavioral analysis and diabetes. The authors explored available research related to behavior and diabetics along with their design and outcomes. The authors used randomized controlled trails to review the data, highlighting some of the trends and gaps in the available data. The study also provided available references related to this paper's topic.

Across the globe, articles such as Chang et al. (2007) have reported on the prevalence of CAM use among diabetic patients. Chang et al.'s study found that CAM use was anywhere between 17% and 78%. Another article by Medagama and Bandara (2014) supported the finding of Chang et al. Their article suggested that 80% of developing countries use CAM to manage health conditions.

Statistical Data

The Data.gov database was used along with the CDC and American Diabetic Association databases to provide much of the statistical data on DM and related comorbidities such as heart disease, blindness, kidney failure, asthma, depression, and lower limb amputations. The statistical data used for this study included DM prevalence and incidence rates.

Sociodemographic and Socioeconomic Influences on Complementary and Alternative Medicine Usage

The use of CAM can depend on many factors, both social and economic. Misawa et al. (2018) examined CAM use among adults in Sendai, Japan. The study found that social determinants of health (SDH) affected CAM use and that households with increased levels of income were more likely to use CAM. The article by Misawa et al. (2018) supported an earlier article by Chao and Wade (2008) that found that households with income at or above \$60,000 annually were more likely to use CAM than households with annual income at or below \$20,000. The article by Chao and Wade went on to suggest that more research is needed to understand the factors influencing the use of CAM among populations like adult diabetics.

Bains and Egede (2011) found that factors influencing CAM use were not the same across the diabetic population, suggesting that various factors could be affecting the DM subgroups differently. Among Chinese and African women subgroups, the social-economic factors affected the population less than other subgroups. The study noted that the higher probability of CAM use was among the White subgroups. The authors also noted that families with limited access to health care used higher rates of CAM, indicating that income is not the only factor driving CAM usage.

Sources of Information

This study used the 2017 NHIS data released by the CDC. Earlier releases of the NHIS were used, including the 2002 NHIS, 2007 NHIS, 2010 NHIS, 2012 NHIS, 2014 NHIS, and 2016 NHIS. The variables location, gender, income, education, diagnosis of DM, CAM usage, and CAM types were included in this study. This data source was chosen based on cost and time restraints (National Center for Health Statistics [NCHS], 2019). Resource articles available to

support the study and answer the research questions included Farzaei et al. (2017) and Nevi et al. (2013) in their exploration of CAM usage and details of the diabetic populations in the United States. Articles similar to Bradley et al. (2012), Shokoohi et al. (2017), and Kim et al. (2011) were used to support the study with their comparison of CAM usage and conventional medicine in the chronically ill to include DM.

Using the 2007 NHIS, a study by Berkman et al. (2011) found that knowledge of CAM affects usage rates. These findings were later supported in an article by Burke et al. (2015). The authors suggested that the lack of CAM knowledge in populations with low income and low education levels could influence less CAM usage based on the decreased comprehension of CAM details.

Available Dataset

The annual 2017 NHIS was used to provide the basis for this study and to answer the research questions. Research and articles that examined topics similar to this paper were used for support. The use of CAM in chronically ill populations including patients with DM was examined in Mbizo et al. (2018) and Kristoffersen et al. (2018). Mbizo et al. (2018) found that 20% of the participants who were diabetic used CAM and suggested that more detailed research was needed in this area. Nguyen et al. (2014) suggested that more research was needed on CAM therapies as possible options to improve DM outcomes. Nevi et al. (2013) examined CAM use in their study of diabetics and made suggestions for more detailed research. A study by Bradley et al. (2012) compared the use of CAM and conventional medicine in the chronically ill population to include DM. The authors suggested that more CAM research was also needed based on their findings. The articles by Shokoohi et al. (2017), Grossman et al. (2018), and Kim et al. (2011) were used to demonstrate the gap in the available data related to targeted research on CAM use in chronically

ill populations. Money spent out of pocket for CAM has been cited by many authors using 2007 data, indicating the need for more CAM-focused research, especially for the growing, global multibillion-dollar CAM industry.

Prevalence of Complementary and Alternative Medicine Usage

Considering the various forms and methods of CAM that have been examined and in use across the globe, some researchers have examined the extent to which CAM is being used. Akhter (2021) reported that it is crucial to understand the patterns and extent of CAM usage in the world for various reasons. The authors suggested that examining the prevalence of CAM use would help develop strategies to enhance health outcomes and treatments for patients with DM (Akhter, 2021). Considering the conflicting findings on CAM prevalence by Adam et al. (2017), one study made the point that past research in the United States had either been restricted to examining the prevalence of CAM usage among inpatients or outpatients of providers with an estimated prevalence of 21% to 63% (Adam et al., 2017). The contrasting findings on CAM prevalence were among patients using a single type of CAM, resulting in an estimated prevalence of 15%–73% (Adam et al., 2017). These examples indicate the basis for the lack of consensus among available CAM data and the possible limitations of generalizations across the United States.

An article by Zhou et al. (2019) supported the suggestion that the available studies lack consensus about the specific prevalence of CAM usage. The lack of consensus could indicate that there is a need for more detailed studies, standardized data collection processes, and methods of analysis (Zhou et al., 2019). The concerns could also indicate that existing studies may not be reliable in their assessments of characteristics or associations of CAM users, patterns of usage, or CAM prevalence. Xia et al. (2019) recommended the use of household surveys to identify different types of CAM usage, associated CAM costs, possible side effects, and CAM prevalence.

Despite the conflicting findings of prevalence, researchers have explored CAM prevalence from different points of view across different regions of the world (Goering & Matthias 2020; Turbin et al., 2020; Vishnu et al., 2017; Wang et al., 2017). The different definitions used for CAM could be attributed to the wide range of its prevalence among diabetic patients ranging 15%-73%. (Adam et al., 2017; Alqathama et al., 2020). In areas of the United States, Rhee et al. (2018) reported that the prevalence of CAM usage ranges from 31% to 58% among adults who have diabetes. In parts of Saudi Arabia, the CAM prevalence was estimated at 66% (Al-Garni et al., 2017). While similar usage findings were shown in Malaysia at 64% (Andrews et al., 2018), Guatemala and Mexico at 62% (Andrews et al., 2018), and Bahrain at 61%. Slightly lower rates were found when comparing results from the UK at 21% and Canada at 27% (Alzahrani et al., 2017). In China, a long tradition of herbal therapy usage supported the high prevalence at 69% among DM patients in one study (Goering & Matthias 2020). Close to China, India recorded one of the highest prevalence of herbal medicine and CAM use in general with a prevalence between 47% and 73% (Chattopadhyay et a., 2020; Vishnu et al., 2010).

Systematic reviews on Chinese and Indian usage of CAM showed adults with DM believed herbal therapies to be more effective treatment over using lifestyle modification alone (Rejeski & Fanning, 2019). Further research has also examined CAM usage in other countries such as Iran, the United Arab Emirates, and Australia. Sheikhrabori et al. (2017) conducted a study on the prevalence of CAM usage among diabetic patients in Iran. Results from their cross-sectional study showed that 88.4% of the adult patients used at least one CAM treatment. In 84.9% of the Iranian patients, the most common CAM used included medicinal plants. Out of this population, 69% were satisfied with the CAM treatment option. This level of satisfaction could indicate a possible bases for the growing demand among diabetic patients in Iran.

The available data suggests that CAM usage is higher in some countries outside of the United States. For instance, in the United Arab Emirates, Radwan et al. (2020) conducted a cross-sectional study of 244 adult participants with DM. The researchers conducted a review of past studies between 2015 and 2019 to examine the prevalence of CAM usage and reported the prevalence to range between 35% and 61%. Correlation of results from the interview responses revealed that a total of 39.3% were actively using CAM in their DM management. Among 51.6% of the participants, the commonly used CAM was herbs and target foods, in addition to spiritual healing and natural remedies such as mineral and vitamin supplements. Up to 42.7% of adult patients with DM were encouraged by family to use CAM, compared to 25% who were encouraged by friends, and 17.7% influenced by social media. The study found only 10% disclosed CAM usage to care providers and 13.5% had been recommended to use it by their physicians.

In the United States, the prevalence of CAM usage among diabetic patients is mixed based on multiple studies focusing on different chronic conditions such as cancer, multiple sclerosis, and chronic allergy. Isbill et al. (2018) conducted a cross-sectional study on adult usage of CAM in the midwestern area of the United States. Results showed that almost 50.8% of the participants expressed interest and were optimistic about the benefits of herbal medications. Up to 48% indicated family members and friends as the source of information for CAM usage, and 54% were willing to use CAM. Isbill et al. (2018) found that 54% used one or more types of herbal remedies daily. For example, 64% of respondents believed that ginger promotes wellness and good health, compared to 58% of those who used garlic, and 56% who used cinnamon.

Reviewing past studies showed that the global trend for CAM usage among DM patients has increased (Amaeze et al., 2018). However, there are conflicting findings on its prevalence

with results showing ranges between 15% and 75%. In the UK and Australia. The prevalence of CAM usage was estimated at 46% among adults with DM. In India and China, the prevalence reached between 69% and 73% with most types of remedies being herbal medications, yoga, and Tai Chi. In the United States, the use of herbal remedies, dietary supplements, and Mind-Body medicine has been on the rise with one study reporting 40% active use (Isbill et al., 2018). Amaeze et al. (2018) reported that DM patients are 1.6 times more likely to use CAM than nondiabetic patients due to various reasons.

Health-Related Motivations for Complementary and Alternative Medicine Usage

Findings from past studies showed that adults with a diagnosis of DM are more likely to use CAM compared to adults with other chronic conditions (Kretchy et al., 2018). Potential reasons for CAM usage vary from treatment failures for those patients using conventional medicine to a desire to reduce costs with recommended conventional treatments (Amaeze et al., 2018; Lago et al., 2018). According to Atwine et al. (2017), a key reason for using CAM among diabetic patients was attributed to the possible fear of side effects from conventional treatments. In addition, some patients expressed cost concerns related to conventional treatment plans (Atwine et al., 2017).

Some of the available data suggests that the increased CAM usage among adults diagnosed with DM can be attributed to the increased cost of diabetic treatment supplies. Not only has the cost of insulin increased for many diabetics but related items like needles, syringes, testing strips, and diabetic monitors have increased in cost over the last decade. A study by Pfiester et al. (2021) examined data from an international cross-sectional study that supported the suggestion that increased cost of treating DM and the related supplies has forced many people to find alternative therapies like CAM (Mbizo et al. 2018). For many people this has led to increased

CAM usage and still others have stopped treatment completely leading to complications and premature deaths (WHO, 2019). An article by Herrick et al. (2020) found that many of the study participants had to make the decision between having enough food, housing, or medications to include diabetes.

Emerging Challenges in Complementary and Alternative Medicine Usage and Knowledge Gap

Despite the growing increase in CAM use among adults with DM, there are potential challenges that remain across scholarly and clinical literature. According to Vishnu et al. (2017) CAM usage was reported to affect glycemic control, growing concerns relates to their mechanism of action and clinical efficacy. In addition, potential side-effects have not been well documented (Vishnu et al., 2017). It should be noted that often adults with DM who use CAM also take conventional medicine or multiple prescriptions (Salah et al., 2020; Suh et al., 2020). Potentially, there are increased risks of negative herb- dietary and herb-drug interactions, resulting in adverse reactions and indicating a need for more focused research on safe CAM usage and related practices (Selçuk et al., 2019; Sheikhrabori et al., 2017).

Lack of information disclosure to care providers further increases the risk of adverse events among diabetic adults taking multiple prescriptions (Salah et al., 2020). Past findings show that less than a third of the adults who use CAM remedies disclose this information to their healthcare providers (Shraim et al., 2017). A gap in the available data was noted with reported levels of patients that shared their CAM usage with healthcare providers (Kretchy et al., 2018; Liu et al., 2021; Obirikorang et a., 2018). Some studies estimated that only 15-18% of practitioners are aware of CAM use by diabetic patients (Huang et al., 2017; Jovanovski et al., 2020). A cross-sectional study by Mekuria et al. (2018) reported that up to 77% of patients with

type 2 DM who used complementary and alternative medicine did not consult with their primary care providers. These findings further show a potential challenge in the effective use of CAM therapies among diabetic patients that might compromise optimal care in the event of potential adverse reactions (Liu et al., 2021; Obirikorang et al., 2018).

The existing gap in communication between diabetic patients and providers can be attributed (on some level) to the perception that many patients expect a negative reaction from providers about their use of CAM remedies (Akhter, 2021; Hermanns et al., 2017). Poor communication and information sharing may be attributed to a lack of inquiry among providers to know whether diabetic patients use CAM in addition to conventional treatments (Sheikhrabari et al., 2017). Studies from Saudi Arabia (Kamel et al., 2017), Iran (Rezaei et al. 2020), and the United Arab Emirates (Radwan et al., 2020) reported that between 9% and 14% of the physicians were likely to ask diabetic patients whether they use herbs, traditional remedies, or other nonconventional medical remedies in their disease management. As a result, the knowledge of potential adverse reactions, efficacy, and other reactions resulting from the combined use of CAM and conventional therapies remains poorly documented.

The WHO research on effective and safe CAM usage and other biological remedies advocated to make available information about other options for diabetic management (WHO, 2018). However, there remains a scarcity of data on CAM practices due to limited clinical data collection or a lack of self-reported surveys (Xia et al., 2019; Zhou et al., 2018). To make available more information on CAM use, there is a need for open collaboration between schools, providers, public health, and pharmacies in addition to clinical practice and policy makers (Wang et al., 2018). Open, multidisciplinary collaborations would offer unique opportunities to examine

potential patterns and determinants of CAM use among adults with DM and other chronic diseases.

Using nonstandardized research methods and measurements further impact current findings on CAM usage. Mbizo et al. (2018) reported that varied findings make it difficult to establish CAM use and trends estimated between 3% and 11% in patient visits annually to CAM practitioners. These varied findings may result from discrepancies in the data collection and reporting methods used along with nonstandardized qualitative instruments in studies that examine treatments or management plans for chronic diseases to include DM (Mbizo et al., 2018).

Alqathama et al. (2020) reported that information from existing studies failed to distinguish between specific CAM users, CAM practitioner recommendations, and the use of CAM for nondiabetic conditions or general well-being. While CAM use is growing, an available data gap remains for specific CAM usage among adults who have DM. This missing data could allow researchers to generalize to the larger adult population (Chan et al., 2020; Liu et al., 2021; Mekuria et al., 2018; Sheikhrabari et al., 2017).

Source of Data for Past Complementary and Alternative Medicine Research

The available research on CAM has been developed from both primary and secondary data sources. These data sources included interviews, surveys, focus groups, past journal publications, and archival data. In one quantitative study, Al-Eidi et al. (2017) obtained their data using primary sources that included questionnaires. Amaeze et al. (2018) also used surveys to collect data on herbal medications used among patients in Nigeria. Azizi-Fini et al. (2017) used primary sources of data that included questionnaires to examine herbal medicine use among patients with type 2 diabetes. Svenson (2018) also used interviews as a source of primary data to

examine the use of CAM among persons with DM in Guatemala. Hermanns et al. (2018) used primary sources of data collection with interviews and surveys to examine patients' views and opinions about Tai Chi use and its effect on their wellbeing. The use of primary sources of data collection was also applied by other researchers to include Alghamdi et al. (2018), Khairy et al. (2021), Kretchy et al. (2018), Mekuria et al. (2018), and Shraim et al. (2017) to examine the potential relationships between CAM usage and DM.

Secondary sources of data have also been used by researchers to supplement primary sources of information (Alzahrani et al., 2021; Ayers et al., 2018; Chen et al., 2019). For example, Alzahrani et al. (2021) conducted a meta-analysis and systematic study to assess the global prevalence and use of CAM among diabetic patients. Data for their study was obtained from past journal publications, longitudinal studies, cross-sectional studies, and observational studies. Dlodla et al. (2010) conducted a meta-analysis study and used data from randomized controlled and nonrandomized clinical trials in their study.

Methodological Limitations of Past Studies

Potential limitations in past studies have been identified and help form a basis for future studies on the CAM topic among the chronically ill population. Adeniyi et al. (2021) examined the use of CAM among patients with DM in Jamaica and found that religion and family did influence CAM use. The author further suggested that many CAM users did not share their information with care providers. Adeniyi et al. (2021) shared potential limitations in their findings. For example, the researchers used convenience sampling to recruit participants in their study, thereby introducing potential bias in representation. Similar bias has been reported in studies conducted by Lago et al. (2018) and Rejeski and Fanning (2019) resulting in a small and

nonrepresentative sample making it difficult to generalize the obtained results on CAM usage to the larger population.

Ramamoorthi et al. (2019) reported an under-representation of data on CAM use among patients resulting in potential limitations on establishing the prevalence of CAM use. In some cases, patients feared that sharing their CAM usage with care providers would result in negative response or attitudes, further indicating a lack of trust between CAM users and healthcare providers (Ramamoorthi et al., 2019). Radwan et al. (2020) added that much of the available data was collected from patients who attend chronic disease clinics, and that data may not be generalized to patients who attend other types of health facility or the general population.

Much of the data used in examining the potential correlation between CAM and diabetic patients is largely self-reported (Johnson et al., 2018; Kaur et al., 2017; Kooshki et al., 2021). Self-reported data may introduce social desirability bias since some adults who use CAM may share inaccurate information about the possible impacts of traditional remedies on their wellbeing (Lago et al., 2018; Oriot & Hermans, 2020). As a result, there is a need to examine household surveys to collect diverse participant demographic data on CAM usage to reduce potential desirability bias in self-reported data.

Amaeze et al. (2018) and Azizi-Fini et al. (2017) also reported potential limitations in data used by past researchers resulting in a lack of consensus on prevalence, motivations for use, and effects of CAM on health outcomes among diabetic patients. Some of the potential shortcomings of past data include surveys limited to patients who attended hospitals and failed to interview undiagnosed patients (Amaeze et al., 2018). It should be noted that failure to include data from private clinics and a lack of physician inquiry about CAM usage trends also affect data validity (Azizi-Fini et al., 2017). Al-Eidi et al. (2017) added that limiting the sample to hospital

settings introduces selection bias implying that results may not be generalized to the entire population of adults who have diabetes. Qualitative methods used to collect data during interviews and focus group discussions may also result in interviewer bias and subjectivity, leading to underreporting of CAM usage (Al-Eidi et al., 2017; Kaur et al., 2017).

Results from interventional and cross-sectional studies also showed mixed findings on the effectiveness of CAM usage and potential sociodemographic and socioeconomic factors influencing its uptake among adults with DM (Kretchy et al., 2018; Mekuria et al., 2018). While some researchers have reported a positive glycemic effect of CAM on patients with DM, other researchers have failed to establish similar findings (Kooshki et al., 2021; Lago et al., 2018). A key concern was the diverse methods, tools, sample size, and data collection processes used among various researchers (Alghamdi et al., 2018; Alzahrani et al., 2021; Chen et al., 2019). Considering the conflicting findings around CAM use it should be noted that it is difficult to identify specific trends of CAM use such as spiritual healing, herbal use, and mind-body approaches among adult diabetics.

The use of different sources of data collection, methods of analysis, and failure to control for potential confounding factors such as age, income, gender, and education could result in conflicting outcomes on the possible associations between CAM use and DM diagnosis (Khairy et al., 2021; Shraim et al., 2017). Johnson et al. (2018) reported that most studies did not control for potential confounders such as age, gender, and socioeconomic status. Considering the potential limitations, there is a need to conduct additional research using large sample size and controlling for potential confounding factors that may influence the potential relationship between CAM usage and patients with a diagnosis of DM (Ayers et al., 2018; Kaur et al., 2017; Oriot & Hermans, 2020).

The purpose of this retrospective cross-sectional study is to examine associations of CAM usage among adult diabetics and examine if income influences any relationships between CAM usage in diabetic adults 21 years and older, adjusting for age, gender, location, and ethnicity. Over the years, DM has become one of the most prevalent chronic diseases with high morbidity and mortality rates. The stated research questions focus on answering whether there is a statistically significant association between CAM usage and a DM diagnosis in adults after controlling for age, gender, location, and ethnicity.

Section 3: Presentation of the Results and Findings

The purpose of the study was to explore statistical influences between the independent variable (DM) and the dependent variable (CAM usage) and the independent variable (diabetes) after controlling for confounding factors. Controlling a series of covariates (e.g., race, age, gender, etc.) and assessing the usage of CAM, using a secondary analysis of the 2017 NHIS. In Section 3, it is concluded that the statistical properties characterizing the samples offering validity for the assumptions and the appropriateness of the study of CAM usage and diabetes in the United States warrant further research. Recommendations are made for future research on the compelling relationship between income and CAM usage.

Data Source and Study Sample

The data source for this study was the 2017 NHIS. The survey was administered by the NCHS of the CDC (Wang et al., 2018). The NHIS is conducted annually as a cross-sectional, in-person interview survey. The data from the NHIS represent health care trends among residents of the United States (Hopf et al., 2018). The NHIS is sponsored by the National Center for Complementary and Integrative Health (NCCIH) of the National Institutes of Health (NIH). The participants were asked to share insights related to their health habits and status. For example, the survey asked participants if they had ever been told by their doctor that they had diabetes. The response choices to this question included don't know, not ascertained, refused, borderline, no, or yes. This study examined data and responses for all participants aged 21 and above and included all covariates such as age, gender, household income, ethnicity, and level of education. The survey response rate was 66.5 % in 2017, with 33,527 families and 33,143 adult participants.

This study included the variables age, gender, location, ethnicity, income levels, education levels, DM diagnosis, CAM usage, and types of CAM used to create a foundation for

the data analysis and to test the research hypotheses. Articles that were used to support the hypotheses and research question included Liu et al. (2021), Mbizo et al. (2018), Parsons et al. (2019), and Wang et al. (2018). These studies were chosen because they also examined CAM usage and details related to diabetic patients in the United States. To compare the use of CAM and conventional medicine, articles by Rhee et al. (2018), Hawk et al. (2017), and Seena (2018) were used in relation to the diabetic patient.

Recent studies that suggest the need for further research on the topic of CAM use among populations diagnosed with DM include Liu et al. (2021), Mbizo et al. (2018), Parsons et al. (2019), Hawk et al. (2017), and Seena (2018). Liu et al. and Mbizo et al. observed a potential gap in data in relation to targeted research on CAM use in diabetic patients and the possible impact of demographic influences on adults to use CAM in place of conventional diabetic therapies in the United States.

Study Design

For this study, the following research questions were examined.

RQ1: Is there a statistically significant association between complementary and alternative medicine usage and DM diagnosis in adults, controlled for age, gender, location, and ethnicity?

H_01 : Complementary and alternative medicine usage is not statistically significantly associated with a diagnosis of DM in adults.

H_A1 : Complementary and alternative medicine usage is statistically significantly associated with a diagnosis of DM in adults.

RQ2: Does income level significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM after controlling for age, gender, location, and ethnicity?

H_{02} : Income level does not significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM.

H_{A2} : Income level does significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM.

The retrospective cross-sectional design was used in this study with the data from the 2017 NHIS. This paper focuses on CAM usage among adults with or without DM in the United States. Comorbidities or multiple chronic conditions were defined as two or more mental or physical health conditions (Rejeski & Fanning, 2019; Selçuk et al., 2019; Sheikhrabari et al., 2017). Creswell (2017) reported that many retrospective studies intend to examine an issue or a phenomenon that has occurred in the past. In this study, the focus is examining trends on the use of CAM among adults with DM in the United States.

Davies (2020) added that retrospective studies entail the collection and use of secondary data based on available information from past databases or previous studies. For example, a retrospective study was needed to examine the relationship between CAM usage and diagnosis of DM based on the data from 2017 NHIS (Al-Garni et al., 2017; Chan et al., 2020; Liu et al., 2021). Creswell (2017) added that the cross-sectional simple design helps with the specific aim of examining the prevalence of a problem, phenomenon, issue, or attitude by taking a cross-section or view of the population. In this study, a cross-sectional design helped assess the attitude of adults with DM or other demographic characteristics such as age, gender, education, and income level and their association with CAM usage.

Measures

In this study, the dependent variable was CAM usage, and the independent variables were the demographic factors. The sample was comprised of adult diabetics over the age of 20 years who responded to both the CAM supplementary file and adult file. For this study, CAM use was focused on the past 12 months. CAM use in the past 12 months was grouped into two categories: (a) CAM users in the past 12 months and (b) CAM nonusers in the past 12 months. Adults with DM who used at least one of the CAM therapy types were considered active users.

Adults who did not use any of the CAM types were considered nonusers of CAM in the past 12 months. A binary variable (Yes/No) was created for each group of CAM use in the preceding 12 months. The study did not exclude adults with any chronic mental or physical conditions such as depression, bipolar disorder, hypertension, hyperlipidemia, and heart diseases. The study included all adults diagnosed with without DM in the United States. The 2017 NHIS study sample consisted of 33,527 families and 33,143 adult participants.

Dependent Variables

Dependent variables relate to CAM usage. Adults 21 years of age and older who had used any type of CAM therapies were used in this study. Specific CAM therapies under consideration included herbal mixtures and folk food, natural and spiritual healing, minerals, and vitamins (Wang et al., 2017). Herbal mixtures and folk foods included anise seed, green tea, cumin oil, coriander, garlic, olive oil, bitter gourd, lemon, ginger, onion, cinnamon, turmeric, and fenugreek (Goering & Matthias 2020; Turbin et al., 2020; Vishnu et al., 2017). Spiritual and natural therapies included naturopathy, Ayurveda, and cupping. Supplements focused on in this study included omega 3, vitamin B6, B-complex vitamins, and multivitamins (Al-Garni et al., 2017;

Amaeze et al., 2018; Azizi-Fini et al., 2018). These CAM therapies were used as dependent variables in the study.

Independent Variables and Covariates

Independent variables included factors associated with CAM use in both adult men and adult women in the United States. The demographic factors included the region of residence, marital status, ethnicity/race, and age group in years (Wang et al., 2017).

The choice of the covariates was based on the social and behavioral wellness model (Wang et al., 2018). Specifically, the model summarizes health-promoting lifestyle factors as consisting of enabling, predisposing, engaging in healthy lifestyles, and undertaking personal health practices (Dworacka et al., 2018; Fekkar et al., 2018). The predisposing factors include gender, age, marital status, ethnicity/race, and educational level. Enabling factors such as geographic region, health insurance, employment status, and poverty levels were controlled for in the analysis. Need factors such as multiple chronic conditions, DM management, and health status were included in the adjusted odds ratio.

Statistical Analysis

The software being used for data analysis in this study was IBM SPSS, version 29. Chi-square test was used to describe gender differences in health status, socioeconomic characteristics, income, and demographic characteristics in CAM usage and health practice. Logistic regression was used to examine relationships between gender, ever used CAM, and CAM usage in the past 12 months with independent variables. It was intended that all independent variables would be included in the multivariate analysis. Controlling demographic characteristics (age, gender, location, ethnicity), the analysis examined the association between gender and CAM use and income level. Gender and CAM use were examined for unadjusted

associations while controlling for the independent variables: age, education, education level, and income level.

While controlling for demographic characteristics, Research Question 1 (Is there a statistically significant association between complementary and alternative medicine usage and DM diagnosis in adults, controlled for age, gender, location, and ethnicity?) was assessed. To examine the association between income levels and CAM use while controlling for socioeconomic variables (age, gender, education, and marital status), assess Research Question 2 (Does income level significantly modify the usage of complementary and alternative medicine among adults diagnosed with DM after controlling for age, gender, location, and ethnicity?).

This study also examined the unadjusted association between socioeconomic characteristics and CAM use among men and women. All socioeconomic variables were included without controlling for any independent variables such as poverty status, health coverage, marital status, and education level.

Internal and External Validity

Efforts to control internal validity and external validity are best considered before the data collection process begins, in the design phase. An article by Arlin Cuncic in 2021 suggested that multiple issues can affect the internal validity of a study, including maturation, attrition, confounding, and experimental bias. To increase a study's internal validity, different authors have suggested blinding, randomization, and using a specific protocol of process for the study. For this study of secondary data, the protocols and methods are reviewed annually using multiple sources of feedback, including academic researchers.

To address the effects of external validity, a study design should consider possible sources of threats. Bhandari (2020) suggested some possible external threats, including sampling

bias, Hawthorne effect, test effect, and situation effect. This study used quantitative data that drew from a wide geographical area, a very wide income level, all genders, and a wide range of professional and nonprofessional participants. Along with a moderate sample size, the data source and participants helped to increase the external validity of this study. Widely acceptable methods of addressing external threats include replication, probability sampling, recalibration, and field experiment as opposed to a laboratory study (Bhandi, 2021; Cuncic, 2021).

Obtained Results

The 2017 NHIS is presented to answer the formulated research questions and hypotheses. Participants' sociodemographic characteristics are presented along with gender differences in CAM use among the study population. The section presents results to answer the formulated research hypotheses.

As provided in Table 1, of the participants, 34.9% ($N = 907$) identified as female and 65.1% ($N = 1,691$) identified as male. A reported 87.3% ($N = 2,268$) were married, 6.8% ($N = 1,767$) were widowed or separated, and 7.2% ($N = 187$) were single. For education levels, 55.3% ($N = 1,437$) reported higher education levels (above high school/GED), with the larger percentage being at the undergraduate level at 44.7% ($N = 1,181$). The higher levels of reported income was over \$50,000 at 13.7% ($N = 356$). The largest geographic region reporting was the south at 36.5% ($N = 948$), followed by the west at 23.6% ($N = 613$) and the Midwest at 22.7% ($N = 590$), with the north reporting the lowest percent at 17.2% ($N = 447$). For this study, an adult was 21 years of age or older, with the median age reported at 44 years.

Table 1*Variable Demographics*

	Percentage	Frequencies (<i>N</i> = 2,598)
Gender		
Males	65.1%	1,691
Females	34.9%	907
Marital status		
Married	87.3%	2,268
Widowed or separated	6.8%	1,767
Single	7.2%	187
Education		
Undergraduate	55.3%	1,437
Higher education	44.7%	1,161
Income		
> \$50,000	13.7%	356
< \$50,000	86.3%	2,242
Geographic region		
South	36.5%	948
West	23.6%	613
Midwest	22.7%	590
North	17.2%	447
Age (Median)	44 years	N/A

The first research question was addressed by Table 2 and Table 3. The main predictor variable and the confounding variables were tested with the dependent variable.

Table 2

Adjusted Odds Ratio CAM Use

	B	df	Sig	OR
Diabetic (1)	-0.133	1	0.002	0.875
CAM use (1)	0.325	1	< 0.001	1.384
Constant	0.046	1	0.003	1.047

Note. CAM use for men, women, and diabetics.

Table 2 shows adjusted odds ratios and statistical significance of the independent variables results for both men and women who had used any CAM over last 12 months. The AOR for Table 3 adult diabetic who had used CAM in the past 12 months was (AOR = 1.472; $p = 0.654$).

Table 3*Adjusted Odds Ratio CAM Use*

	B	df	p	OR
Diabetic (1)	0.386	1	0.654	1.472
Family income	-0.711	1	0.213	0.491
Gender (1)	-0.262	1	0.585	0.770
High Dip/GED	-0.468	1	0.600	0.626
Some education/AA	-0.154	1	0.844	0.857
BS	0.436	1	0.603	1.547
Master's and higher	1.439	1	0.103	4.214

Note. Family income levels, CAM use of male, women, diabetics, and family education levels.

Table 3 shows the logistic regression results for education, income, sex and DM. Table 3 also show that participants with higher education levels of master's and above had (AOR: 4.214; $p = 0.103$) had higher odds of CAM usage compared to participants with education levels of High Sch/GED (AOR: 0.626; $p = 0.600$). After adjusting for education, gender, and DM the ($p = 0.626$) indicates there is not a statistically significant association between education and CAM use among adult diabetics in the United States. The influence of income on CAM use among adults was shown at (AOR: 0.491; $p: 0.213$) The findings show that income level doesn't significantly influence the use of CAM among adults diagnosed with diabetes after controlling for income and gender. The results do not confirm the second research hypothesis which postulated that:

H_{A2}: Income level does significantly modify the usage of complementary and alternative medicine among adults diagnosed with diabetes.

Table 4*Adjusted Odds Ratio CAM Use*

	B	df	p	AOR
Diabetic (1)	0.167	1	0.011	1.181
Sex (1)	0.328	1	< 0.001	1.388
Age (1)	0.093	1	0.456	

Note. Adjusting for CAM use, age, and diabetics.

According to Table 4, the model was adjusted for CAM usage, sex, age, and diabetes. The odds ratio of diabetes (1.181). Additionally, gender was determined to be statistically significant at (p : 0.001). These findings show a significant association between CAM usage and diabetes diagnosis in adults, controlling for age, gender, and thereby confirming of hypothesis one, which postulates:

H_{A1} : Complementary and alternative medicine usage is statistically significantly associated with a diagnosis of DM in adults.

Section 4: **Application to Professional Practice**

The purpose of this retrospective cross-sectional study was to examine whether CAM usage influences DM status and if income influences the relationship between CAM usage and diabetes diagnosis among noninstitutionalized adults 21 years and older, after adjusting for age, gender, location, and ethnicity. In this section, the focus is to discuss the obtained results from the 2017 NHIS in line with the formulated research questions, research hypotheses, past studies on the topic, and the theoretical framework in the HBM. The chapter outlines potential implications for practice and identifies the limitations of the current study. Based on the identified limitations,

the chapter subsequently outlines and elaborates on various recommendations for future research to address the identified knowledge gap.

Interpretation of Findings

In this discussion of the results obtained from the analysis of the 2017 NHIS, specific focus is anchored on answering the formulated research questions and hypotheses that were formulated in Chapter 1. The first research question was created to examine whether there is any relationship between CAM and a DM diagnosis in adults after controlling for age, gender, location, and ethnicity. The second research question was developed to assess whether income levels have a significant effect on CAM usage after controlling for age, gender, location, and ethnicity. Subsequent subsections chronologically discuss findings related to these research questions and identify points of convergency and divergence from past studies.

Statistically Significant Relationship Between Complementary and Alternative Medicine Use and Diabetes Mellitus in Adults

Research Question 1 was formulated to investigate the following: Is there a statistically significant association between complementary and alternative medicine usage and diabetes diagnosis in adults, controlled for age, gender, location, and ethnicity? Results from AOR showed that after controlling for potential confounders such as location, gender, and age, there was a statistically significant relationship between CAM usage and diabetes status in noninstitutionalized adults with diabetes (AOR = 1.388; $p = 0.001$). These findings align with past studies where diabetic populations were reported to have a high prevalence of CAM use ranging from 15% to 73% (Adam et al., 2017; Alqathama et al., 2020). According to Turbin et al. (2020), individuals with diabetes are 1.6 times more likely to use CAM compared to nondiabetic patients for various reasons.

Past studies also reveal that adults who have diabetes are more likely to use CAM to lower their blood pressure, reduce costs of treatment, eliminate potential side effects of conventional medicine, and enhance their quality of life (Amaeze et al., 2018; Kretchy et al., 2018; Lago et al., 2018). Among the American population, the commonly used CAM remedies include dietary supplements, relaxation techniques, herbal medicines, and spiritual healing (Goering & Matthias 2020; Owusu et al., 2020; Turbin et al., 2020). These observations might explain the current findings on the potential relationship that exists between CAM use and diabetes diagnosis among the American adult population with DM.

The 2017 NHIS showed that higher levels of men used CAM over a 12-month period (AOR: 1.384; $p < 0.001$), compared to women's use at (AOR: 0.325; $p < 0.001$). Researchers have attempted to examine potential reasons for CAM usage among diabetic patients in the United States (Liu et al., 2021; Mbizo et al., 2018; Parsons et al., 2019). A key factor for the growing use of CAM medicines may be attributed to failures of conventional therapies and decreased management of DM complications (Chan et al., 2020; Liu et al., 2021). This could be one explanation for the observed findings on the statistically significant association between CAM usage and a DM diagnosis in American adults 21 years and older, even after controlling for age, gender, and location.

According to Chan et al. (2020), most diabetic patients use CAM remedies enthusiastically and, in some cases, largely believe in their benefits despite a lack of clinical evidence. There is a need to understand their perceptions and appreciate their growing support for CAM remedies. Based on this study, the observed significant relationship between CAM use and a DM diagnosis in American adults may be explained by the HBM. According to the HBM, a person's belief in health care outcomes influence their choices to participate in health-promoting

initiatives (Chan et al., 2020; Liu et al., 2021; Owusu et al., 2020; Sheikhrabori et al., 2017). Adults with diabetes are likely to be influenced by two factors to use CAM: desire to get well and a belief that using CAM alone will enhance their well-being (Glanz et al., 2015; Naja et al., 2017). The HBM helps identify potential factors that might contribute to the use of CAM among diabetic patients, including low cost of CAM products and accessibility (Amaeze et al., 2018; Kretchy et al., 2018; Lago et al., 2018).

The HBM holds that an individual's action to embrace healthy lifestyle change is informed by perceived benefits or barriers associated with such intentions (Owusu et al., 2020; Sheikhrabori et al., 2017). Individual actions may be influenced by six HBM constructs: (a) perceived susceptibility, (b) perceived severity, (c) perceived benefits, (d) perceived barriers, (e) cue to action, and (f) self-efficacy (Goering & Matthias, 2020). Perceived susceptibility creates concern among adults with diabetes about the potential outcome of continuing using conventional medicine and associated side effects or declining quality of life (Goering & Matthias 2020; Turbin et al., 2020). Individual feelings about the vulnerability of clinical management and associated adverse events may influence their choice to seek CAM (Owusu et al., 2020).

According to Vishnu et al. (2017), taking action towards promoting individual health, such as through lifestyle change, is considered better than inaction. Using the HBM, diabetic patients believe that remaining inactive to change would be worse than taking a proactive step such as using herbs, supplements, and body-mind therapies (Vishnu et al., 2017; Wang et al., 2017). Upon recommendations from family and friends that CAM use may supplement conventional treatment or even reduce their potential side effects, diabetic patients may embrace CAM use due to its perceived benefits. These perceived benefits could present without clinical evidence to support the belief (Atwine et al., 2017; Goering & Matthias, 2020).

Perceived barriers may also help in understanding the potential correlation between CAM use and adults with diabetes. Obirikorang et al. (2018) suggested that most patients take action or fail to take action after considering their ability and capability to execute a task. For example, high-income adults and those with higher education qualifications or relevant knowledge may find it easier to access and use CAM due to the ease of overcoming the cost of buying supplements and access to information on their use (Naja et al., 2017; Shabibi et al., 2017). By contrast, individuals who may lack the financial capability and lack relevant knowledge about CAM use may find it increasingly difficult to access dietary supplements due to cost and information barriers (Kamel et al., 2017). The HBM clarifies that potential obstacles may hinder access to CAM use. That is, a person's will to use CAM will be influenced by personal perceptions about time, convenience, accessibility, possible side effects, and financial costs (Obirikorang et al., 2018).

After evaluating aspects such as perceived susceptibility, perceived severity, perceived benefits, and perceived barriers to CAM use, adults with diabetes take the last approach on cue to action (Goering & Matthias, 2020). At this stage, they may consider using CAM or avoid using it over conventional therapies. The cue to action is attached with suitable stimuli that influence the individual with diabetes to use CAM therapies. The cue to action may be influenced by external and internal factors. Internal factors include side effects of clinical medications, declining quality of life, prolonged disease condition, and comorbidities. External cues to action may be influenced by advice from friends and family to use CAM, social media adverts, the impact of care on family finances, and lack of suitable medication therapies (Wang et al., 2017). In the light of these considerations, the HBM plays a key role in helping to understand potential reasons why there is a statistically significant and positive relationship between CAM use and DM among American adults.

Self-efficacy may also facilitate individual ability to use CAM therapies. According to Chan et al. (2020), self-efficacy relates to an individual's ability to execute desired outcomes. As it applies to diabetic adults, actions such as the ability to access CAM therapies and prepare, formulate, and plan their daily intake could lead to self-efficacy (Oriot & Hermans, 2020). According to Handley et al. (2017), adults who are more knowledgeable about CAM are more likely to show high self-efficacy and subsequent intention to use CAM than those with limited information.

Income Levels Significantly Influence Complementary and Alternative Medicine Usage Among Diabetic Adults

Research Question 2 was formulated to investigate the following: Does income level significantly modify the usage of complementary and alternative medicine among adults diagnosed with diabetes after controlling for age, gender, location, and ethnicity?

Results from the surveyed participants show that income level does not significantly modify the use of CAM among adults diagnosed with diabetes after controlling for age, gender, ethnicity, and location. For this study, ethnicity did not have enough cases to analyze in SPSS version 29. Contrasting observations between this study and much of the available data show income levels can influence decisions among adults with diabetes to use CAM (Owusu et al., 2020; Sheikhrabari et al., 2017; Tangkiatkumjai et al., 2020). Mekuria et al. (2018) reported that female diabetics with high income levels and higher education levels are more likely to be CAM users. Much of the growing available data show that CAM users are increasingly female, have higher education levels, affluent, single, and middle aged (Khairy et al., 2021; Shraim et al., 2017).

The observed disparity in income as relates to its impact on CAM usage may be explained by the HBM framework, especially when considering the three constructs of perceived

barriers, cue to action, and self-efficacy (Kamel et al., 2017). First, it may be noted that in line with the HBM, perceived barriers refer to individual feelings regarding obstacles to performing a desirable action. When comparing between low-income earners and middle- to high-income earners, there is a wide variation in a person's feelings of impediments or barriers that lead to different-benefit analysis (Alghamdi et al., 2018; Kretchy et al., 2018; Mekuria et al., 2018). Kamel et al. (2017) suggested that many segments of low-income individuals are less likely to need much money to purchase CAM therapies such as dietary supplements, herbs, or botanical products. Many services of mind-body therapies such as meditation are low cost.

For this study, a cue to action is a stimulus needed to trigger the decision-making process to accept lifestyle change and recommended health actions. The cue to action may be external and related to the cost of or access to CAM therapies. Alghamdi et al. (2018) observed that low-income families are more likely to fail to access supplements in clinical care due to financial constraints. By contrast to this study, Alghamdi et al. (2018) observed that financial ability among high-income families would facilitate their access to CAM professional services to supplement clinical care management (Khairy et al., 2021; Shraim et al., 2017). As such, cost-benefit analysis related to the ability to access and use CAM therapies would substantially influence which actions are taken or omitted in CAM use among adults with diabetes.

Third, self-efficacy of the HBM framework is another important construct that relates to whether an adult with diabetes embraces the needed behavior to perform the desired behavior. In line with perceived barriers and cues to action, self-efficacy may be influenced by access, costs, and financial abilities (Obirikorang et al., 2018). In this study, it cannot be assumed that lack of financial ability is likely to present a barrier to low-income earners from feeling capable of using supplements in managing their DM and possible comorbidities (Obirikorang et al., 2018). By

contrast, much of the available research show that affluent diabetic adults from high-income households are likely to express the ability to access CAM services and thereby their competence to successfully perform a behavior (Naja et al., 2017; Shabibi et al., 2017).

Results from this study do not align with much of the past findings where high-income levels strongly influence CAM usage (Oriot & Hermans, 2020), even after controlling for age, gender, and place of residence. Researchers have reported that a high income level is closely linked to education, having a job, and having access to medical insurance (Chan et al., 2020; Handley et al., 2017). Future research may consider controlling for these social and economic factors and assessing details of how income level is likely to affect CAM usage among adults with diabetes (Goering & Matthias 2020; Owusu et al., 2020; Turbin et al., 2020). Chan et al. (2020) also found in their multivariate analysis that income level is a strong predictor of CAM use.

Over the years, there has been growing consensus regarding the impact of socioeconomic status, especially income level, on CAM use. Findings from this study do not echo much of the past findings and the postulation that individuals with high income have higher odds of CAM use than individuals from lower income levels (Abdullah et al., 2018; Mbizo et al., 2018; Nuño-Solínis et al., 2021). For much of the available data, there is a positive correlation between higher income levels and CAM use among adults. This suggests that high-income earners would prefer high-quality supplements and costly CAM therapies from pharmacies instead of preparing home remedies such as herbs (Al-Eidi et al., 2017; Chan et al., 2020; Handley et al., 2017; Kamel et al., 2017; Liu et al., 2021; Owusu et al., 2020).

Limitations

There are potential limitations associated with this study that should be taken into consideration. First, the diagnosis of diabetes was self-reported, and the analysis did not distinguish between the many types of diabetes. The definition lacks precision because it was not possible to examine the relationship between CAM use and the many types of diabetes. Second, self-reported data may be subject to recall bias and/or placebo impact of CAM use on DM (Liu et al., 2021; Mbizo et al., 2018). Third, the findings from this study suggest that persons with diabetes use CAM therapies, but the study did not examine potential reasons for using these nonconventional therapies. Lastly, the study did not distinguish whether surveyed adults used CAM for diabetes or because of other medical conditions. Past studies have shown that diabetic patients might use CAM remedies for both treatment and wellness, followed by wellness alone (Parsons et al., 2019).

Fourth, the study did not examine in detail the many types of CAM used, as researchers have noted that there are varied types of herbs and techniques in use among diabetic patients (Seena, 2018). Examining the types of CAM use would help in assessing potential remedies that significantly influence the relationship between CAM use and DM among adults (Mbizo et al., 2018). Finally, the study did not examine the outcome of CAM use for both DM status and wellness. Findings from past studies indicate various outcomes of CAM use such as improved overall health, feeling better, and a sense of control of personal health (Goldman et al., 2020; Perricone et al., 2020; Singh et al., 2020).

Section 5: Implications and Conclusions

Implications for Clinical Practice

Findings from this study suggest that CAM usage among American adults with diabetes is not high. These insights emphasize the need for providers to consider global trends of CAM use and patterns among patients when advising them about CAM use with prescribed medications. Providers should consider inquiring on CAM use and medication adherence among diabetic patients. There is a need for clinical providers to be aware of patients' CAM use, considering the results of some herb-drug interactions leading to potential deadly side effects (Alzahrani et al., 2021). For instance, cinnamon might increase the risk of hypoglycemia as it inhibits the YP3A4 enzyme in animal models (Alzahrani et al., 2021). The use of aloe vera has been noted to have interactions with 45 different conventional medications, including diabetic drugs such as glimepiride, resulting in hypoglycemic effects (Chan et al., 2020; Handley et al., 2017). Aloe vera use has also been associated with inhibiting ATP sensitive potassium channels in pancreatic β cells, resulting in a higher release of insulin. Understanding CAM use could improve clinical care through consideration of any potential interactions between herbal remedies and conventional medications, resulting in optimal outcomes (Adam et al., 2017; Alqathama et al., 2020). An increase in CAM research should increase the knowledge of CAM use among patients and providers. This increased knowledge could result in the prevention of negative herb-drug issues (Chattopadhyay et al., 2020; Vishnu et al., 2020).

In terms of patients, assessing and questioning CAM use patterns would encourage patients to disclose more information about their diabetic condition and herbal use. The literature showed that less than a third of diabetic patients disclose their information on CAM use to their providers (Liu et al., 2021; Mbizo et al., 2018; Parsons et al., 2019). This study's findings showed

that a low percentage of adults with diabetes use CAM in the United States. Further, CAM usage was found to be significantly associated with the diagnosis of diabetes. Comparing available data and findings from this study, there is a need to examine CAM usage patterns by encouraging more patient CAM disclosure. Increasing the global use of CAM therapies has been observed and implies that the use is less likely to reduce over the years. Therefore, care providers may consider the need to acknowledge CAM use and routinely discuss it with patients (Rhee et al., 2018; Seenaa, 2018; Wang et al., 2018).

Directions for Future Research

Recommendations for future research should focus on addressing the identified knowledge gaps identified in this study. A future research suggestion is to examine the research topic using self-reported data and clinical data to enhance the findings of this study. Past studies indicate a lack of consensus on potential reasons that inform patient use of CAM due to lack of clinical data, with most studies drawn from self-reported data (Perricone et al., 2020). As a result, recall bias could affect findings and introduce structural biases that may be addressed through data triangulation where information on CAM usage patterns is collected from multiple diverse sources (Liu et al., 2021; Mbizo et al., 2018).

Considering the high usage rate of CAM remedies reported in available data, future researchers should consider examining reasons for CAM use and assess actual outcomes of diabetics using CAM. Information on this topic would help in understanding why adults with diabetes are likely to use CAM remedies and provide insights to improve clinical practice and safe use by individuals. Future information on the topic could also help examine whether CAM usage is informed by the need for a lifestyle change, wellness, or management of an existing diabetes condition (Parsons et al., 2019). The researched outcome of using diabetes remedies may

also help fill the knowledge gap on outcomes of CAM use for DM (Mbizo et al., 2018; Seena, 2018).

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