2020

Self Reported Cardiovascular Disease Risk Factors Among Deaf Users: A Communication Barrier

Dr. Jolene Ayres Ogunjirin
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral study by

Jolene A. Ogunjirin

has been found to be complete and satisfactory in all respects,
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Review Committee
Dr. Donald Goodwin, Committee Chairperson, Public Health Faculty
Dr. Adebowale Awosika-Olumo, Committee Member, Public Health Faculty
Dr. German Gonzalez, University Reviewer, Public Health Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
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Abstract

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Jolene A. Ogunjirin

MPH, Howard University, 2007

BA, Gallaudet University, 2001

Doctoral Study Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Public Health

Walden University

February 2020

Abstract

Cardiovascular disease (CVD) is the number one cause of mortality worldwide, and may disproportionately affect the Deaf and Hard of Hearing (DHOH) subpopulation in the United States. It has been suggested that communication barriers among the DHOH subpopulation contribute to the high prevalence of CVD risk factors. To assess this claim, this quantitative study utilized a cross-sectional data set of 400 DHOH and 400 non-DHOH participants taken from the National Health and Nutrition Examination Survey (NHANES) database. The differences of being told by a health professional of having specific CVD risk factors were assessed between the two groups and chi-square test and odds ratio were used to assess significant differences. Results showed the DHOH participants were told more often of having diabetes than non-DHOH ([OR= (3.17), $p<0.001$]), and of having health risk for diabetes ([OR= (1.63), $p=0.04$]), but were less likely to have been told they have high cholesterol ([OR=(0.59), $p=0.01$]) which is a CVD risk factor. There were no significant differences observed between the two groups of having been told they had high blood pressure or having been told they had high blood pressure more than twice ([OR= (0.97), p =.89], [OR= (1.21), p=.63]), respectively. Future research should seek to validate self-reported health status with clinical assessment findings, including actual diagnoses to enable clinical validation of self-reports. The positive social implication for this research is the advancement of the research needs of the DHOH community, including possible unaddressed communication challenges in healthcare delivery to DHOH patients.

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Dedication

This study is dedicated to the Almighty God. It was because of God I am able to complete such an unimaginable task. I was brought here at an early age: the daughter of immigrants, unaware of American ways of life. I could not read or write until my late adolescence, and was dismissed by society because of my disabilities. I was considered nothing but a burden at the time. Here stands a testimony of a miracle only God could create. My perils as a child, never given the opportunity to succeed, I tore down every societal, cultural, and economic barrier that came my way. I worked my way through the educational system with only the help of a few to guide me. I pushed beyond the limits of my barriers and excelled in all I did. I made sure that my success story would lay the groundwork and inspire those who face trials similar to mine. This work is dedicated to God as a testimony that He who gives us strength does not discriminate, or segregate; He gives to those who diligently seek Him.

Acknowledgments

An acknowledgment goes to my external advisors, mentors, church members, and family who had empowered me with the persistence that strengthen my academic achievements. I also like to give special thanks to Dr. Donald J. Goodwin, my dissertation chair that has worked with me over the years in perfecting this dissertation. Along with my committee member Dr. Adebowale I. Awosika-Olumo and University Research Reviewer Dr. German A. Gonzalez, for their guidance as well as Dr. Nancy Rea program director for overseeing the quality of this public health program. I want to acknowledge the various medical mission outreach organizations that I collaborated with & participated in since the year 2006 in serving the Deaf communities in developing nations. I openly thank every one of you in the medical mission outreaches for your patience in assisting me in serving the hundreds of Deaf people who could not have received medical and surgical treatments. Your sincere service could not have been possible if God's salvation did not rest upon your hearts. Finally, I want to express gratitude to the Almighty God, who made my dream of becoming a doctorate a reality. Indeed, all things are possible for those who love Him and are called according to His purpose.

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Section 1: Foundation of the Study and Literature Review

Introduction

Cardiovascular disease (CVD) is the number one cause of mortality worldwide (McNamare, Alzubaid, & Jackson, 2019). In the United States, different groups experience unequal access to health care services. One medically-underserved group is the American Deaf and Hard of Hearing (DHOH) subpopulation (Barnett et al., 2011). The understudied DHOH subpopulation requires studies to understand their cardiovascular disease (CVD) risk factors. Communication barriers in health care affect the DHOH subpopulation, particularly those who share American Sign Language (ASL) as their common linguistic heritage. The DHOH community, who developed a culture and ethics of acceptance of their deafness, have been found to have poorer health than the hearing population; this is a significant health disparity issue (McKee, Paasche-Orlow, et al., 2015). Researchers assume the cause of this health disparity is communication barriers (McKee & Paasche-Orlow, 2012). Retrospectively, there has been lack of accurate and adequate data regarding the prevalence of health issues in the United States in the DHOH subpopulation due to their low telephone ownership and subsequent lack of participation in telephone-based surveys along with language barriers (Barnett & Frank, 1999). However, the information available from research supported by the Centers for Disease Control and Prevention (CDC) disseminated via a telephone-administered surveillance system indicates that the DHOH subpopulation generally experience range of health disparities compared to the hearing population (Barnett et al., 2017).

According to McKee, Paasche-Orlow, et al. (2015), 49% of the DHOH were documented as having inadequate health literacy compared to 26% of the hearing population when controlling for age, gender, race/ethnicity, education, and income. Moreover, according to DHOH individuals, the severity of their deafness is significantly associated with self-reported communication difficulties (Simons, Moreland, & Kushalnagar, 2018). For example, Simons et al. found that 14% of Deaf African Americans are under-diagnosed with self-reported hypertension compared to 19% of hearing African Americans. The researchers hypothesized that this disparity was due to low health literacy and poor patient-physician communication (Simons et al., 2018). However, the prevalence of self-reports of CVD among Deaf is significantly less than for the hearing population, 24% vs. 46% respectively (Emond et al., 2015b). This disparity requires further investigation. Public funding is important to support Deaf health-related public health research (Smith, Kushalnagar, & Hauser, 2015). Access to quality healthcare for the DHOH subpopulation is supported by the Americans with Disabilities Act (ADA) of 1990. The ADA provides a strong legislative framework to protect the rights of disabled Americans in employment, social service, and health care service usages. Despite the advancements suggested by the passage of the ADA, the DHOH subpopulation still presents serious unmet health concerns for the U.S. Government as it strives for health equality for all Americans (CDC, 2015d).

This quantitative study aims to address the differences in self-reports between the DHOH and the non-DHOH patients regarding having been told by medical professionals that they have the CVD risk factors of high cholesterol (Montori, Brito, & Ting, 2014;

Stone et al., 2014), high blood pressure (Papademetriou et al., 2016), and diabetes (Papademetriou et al., 2017; Turner, Cicuttini, Pearce, & Mazza, 2017). A survey was utilized to compare findings between DHOH and non-DHOH individuals and examined possible communication barriers as assessed by self-reported health care providers communications regarding CVD risk factors in DHOH individuals. With this study, I offer recommendations for improvement in DHOH access to health care services regarding providing other means of effective communication. In the DHOH subpopulation, improving health and self-care knowledge may help to improve health care professionals and Deaf patients' communication in order to optimize patient decisions regarding their behaviors that could help prevent unattended CVD (Emond et al., 2015b).

Based on the problem and purpose, the formulated research question and hypotheses investigated the potential communication barriers relative to health care provider communications about CVD risk factors when working with Deaf people. The literature review section addresses people with deafness followed by definitions of key terms, statements of assumptions, the study's scope, and delimitations. The section ends with a summary and an argument for the need to address healthcare communication barriers for DHOH patients in order to further prevent CVD risk factors in this subpopulation.

Problem Statement

Health inequality continues to concern public health professionals and stakeholders when considering the health care challenges faced by DHOH communities worldwide (Tomlinson et al., 2009). In the United States, health inequality relates to differences in education and income by race, gender, and geography (Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010). The United Nations Convention on the Rights of Persons with Disabilities considered health inequality in terms of the needs of people with disabilities to have right to attain a high standard of health care (United Nations, 2019). The needs and challenges of many subpopulation groups in the United States are not adequately understood or addressed (Oh et al., 2015). Moreover, challenges relating to ethical, cultural, and linguistic origin prevail among DHOH individuals are often in conflict with the medical arena's perception of DHOH patients (Svirsky, Teoh, & Neuburger, 2004). For instance, the medical profession largely understands DHOH status merely as a hearing deficiency to be corrected through the assumed use of auditory devices to reduce deafness; they do not treat DHOH patients as members of a population with special communication needs (Svirsky et al., 2004). The United Nations' Convention on the Rights of Persons with Disabilities shifted from viewing DHOH and other related disabilities as an object of medical treatment, to considering these individuals as members of society with rights to make decisions based on informed consent (United Nations, 2019).

The DHOH subpopulation has been consistently underrepresented and underserved and in greater need of preventative services than the non-DHOH population. Deaf individuals who reported having a concordant provider were more likely to report a greater need for preventive services (McKee, Barnett et al., 2011). McKee, Barnett et al. (2011) highlighted the ethical and social issues pertaining to the absence of representation of the Deaf community in research and informed consent; marginalization of this community isolates them from participating in most health outreach research and surveillance programs. Moreover, mistrust and low English and health literacy levels further impact the DHOH community, because most are unable to report their experiences and problems first-hand (Mathos & Pollard, 2016). Consequently, policymakers and health care providers have little understanding of the challenges that this subpopulation faces on a daily basis. DHOH health professionals could improve the scope and quality of communication between the DHOH community and the health care system by helping to identify marginalization and areas of need, facilitating the engagement of DHOH people in health research.

According to Anderson et al. (2017), there were at least 500,000 Deaf ASL users in the United States. According to the National Institute on Deafness and Other Communication Disorders (2016), nearly 15% of American adults, or 37.5 million people, report some trouble hearing. Furthermore, approximately 14.1% of the U.S. population aged 12 years and older have hearing difficulties in both ears (Hoffman, Dobie, Losonczy, Themann, & Flamme, 2017). Notably, the primary cause of poor health (such as high CVD risk factor prevalence among the DHOH subpopulation) is communication barriers among these ASL users (McKee & Paasche-Orlow, 2012). The DHOH subpopulation experiences difficulty perceiving and communicating information, which negatively affects their health literacy and well-being (McKee & Paasche-Orlow, 2012).

The DHOH subpopulation is impacted by poor language and communication skills and thus have a high risk of possessing inadequate health literacy (Hommes, Borash, Hartwig, & DeGracia, 2018). In relation to CVD risk factors, empirical research is emerging on the association between DHOH status and doctors' communication to further understand the impact this relationship has on CVD risk factors (Pinilla, Walther, Hofmeister, & Huwendiek, 2019). At present, DHOH individuals demonstrate inconsistencies in their cardiovascular health knowledge and possess inadequate knowledge about stroke, heart attack, and cholesterol levels (Smith, Kushalnagar, & Hauser, 2015). Poor communication issues such as lack of available interpreters and DHOH health professionals to intervene on behalf of this subpopulation prevent DHOH from engaging in healthy behaviors and lifestyle activities that are accessible to the broader public (Lesch, Burcher, Wharton, Chapple, & Chapple, 2019). Many DHOH people simply do not know early signs and symptoms of CVD to take the necessary preventative action; their lack of health knowledge leads to the increasing cost of treatment and care, which averages $2.1 billion annually for all health issues among this subpopulation (CDC, 2015b).

Purpose of the Study

The purpose of this quantitative research study was to compare if there was significant difference in whether DHOH participants would report having been informed by a health care professional that they have diabetes, high cholesterol, or high blood pressure vs. the non-DHOH patients (assumed to be due to communication barriers).

Research Question and Hypothesis

I answer the research question using data from the 2013–2014 National Health and Nutrition Examination Survey (NHANES). The NHANES asked survey respondents if they had hearing difficulties and whether they had been informed by a health care professional that they have diabetes, high cholesterol, or high blood pressure (CDC, n.d). Based on the communication challenges of DHOH patients, the research question for the study was: Is there a difference in the self-reports of being told between the DHOH and the non-DHOH of having a CVD risk factor? In other words, the study sought to determine whether the DHOH individuals would report having been told by a health care professional that they have diabetes, high cholesterol, or high blood pressure. Cardiovascular disease risk factors were the dependent variables and the independent variable was hearing status (being DHOH or not). The association being tested was whether there were significant differences in being told of having CVD risk factors between the DHOH and the non-DHOH populations. The questionnaires for this study were not clinically verified. Thus, presence of the CVD risk factors relied patients' completion of the questionnaire. In my analysis, I applied the Chi Square test to data taken from the NHANES database. The specific research question (RQ) and related hypotheses (H) for this study were:

Research Question: Is there a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations?

H_0: There is no difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations.

H_a: There is a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations.

Theoretical Foundation of the Study

The social ecological model of health behavior (McLeroy, Bibeau, Steckler, & Glanz, 1988) is the theoretical underpinning of this study. This theory postulates that there is a close association between individual behavior and the environment, which is why health-related decisions are influenced both by internal and external factors (McLeroy et al., 1988). In the current study, the ecological environment of the DHOH subpopulation will be contrasted to that of the non-DHOH population. The social ecological model assumes that population groups have unique qualities that provide a different interaction with the environment that influences individuals’ health decisions—in this case, being told about their CVD risk factors (see Beckfield et al., 2015). This study of the differences between the DHOH and non-DHOH patients in regard to whether they report having been told by a health care professional that they have diabetes, high cholesterol, or high blood pressure, aimed to promote positive health and behaviors at the individual-level and environmental-level (see Ingram et al., 2016).

The ecological model emphasizes the interconnectedness of individuals with their communities, organizations, and policies, stressing the importance of shared impact on individual health behaviors and attitudes (McLeroy et al., 1988). The ecological model's central assumption is that to achieve positive changes in health attitudes and behavior, a combination of individual-level and environmental-level interventions is required to manage disease (Ingram et al., 2016). The engagement of institutional aspects such as the corporation or culture further affects individual health behavior relating to self-care (Beckfield et al., 2015). Relationships among institutions and community organizations, as well as social activism, may either support or undermine health interventions, considering their necessary roles when addressing individual CVD risk factors (CDC, 2015e). Local, state, and national policies are disseminating factors in and for social justice (Beckfield et al., 2015; Goodwin, 1999), and therefore the health equity of the DHOH subpopulation.

The ecological model of health behavior is used in clinical practice to enhance patient-centered approaches to disease prevention and management (Golden & Earp, 2012). It stresses the importance of contextualizing patient experiences because individuals act differently in different environments. This means that health behaviors are affected at multiple levels, which includes the factors of institutional culture, community, environment, and policy. In this manner, the model serves as a reminder that patient knowledge and a supportive environment are crucial components in behavior change (Sallis, Floyd, Rodriguez, & Saelens, 2012). Hence, the social ecological model of health behavior is applicable to the DHOH subpopulation in that health promotion, awareness, and education is where primary prevention will ultimately reduce high blood pressure, high cholesterol, and diabetes-associated costs in the DHOH subpopulation

(Aubrey-Bassler et al., 2019; Blackwell, Lucas, & Clarke, 2014; CDC, 2015b; Golden, McLeroy, Green, Earp, & Lieberman, 2015; McCormack, Thomas, Lewis, & Rudd, 2017).

Nature of the Study

Positivist research regards the world as rational and seeks to explore potential causal relationships between variables. Therefore, using positivist research, I used self-reported responses to the question about the DHOH and non-DHOH populations being informed of diabetes, high blood pressure, and high cholesterol risk factors based on the assumption that both groups understood the questions equally and the self-reports were accurate. Data was obtained from the NHANES database, a trusted source drawn from the nationally representative study for assessment of the health and nutritional condition of children and adults in the United States (CDC, 2016). The NHANES program reports vital health information about people in the United States, including those with disabilities (CDC, 2015a). The NHANES survey data includes those with difficulties hearing for the purpose of accessing reliable health-related statistical findings. This study utilized the NHANES data for all age groups, including newborns (American Academy of Otolaryngology, Head and Neck Surgery, 2016).

The key variables of interest in this study included the dependent variables of ever being told of having diabetes, high blood pressure, and high cholesterol and the independent variable of being DHOH or non-DHOH. The study participants were asked if they had been informed by their doctors about possessing a certain CVD risk factor. The hypotheses testing followed a quantitative methodology based on the selected positivist research paradigm of having been informed of about the presence of health risk factors for cardiovascular diseases.

Literature Search Strategy

I applied a search strategy to identify the most relevant range of published material to formulate the proposed research question (Cook, 2008). A search strategy is an algorithm for efficient identification of the information necessary to carry out the literature review on the subject of CVD. Planning a strategy carefully increases the probability of retrieving information more significant to the researched area. This literature search strategy included: (a) a carefully worded research question; (b) a list of keywords and synonyms with alternative spellings; (c) a list of databases for data search; (d) formulation of inclusion and exclusion criteria; (e) selection of a timeframe within which the literature of interest should have been published; and (f) a clear and methodical way of working and recording the literature search progress.

After formulation of the research question presented above, keywords and concepts for the literature search were identified, which included: *communication barriers*, *CVD occurrence*, *CVD risks*, *Deaf population*, *DHOH population*, *health care access*, and *health knowledge*. I then conducted a search using three databases storing health care-related publications (ProQuest, PubMed, and ScienceDirect). To be included, studies had to fit the following criteria:

- Available in full-text ;
- Published in English;
- Utilizing the DHOH population as the study sample;

- Relating to health care access barriers for the DHOH population;
- Examining the DHOH population's morbidity or exposure to health risks;
- Examining the DHOH population's health literacy and health education issues;
- Peer-reviewed.

I also developed a methodical way of recording the literature search progress to keep track of studies identified as relevant for this research. After finding the studies fitting the inclusion criteria, the literature was recorded over time using an Excel spreadsheet indicating the title of the study, authors, date of publication, aim, research design, and primary study findings. The results of the literature search were categorized into relevant themes, as presented in the following literature review section. Overall, the literature review discusses past studies concerning DHOH individuals. The review includes a discussion on existing studies regarding postlingual hearing loss, the DHOH subpopulation's morbidity, communication challenges, and access to health care services in the United States. Additionally, the role of health education in preserving good health and managing disease was examined. The focus was not only on the findings, but also on the methodology and strengths and weaknesses of each study. Based on the results, I identified the research gaps, thus justifying my proposed study.

Literature Review

Overview of the DHOH Population

There were approximately 360 million people globally in the year 2011 who experienced some degree of deafness (Olusanya, Neumann, & Saunders, 2014). Of this number, 32 million were children, many of whom had the genetic predisposition for deafness (Olusanya et al., 2014). Lin et al. (2011) suggested that one in eight people aged 12 years and older have bilateral hearing loss in the United States. Moreover, approximately 234 million American adults could benefit from hearing aids to facilitate communication (Blackwell et al., 2014). The National Institute on Deafness and Other Communication Disorders found that approximately 37.5 million (15%) of adults in the United States aged 18 and over have some trouble hearing (Blackwell et al., 2014). Evidence has shown that globally, half of all Deaf health cases could be avoided through prevention; however, these interventions are not accessible to disadvantaged population groups, especially in developing regions such as sub-Saharan Africa, South Asia, and Pacific Asia (Olusanya et al., 2014). Many of these the cases could also be addressed with the help of cochlear implants, hearing aids, and other assistive devices, as well as through proper medical and surgical treatment and education (Olusanya et al., 2014).

Although some DHOH people use hearing aids to increase their access to health care services, hearing aids alone do not alleviate communication barriers (Kuenburg, Fellinger, & Fellinger, 2016). According to the estimates, one out of five persons in the United States could benefit from wearing hearing aids because the technology is not suitable for all DHOH individuals (Valente & Amlani, 2017). In addition, the one in five may have economic access issues to attaining hearing aids mainly because of the high cost of these devices (i.e., hundreds of dollars of out-of-pocket expenses; Valente & Amlani, 2017). Qualified children and young adults under 21 years old may be eligible for free diagnostic evaluation and hearing aids under Medicaid. Still, the high cost of hearing aids makes it difficult to depend on such devices to aid health care communication for the approximately 2 million DHOH users who are not under the age of 21 (Blustein & Weinstein, 2016).

Another medical device, cochlear implants, assists people with severe and irreparable deafness. Unlike hearing aids, cochlear implants require a surgical procedure and postoperative rehabilitation care (Semenov et al., 2013). Maintenance costs for cochlear implants may increase in the individual lifetime totaling an average of $223,528 (Chen, Amoodi, & Mittmann, 2014). In the United States, $2.1 billion annually is spent on the DHOH subpopulation's care and treatment (CDC, 2015b; CDC, 2015c). This figure does not account for the indirect costs associated with chronic diseases and the other health care expenses that the 37.5 million persons with deafness may encounter in their lives (Blackwell et al., 2014).

Morbidity in the DHOH Population

Research conducted by Lohi, Hannula, Ohtonen, Sorri, and Mäki-Torkko (2013) found no significant association between CVD, CVD risk factors, and deafness in a non-ASL population study. The unscreened, epidemiological, cross-sectional study used a sample of 850 adults aged 54–66 years (383 or 45.1% men; 467 or 54.9% women) with the average age of 60.9 years. Fifteen percent of participants reported having at least one CVD. The prevalent population of the subjects with deafness had a history of heart attack (11.3% or $p = 0.40$ and 4.7% or $p = 0.27$ for men and women, respectively); compared to hearing men and women (who, respectively reported heart attacks at a rate of 8.7% or $p = 0.40$ and 2.4% or $p = 0.27$). The male hearing loss and no hearing loss subjects who reported having ischemic heart disease were 16 % versus 13.6% (p = 0.48), and the rates of deafness and hearing females' ischemic heart disease were 8.1 versus 6.3% (p = 0.54). Stroke reports were 2.7% of the overall subject population, with deaf versus hearing being 7.8 and 2.1% (p = 0.007) for males, compared to 2.3 and 1.3% (p = 0.62) for females (Lohi et al., 2013). In the same study (Lohi et al., 2013), looking at the risk factors for CVD, subjects with deafness and no deafness most reported having hypertension, 33.3 versus 32.6% (p = 0.89) in males and 34.9 versus 34.6% (p > 0.9) for females. For men compared to women, high cholesterol reports were 20.6 versus 16.1% (p = 0.27) and 17.4 versus 22.8% (p = 0.27) for deafness versus no deafness, respectively. Finally, diabetes for deafness versus no deafness reports for men and women were 10.6 versus 8.7% (p = 0.53) and 11.6 versus 8.1% (p = 0.30), respectively (Lohi et al., 2013). The reports on CVD and CVD risk factors showed there was no major statistically significant association with deafness in the study subject populations (Lohi et al., 2013). Therefore, more studies are needed to confirm if there is any significant in CVD risk factors among both groups. Lohi et al.'s (2013) methodology could be used to further establish a clear connection between hearing function and cardiovascular system, as there is still a lack of understanding on the comorbidities associated with deafness due to the limited research conducted on the DHOH population.

Yet, scholarly evidence shows that chronic diseases affect the DHOH population disproportionately as they are linked to many health problems, such as diabetes (Bainbridge, Hoffman, & Cowie, 2011; Blakely & Salvo, 2019; Kuenburg et al., 2016; Meena, Sonkhya, & Sonkhya, 2016), and cardiovascular disease (Liljas et al., 2016a, 2016b; Pinilla et al., 2019). Hospital visitations is frequent among DHOH people, and research suggests that DHOH individuals are more likely to experience miscommunication with their health providers (Kritzinger et al., 2014; Kuenburg et al., 2016). Moreover, self-reported interpersonal factors (such as over-protectiveness, nonquestioning attitude, and lack of independent thought) also negatively affected access to health care services because DHOH patients frequently misunderstood the information provided by their health care providers (Kritzinger et al., 2014; Pinilla et al., 2019). Kritzinger et al., (2014) noted that sign language provision alone would not make health care equitable for Deaf patients. Therefore, overcoming communication barriers is crucial to prevent morbidity to ensure quality of services for Deaf patients, but there are additional barriers to consider besides communication challenges.

Barriers in Communication and Unaddressed Needs of the DHOH Population

DHOH individuals face considerable communication obstacles in health care irrespective of age. Whereas people with partial deafness who do not know ASL may benefit from hearing aids that compensate for impaired hearing function, profound to severely Deaf individuals cannot use these devices. Meanwhile, as ASL communicators, DHOH individuals rely on visual clues exclusively to communicate with the health care world. Empirical studies have investigated the DHOH subpopulation’s communication barriers and also predicted that health problems and communication barriers begin at an early age for these individuals. Numerous studies argued that students with deafness risk being excluded from the learning process because of their limited ability to interact with their educators and peers (Akram, Nawaz, Rafi, & Akram, 2018; Gudyanga, Wadasango, Hove, and Gudyanga, 2014). Akram et al. (2018) identified Deaf people’s feelings of anxiety, depression, frustration, isolation, and stress resulting from a lack of interaction with others. The DHOH people may also feel helplessness and greater fatigue than their peers because of the efforts they take to lip-read, understand others, and communicate their ideas (Dreyzehner & Goldberg, 2019). People with deafness vitally depend on formal and informal support to promote their overall well-being (Zaidman-Zait & Dotan, 2017).

Communication challenges faced by DHOH individuals at school and university affect their employment status as well. Perkins-Dock, Battle, Edgerton, and McNeill (2015) argued that disability adversely affects communication skills, educational opportunities, and social interaction of DHOH individuals, which, in turn, makes it difficult for them to build successful careers. Perkins-Dock et al.’s (2015) survey of 224 adults with deafness demonstrated that communication obstacles and conflicts related to Deaf culture were the major barriers to employment in this subpopulation. Among other problems, the authors found that unavailability of interpreters, increased pressure, discrimination, low morale, misunderstanding, inconsistent or unrealistic expectations of employees, and other factors affected the education and employment of DHOH individuals (Perkins-Dock et al., 2015). Unemployment also increases the risk of developing CVD and other related health conditions among DHOH patients due to social injustice, stress, and communication frustrations (Perkins-Dock et al., 2015).

Some changes to alleviate unemployment and the associated stress caused by communication barriers may also potentially decrease CVD risk factors through increased advocacy programs, ADA awareness, and better communication to improve opportunities for advancement in the DHOH population (Perkins-Dock et al., 2015). Barnett et al. (2011) highlighted the importance of training DHOH individuals to become health care professionals to address communication and access barriers for other DHOH individuals. As providers, DHOH individuals can communicate in the language of the population and are better suited to adapt assessment practices and remove communication challenges. The employment of DHOH health care providers can facilitate in the reduction of communication gaps and make the needed modifications and accommodations in the health care environment through advancement of modern technologies.

Effect of DHOH on Health Care Quality and Accessibility

Some of the health challenges faced by the DHOH subpopulation outlined above are related to and lead to health care disparities in the U.S. population. Evidence suggests that deafness itself is a problem for primary care providers who often overlook addressing communication barriers when they interact with DHOH patients (Lesch et al., 2019; Pinilla et al., 2019; Steinberg, Barnett, Meador, Wiggins, & Zazove, 2006). In addition, the ability to screen for health conditions in the DHOH population and provide appropriate referral services to manage health conditions is currently compromised by communication gaps (Blakely & Salvo, 2019; Kritzinger et al., 2014). As a result, DHOH patients do not receive high-quality health care services even though they are at an increased risk of developing other diseases such as CVD (Kritizinger et al., 2014; Kuenburg et al., 2016). More importantly, DHOH patients are unable to take advantage of health care services because communication and illiteracy challenges limit their ability to understand the information provided by hearing, nonsigning health care professionals (Kritzinger et al., 2014; Kuenburg et al., 2016; Pinilla et al., 2019).

Another important problem is the frequent unnecessary visitation of health services by some people diagnosed with deafness. Mikkola et al. (2016) collected data on 2144 adults aged 65 and above to find the association between deafness and the utilization of health services. The authors found that DHOH individuals were 3.2 times more likely to use health care services than those with normal hearing (OR= 3.2, 95 % CI 1.3–7.9,*p*= .034; Mikkola et al., 2016). Moreover, people with perceived hearing difficulty were found to be dissatisfied with provided services and more likely to report unmet health care needs when compared to participants with no hearing problems, due to communication issues (Mikkola et al., 2016). The disproportionate utilization of healthcare coupled with these reports of unmet needs in the DHOH population continues to highlights an enormous gap between healthcare needs and their ability to access care (Kritzinger et al., 2014). Families, communities, and health care providers should give Deaf people essential care and support, which further will decrease their risk of developing conditions such as CVD (Kritzinger et al., 2014).

Lai, Serraglio, and Martin (2014) examined potential barriers to health care access for children with deafness. The authors found Deaf children are highly dependent on timely and quality health care because the earlier a DHOH child gets help, the better the health outcomes. Given the importance of health care for such children, the cross-sectional study aimed to determine barriers to care that their families may experience.

Lai et al. (2014) enrolled 133 participants and used inferential statistics to analyze differences in access based on their geographical, socioeconomic, and ethnic status. The results revealed that families closer to the hospitals (p = .000) were more likely to seek access (p = .005) to a health care facility compared to those living in distant regions. Also, the authors found that it took more time for individuals from ethnic groups to enroll in health intervention services (p = .04). Notably, there seemed to be no difference between families from different socioeconomic backgrounds (Lai et al., 2014).

The utilization of emergency health care services by Deaf patients has also been investigated in a retrospective cohort study of medical records. McKee, Winters, Sen, Zazove, and Fiscella (2015) studied emergency department (ED) utilization by ASL users in Rochester, New York. The study included 200 Deaf patients and 200 patients with normal hearing function. McKee, Winters et al. (2015) found that Deaf patients were more likely to use ED services compared to hearing individuals. The researchers found that DHOH individuals might not seek care until they are in extreme pain and need urgent medical care (McKee, Winters et al., 2015). The study performed statistical tests identifying the difference in ED usage by comparing sample populations using t-test for continuous or chi-square for categorical data, univariate analysis to identify the associations with ED uses. Given the assessment association between the primary independent variable, Deaf versus hearing patients and the ED usage over a period of the past 36 months used logistic regression (McKee, Winters et al., 2015). Logistic regression was used to control for available demographics such as sex, age, race/ethnicity, smoking status, and insurance types. The results showed Deaf individuals were almost two times more likely to use the ED in the 36-month period shown in the data assessment recorded the OR, 1.97; 95% CI 1.11–3.51, <0.001 compared to hearing ED patients. While McKee, Winters et al. (2015) findings have not been validated by others, it remains an important empirical study to reflect the issues faced by DHOH patients.

Emond et al. (2015a) also focused on subjective assessment of care among the DHOH population. The authors argued that although people with deafness have poorer health status and use health care services more often, they tend to be dissatisfied with the quality of care. Deaf patients described their contact with general practitioners as difficult and believed that health care professionals were not helpful and were unable to provide appropriate explanations (Emond et al., 2015a). Emond et al. (2015a) found that Deaf individuals have less confidence and trust in their health care providers compared to the rest of the population. This study provides valuable insight into challenges and perceptions of DHOH patients and could be used to design effective interventions to address the needs of DHOH patients. Barnett, Koul, and Coppola (2014) similarly investigated satisfaction of DHOH patients with health care services. The analysis showed that DHOH patients were dissatisfied with the quality of provided services, mainly due to communication barriers (Barnett, Koul et al., 2014). Hence, there is a need to gather data that could help healthcare providers to reduce health disparities for DHOH individuals and ultimately increase patient satisfaction.

Increasing the DHOH Population's Access to Health Care

Under the ADA (1990), DHOH people are protected against any discrimination or inequality based on their disability. The ADA mandated accessibility to health care for the DHOH subpopulation and encouraged health care providers to pay greater attention to the unique needs and challenges of people with deafness. The ADA requires health care institutions to seek alternative and innovative means of communication to achieve equitable and accessible health care (ADA, 1990). It is the legal obligation of all hospital programs and services—including inpatient and outpatient services, emergency room care, surgery, and educational classes—to provide adequate and efficient means of communication that meet the DHOH clients' needs and preferences (ADA, 1990).

Most DHOH patients benefit from communicating with health care providers who know sign language. Education is required for doctors to become aware of the cultural health care needs of the DHOH population in order to provide more patient-centered and quality care (Magowan, 2014). However, the ADA did not stipulate training for health professionals to meet the communication needs of DHOH patients. As such, one of the ways to improve face-to-face communication with patients is to raise providers' awareness and knowledge of their patients' unique needs and to employ a greater number of public health professionals who are also DHOH. Employing DHOH health care providers could facilitate direct communication with Deaf patients. Alternative communication services available to the DHOH population include interpreters, assistive hearing devices, lip-reading, written materials, and DHOH-accessible and usable websites (Kushalnagar et al., 2015). These services can be made available by hearing health care providers. Written notes may be useful when there is no need to explain medical information, such as when filling out admission forms or during billing (ADA, 1990). Notes may also be used to inquire about or explain the room number or similar issues. However, more complicated communication (such as the discussion of symptoms or treatment options) requires the use of interpreter services regardless of an ASL user's literacy level (McKee & Paasche-Orlow, 2012; McKee, Winters et al., 2015). The ADA (1990) requires all health care institutions to provide an interpreter or other assistive services to ensure accurate transmission and understanding of information. It is preferable to consult with each DHOH patient concerning his/her communication needs to be able to provide quality services. Despite ADA (1990) requirements, there is an issue of compliance with the law in the healthcare arena. Notably, under the ADA (1990), the cost of interpreter services cannot be billed to the patient nor charged to their health insurance plan, as hospital facilities are responsible for rendering payment directly to interpreter agencies. Thus, it makes it difficult for healthcare facilities to enact compliance to ADA (1990) requirements. The development of assistive technologies helps to diversify communication options and devices for DHOH patients, thus increasing direct access to health care professionals as allowed by the ADA (1990).

Health Education for the DHOH Population

The need to preserve health care funds has shifted population health towards health education as an effective way to reduce high U.S. government deficits. The DHOH population costs billions of dollars annually due to inadequate health literacy, which prevents DHOH individuals from receiving timely and quality care (Blackwell et al., 2014; CDC, 2015b; CDC, 2015c). Smith and Samar (2016) examined DHOH adolescents' health literacy by surveying 187 high school students with deafness and 94 hearing students to find out whether deafness affects health literacy. The researchers translated questions into sign language to avoid bias or misunderstanding when collecting data, and used various questionnaire forms to quantify the DHOH and hearing adolescents' health literacy differences. Although printed materials with health-related information Although printed materials with health-related information, the authors found that DHOH adolescents had significantly lower scores and functional health literacy compared to their hearing peers on all questionnaires ($p < .0001$) when given the Instrument-Short Form, Short Form of the Test of Functional Health Literacy, and Comprehensive Heart Disease Knowledge Questionnaire assessments.

Smith & Samar's (2016) findings resulted from analyses of covariance (ANCOVA) for the standard health literacy outcome measurements and logistic regressions to report the interactive and critical health literacy measures between the DHOH and the hearing in testing for gap in-group disparities. The study also conducted a within-group assessment using ANCOVAs to report the categories of interactive and critical health literacy pertaining to Deaf-related demographics between-subjects factors to predict all three standard health literacy assessment measures. In addition, ANCOVAS, logistic, and covariates were used to adjust for participants' age, grade, gender, race/ethnicity, and childhood socioeconomic status when reporting their race/ethnicity to provide dichotomous covariate results. DHOH participants who reported wearing hearing aids, having quality communication with parents, and regularly attending hearing schools had better health literacy skills (all P's < .025) than other DHOH patients without hearing aids (Smith & Samar, 2016). Half of the DHOH participants who reported English as their preferred language had a higher cardiovascular score ($p < .03$), which demonstrates the importance of access to information in one's preferred language.

Furthermore, Smith, Kushalnagar, and Hauser (2015) noted that DHOH individuals had a lower CVD literacy in an additional study on Deaf adolescents. Smith et al. (2015) conducted a phenomenological study of 20 participants recruited from one Deaf school and one mainstreamed public school that contained Deaf students. The age range of the Deaf sign language-using American participants were from 14 to 17 years old in ninth to 12th grade with various home background and communication background skills in the city of Rochester, New York. Participants were interviewed by Deaf bilingual researchers to ensure the accuracy of collected data. The authors found that the main sources of information for Deaf students to obtain health literacy were family members, health care providers, health educators, and printed and informal sources. While the 20 Deaf adolescents had access to sources that would provide good health information, they faced considerable challenges when accessing information. They possessed limited knowledge relating to cholesterol levels, heart attack, and stroke.

McKee, Paasche-Orlow et al. (2015) conducted a cross-sectional study of 405 participants including 166 people with deafness and 239 with standard hearing aged 40 to 70 years. The principal aim was to compare health literacy levels between these two groups using the Newest Vital Sign translated (ASL-NVS; adapted in an ASL version), and strength of the association between ASL-NVS and participants' educational attainment. Several statistical tests were run including bivariate association using chi-square, Spearman correlation for data that were continuous, and ordinal logistic regression to assess health literacy levels. The results revealed that 48% of DHOH participants had inadequate health literacy, and were seven times (adjusted odds ratio [aOR] 6.88; 95% [CI] 4.20–11.24, $p<.001$) more likely to have limited health literacy compared to their hearing counterparts (McKee, Paasche-Orlow et al., 2015). An example taken from the ASL-NVS showed that most of the Deaf participants were socioeconomically poor ($p = 0.036$) non-Hispanic Caucasians ($p < 0.01$) who scored low on their ASL-NVS ($p < 0.01$). After controlling for age, gender, race, education, and income, the participants who were Deaf remained less literate in cardiovascular health than their hearing counterparts. Moreover, the negative correlation in cardiovascular health knowledge and the score for health literacy for the Deaf were higher than those who could hear ($r = 0.21$ for Deaf and 0.06 for hearing; $p < 0.01$). Overall, the study found that lower health literacy is more likely for uneducated Deaf people in the low-income population and among those who have insufficient English reading comprehension. Similar to Smith and Samar (2016), given the high prevalence of DHOH people with inadequate health knowledge and skills, researchers must develop effective educational strategies to raise health literacy in this vulnerable population group.

Kushalnagar et al. (2015) further found that DHOH individuals with poorer health literacy had difficulties in obtaining health-related information. The authors evaluated several health websites designed specifically for Deaf ASL users and concluded that the simple navigation was not enough to help ASL users to take advantage of all health information available on the sites (Kushalnagar et al., 2015). Kushalnagar et al. (2015) divided the group into two: those who used ASL as their preferred mode of communication (*n* = 19) and those ASL communicators who preferred English (*n* = 13). The study used chi-square, bivariate correlation, and *t*-tests to provide descriptive analyses of their participants' perceptions of website videos by examining the relationships between the various domains (i.e., navigation in finding tasks, usability of the website, and simplicity of understanding video in ASL). The study also looked at the mean differences between the health literacy of participants utilizing an unpaired t-test and brief open-ended interviews. The result revealed that the ASL population scored generally lower in health literacy compared to participants who reported a preference for English. Lower health literacy occurred among the primary ASL users, which the authors suggested was due to longstanding restrictions to health communication access and ASL health materials over participants' lifetimes. The Health Information National Trends Survey (HINTS) is a national survey that provides data about how Americans use available health information. According to Kushalnagar, Harris, Paludneviciene, and Hoglind (2017), this tool has not been available to Deaf Americans who communicate in American Sign Language until recently. After the adaptation of this tool to ASL, over 1,350 Deaf ASL users have taken this survey to better understand their comprehension of health messages through traditional means. According to the researchers, in order for health information to be of benefit to the DHOH, it was recommended that such information be provided either in ASL videos or through the use of video remote interpreting services in health settings (Kushalnagar et al., 2017).

Conclusion of the Literature Review

To summarize, an abundant body of empirical literature exists concerning the DHOH subpopulation’s health needs, communication barriers, and access to health care services. However, there are gaps in the literature concerning how communication barriers interfere with DHOH patients specifically, and affects access to quality health care services. The main idea that can be observed in the majority of these studies is that people with deafness face unique communication barriers that prevent them from accessing quality health care (McKee, Paasche-Orlow et al., 2015). Additionally, DHOH people are more prone to developing diseases such as diabetes and other CVD risk factors, mainly due to poor health literacy and limited sources of health-related information. Although, the ADA (1990) has helped achieve greater equality for the DHOH community by urging health care providers to become innovative and adjust their services, much still needs to be done to ensure that these individuals receive appropriate, patient-centered care.

Definitions

Access to health care. Levesque, Harris, and Russell (2012) characterized *access to health care* as a complex phenomenon that escapes a clear and unambiguous definition because the reasons for limited health care access are different among populations. People with different barriers to access are underserved because health care is either unavailable to them, or because their interaction with caregivers deters or diverts their help-seeking behaviors (Levesque et al., 2012). In the case of the DHOH subpopulation, communication barriers and the absence of a viable means for proper communication may deter DHOH individuals from seeking health care assistance. According to the Agency for Health Care Research and Quality (2011), some individuals (including DHOH individuals) have an impaired ability to gain access and entry to the health system and the appropriate sites of care to receive the required services. Hence, increasing access to health care for special populations has become an essential component of high-quality, inclusive health care coverage (Institute of Medicine and National Research Council, 2011).

Cardiovascular disease (CVD). A complex of heart and blood vessel problems, most of which relate to atherosclerosis (Wilmot et al., 2012). The latter condition develops when plaque builds up on the walls of blood vessels and inhibits the blood flow, causing a heart attack or stroke. Other CVD types are the risk factors that include blood pressure, cholesterol, and diabetes (CDC, 2016). Heron and Anderson (2016) stated that CVD remains the leading cause of death globally, even though mortality has been significantly reduced in developed countries due to availability of effective treatment.

Deaf and Hard of Hearing (DHOH) subpopulation. A heterogeneous population comprised of individuals with special needs; while the term *Deaf* is mistakenly used to refer to all people with some types of hearing difficulty, Deaf individuals (with capitol “D”) are those with little or no functional hearing who use ASL for communication (Sacks et al., 2013). *Hard of Hearing* term (with capitol “H”) is used to denote individuals who may have a certain degree of deafness and communicate in sign language or with little interest in spoken language (DeafTEC, 2016). Some DHOH individuals develop or have speech problems because of a limited ability to hear their own voices clearly (Lederberg, Schick, & Spencer, 2013). Both terms, Deaf and Hard of Hearing are interchangeable used here to refer to the same subpopulation of people that share the cultural experiences and common language (ASL) as per Sacks et al. (2013).

Hearing loss. A certain degree of degradation in hearing sensitivity. A person with normal hearing ability is susceptible to sounds ranging within 250-2,000 Hz. *Hearing loss* can be bilateral (with both ears' reduced sensitivity) or unilateral (with only one ear affected); it can also be symmetrical (with both ears affected similarly) or asymmetrical (with different degrees of hearing loss in the two ears), and fluctuating (with different degrees of sensitivity changing over time) or stable (with constant level of hearing sensitivity degradation; Fitzpatrick, Durieux-Smith, Gaboury, Coyle, & Whittingham, 2015). Such individuals typically do not use ASL to communicate with the outside world.

Hearing aids. Devices used for amplifying sound. These devices do not discriminate between wanted and unwanted sounds, so it delivers both background noises and the interlocutors' messages to the DHOH individuals (Minnesota Department of Human Services, 2016). The Merriam-Webster Dictionary (2016) defined *hearing aid* as an electronic device that is worn in or behind a hearing-impaired individual ear(s) for the sake of sound amplification. Thus, hearing aid devices are used to assist DHOH individuals to hear in both quiet and noisy situations, to communicate, and to participate more fully in daily social activities. The mechanism of any hearing aid includes a microphone, an amplifier, and a speaker. The sound comes through a microphone, converts sound received with sound waves into electrical signals, and sends them to the amplifier for the latter to increase the power of signals and transmit them to the user's ear through a speaker.

Health behavior (health behavior change). The earliest definition to *health behavior* was given by Gochman (1982), characterizing it as a complex of individual beliefs and values, personal features, and emotional states and attitudes manifested in human conduct related to health advancement and maintenance. Examples of individual health behaviors include the use of condoms, seatbelts, and getting vaccinated, while collective health behaviors involve making changes in the built environment to promote physical activity, such as starting a local farmer's market for healthier nutrition. A *health behavior change*, in turn, is defined as improvement of health behaviors and gradual adoption of prohealth beliefs and behaviors as a result of health education or broader social change (i.e., policy, advocacy, and organizational changes; Orji, Vassileva, & Mandryk, 2012).

Health disparity. The set of inequalities existing between members of certain population groups in terms of benefitting the same health status as other groups. In line with that definition, health disparity groups are seen as different population categories witnessing different rates of disease incidence, prevalence, morbidity, mortality, and survival rates (Krahn, Walker, & Correa-de-Araujo, 2015). *Health disparities* arise among diverse populations as a result of designated chains of events and when there are pronounced differences in environmental aspects, access to, use, and quality of care in terms of gender, race, religion, and other sociodemographic characteristics, individuals' health status, and health outcomes (as seen from the sociological perspective). For instance, in social terms, poverty is a significant contributor to health disparities, while the biopsychological perspective offers a view on biological variations that occur among groups regardless of their race, ethnicity, SES, and access to care. From this viewpoint, health disparities take place at alarming and disproportionately higher rates among certain categories people such as disabled groups, ethnic minorities, due to a complex interaction of genes/biology, environment, and behavior (Krahn et al., 2015).

Telemedicine and telehealth. *Telemedicine* refers to the use of modern information technologies, in particular the interactive two-way audio and video communication devices. Computers and telemetry, for example, are used to deliver quality and efficient health care services and to facilitate communication exchange between physicians and users of health care services (Morgan et al., 2014). Telemedicine is defined as the use of advancing telecommunication technology for the exchange of health information and provision of needed health care services across geographic, time, social, and cultural barriers (Weinstein et al., 2014). In this approach, *telehealth* is referred to as a remote type of health care services and education by the means of information and communication technology (ICT); it is understood as the integration of the telecommunications systems into health practices to protect and promote health, health education coverage, public and community health, health systems development, and epidemiology. In contrast, telemedicine is more relevant towards clinical aspects of curing the disease (Weinstein et al., 2014).

Assumptions

The proposed study is guided by several assumptions that determine its structure and contribute to the formulated method and research approach. The initial assumption on which the inquiry is based is that DHOH Americans have poorer access to health care because of their communication barriers (McKee & Paasche-Orlow, 2012). In particular, it is assumed that this subpopulation has poorer access to health care, poorer health status, and lower quality of care coupled with more adverse health events for those who have limited English language capacity or otherwise need interpreter services. Taking into account that one in five people in the United States has a certain form of disability, and a large number therein have communication disabilities, the problem of providing such individuals with adequate access to health care services presents a challenge in making U.S. health care more inclusive and universal (U.S. Census Bureau, 2016).

Another assumption guiding this study is that DHOH subpopulation have low health literacy because of their lack of access to traditional forms of health education. McKee, Winters et al. (2015) stated ASL users are a linguistic subpopulation with poor health because of the existence of communication barriers along with low health literacy, which causes more frequent use of ED services. This problem is also recognized by the National Association of the Deaf (2016), who identified the problem of the U.S. health system's persistent inability to ensure and provide accessible language services and health education information to the DHOH subpopulation. Accordingly, DHOH individuals are also frequently excluded from health surveillance, outreach programs, and mass media health messages because of their use of ASL and inability to perceive information through the majority of mainstream media sources. These trends contribute to DHOH individuals' poorer health knowledge, insufficient follow-up, lower access to preventative services, worse CVD health conditions/outcomes, and higher rates of CVD risk factors (i.e., obesity; Emond et al., 2015b). This may indicate a need for public health services and ASL public health doctors to facilitate and reduce the health disparities.

Thus, communication barriers and poor health literacy lead to DHOH individuals' inability to assess their health status adequately and in a timely manner. Such individuals are unable to detect CVD risks and symptoms on time at their early onset; as a result the disease goes unattended for a certain period, and they have more adverse CVD outcomes, suffer higher medical costs, and overall experience greater CVD prevalence (Lohi et al., 2013). Greater CVD risks among DHOH populations were previously found in various research samples; for instance, Emond et al. (2015a) identified higher levels of obesity, hypertension, and elevated cholesterol levels among DHOH individuals, while the majority of the sample did not know about their health risks. This finding is also supported by Kyle, Sutherland, Allsop, Ridd, and Emond (2013), who stated that self-reported CVD is disproportionately lower among DHOH populations than it is in the general population, suggesting that this category of individuals finds it harder to identify CVD symptoms and risks. The proposed study hypothesizes that DHOH patients have a disproportionately higher rate of prevalence for CVD risk factors than the hearing patients.

Scope and Delimitations

The scope of this study is limited to comparison of DHOH and non-DHOH results pertaining to if they have been informed by the doctor of the CVD risk factors. The information retrieved is limited to the CVD risk factors as evident in the NHANES 2013–2014 database (CDC, n.d). The study will not assess the proportion or availability of practitioners who can communicate in ASL, as there is no way from the dataset to determine if hearing doctors know sign language to communicate. However, the data does enable the researcher to obtain vital health information to determine if the DHOH patients have ever been told or spoken to their doctor about their CVD risk factors. The assumption is the differences in the prevalence of these risk factors between the DHOH and non-DHOH participants' responses to the binominal questionnaire—a yes or no response to the question about their having been informed about CVD risk factors—is one way to determine if communication barriers exist for DHOH patients. Furthermore, this study will not assess ADA mandate compliance or which ADA mandates have been applied by practitioners due to limitations in the dataset.

Significance, Summary, and Conclusions

The issue of a need for increased access to health care by Deaf people is internationally pressing. Boff (2015) underscored that health disparities still exist between Deaf and non-Deaf people; while DHOH individuals use conventional health services, these services do not meet the needs of the DHOH community. Deaf individuals experience increased hypertension and diabetes, and generally have lower life expectancy than does the general population (Emond et al., 2015b). For DHOH individuals to have better access to health care, they must be able to communicate with health care staff easily; such communication impacts all aspects of healthcare delivery, including referral to a health care specialist, booking an appointment, discussing treatment options, and understanding the diagnosis and prognoses under various treatment options.

Research conducted among Deaf populations has identified the need for communication support (McKee, Winters et al., 2015), which, if provided, may lead to improved and coordinated access to health care services for the DHOH. The introduction of DHOH public health professionals in the health care arena may also facilitate improved health care access, and help relieve the burden of nonsigning health care professionals, who lack communication skills and cultural and linguistic sensitivity to communicate with DHOH patients. While more research is needed, finding ways for effective communication may positively contribute to a more efficient health care services, and reduce some of the DHOH patients’ burden.

Section 2: Research Design and Data Collection

In Section 1, I established the issue of healthcare access for the DHOH subpopulation as characterized by two major problems: (a) communication barriers between healthcare professionals and DHOH patients, and (b) poor health literacy. Therefore, this study aims to address these problems by pursuing the overarching research question: What are the differences in self-reports of having been told they have CVD risk factors (i.e., diabetes, blood pressure, and cholesterol) between the DHOH and the non-DHOH patients? The specific research question and related hypotheses for this study are presented as:

Research Question: Is there a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations? The hypothesis was as follows:

H_0: There is no difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations.

H_a: There is a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations.

All data were retrieved from the 2013–2014 NHANES database cycle year questionnaires about whether the participants have been told by a healthcare professional of having diabetes, high blood pressure, or high cholesterol, or risk factors for these conditions (CDC, n.d.). The delivery of communication to assess the participants having been told of diabetes, high blood pressure, and high cholesterol on both the DHOH and non-DHOH were analyzed. In this study, to assure comparability, I purposively selected the participants; the study focused on survey respondents who disclosed disability status of hearing difficulties. Non-DHOH participants were matched with the DHOH subjects by age, gender, and race/ethnicity, and all non-DHOH participants were asked the same questions regarding if they were informed of having the various CVD risk factors. This range in age, gender, race, and annual income provided for a broad demographic understanding of the selected population.

In the following section, I present the rationale for selecting a quantitative research design, the study variables, and a discussion of how the study may inform the broader discipline of healthcare for DHOH individuals. Then I present the population and sample, the sampling procedures and strategies, instrumentation and operationalization of the study variables, and the data analysis plan. In the remaining subsections, I examine potential threats to validity stemming from the study’s methodology and the study’s ethical procedures.

Research Design and Rationale

Tekin and Kotaman (2013) stated that quantitative research is essentially about quantifying the relationships between variables; therefore, quantitative studies over time (e.g., public health surveillance) are necessary to enable comparative assessments of both services delivered and outcomes of interest for any intervention assessments. Therefore, assessing the difference in diabetes, high blood pressure, and high cholesterol between the DHOH subpopulation and the non-DHOH group was carried out through a quantitative research design. The study design tested the various CVD risk factor outcomes by validating if there are any significant differences in health communication between the DHOH and non-DHOH populations. Moreover, the quantitative methodology provided statistical evidence to determine whether a CVD risk factor health disparity exists between the DHOH and the non-DHOH groups.

The present study examined the relationship between deafness and the information obtained through communication delivery of the risk factors of CVD such as diabetes, high blood pressure, and high cholesterol compared to non-DHOH participants. The quantitative research design revealed differences between groups, using chi-square statistical analysis. Utilizing the data collected from the NHANES, analyzed the dependent variables relating to communication about the three CVD risk factors. In the questionnaire, these variables were presented as: (a) whether a person was told by a doctor they have diabetes; (b) whether a person was told they have risk factors for diabetes; (c) whether a person was told they have high blood pressure; (d) whether a person was told they had high blood pressure two or more times; and (e) whether the doctor told the person they have high cholesterol level. A well-funded and lengthy research process by the NHANES resulted in the collection of healthcare data that serves as a strong representative sample of the U.S. population. The secondary data taken from the 2013–2014 NHANES dataset survey contains an annual national sample size of 5,000 individuals, of whom approximately 400 have deafness (CDC, 2015a; n.d). This study, hypothesized there was a difference in being told of having CVD risk factors between the DHOH and the non-DHOH because of communication barriers between DHOH patients and their physicians. In Table 1, I describe the variables for the CVD risk factor assessment; all questionnaires are categorical in presenting the research question and hypotheses.

Methodology

Population

The DHOH subpopulation of the NHANES survey conducted in the United States constitutes the target population of the proposed study (CDC, 2016). In assessing the outcome differences of being told of having the CVD risk factors between the DHOH and the non-DHOH populations, I assumed differences are related to the lack of adequate healthcare communication. Therefore, CVD risk factors questionnaire was taken from the annual national sample, which contained a sample size of 800 participants with and without hearing difficulties as shown in the CDC NHANES 2013–2014 database (CDC, n.d.).

Table 1

Description of Variables

Risk Factors Communicated	Dependent	Independent	Scale
"Doctor told you have diabetes?"	Diabetes	DHOH	Yes
		Non-DHOH	No
"Ever told have health risk for diabetes?"	Diabetes	DHOH	Yes
		Non-DHOH	No
"Ever told you had high blood pressure?"	High blood pressure	DHOH	Yes
		Non-DHOH	No
"Told had high blood pressure?" 2+ times	High blood pressure	DHOH	Yes
		Non-DHOH	No
"Told have high cholesterol level?"	High cholesterol	DHOH	Yes
		Non-DHOH	No

Note. Types of variables categorical

The NHANES Sampling and Sampling Procedures

The sampling strategy for the present study involved isolating data from the 2013-2014 NHANES database on DHOH status and communication about being told by a doctor that they have a risk factor for CVD. The national survey comprised a multidimensional health examination of resident, civilian, and non-institutionalized people in the United States, including disability communities. Hence, the NHANES initially excludes all persons in active military duty, active-duty military members residing overseas, those in supervised care or custody in institutional settings, and other U.S. citizens living outside of the 50 states and the District of Columbia (Johnson, Dohrmann, Burt, & Mohadjer, 2014).

Having undergone several modifications since the first cycle in 1974, NHANES today targets residents of the United States of all ages and genders, and oversamples on certain races, ethnicities, and socioeconomic statuses. This purposive sampling assures that the subpopulation of particular interest to the field of public health have sufficient numbers of representation. If simple random sampling were used, the numbers included from the smaller populations of interest may be too few to enable meaningful findings.

This modification and stratification in the national sample ensure that the sample of participants for this study represents diverse backgrounds (CDC, n.d.). Moreover, NHANES data collection involves an initial screener, personal interview questions, and a medical examination to determine a person’s health and nutritional status. The household screener serves to identify the eligibility of household members for the NHANES interview and medical examination (Johnson et al., 2014).

Study Sample

In seeking a nation-wide sample, this study relied on the findings of the 2013–2014 NHANES assessment database concerning the DHOH subpopulation. The study used the NHANES datasets to retrieve data for DHOH and non-DHOH respondents who were asked about whether they belong to the “difficulty hearing” group (CDC, n.d.). Additionally, the basic demographics were reviewed such as sex and race of the DHOH and non-DHOH participants. The study sample of the hearing population (non-DHOH) was selected to match the DHOH subpopulation that of sex, race, health insurance coverage, annual family income, and age. Thus, the study’s participants consisted of an equal number of DHOH and non-DHOH survey respondents matched by gender, race, insurance coverage, and age in which both groups were similar. Moreover, the race or ethnicity and the annual family income of study subjects was also similar for both the DHOH and non-DHOH study groups. Based on the G*power analysis, a total sample size of 208 was needed to detect an effect size of .25 with 95% power; the accessibility of the data in the NHANES database allowed for oversampling. The t-test statistical test means were used for the continuous variables and chi-square statistic applied to the categorical or ordinal variables to facilitate the determination of whether to reject or accept the null hypotheses.

Instrumentation and Operationalization of Constructs

The instrumental and operational constructs for obtaining the applicable questionnaires for this research were retrieved from one database, 2013-2014 NHANES database set. NHANES is a trustworthy database since federal and national agencies such as the National Institutes of Health, the Food and Drug Administration, the U.S. Department of Agriculture, and the U.S. Environmental Protection Agency utilized this NHANES to design, implement, and evaluate various program activities (CDC, 2015b). Though results of NHANES assessment are publicly available, the privacy of all persons involved in the study is protected by public laws reducing ethical violations. Furthermore, all information obtained through the survey is kept confidential, as the data is aggregated and deidentified. The NHANES is an empirically tested and validated instrument for estimating the distribution of chronic diseases and risk factors among populations (Johnson et al., 2014).

Hence, this study used the NHANES 2013–2014 data to obtain the co-morbidities from survey questionnaires, to determine the differences between the DHOH and the non-DHOH patients when they were asked if they have ever had a certain CVD risk factor. Therefore, in this study received health communication statuses of DHOH and non-DHOH were measured by reports assessing: (a) whether a doctor told them they have diabetes; (b) whether a person was ever told they have health risk factors for diabetes; (c) whether a person was ever told they had high blood pressure; (d) whether a person was told they had high blood pressure two or more times; and (e) whether the doctor told them they have high cholesterol. Confounders controlled by matching were: education, gender, annual family income, health insurance coverage, and age.

Data Analysis Plan

The study data utilized descriptive statistics to provide an overview of the demographic population needed to distinguish its sociodemographic characteristics such as age, gender, race, annual family income, and insurance status of the population (Pinkham et al., 2014). This study used descriptive statistics counts and frequencies to lay the foundation for the data analysis plan. The independent and dependent variables (see Table 1) were computed utilizing SPSS software to analyze the study questionnaires. Chi-square test was applied to the blood pressure, diabetes, and cholesterol questions which comprised the dependent variables in assessing comparability of the two independent groups (DHOH and non-DHOH; see Table 1). The SPSS software was used to analyze the data set in accordance with the predefined characteristics. The purpose was to determine the comparative differences of each CVD risk factor in the DHOH and non-DHOH subjects using chi-square. Chi-square is an appropriate statistical test for this study because both the independent and dependent variables are dichotomous (i.e., categorical with two categories). The outcome of chi-square was used to determine whether to reject or accept the null or alternative hypotheses in answering the research question: is there a difference in diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations?

Threats to Validity

As in the case for any academic endeavor, this research requires consideration of validity threats imposed by the chosen research method, data, and procedures. In this type of quantitative research, scholars should consider distinguishing two major validity types that influence the plausibility of the achieved results: external/internal validity and construct/statistical validity (Wahyuni, 2012). External/internal validity is important for quantitative studies, impacting the ability to apply research findings to the wider population and other settings. The empirically-tested and institutionally-approved design and the generally rigorous procedures of the NHANES have already been validated. Taken into consideration, the separation of the researcher from the NHANES data is in some ways a threat to validity because of the inability to maneuver the dataset. The current study's threat to validity concerns the vested interests that may have indirectly or subconsciously shaped data collected. For example, the sample matching was used to control a set of identified confounders that of the non-DHOH selection.

Construct validity is also important for this study; the ability to determine if one is measuring what they think they are measuring (Wahyuni, 2012). The issue to consider is whether the hearing loss population sample taken from the 2013–2014 data is actually a true representation of Deaf ASL communicators, as there was no question on the NHANES study about whether those who identified hearing loss communicated using ASL. Therefore, one way to improve the construct validity of this research would be if the NHANES added a question about the participants communication preference. A questionnaire inquiring if the participants who were not told they have a CVD risk factor, but actually have a certain CVD risk factor and communicate in American Sign Language would improve the construct validity. Another source of construct validity is the problematic of describing the perception of the questionnaire responses causing a potential misinterpretation and misleading statements when attempting to present interpreting the results. A truly representative measurement of the ASL DHOH subpopulation communicators might validate the findings of Kushalnagar et al. (2015) who identified CVD and communication as issues for ASL users.

Ethical Considerations

The ethical considerations relating to human subjects research are not relevant for this study because it utilized secondary data analysis of deidentified data from the 2013–2014 NHANES. The only ethical requirement relevant for this study is the ethical obligation to treat primary data collected by other researchers sensitively, professionally, and delicately. The broadest ethical issue with secondary data research is the inappropriate use of primary data sources; for instance, surreptitious utilization that makes the research process easier and quicker but deprives it of the ethical dimension. To address the ethical issues in secondary research, researchers have to be aware of the initial misalignment between the purpose and the data sourced (Weiner, 2014). It is also necessary to keep in mind that people participating in NHANES granted their informed consent for participation and took part in it because of their trust in the credibility of the CDC as an authoritative national body of healthcare researchers.

To make the secondary research process ethical, the steps for accessing and using secondary data is related to whether the data collected is able to be reanalyzed, as well as verifying that rigorous, objective, and replicable analytical techniques are used to avoid data distortion or misinterpretation. The questionnaire interpretations could be misleading when aim to structure sentences to provide concrete interpretation of the questionnaire responses. Thus, results misleading the scholars are an ethical consideration. Another consideration is while primary materials may be stored online and in other publicly-available resources, there is still a need to obtain approval from the original study’s authors to determine whether they will allow the use of their raw data in subsequent studies. Here, ethical approval for utilization of this researchers' datasets was approved under number 07-06-18-0545509 in which was obtained through Walden University's institutional review board (IRB; (Sundaram, Vemana, & Bhayani, 2014).

Finally, it is necessary to take note of the essence of secondary research, which also presents ethical dilemmas. There is a fundamental distinction between reanalyzing primary data collected by other researchers in the same manner and presenting a new, fresh, or even conflicting opinion on what that data suggests from the viewpoint of a DHOH public health scholar. This means closely analyzing the original study and the data collected by those researchers and providing a new interpretation of what the findings suggest. A separate issue is taking the primary dataset and using it to test hypotheses different from those pursued by the original study, which is much more ethical in regard to the primary researchers' contribution (Brakewood & Poldrack, 2013). This inquiry utilized the secondary collected data for analysis of whether the DHOH and non-DHOH Americans reports of having being informed by a health care provider if they have a particular CVD risk factor. Thus, this study aims to understand communication barriers among the underserved and understudied DHOH subpopulation and CVD risk factors when being informed by healthcare providers.

Summary

This section presented the methodological details of the proposed study, including the rationale for selecting a quantitative research method. It provided an explanation of the quantitative approach that was used, and the hypothesized relationships between the dependent and independent variables of interest. The study used a cross-sectional quantitative methodology and secondary analysis of 2013–2014 NHANES representative of a subsample to present if DHOH subpopulation reports of having been informed by their health care providers of having blood pressure, high cholesterol, and diabetes (CDC, n.d.). The section concluded by discussing sampling strategies and procedures, threats to validity and reliability, and ethical issues arising from secondary research.

Section 3: Results

This study addressed health challenges experienced by members of the DHOH community and the disparity in morbidity that exists between the DHOH and non-DHOH. The purpose of this study was to provide the difference in being told of having a CVD risk factor between the DHOH and non-DHOH populations. The research question is:

Research Question: Is there a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations? The hypothesis was as follows:

> H_0: There is no difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations.
>
> H_a: There is a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations.

In this section, I will present the demographics of the sample population, followed by a discussion of the results for each component of the RQ, distinguishing between the DHOH and non-DHOH and the three CVD risk factors. The section addresses discrepancies in the use of the secondary data set, baseline descriptive and demographic characteristics of the sample, how representative the sample was of the population of interest, and the results of basic analyses. The results are presented through the use of descriptive statistics, evaluation of statistical assumptions, reporting of inferential statistics, and the chi-square tests performed. Section 3 ends with a summary and a discussion of whether to reject or accept the null hypothesis, transitioning to the material findings introduced in Section 4.

Study Demographics

The study's participants consisted of 400 DHOH and 400 non-DHOH survey respondents who answered whether they reports of having been informed by a health care if they have a CVD risk factor. The initial survey population consist of 10,175 participants that includes the DHOH subpopulation (CDC, n.d.). DHOH participants include all of those who reported having serious difficulty hearing in the NHANES 2013-2014 database. The two groups of participants were statistically similar by gender, race, insurance coverage, and age in which the variables item were matched (see Table 2). Moreover, the race or ethnicity and the annual family income of study subjects were statistically similar for both the DHOH and non-DHOH populations (see Tables 2 and 3).

Table 2

Demographics of the DHOH and non-DHOH Survey Respondents

		DHOH respondents (*n*=400)	non-DHOH respondents (*n*=400)	Test statistic	*p*-value
Gender	Male	203 (50.7%)	194 (48.5%)	X_2(*df*=1) = .41	.53
	Female	197 (49.3%)	206 (51.5%)		
Race	Mexican Americans	73 (18.3%)	73 (18.3%)	X_2(*df*=4) = .00	1.00
	Other Hispanics	35 (8.8%)	35 (8.8%)		
	Non-Hispanic White	146 (36.5%)	146 (36.5%)		
	Non-Hispanic Black	99 (24.8%)	99 (24.8%)		
	Other Non-Hispanic Races	47 (11.8%)	47 (11.8%)		
Insurance Coverage	Yes	325 (81.2%)	330 (82.5%)	X_2(*df*=1) = .21	.65
	No	75 (18.8%)	70 (17.5%)		
Age (Years)	Minimum	0	0	*t*(*df*=798) = .23	.82
	Maximum	80	80		
	Mean (*SD*)	31.73 (24.14)	32.14 (25.06)		

Table 3

DHOH and non-DHOH Annual Family Income

Annual family income	DHOH group (*n*= 400)	non-DHOH (*n*= 400)
Under $20,000	104 (26.0%)	92 (23.0%)
$20,000 and Over	280 (70.0%)	298 (74.5%)
Refused	8 (2.0%)	4 (1.0%)
Don't know	3 (0.8%)	1 (0.3%)
Missing	5(1.3%)	5(1.3%)

Note. $X_2(df=3) = 3.63$, $p = .30$.

Hypothesis Test Results

This section details the results of the hypothesis tests used based upon the survey responses from the 2013-2014 NHANES database the reports of having been informed if they have diabetes, high blood pressure, or high cholesterol among both the DHOH and the non-DHOH participants. The results section begins with DHOH vs. non-DHOH population results using chi-square and odds ratio outcomes to determine whether or not to reject or accept the null hypothesis based on the 5% level of significance. Chi-square tests were performed to determine the statistical significance of any differences between participants with and without hearing difficulties relative to being told of having specific CVD risk factors. Odds ratios were computed to determine whether the DHOH subpopulation are being told of their CVD risk factors more or less often when compared to non-DHOH population. It is important to note that these results do not use any diagnostic tools, and instead merely look at what doctors reportedly told patients. Also, there was substantial missing data in the study, which was not included in each analysis.

Provided that the participants may have chosen to skip answering specific questions. These results could be subjected to bias being not uncommon with retrospective studies in which is addressed in the study limitation. Thus, the first comparison was based on having been told that they have diabetes.

DHOH participants were more likely to report being told they have diabetes than non-DHOH participants, $X_2(df=1) = 31.13$, $p < .001$ (see Table 4). Specifically, 23.7% of DHOH participants reported being told they have diabetes compared to 8.9% of non-DHOH patients. The odds ratio was 3.17, which suggests that being DHOH increases the odds multiplicative by 3.17 times that the patient will be told they have diabetes, compared to the non-DHOH patients. Therefore, at the 5% level of significance, the null hypothesis was rejected that there is no statistically significant difference between DHOH and non-DHOH patient being told they have diabetes.

Table 4

*DHOH vs. non-DHOH * Told Have Diabetes (*N*=773)*

	DHOH	Non-DHOH
Told have diabetes	90 (23.7%)	35 (8.9%)
Not told have diabetes	290 (76.3%)	358 (91.1%)
Odds of being told you have diabetes	.45	.11

Note. $\chi^2(df=1) = 31.13$, power =.99, $p < 0.001$ odds ratio = 3.17; 27 pre-diabetic people excluded.

The second set of calculations examined whether there were differences between DHOH and non-DHOH participants in being told they have health risks for diabetes (Table 5). DHOH participants were more likely than non-DHOH participants to have been told they have health risks for diabetes, $X_2(df=1) = 4.17$, $p = .04$. Specifically, 18.4% of DHOH participants reported being told they have diabetes compared to 12.2% of non-DHOH patients. The odds ratio was 1.63, which suggests that being DHOH increases the odds multiplicative by 1.63 times that the patient will be told they have a health risk for diabetes, compared to the non-DHOH patients. Therefore, at the 5% level of significance, the null hypothesis was rejected that there is no statistically significant difference between DHOH and non-DHOH patient being told they have risk of diabetes.

Table 5

*DHOH vs. non-DHOH * Told Have Health Risk for Diabetes (N=552)*

	DHOH	Non-DHOH
Told you have risk for diabetes	53 (18.4%)	32 (12.2%)
Not told you have risk for diabetes	235 (81.6%)	232 (87.9%)
Odds of being told you have risk of diabetes	.29	.16

Note. $X_2(df=1) = 4.17$, power =.56, $p = .04$, odds ratio = 1.63; Missing data on 248 people.

The next result examined whether there were differences between DHOH and non-DHOH participants in being told they have high blood pressure (see Table 6). Being DHOH did not significantly increase the odds of being told that an individual had high blood pressure ($OR = 0.97$). This conclusion is confirmed by the chi-squared test, which shows that the two are independent. χ^2(1df = 1)= .02, p =.89. Therefore, the results of the statistical test support the null hypothesis that there is no statistically significant difference between DHOH and non-DHOH individuals and being told they have high blood pressure.

Table 6

*DHOH vs. non-DHOH * Told Have High Blood Pressure (*N*=545)*

	DHOH	Non-DHOH
Told Have High Blood Pressure	89 (32.0%)	87 (32.6%)
Not told Have High Blood Pressure	189 (68.0%)	180 (67.4%)
Odds of being told have high blood pressure	.89	.94

Note. χ^2(df=1)= .02, power =.05, p =.89, odds ratio = 0.97.; Missing data on 255 people.

The next comparison made presents the chi-square result to determine whether there was a statistically-significant difference between DHOH and non-DHOH participants being told they have high blood pressure two or more times (Table 7). The statistical test showed that there was no statistically significant difference between the two groups χ^2(df = 1)=.23, p = .63. The odds ratio was 1.21suggests that being part of either group does not make it more likely that they are told they have high blood pressure two or more times. Therefore, the test supports the null hypothesis that there is no statistically significant difference between DHOH and non-DHOH being told they high blood pressure two or more times.

Table 7

*DHOH vs. non-DHOH * Told Have High Blood Pressure 2+ Times (*N*=176)*

	DHOH	Non-DHOH
Told Have High Blood Pressure 2+ Times	76 (85.4%)	72 (82.8%)
Not Told Have High Blood Pressure 2+ Times	13 (14.6%)	15 (17.2%)
Odds of being told high blood pressure 2+ times	1.21	1.26

Note. χ^2(df = 1)=.23, power =.08, p = .63, odds ratio = 1.21; Missing data on 624 people.

The final comparison assessed whether there was a statistically significant difference between DHOH and non-DHOH participants being told that they had high cholesterol (Table 8). The results showed that non-DHOH participants were more likely than DHOH participants to have been told that they had high cholesterol. The odds ratio of 0.59, suggests that being DHOH significantly decreases the probability of being told that they had high cholesterol. The chi-squared test supports this conclusion $\chi^2(df = 1)=7.69$, $p = .01$. Therefore, the results of the chi-squared test support rejecting the null hypothesis that there is no statistically significant difference between DHOH and non-DHOH in terms of being told that they have high cholesterol.

Table 8

*DHOH vs. non-DHOH * Told Have High Cholesterol Level (N= 544)*

	DHOH	Non-DHOH
Told Have High Cholesterol	68 (24.5%)	94 (35.3%)
Not Told Have High Cholesterol	210 (75.5%)	172 (64.7%)
Odds of being told have high cholesterol	.48	1.21

Note. $\chi^2(df=1)=7.69$, power =.799, $p = .01$, odds ratio=0.59 ; missing data on 256 people.

Overall Summary and Conclusions

As observed from the findings of this study, the DHOH show they were more often told about having diabetes than non-DHOH (Table 4 and Table 5). Such could imply that this CVD risk factor is probably greater than estimated being an issue in the DHOH, but was underestimated because of the communication barriers. However, being told of having high blood pressure either group of patients did not make a difference.

Such could imply that this risk factor in DHOH subpopulation is probably overestimated and overstated as being a communication barrier compared to the general population (Table 6 and Table 7). Finally, DHOH were more often not told about having high cholesterol (Table 8). Which could imply that high cholesterol is probably not overstated as an issue for DHOH patients because of the potential communication barriers in the health care system.

In sum, the chi-square results show a statistically significant difference in three domains:

1. Told you have diabetes ($p<0.001$)
2. Ever told have health risk for diabetes ($p=0.04$)
3. Told you have high cholesterol level ($p=0.006$).

Of the three test results that demonstrated statistical significance, Tables 4 and Table 5 showed that the odds of being told of having diabetes is higher in the DHOH subpopulation compared to the non-DHOH. In Table 8, the odds of being told of having high cholesterol is less likely in the DHOH subpopulation compared to their non-DHOH counterparts.

The following section contextualize the obtained findings as it relates to the access to health care rights of DHOH people. The discussion will consider whether the findings are supported by previous literature and consider possible reasons for the difference between the DHOH and the non-DHOH patients. Individual analyses were performed to investigate the main research question and find support (or lack of support) for the hypothesis that individuals who are DHOH have greater prevalence of the overall risk factors of CVD than those who are non-DHOH (Kushalngar et al. 2015).

Section 4: Application to Professional Practice and Implications for Social Change

This study on DHOH individuals in the United States is valuable from many perspectives because it illuminates some of the health care challenges potentially stemming from patient and physician communication challenges (see Simons et al., 2018). The UN Convention on the Rights of Persons with Disabilities set the standard that people with disabilities have the right to attain high standard of health care without difficulty (United Nations, 2019). Included in this United Nations convention is a convention agreement between nations to encourage promulgated health care standards for disabled people that include the Deaf communities. Inherent in this right is that people with disabilities should attain the same range, quality, and standard of affordable health care as provided for the non-disabled communities (United Nations, 2019). The movement is supported by the National Association of the Deaf (2019), who advise their community that under Section 504 of the Rehabilitation Act of 1973 and the ADA, that federal disability discrimination laws should facilitate seeking equality of health care services and their potential benefit and promote effective communication with health care providers. It is the ethical and legal responsibility of health care providers to make themselves accessible to the DHOH community. While research in the DHOH community continues, there is still a need to overcome communication barriers in non-communicable diseases; this requires frequent assessment of findings to improve collaboration and implementation programs (Goodwin, 1999; Pinilla, Walther, Hofmeister, & Huwendiek, 2019).

Overall, improving communication requires health care providers to be trained on cultural competence, which ensures that communication with the DHOH patient is a top priority (Pinilla et al., 2019). The risk of unachieved competency health goals must be made known to the providers, such as possible life-threatening mistakes leading to morbidity and mortality epidemics (Emond et al., 2015b). Therefore, providers should seek the development of care and compassion towards culturally-appropriate healthcare services for the DHOH community. Methods, standards, and funding are in place to facilitate healthcare achievement within this disadvantage population (Goodwin, 1999). Health administrators are increasingly aware of the need to raise competencies for better public health collaboration (Goodwin, 1999). Worldwide, changes are gradually being implemented to improve the communication gaps for DHOH people in health care setting (United Nations, 2019).

Analysis of these issues contributes to the overall understanding of certain health outcomes presented in the DHOH community. Therefore, the interpretations of the findings of this study should begin with an important clarification that deafness is not a disease, nor is it a debilitating problem for DHOH individuals, but rather a challenge of access to basic healthcare services because of communication issues (McKee, Paasche-Orlow et al., 2015). This barrier occurs because a majority of healthcare workers do not understand the communication issues faced by DHOH individuals (McKee, Winters et al., 2015). DHOH public health professionals may be able to create innovative ways of addressing health challenges in order to reduce poorer health outcomes within the DHOH communities they serve in the healthcare system.

In this section, I provide an overview of the findings obtained from examining the 2013-2014 NHANES data, lay out the interpretation of the findings and their potential implications for the broader field of study. Moreover, this section will discuss the limitations of this research connected with its specific methodology, and present recommendations for theory advancement and practices for DHOH individuals. The section also reviews the potential implications for professional practice and social change that would result from the adoption of innovative technologies to improve healthcare communication between doctors and DHOH people. Implementing innovative technologies such as telehealth videophones in the healthcare system to help DHOH individuals communicate effectively with primary care physicians—and increasing the number of DHOH public health professionals in the healthcare arena—might facilitate the management and reduction of the risk factor for cardiovascular diseases. Hence, the conclusions are drawn based on the study findings to show the overall contribution of this study to the existing body of research and potential social change towards greater inclusivity and patient-centered healthcare delivery within the contemporary American system.

Interpretation of Findings

The purpose of this study was to investigate the differences between the DHOH and non-DHOH populations' self-reports of having been about their CVD risk factors. Specifically, this study sought to address the question, "Is there a difference in self-reports of having been told of having diabetes, high blood pressure, or high cholesterol between the DHOH and the non-DHOH populations?" To address this study question, secondary data provided by the 2013-2014 NHANES study was analyzed utilizing chi-square tests and odds ratios to assess differences in whether the DHOH and non-DHOH participants self-reports of having been told that they had diabetes, high blood pressure, or high cholesterol. Any differences were determined to be significant if the probability of statistical error or chance impacting results was less than 5% ($p < 0.05$). Any differences found were assumed to be attributable to communication barriers.

The results indicate that DHOH people are more frequently told they have diabetes than the hearing (non-DHOH) population. This finding supports the main hypothesis of this study, that the DHOH subpopulation reports of having been informed more often of having diabetes than the non-DHOH population. The second finding of this study was that DHOH people were more likely to self-report having been told they have health risk factors for diabetes than were non-DHOH people.

Next, there was no statistically significant difference in the odds of members of the DHOH community and members of the non-DHOH community of having ever been told they had high blood pressure. This finding did not support previous expectations and fails to support the main hypothesis of this study. The reason that this finding did not support this study's hypothesis is not clear. However, high blood pressure is commonly assessed at each clinical visit; therefore, is more likely to have been identified because of the frequency of the assessment compared to diabetes assessments. Conversely, symptoms of diabetes are often more difficult to detect by both patients and doctors. Therefore, communication barriers may be less likely to have been reinforced over time as would CVD risk factors because of the much more frequent assessments between the

DHOH patients and doctors in regard to blood pressure than in regard to the less directly-observable signs and symptoms of diabetes.

Regarding high blood pressure, I found no significant difference in having been told of having high blood pressure two or more times in participants with high blood pressure, both with and without hearing difficulties. This question was asked in relation to two or more times because hypertension requires an elevated blood pressure reading more than two times. This finding did not support expectations and failed to support this study’s hypothesis. One possible explanation for why this finding failed to support this study’s main hypothesis is because blood pressure is more likely to have been identified due to the frequency of the assessment compared to diabetes. One potential cause of this outcome may be the lack of any real communication differences of this particular cardiovascular risk factor between the DHOH and non-DHOH community. Future research is needed to validate the accuracy of this outcome.

Next, results from this study showed that there was a statistically significant difference in the non-DHOH than the DHOH participants of having been told they had high cholesterol. DHOH people may have higher cholesterol than non-DHOH people but may be less likely to be informed about their high cholesterol due to communication issues. Nevertheless, future research is needed to verify the cholesterol outcome by examining actual diagnosis of DHOH patients to determine if the DHOH patients who face communication barriers have high cholesterol.

Overall, there are differences concerning what DHOH patients report being told as compared to the non-DHOH. There is a possibility this is attributable to communication barriers, high cholesterol for instance, suggests that healthcare providers may be trying to communicate more with these DHOH patients. Future studies should consist of actual diagnosed subjects with CVD risk factors, and compare with the findings based on self-responses on whether they were told about their risk factors of CVD. If the DHOH patients who are diagnosed with CVD risk factors are less likely to be told, this would suggest a stronger connection between communication barriers and risk factors. Future researchers could modify their methods in order to address the limitations of this study so that the results lend themselves to more objective interpretation; for example, screening of all study subjects so that their actual status relative to the CVD risk factors is known as of the date of the survey. Also, attempts should be made to validate these informed risk factor reports with clinical review records.

The purpose of this subsection was to offer a summary of the main findings of this study, considering the relationship between these findings and recent research and theory related to cardiovascular disease risk factors and hypothesized communication barriers between healthcare workers and patients in the DHOH subpopulation. Although communication barriers were not assessed directly in the current investigation, supported statistics on the difference of CVD risk factors amongst ASL signers would help support the notion that the DHOH subpopulation faces communication barriers in healthcare (Emond et al., 2015b). My findings are not ready for broad distribution to the healthcare industry but provide preliminary insight into the estimated differences in self-reports of having been told they have CVD risk factors of those with and without hearing challenges. Findings from this study add to the general body of evidence surrounding communication between healthcare providers and the DHOH subpopulation.

Limitations of the Study

Though this study yielded a number of valuable findings including that being DHOH does increase the odds of being told that one is at risk for diabetes (Tables 4 & 5). It is nevertheless important to delineate the limitations of the study to ensure objective evaluation of its reliability and validity. First, one should consider limitations connected with the study's cross-sectional nature and the use of secondary data to draw conclusions. Unlike experimental and cohort studies, one cannot determine the causality in a cross-sectional study. This happens because the information is obtained in a single time phase collection (Pennell et al., 2013). Secondary data involves the use of a dataset collected and analyzed by another organization for another research purpose, which means it may not be completely relevant to a new research objective. If this study involved primary data collection, I would have collected participants' actual diagnoses to determine whether DHOH patients with a diagnosis were less likely to be told of their diagnosis than non-DHOH patients. This information could provide more evidence of a communication barrier; therefore, one limitation of this study to overcome in future research would be to ascertain patients' actual status with regard to CVD risk factors. Moreover, the raw primary data used for secondary research may be outdated; there are often rapid changes in the health conditions, disease prevalence, and trends among populations, and so analysis of other organizations' data collected several years ago may not give current insight into the issue of research interest.

Furthermore, the study was quantitative in nature, which presupposes certain limitations. This study did not assess the impact of communication barriers directly, but instead assumed communication barriers exist based on the responses relating to received communication about particular CVD risk factors. This could be mitigated in future studies by attempting to determine the actual status of CVD risk factors in individuals, in addition to looking at how often physicians communicated with patients. Further, it would be useful to examine the intersections of these potential communication barriers with participants' social, economic, ethnic, and racial realities—Non-Hispanic Whites made up most of the DHOH study participants (see Table 2). Notably, the study did not address the prevalence of CVD risk factors because this study did not validate the clinical diagnosis patient status, a limitation to understanding the prevalence differences between the DHOH and non-DHOH. Thus, it would have strengthened this study and provided more accurate insights into the healthcare communication barriers that exist between the DHOH patients and their doctors. For example, the study does not state whether DHOH people are more frequently told about diabetes because they are more likely to have diabetes, which would be an important consideration in future studies.

Additionally, future researchers might need to consider employing several methods to accurately assess communication and communication barriers. A case study or observation would have been useful in assessing the actual type and quality of communication that exists between doctors and members of the DHOH community in regard to disease prevalence. Because the findings from this study were based entirely on patient self-report, concurrent survey of healthcare professional and patients' self-reports may have provided different insights. The healthcare professional may feel that they have communicated the risk factors of CVD without altering their approach to the DHOH patients being a generic communication style that may work well for other patients. The assumption is while the DHOH may have issues they may have wanted to communicate to the health professional, but are not given the opportunity due to the limited time available for the health professional and themselves as patients to interaction. Especially, since the DHOH patients takes up more of their physician's time and attention to explain health issues (Barnett, Klein, et al., 2011). Therefore, the assumption that a DHOH report of not having been told their risk factor by a health professional without getting the health professional' report on that issue is might be a problem that may have impacted the outcomes.

Another limitation was the missing study subjects—the proportion of each study group which were not included in each analysis. The missing data could have introduced result bias because participants may have chosen to skip answering these questions. For instance, if the participants do not have a primary doctor, they may decide to skip answering these questions because the questions were irrelevant to their situation. Likewise, participants without a primary care doctor may be more likely to have diabetes, high blood pressure, or high cholesterol. Thus, the potential for unanswered questions to introduce bias into the reporting results is a study limitation. In addition, missing data reduces the power of a test (i.e. less than .8) being underpowered. The missing data presented (see Table 5, 6, & 7) suggest inadequate power in considering the potential study limitations. A final limitation is the need to consider the use of the OR as an approximation of the relative risk for certain assumptions, which were not specifically addressed in this study that includes the frequency of the outcome-of-interest (CVD risk factors) in the small study population (Siegerink & Rohmann, 2018).

Recommendations

The significance of the study concerns its attempt to address the fact that the DHOH subpopulation experiences health inequalities; relying on earlier research in the field of health and social function of people with deafness (Lin, Niparko, & Ferrucci, 2011; Blackwell et al., 2014). This study found that being DHOH increased the odds of being told that individuals had diabetes or were at risk for diabetes, while also decreasing the odds that they would be told they had high cholesterol.

The DHOH community is an important subpopulation to study as the estimated the number of persons in America diagnosed with deafness has increased from 30 million in 2001 to 48.1 million in 2008 (Lin, Niparko et al., 2011). Most doctors are likely to encounter DHOH patients as the subpopulation continues to grow, and so the removal of communication barriers is vital to the future of the U.S. healthcare system. The key recommendation is to conduct primary research on the DHOH subpopulation. Focusing on specific health conditions and social functions of Deaf people, as well as particular factors affecting their lifestyles and self-perceived awareness of CVD signs and symptoms. Thus, the focus should be on how to address communication challenges on lowering the risk of heart disease in the DHOH subpopulation.

Shargorodsky et al. (2010) found an increased risk of CVD in DHOH people; thus, study need to focus on the core issue of addressing communication barriers in the healthcare arena for the DHOH subpopulation. Further studies concerning the vulnerability of DHOH people to CVD risk factors should produce a comprehensive picture of the specifics of life and daily experiences of DHOH persons as it relates to communication access. A multidimensional perspective on DHOH people should encompass their access to health care with respect to their communication abilities. When it comes to Deaf people as a major subpopulation in society, it is also essential to consider how the communication barriers intersect with the race and ethnicity of a person with deafness, since the intersection of these domains is likely to have a compound effect on the individual's access to health and the cultivated ability to detect early signs of CVD risk factors.

In respect to the DHOH, addressing communication barriers will likely require engaging DHOH public health professionals. The employment of Deaf public health professionals could facilitate conversations with DHOH individuals. A personal interview with people who are DHOH would enable an in-depth understanding of their life and social functions. The use of ASL in interviews (particularly through the use of DHOH public health interviewers or translators) would be an important tool in qualitative research. Obtaining interviews with ASL persons may reveal aspects affecting their communication with non-DHOH doctors, and other unaddressed healthcare issues. Thus, communicating with DHOH public health professionals in both formal and informal settings can further contribute to the recommended future research.

The above recommendations for further research suggest a need to remove communication barriers between DHOH patients and non-DHOH healthcare providers. In particular, practitioners could implement telehealth videophone (TVP) technology being an alternative promoted in the health care (McKoy et al., 2015); to reach DHOH patients and conduct public health education targeting the DHOH community nationwide. The TVP technology could ultimately help healthcare professionals to help reduce the prevalence of diabetes, high blood pressure, and high cholesterol in the DHOH subpopulation (McKoy et al., 2015). Thus, the implementation of a telehealth videophone service may improve overall health and well-being of DHOH patients, which could reduce their CVD risk factors (McKoy et al., 2015).

Implications for Professional Practice and Social Change

The DHOH people experience confusion, miscommunication, and shame due to taking more of their physician’s time and attention to explain health issues (Barnett, Klein, et al., 2011), suggest numerous of reforms needed to improve the United States healthcare system. The need for public health professionals to address communication barriers in the DHOH subpopulation is vital to reduce CVD risk factors. This study finding could assist advance the cause to promote positive social changes in the DHOH communities. Researchers and policy makers can use this study information to further work on raising the awareness and fund programs, respectively, to address DHOH communication issues and their self-reported risk factors of cardiovascular diseases. Thus, is in regards to considerable action needed to engage implementation strategies to facilitate reducing the mortality and morbidity of the millions DHOH communities worldwide (Olusanya et al., 2014).

Hence, the need to advance a cause for the DHOH individuals to gain better access preventative services is an important factor in the healthcare arena as it relates to communication needs of this subpopulation. Communication is an important part of healthcare in which optimal communication between health professionals and DHOH patients should be achieved in health care services. Physicians able to understand DHOH people's health concerns will facilitate improve communication that could led to better health care access and useful health intervention programs. The ability to build and maintain productive communication with health care professionals is a core component of improving accessibility for Deaf people.

Conclusion

Historically, DHOH people were excluded from the mainstream research activities, denied access to quality of healthcare and health education services due to communication barriers. These difficulties communication lead to the development of chronic diseases and a tendency to seek treatment at later stages of disease development; once the symptoms become highly pronounced and health is already endangered (Emond et al., 2015a). Based on this study finding DHOH people were more likely to self-report of having been told they have health risk factors for diabetes. Moreover, non-DHOH participants were more likely than DHOH participants to self-report having been told that they had high cholesterol but DHOH were less likely to self-report having been informed about their high cholesterol due to the possibility of communication issue.

In sum, the study findings on the informed CVD risk factors suggest there is still a need to focus on improved communication between the DHOH patients and their health care providers. DHOH are less likely to self-report having been informed about their high cholesterol due to the possibility of communication barriers. Therefore, it is recommended that: a) a telehealth videophone system to provide DHOH patient-centered care by assurance they are informed about their health and health risk factors; and b) the integration of Deaf public health professionals could reinforce care management to facilitate effective and efficient communication. Likewise, the ability to encourage health professionals to learn ASL within their health care environment may promote effective communication. Facilitating communication between DHOH patients and their healthcare providers might lead to an increase in preventative care and potentially a reduction in chronic disease within the DHOH community due to enhanced health awareness. The communication tool recommended, TVP, is facilitating this study subpopulation to achieve optimal health. Thus, is the consideration of the national healthcare needs to reduce healthcare spending, as well as the $2.1 billion annually expenses on care and treatment of the 37.5 million DHOH patients in the U.S. (Blackwell et al., 2014; CDC, 2015b; CDC, 2015c). The recommendation services that of TVP and DHOH public health entities might help the U.S. government not only reduce CVD risk factors but also improve communication barriers.

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