2020

Factors Affecting Seatbelt Use Among the Deaf and Hard-of-Hearing

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2020

Abstract

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by

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MSHE, Western Governors University, 2010

BSN, University Texas Health Science Center San Antonio, 1992

Doctoral Study Submitted in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Public Health

Walden University

May 2020

Abstract

In the United States, despite the proven significant economic, health, and social benefits of seatbelt use, millions of Americans do not use seatbelts. It is known that some factors, including obesity, reduce the rates of seatbelt use; however, a lack of research exists regarding whether individuals who are deaf or hard-of-hearing (HOH) have different rates of seatbelt use. The purpose of this study was to examine the difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for individual-level factors (BMI, marital status, education, and access to health care). The theoretical foundation for this study was Stokols' social ecological model for health promotion. This quantitative cross-sectional study was conducted using secondary data from the Behavioral Risk Factor Surveillance System (BRFSS) in 2017. Ordinal logistic regressions was used to address the research questions. The results showed that deaf or HOH individuals, and specifically those who were obese, were less likely to use seatbelts. The findings also showed that having access to health insurance and being married increased the chance of using seatbelts. The impact this study will have on social change is that it will inform car manufacturers of the need to address seatbelt safety reminders for the deaf or HOH, ultimately leading to vehicles equipped with flashing lights and vibrating seats designed to remind the driver and its occupants to buckle up.

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Dedication

This journey is dedicated to the ones I love! To my parents, this endeavor would not have been possible without the selfless sacrifices you both made to prepare my siblings and I to live a full life unafraid to reach for our dreams; especially, you Dad. I would not have survived this life if not for the ultimate sacrifices you made on my behalf. To my siblings, I thank you, your spouse, your kids, and your grand-kids for your love and support during the many challenges I faced along this journey. Alas, to my two sons RQue and Terrence, when life gives you lemons, make lemonade. During our time apart, this is the 'lemonade' I have been making. I wish things would have been different for us; however, we can't change the past. I wish you both the best of everything this life has to offer. I love you immensely and when life sends lemons your way, I hope you too have the strength and fortitude to make lemonade. Rise above your raising!

Acknowledgments

First and foremost, I would like to give glory and honor to my Lord and Savior, Jesus Christ for blessing me throughout this process and giving me the perseverance and fortitude to complete this journey.

I would like to acknowledge the chair of my committee, Dr. Jirina Renger, my committee member, Dr. Manoj Sharma, my URR contact Dr. Joseph Robare, my program director, Dr. Nancy Rea, my research coordinator, Dr. Radak and my IRB contact, Dr. Libby Munson for providing their invaluable support, time, patience, and wisdom throughout this process. Without the invaluable support of these individuals, completion of this capstone research study would not have been possible.

I would like to thank my employers and their significant others for allowing me the time and flexibility in my time on the job to accomplish this feat.

Last but not least, I would like to thank my entire family and everyone else who has contributed in any way to my success in this program!

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Section 1: Foundation of the Study and Literature Review

Introduction

In this study, I examined the difference in seatbelt use between deaf or Hard-of-Hearing (HOH) individuals and hearing individuals. I do so because it is possible that the deaf or HOH population may experience increased failure to use seatbelts for a variety of reasons. For example, unlike hearing individuals, some individuals who are deaf or HOH may be unable to hear the seatbelt reminder alarms that are equipped in modern vehicles (Arrive Alive, 2018). My study also pertained to individuals who are obese and deaf or HOH, because it is possible that they may use seatbelts less often, compared to those with normal weight. Seatbelt extenders needed by obese individuals, which can be obtained from car dealers at no cost to the consumer, are not adapted for deaf or HOH specific needs (e.g., flashing lights or vibrating seats for the deaf or HOH; Canada Safety Council, 2018).

In this initial chapter, I provide an introduction to the disparities that exist in the deaf or HOH community more generally, and specifically how obese deaf or HOH individuals may be at risk for reduced seatbelt use. I developed the purpose of the study and the emergent research questions to address this problem. In the chapter, I also detail the social ecological model (SEM), the theoretical framework used for this study. To address the questions, I used that a quantitative cross-sectional design involving secondary data from the Behavioral Risk Factor Surveillance System (BRFSS). The literature review for this study exposes a gap in research in the deaf or HOH and obese or morbidly obese population and explains the need for this study. Furthermore, this chapter includes definitions, assumptions, limitations, and the scope of the study. Finally, the chapter concludes with the significance of the study.

Problem Statement

In the United States, obesity, hearing impairment or loss, and motor vehicle crashes (fatal and nonfatal) are significant public health issues in and of themselves. Obesity prevalence from a 2015–2016 report showed that 39.8% (93.3 million) of individuals older than the age of 18 in the United States were obese (Centers for Disease Control and Prevention [CDC], 2019h). In the summer of 2017, the National Institute of Health report that about 15% (37.5 million) were affected by hearing loss (National Institutes of Health Medline Plus Magazine, 2017). In 2018 the National Highway Traffic Safety Administration noted that in the prior year, 37,133 individuals died in automobile accidents. The Federal Highway Administration (2019) reported that in 2017, about 4.57 million people were injured in motor vehicle accidents seriously enough to require medical attention. When combined, these three public health issues become even more concerning. Obese and deaf or HOH drivers have an increased likelihood of being involved and injured in motor vehicle accidents (Zhou & Qiu, 2016). For example, deaf and HOH drivers are three times as likely to become casualties of an automobile accident as their hearing counterparts. Gordon and Pearson (2016) notes that deaf and hard-of-hearing individuals have a one-and-a-half to nine times higher likelihood of having a serious injury or mortality in an automobile accident when compared to their hearing counterparts.

Despite the proven significant economic, health, and social benefits of seatbelt use, millions of Americans still do not use seatbelts (CDC, 2019g). For example, in 2017, 39.1% of passenger vehicle occupant fatalities (daytime) were unrestrained (Federal Highway Administration, 2019). Obese individuals use seatbelts significantly less compared to those with normal weight (Jehle, Doshi, Karagianis, Consiglio, & Jehle, 2014). This decreased use leads to a higher likelihood that these individuals will sustain more serious injuries or die in a vehicle accident (Federal Highway Administration, 2019; Jehle et al., 2014). Unfortunately, similar statistics are not available for the deaf or HOH because research specific to this community pertains to road safety and fitness of the deaf and HOH to drive, as opposed to the use of seatbelts and factors contributing to the lack of seatbelt use (Arrive Alive, 2018).

I analyzed the association between body mass index (BMI), marital status, education, access to health care, and the use or lack of seatbelts by the deaf or HOH. Health care presents a critical factor because of the importance of routine screenings and for physicians to counsel and educate patients about at-risk behaviors, such as seatbelt use (Chaffee, 2001). The findings may be used to develop new, or modify current, traffic injury prevention strategies designed for the deaf or HOH. The BRFSS 2017 relies on self-report responses. This tool asks respondents to provide information about themselves relative to their experiences. Furthermore, the question in the BRFSS asks, “How often do you use seatbelts when you drive or ride in a car?” The data from this question do not distinguish between driver and passenger. The survey question pertains to the respondents’ use of the seatbelt as a driver or passenger. This study was not delimited to drivers.

Purpose of the Study

This cross-sectional quantitative study using secondary data from the BRFSS 2017 allowed me to examine two aspects of the research problem. First, I sought to identify the association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and seatbelt use among deaf or HOH individuals. The BRFSS 2017 relies on self-report responses. Respondents are asked to provide information about themselves; therefore, participants' responses relate to their experiences. Furthermore, the question in the BRFSS 2017 asks, "How often do you use seatbelts when you drive or ride in a car?" Therefore, the data do not distinguish between driver and passenger. The survey question pertains to the respondents' use of the seatbelt as a driver or passenger. This study is not delimited to drivers. Second, I assessed the difference in seatbelt usage between deaf or HOH individuals and hearing individuals after adjusting for an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to healthcare).

Research Questions and Hypotheses

The following research questions guided this study:

Research Question 1: What is the association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and seatbelt use among the deaf or HOH individuals?

$H_0$1: There is no association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and the use of seatbelts among deaf or HOH individuals as measured by the BRFSS.

H_a1: There is a statistically significant association between an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and the use of seatbelts among deaf or HOH individuals as measured by BRFSS.

Research Question 2: Is there a difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care)?

$H_0$2: There is no difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) as measured by the BRFSS.

H_a2: There is a statistically significant difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) as measured by the BRFSS.

Theoretical Foundation for the Study

Description

The theoretical base for this study was Stokols' (1992, 2003) SEM for the promotion of good health. Public health and health promotion interventions are more likely to be successful when paired with an ecological perspective (Glanz, 2019). An ecological perspective in public health presents a framework to understand a wide range of factors relating to health and wellness (Rural Health Information Hub, 2019). For instance, intrapersonal factors refer to the knowledge, attitudes, beliefs, and personality of the individual, which may affect seatbelt use and BMI. Interpersonal factors relate to how individuals interact with other people, which can have positive or negative influences on seatbelt use. Community-level factors refer to formal and informal social norms that may influence the behavior of individuals, groups, or organizations in a manner that enhances or limits health behaviors, such as seatbelt use. Local, state, and federal policies govern the policy-level factors of the SEM that support or enforce actions that influences health behaviors.

The SEM is based on four assumptions. According to Glanz, Rimer, and Viswanath (2015), the first assumption is that the physical environment influences health behavior and lifestyle choices, such as seatbelt use and the consumption of calorie-dense foods. The second assumption recognizes environments as multidimensional. Specifically, multiple influences exist within an individual's environment that range from simple to complex and was considered throughout this study. The third assumption states human-environmental interaction occurs at various levels; this study considered the human-environmental interactions that occur in the human social systems and the ecosystem. The final assumption purports people influence settings and, in turn, the setting influences health behavior (Glanz et al., 2015).

Varying factors influence public health and health promotion according to Stokol (2003) theorists of the SEM. Intrapersonal factors refer to the knowledge, attitudes, beliefs, and personality of the individual and those factors may affect seatbelt use and BMI. Interpersonal factors relate to how individuals interact with others, which can have positive or negative influences on whether people use seatbelts. Community-level factors refer to formal and informal social norms that may influence the behavior of individuals, groups, or organizations in a manner that enhances or limits health behaviors, such as seatbelt use. Local, state, and federal policies form the policy-level factors that support or enforce actions that influences health behaviors.

Justification

According to Glanz et al. (2015), researchers widely used the SEM and it has informed various other theories. The SEM shares key constructs with other models that researchers use to explain and promote changes in behavior. These constructs also explain and promote the views individuals hold of the world and the importance of these views. Researchers using the SEM can explain influences that occur at multiple levels. These researchers explain behavior change as a "process." This process involves motivation versus intention, intention versus action, and changing behavior versus maintaining behavior (Glanz et al., 2015). This socioecological perspective serves as a useful framework for explaining the range of influential factors to health behaviors and the social determinants of health (Glanz, 2019). In this study, I examined the relationship among factors from the different levels of the SEM: individual level (BMI), interpersonal level (marital status), community level (education), and policy level (having access to healthcare).

A central tenet of the SEM pertains to being a guide to health promotion and working towards changes in policy and social change. The social inclusion aspects of the SEM make this model a logical choice for application. The SEM provided the most appropriate and logical choice for the framework of this study because it is appropriately suited to address the numerous variables and characteristics presented in this study. A multitude of dynamics exist when applying the sometimes-overlapping levels of the SEM (intrapersonal, interpersonal, community, and policy levels).

The SEM relates to this present study because the four levels of the SEM examined through Research Questions 1 and 2 build on existing theory. For instance, the intrapersonal level is made up of individual knowledge, beliefs, and attitudes that all play a part in influencing behaviors, such as seatbelt use. At the interpersonal level, I consider social networking with family, friends, and peers, which all play a role in whether an individual chooses to employ their seatbelt. Community-level factors pertain to barriers, incentives, advantages, and disadvantages that exist within the community and that contribute to the use or nonuse of seatbelts. Last, at the policy level, I consider health care including an individual's access to it and its influences on the use or nonuse of seatbelts by the target population.

Nature of the Study

This was a cross-sectional quantitative study using secondary data. A quantitative method was appropriate because the variables of interest in this study were objectively quantifiable and my aim was to investigate the statistical associations between the variables of interest (i.e., seatbelt use, BMI, deaf of HOH status, and individual characteristics). The research questions allowed for analysis of the association between several variables at the same point in time; therefore, a cross-sectional design was appropriately selected for this study. Other design methods, such as a longitudinal study, cohort study, case-control study, or a meta-analysis were not appropriate because the research questions did not involve an examination of change over time. A cross-sectional study is appropriate because it involves the observation of a sample, or cross-section of a population (Babbie, 2017). Advantages to a cross-sectional design include cost effectiveness, expediency, and ability to assess multiple variables (Setia, 2016). The disadvantages of a cross-sectional design are that behavior cannot be analyzed, it does not lend itself to determining cause and effect, and finally, the sample taken may not be representative of the population (Setia, 2016).

Key Study Variables

The independent variables in this study included BMI, which is a measure of an individual's degree of body fat as it relates to their height and weight (National Heart, Lung, and Blood Institute, 2019), and hearing ability (i.e., deaf or HOH versus hearing individuals). Deaf refers to individuals who have very little or no functioning hearing (deaf) and HOH refers to those who have mild to moderate hearing loss (Technological Education Center for Deaf and Hard-of-Hearing Students, 2019). The dependent variable in this study was the use of seatbelts. The covariates in this study included an interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care).

Summary of Methodology

Data collection. Secondary data from the BRFSS 2017 were used in this study. A national health-related telephone survey (the BRFSS) collects data from residents regarding their health-related behaviors, conditions that are chronic, and the use of preventive services (CDC, 2018a). The BRFSS collects data from all of the states in the union and the District of Columbia, and three U.S. territories (CDC, 2018b).

Data analysis. Data analysis involved conducting ordinal logistic regressions using SPSS (IBM Corporation, 2017). I used the Internet to search for videos designed to help select the best statistical tests to use, how to clean data for analysis, how to run ordinal regressions, and for descriptive and various correlational tests using SPSS software. I referenced Gertsman's (2015) *Basic Biostatistics* textbook as needed to clarify statistical terms and output results. Consultation of a tutor skilled in quantitative statistics occurred as needed for support with using the aforementioned statistical software. The following YouTube videos were accessed for this study:

- Data Cleaning in SPSS
- How to Clean SPSS Data
- Choosing Which Statistical Test to Use
- Conducting Ordinal Regression in SPSS
- Types of Statistical Tests

I conducted ordinal regressions because more than one independent variable was used in this study and interaction between independent variables allowed for prediction of the dependent variable (Laerd Statistics, 2019). Furthermore, ordinal regression was used because the response option for the seatbelt use question was not dichotomous (yes or no). Instead, a Likert scale allowed for measurement of the responses. The options were *always*, *nearly always*, *sometimes*, *seldom*, or *never*. Using SPSS, I conducted a frequency analysis on the variables of interest (deaf or HOH, overweight or obese, seatbelt use, access to health care, marital status, and education). Analysis included determining central tendencies (mean, median, and mode) as well as dispersion (standard deviation and variance). I created a bar chart to display the data. I used data imputation if the cases of missing data were less than 5%; however, if the number of cases was higher than 5%, the values were dropped.

Literature Search Strategy

To conduct my literature review, the databases searched included Google Scholar, Thoreau, Walden library's database of dissertations and theses, and Gallaudet University library. Thoreau is a multi-database search tool developed for Walden University Library (2018). It is useful for quick, simple, and broad searches. Unfortunately, not all library content is searchable because of licensing and copyright restrictions (Walden University Library, 2018). Google Scholar allows researchers to search scholarly literature across many disciplines. Multiple sources, books, articles, theses, and court opinions exist in the Google Scholar database. Walden library's database of dissertations and theses contain full text dissertations and theses written by Walden University students (Walden University Library, 2018). Gallaudet University Library is the world's largest collection of material for the deaf. The library builds and maintains a collection of journals, databases, videos, and other academic material (Gallaudet University, 2019). Terms searched included, *seatbelt use and the deaf; use of seatbelts in the deaf or HOH; disparities in road safety among the deaf or HOH and obesity and seatbelt use; morbidity* *and mortality related to seatbelt use; seatbelt use and BMI; obesity epidemic; how to change health behavior; body mass index; about the BRFSS 2017; define deaf and HOH; define overweight and obesity; define socioecological model; define education; disparities in deaf community; deaf and car sensing systems; deaf statistics; cross-sectional studies and deaf; seatbelt laws and vehicle fatalities; risk of injury while using seatbelts; socioecological model as a framework; prevalence of obesity; what is causing obesity; longer seatbelts and obesity; deaf community and improving research; secondary analysis of existing data; major injuries and seatbelt use; interventions to change health behavior; key to deaf health research; seatbelt use by socioeconomic status; deaf statistics; driving and use of sign language; hearing statistics; health behavior in deaf community; hearing loss and those affected; American Sign Language users and seat belt use by drivers; users of American Sign Language and seat belt use by drivers; use seat belt signs in America Sign Language; define physical environment and influences on health behavior; define healthcare access; what is a community;* and *linguistic neglect of deaf children.*

After searching multiple databases from the Walden Library and the Gallaudet University library (a private University for the deaf and HOH), no articles about seatbelt use by obese individuals in the deaf or HOH community emerged; however, the resulting articles did pertain to (a) deaf drivers and the distraction of using sign language while driving, (b) special add-ons to vehicles to help the deaf know when emergency vehicles were using their sirens, and (c) the role that enforcement of seatbelt laws plays in preventing death from automobile accidents. Furthermore, Alper (2018) reported that poor health literacy, as it relates to those with disabilities, has many negative consequences, such as disabled individuals being disproportionally affected by health disparities and a lack of health equity. Moreover, researchers also indicated that individuals who are obese are less likely to use seatbelts (Bhatti, Nathens, & Redelmeier, 2016; Jehle et al., 2014). Given the complications with seatbelt alerts among those who are obese, and the lack of knowledge about deaf drivers and seatbelt use (Gordon & Pearson, 2016), the findings indicate a clear gap in the research. The literature reviewed for this study included peer-reviewed works published between 2015 and 2019 to maintain currency. Some exceptions to the recent literature include seminal works related to the theoretical framework and some early research published regarding deaf drivers (e.g., Booher, 1978; Harrison & Senserric, 2000) because it is the most recent research available. In instances where no research was found on a subject, such as seatbelt use in the deaf community, I noted in-text and available information on the hearing community.

I took deliberate steps to identify key authors on this topic. For instance, the Gallaudet University library was accessed in hopes of finding articles on this topic that identified leading authors spearheading research related to this topic; however, none were found. Results did show organizations that focused their research on the deaf or HOH and obesity in that population, but no researchers have examined seatbelt use in this population. A literature search identified the National Center for Deaf Health Research (2019) at the University of Rochester Medical Center successfully conducted a lifestyle intervention project in the deaf population aimed at understanding the effectiveness of interventions to reduce obesity in this population. The National Center for Deaf Health Research (2019) was the first institution in this country to conduct a randomized control trial of a healthy lifestyle intervention conducted in a deaf population. Seatbelt use was not examined in that study, however. In attempt to create the fullest picture of the issue and problem, I took other deliberate steps during the literature review to identify any journals specific to or closely related to this topic. Journals on obesity and journals on deaf studies were identified but no journals on the combined topic of deaf and obesity emerged; thus, articles on obese deaf and seatbelt use were not discovered.

Literature Review Related to Key Variables and Concepts

This section provides the literature related to the variables, constructs, and methodology of choice. These findings are consistent with the scope of this study and include deaf or HOH drivers, seatbelt use, seatbelt use among the obese, seatbelt use among deaf or HOH individuals, and seatbelt use and the SEM. Subsequently, I discuss the gap in the literature to highlight the need for this study.

Deaf or HOH Drivers

A significant dearth of literature exists regarding drivers who are deaf or HOH. Edwards et al. (2017) noted that vision is considered the main sense used when driving. Hearing is also highly important for providing information about traffic, such as approaching vehicles, road hazards, and problems with the vehicle. Edwards et al. further remarked it is problematic that the relationship between hearing and driving has been explored insufficiently. The call has gone out for decades to conduct further research relating to the deaf or hearing-impaired driver (e.g., Booher, 1978). The relative lack of data regarding deaf/HOH drivers is part of a larger issue with missing health data for those with disabilities, including deaf/HOH individuals. Alper (2018) pointed to the disparities of health information in those living with disabilities. For the deaf community, health disparities may be compounded by cultural and language barriers that exists between the deaf and hearing communities.

The prevalence of accidents among deaf or HOH drivers is somewhat contested. In some of the earliest research, Booher (1978) reviewed a series of surveys, analyses, and experimental studies to determine the driver's education and training needs, as well as the requirements for the licensing of drivers. He looked at the requirements for licensure and driving performance of individuals with vision and hearing deficits. Booher noted deaf drivers were less likely to incur driving violations and offenses as compared to the violations and offenses incurred by hearing drivers. His analyses showed that deaf drivers had 1.78 times more accidents and 1.26 times more convictions than their hearing counterparts. Zhou and Qui (2016) found deaf or HOH drivers have an increased possibility of being involved in an automobile accident than their hearing counterparts. Gordon and Pearson (2016) analyzed accidents on the roadway by deaf and HOH drivers to determine whether drivers who are deaf or HOH were more likely than hearing individuals to be involved in an accident on the roadway. Data stemmed from the National Automotive Sampling System (NASS) and motor vehicle accident records from the Rochester Institute of Technology and the National Technical Institute for the Deaf campuses. The NASS data analysis results suggested that drivers who are deaf or HOH have a one-and-a-half to nine times higher likelihood of being seriously injured or killed in a motor vehicle accident; however, these individuals were not more likely to get into an accident than the hearing (Gordon & Pearson, 2016).

Surprisingly, Herbert, Thyer, Isherwood, and Merat (2016) found that hearing impairment did not influence driving performance. Participants in Herbert et al.'s study drove on a simulated roadway while completing tasks under conditions that simulated hearing loss or normal hearing conditions. Findings suggested that hearing loss did not influence the control maintained of the vehicle or patterns of eye movement; however, Herbert et al. stated that further research was needed stating that future researchers should incorporate a wider variety of driving scenarios and auditory tasks to confirm the findings.

Although research among deaf or HOH drivers is limited, a wider focus has emerged on drivers who lose hearing capabilities as they age. For example, to address a perceived lack of knowledge about hearing impairment and driving, Edwards et al. (2017) studied the association between driving mobility and hearing-impaired older adults. This was a 3-year longitudinal study using secondary data from the Staying Keen in Later Life study of 500 individuals aged 63–90 years. Results showed individuals with a moderate or higher degree of hearing impairment had an increased likelihood of being involved in an adverse driving event, such as increased crashes, poor performance on the road, and increased citations.

Brown et al. (2017) noted increased morbidities among the elderly led to changes in the ways they drove. The researchers analyzed the relationship between morbidities affecting physical function and other factors, such as comfort, seat cushions, and the repositioning of the seatbelt, using mediation analysis. This study involved 380 drivers who were 75 years and older. The results showed morbidities in the musculoskeleton increased the likelihood of the repositioning of the seatbelt in a motor vehicle accident.

Doroudgar et al. (2017) compared driving performance between older and younger drivers. Through this cross-sectional study, the researchers compared the differences in the driving performance, including reaction times of adult drivers, ages 18–40 years, and older adult drivers, 60 years or older. Results of the study showed a significantly slower reaction time in older drivers than younger drivers. Also, older drivers had more collisions, drove slower than younger drivers, and had more difficulties being able to maintain a constant pace behind a paced car than younger drivers. Based on these results, the researchers concluded differences exist in driving patterns when comparing driving pattern of older drivers to the driving pattern of younger drivers, as measured by reaction times and the results of outcomes in a driving simulator.

Overall, review of the research indicates a significant lack of research regarding deaf drivers. What research does exist seems, as indicated by Arrive Alive (2018), to focus on fitness for driving, rather than on safety behaviors of deaf drivers. However, assessing the safety behaviors of deaf or HOH drivers may reduce the likelihood of injuries and deaths within this population, and is therefore worthy of pursuit. Particularly, examining seatbelt use as a safety behavior may be essential.

Seatbelt Use

Seatbelt use remains a consideration among public health experts and researchers. Seatbelt use can reduce death and serious injury by half in the event of an accident (CDC, 2019f). Through a meta-analysis based on 24 studies, Haye (2016) assessed whether increasing seatbelt use would affect the number of individuals who were maimed or killed in light vehicle accidents. Haye determined that both fatal and nonfatal injuries were reduced by 60% among individuals in the front seat and by 44% among rear seat occupants. For public safety, people in vehicles must appropriately use seatbelts.

According to prior research, the majority of individuals do utilize seatbelts while driving (National Safety Council, 2020). Using a random telephone survey of 1,218 adult drivers and passengers, Kidd, McCartt, and Oesch (2013) assessed seatbelt use, buckling routine, and different types of belt interlocks. The researchers found that 91% of respondents said they always used their seatbelts. Only 8% of respondents said they used their seatbelts sometimes and 1% said they never used their seatbelt. The National Highway Traffic Safety Administration (2019) reported that 37,133 people were killed in motor vehicle crashes in 2017; of those killed, 47% were not wearing seatbelts. Previous researchers, including Kidd (2012) and Williams, Wells, and Farmer (2002), indicated that the introduction of seatbelt alarms significantly increased seatbelt use. However, according to the CDC (2019g) and Federal Highway Administration (2019), millions of Americans still do not use seatbelts. For example, prompted by increased automobile fatalities in 2015 and 2016, Sunshine, Dwyer-Lindgren, Chen, and Mokdad (2017) examined seatbelt use in counties throughout the U.S. The researchers found limited progress has been made to meet the 2020 goals of Healthy People 2020. The prevalence of reported seatbelt compliance in counties throughout the United States varied across the nation. For instance, The National Highway Traffic Safety Administration (2018) reported that in 2017, seatbelt use in the United States had a range of 67.7% in New Hampshire to 97.1% in Georgia.

Because some individuals do not use seatbelts despite their benefits, many researchers attempted to assess the factors and underlying mechanisms involved in the decision to use seatbelts. For example, Jans et al. (2015) studied the scenarios that motor vehicle occupants may encounter when gauging the risk perceptions involved in the decision to use or forego the use of seatbelts. Factors that influenced seatbelt use included risk perception, demographics (gender, age, race, socioeconomic status, marital status, and locale), environmental factors (road type, vehicle type, presence of other passengers), personality constructs, personality characteristics, insurance incentives, social norms, and law enforcement (Jans et al., 2015). Salmon et al. (2019) contemplated whether personal bad behavior or societal failure were primarily to blame for drivers who engaged in fatal driving behaviors. Salmon et al. investigated the influential factors of drivers' engagement in behaviors described as the "fatal five" (drunk and drug driving, distraction and inattention, speeding, fatigue, and failure to wear seatbelts). The researchers used driver surveys and a workshop for experts to gauge drivers' and road safety experts' notions of what contributes to the engagement in the fatal five behaviors. They found that fatal five behaviors are a result of several interacting contributory factors. Salmon et al. also found this is a systems problem, as opposed to being a problem solely with the driver; Road safety implications for interventions should include a cohesive public health approach to achieve additional gains in road safety.

Moreover, the drivers' attitudes towards seatbelt use can influence their use. Han (2017) discussed the influence a driver's attitude about seatbelt use have on passengers. Using an injury surveillance system that is statewide, Han surveyed 36,012 persons involved in automobile accidents. The researcher found that when a driver wore his or her seatbelt, 92.6% of the time the passengers also wore their seatbelt. In contrast, when a driver refrained from wearing a seatbelt, only 19.1% of the passengers wore their seatbelt. Kidd et al. (2013) further discussed drivers' attitudes toward seatbelt use and seatbelt reminder systems. Of the small number (8%) of respondents who said they use their seatbelt sometimes, 67% said they did not use the seatbelt when driving short distances, 60% said they would forget to use the seatbelt, and 47% stated comfort as a reason for not using the seatbelt (Kidd et al., 2013).

Seatbelt reminders are an effective tool to increase the use of seatbelts by vehicle occupants. Williams et al. (2002) indicated that after Ford's adoption of a seatbelt alarm, the alarm led to increased use of seatbelts, although passengers reported feeling irritated by the reminder system. Additionally, Kidd (2012) discussed part-time seatbelt users and their response to the enhanced seatbelt reminder system. Specifically, Kidd's study analyzed the influence of the duration and cycle of the seatbelt reminder system on the effectiveness and annoyance of the system to these part-time users. One of 80 part-time seatbelt users were alerted with one of four seatbelt reminders inside of a driving simulator. The drivers were then asked to rate how likely they were to buckle up. The researchers also asked the participants to rate how annoyed they were during a 45-second cycle. The results showed that increasing the duration of a reminder alert did not significantly increase the likelihood of buckling up. New passenger vehicles that are equipped with information collecting programs can provide data to vehicle manufactures. Manufactures can be inspired to install these enhanced reminders (Kidd, 2012).

Young et al. (2008) similarly evaluated seatbelt reminder systems and the effects of this system on drivers' behavior and acceptance, particularly long-term effects and driver behavior and tolerance of the seatbelt reminder system. Young et al. evaluated the system's effects both alone and in combination with two other warning systems. Overall, findings from observational studies suggested that seatbelt reminder systems are effective in increasing seatbelt usage rate (Young et al., 2008). However, Young et al. indicated that for a reminder system to be effective, it must speak to the underlying motivational and behavioral factors that add to the lack of seatbelts use. For example, some people simply choose not to wear the seatbelts but others may merely forget to put them on, and each of these groups may require a different reminder system. These findings indicated the importance of motivation and attitude as key factors in seatbelt use, included in all aspects of seatbelt research (e.g., Han, 2017; Jans et al., 2015; Kidd et al., 2013). Some drivers are willing to ignore reminder systems based on comfort (Kidd et al., 2013), while others will adhere to seatbelt reminder systems out of annoyance (Williams et al., 2002). However, for those drivers who are deaf or HOH, seatbelt alarms may not constitute a significant annoyance to motivate change. Moreover, if the driver is obese, seatbelt use may significantly impose on their comfort, as discussed in the following section.

Seatbelt Use Among Individuals Who Are Obese

One aspect that may influence the comfort factor in seatbelt use is obesity. Canada Safety Council (2018) highlighted individuals who were morbidly obese were more likely to meet their demise in a motor vehicle accident. Specifically, obesity presented a driving safety problem because standard seatbelts are not designed to fit obese or morbidly obese people (Canada Safety Council, 2018). Hartka, Carr, Smith, Melmer, and Sochor (2018) discussed the effect obesity has on the position of seatbelts in a motor vehicle collision. The researchers recognized that with increased BMI, the lap belts moved forward, up, and away from the bony pelvis. The main goal of Hartka et al.'s research was to discern if the location of the lap belt loading is relative to the BMI for those involved in a motor vehicle collision. The researchers accessed a database to study occupants of a vehicle during a 10-year period (2003–2012) who used a three-point seatbelt. Computed tomography allowed for discerning if the presence of subcutaneous fat stranding was as a result of seatbelt loading. In cases where stranding of subcutaneous fat was found to result from seatbelt loading, Hartka et al. measured whether anterior and superior displacement attributed to seatbelt loading on both sides. The researcher correlated this displacement with BMI and the severity of injuries.

Jones, Ebert, and Reed (2016) also indicated that obese individuals share an increased risk for injury severity because of the anatomical and physiological differences in how the lap belt will fit. Jones et al. stratified participants, 26 men and 26 women, based on BMI. The recruitment of participants happened through online postings and through communications with health care providers. Findings confirmed an increased BMI is associated with a poor fitting lap belt. Therefore, in a car crash, an obese person is at a disadvantage because the standard size seatbelt will not grip the correct bones (e.g., hip, sternum, shoulder, and ribs), which would keep the individual fastened to the seat and minimize the chance of being thrown from the vehicle. Instead, the fat acts like air and creates a gap from which the person can slide from beneath the seatbelt and be thrown from the car (Canada Safety Council, 2018).

Many researchers have assessed whether and how obesity influences driver safety in the event of an accident. Shi, Cao, Reed, Rupp, and Hu (2015) studied obesity and the effects it had on occupant responses in a frontal crash using a model of the human body. These models represented occupants with different levels of obesity. Shi et al. then performed parametric analysis because a need existed to investigate the effects of BMI on occupants' injuries. The researchers found the higher injury risks were a result of increased BMI and poorly fitting seatbelts as a result of the increased amount of adipose tissue in the obese automobile occupants.

Durgun et al. (2016) found it necessary to explore the effects of obesity on the prognosis of patients who suffered trauma. The researchers conducted a prospective study using trauma patients older than 15 years of age who were treated at the emergency department trauma unit between June 1, 2013 and May 31, 2014. During this 1-year period, 4,328 patients of trauma were presented to the emergency trauma unit. Patient analysis included two groups of patients based on the severity of their trauma. Durgun et al. noted unrestrained motorists had a higher injury severity score when they are unrestrained, regardless of having a higher BMI, than restrained motorists; however, when analyzing all the patients, the injury severity score increased in proportion to an increased BMI.

Bhatti et al. (2016) similarly examined obesity trends in U.S. drivers who were involved in fatal crashes to discern whether differences occurred between obese and nonobese drivers regarding crash risk factors. During the study period (January 1, 1999–December 31, 2012), 753,024 drivers were involved in fatal crashes, and obesity information was available on 534,887 of those drivers. The findings indicated that compared to normal-weight controls, obese drivers had significantly higher risks for fatality, nonuse of seatbelts, need for extrication, and ambulance transport time higher than 30 minutes. In total, Bhatti et al. found seatbelt use, more than obesity, influenced driver safety, although those who were obese were more likely to experience injury.

Obesity also results in a higher risk of death when involved in an automobile accident. Joseph et al. (2017) examined obesity and the risks of trauma mortality in motor vehicle crashes. Using a multivariate logistic regression, Joseph et al. conducted a retrospective study involving secondary data analysis of the National Trauma Data Bank from 2007–2010 data. The sample contained 214,306 motor vehicle crash occupants, 48% (10,260) of which were morbidly obese patients. The findings of this study showed motorists who are morbidly obese have a higher risk of death than those who are not morbidly obese.

In a 4-year review of a Level 1 trauma registry, Elkbuli et al. (2018) examined whether BMI and seatbelt use affected the outcomes of adult trauma patients. Patients were divided according to their BMI (normal, overweight, and obese); the researchers then divided these groups into subgroups of patients wearing their seatbelt at the time of injury and patients who were not wearing their seatbelt. The study included a total of 11,792 patients; 38.3% were normal weight, 38.9% were overweight, and 22.8% were obese (Elkbuli et al., 2018). Elkbuli et al. found those who wore seatbelts regardless of BMI had a significantly lower mortality rate.

Like Bhatti et al. (2016), other researchers have indicated that obese individuals were less likely to use seatbelts. Jehle et al. (2014) compared use of seatbelts in normal-weight individuals to seatbelt use in individuals who are obese. Jehle et al. had a scientific belief that drivers who were obese and involved in a fatal crash were less likely to be wearing seatbelts than their normal-weight counterparts. This study was retrospective and involved analysis of drivers who were involved in motor vehicle crashes. The study consisted of individuals who were entered into the Fatality Analysis

Reporting System database between 2003 and 2009 (Jehle et al., 2014). Based on the World Health Organization's definition of obesity by body mass, participants (drivers) were grouped into weight categories. Jehle et al. then studied the use of seatbelts based on BMI. The researchers discovered normal-weight individuals were found to have a 67% higher likelihood of wearing their seatbelt than the morbidly obese. Jehle et al. concluded seatbelt use is statistically, significantly less likely to occur in obese individuals compared to their normal-weight counterparts.

As evident from the literature, much research exists on obesity, driving patterns, and the use of seatbelts. Most researchers indicated the main issue influencing injuries in motor vehicle crashes is seatbelt use (Durgun et al., 2016; Elkbuli et al., 2018). However, obese individuals are more likely to experience increased injury and death because of physiological differences in their bodies and seatbelt design (Hartka et al., 2018; Jones et al., 2016; Shi et al., 2015). This difference is particularly troubling for public health because obese individuals are less likely to wear seatbelts (Bhatti et al., 2016; Jehle et al., 2014). Seatbelt alerts may lead some obese individuals to use seatbelts regardless of discomfort, but for those who are deaf or HOH, the auditory alarms may not be effective. However, it is not known how often obese individual who are deaf or HOH use seatbelts.

Seatbelt Use Among Deaf and Hard of Hearing Individuals

A clear gap in literature is apparent relating to seatbelt use in the deaf or HOH population, particularly among those who are obese. Arrive Alive (2018) denoted that research specific to deaf or HOH drivers pertains to road safety and fitness of the deaf or HOH to drive, as opposed to safety behaviors, such as seatbelt use. This is problematic considering the importance of seatbelt use to minimizing physical damage in the event of motor vehicle accidents. This body of research indicates conflict regarding whether deaf or HOH individuals have an increased likelihood of getting into a motor vehicle accident. However, most researchers agree deaf or HOH drivers are more likely to be severely injured or killed (Gordon & Pearson, 2016; Zhou & Qiu, 2016). Seatbelts are a primary method of reducing injuries and death in motor vehicle accidents, and therefore should be considered a key consideration for improving safety.

This lack of research may significantly influence safety for deaf or HOH drivers who are obese; for example, many patents and devices on the market are aimed at alerting deaf drivers to various hazards using nonauditory cues. However, no devices or patents are targeted towards seatbelt use—this lack of attention may be because of missing data about seatbelt use in this population. Because of the positive influence of seatbelts on reducing injury severity and death in accidents, Gordon and Pearson (2016) highlighted that one key missing piece of data was whether deaf or HOH drivers used seatbelts. This need may be exacerbated among those who are deaf or HOH and obese, given the lack of seatbelt use demonstrated among obese individuals.

Little research exists regarding the use of seatbelts among deaf or HOH drivers, and even that research is more tangential than a key focus for researchers. For example, Harrison and Senserric (2000) conducted a discussion group about using seatbelt alarms with three main phases of assessment. In the initial phase of assessment, participants responded to a detailed questionnaire probing their seatbelt use pattern and motivations. This probe also included their likely reaction to a new seatbelt reminder system. The second phase of the assessment consisted of a loosely structured discussion section in which the participants were asked to discuss a series of issues concerning the use of the proposed seatbelt alarm system (Harrison & Senserric, 2000). The third phase of the assessment consisted of a final questionnaire that sought information about a hypothetical query, which asked how the participant would behave if they had a vehicle with the seatbelt alarm system in place and how they believe people in general would behave (Harrison & Senserric, 2000). Among the concerns expressed by the groups were potential issues for deaf drivers. For instance, participants expressed concerns that the volume of the seat belt reminder tone may not be loud enough for HOH people or people with various degrees of hearing impairment (Harrison & Senserric, 2000). Similarly, in assessing deaf or HOH drivers' safety, Gordon and Pearson (2016) indicated the need for more research on seatbelt use in assessing safety. The researcher designed the current study to examine this problem in full, with the aim of contributing to the safety of deaf or HOH drivers and to prompt action by vehicle designers and researchers who may better motivate seatbelt use.

Socioecological Model and Seatbelt Use

Stokols' (1996) SEM served as the theoretical base for this study. Stokols expressed concern that most often, health promotion programs lack a clearly stated theoretical foundation. Specifically, lifestyle modification programs focus on individual behavior change strategies while neglecting the environmental or root causes of poor health and illness of an individual. Researchers have criticized the field of health promotion for ignoring related forces that influence health while focusing on lifestyle changes (Golden & Earp, 2016).

Conversely, Stokols (1992a) proposed the social ecology of the promotion of health while establishing and maintaining a healthy environment. Stokols, Allen, and

Bellingham (1996) noted the ecology of health promotion and the implications it holds for research and practice. The researchers assure it has been long noted that patterns of health and illness closely link to the many different kinds of sociocultural, political, and physical-environmental conditions that occur within the community. Effective strategies within an organization include health risk appraisal, counseling, lifestyle change programs, cultural change, strategies within organizational settings, and the provision of clinical preventive services. The SEM recognizes individuals as a part of a larger social system with interactive characteristics that underlie health outcomes (Golden & Earp, 2016).

Stokols (2019, 2002, 1992) provided the seminal works for the SEM used for this study. He notes that in several disciplines, such as biology, psychology, economics, sociology, and public health, the SEM paradigm has evolved. It provides a framework that is general to the understanding of the nature of how people interact with one another in their physical environment and sociocultural surroundings. What is known through an exhaustive literature review is that researchers can utilize all four levels (intrapersonal, interpersonal, community and public policy) of the SEM as a theoretical framework. In this study, the SEM allowed for the analysis of seatbelt use in deaf or HOH obese individuals. What is not known is the generalizability of these research findings conducted on a sample from mainstream America generalized onto those who are deaf or HOH.

A long history exists of using SEM for health promotion. From its inception, Stokols (1992b) looked at the social ecological theory and how it translates into guidelines for community health promotion. Golden and Earp (2016) indicated that for the last 20 years, the SEM has guided health education and behavior promotion interventions. Hanson, Vardon, and Lloyd (2002) examined an ecological approach to safety promotion for safe communities and likened examining public health issues through the SEM to a multifaceted crystal that can be looked at from various perspectives. Each perspective is unique, important, and contributes a different truth; yet, none of these different perspectives are sufficient enough to provide a comprehensive understanding of the problem. The different facets (described as paradigms) involved in the promotion of safety are the medical paradigm, the health education paradigm, the public health paradigm, the bioengineering paradigm, the systems engineering paradigm, and the sociological paradigm. Each paradigm brings a unique perspective to the problem.

Further, many researchers have used SEM to assess driving behaviors and safety. For example, Savage, Howell, Saylor, Johnson, and Snyder (2016) used the SEM to assess safety among young drivers, such as distracted driving, seatbelt use, and drinking and driving interventions. Eight leading causes of teen injuries related to motor vehicle accidents were identified: driver inexperience, driving with teen passengers, nighttime driving, not using seatbelts, distracted driving, drowsy driving, reckless driving, and impaired driving (Savage et al., 2016). Driving strategies had diverse influences that included all levels of the SEM; therefore, Savage et al. indicated effective intervention should incorporate the SEM to address motivation at multiple levels. Further, Hezaveh and Cherry (2019) expressed how neighborhood level factors affected seatbelt use or nonuse. The researchers used roadside observations and interviews to gather information about seatbelt use or nonuse. They recognized that individuals with higher education and higher income tended to use their seatbelt more often. Therefore, using the SEM to assess driving behaviors, like seatbelt use among deaf or HOH and obese populations, holds some precedence.

Setia (2016) discussed the advantages and limitation of a cross-sectional design. The strengths of a cross-sectional study are that they are relatively inexpensive. Researchers can conduct this design before planning a more expensive design such as a cohort study. A cohort study would be much more expensive to conduct than a cross-sectional study. The SEM can lead to information about prevalence or exposures and this study design may be useful in public health planning. The limitations of this type of a design are that it is a one-time measure and it is difficult to find a causal relationship from this type of analysis. This design is prone to certain types of biases. The prevalence outcome depends on the incidence of the disease as well as the length of survival following the outcome.

Romano, Thomas, and Ramirez (2018) examined the feasibility of being able to model the relationship between seatbelt program input and outcomes. Through this project, the researchers set about the task of discerning the feasibility of building a model that would help programs be the most effective in influencing the use of seatbelts. Romano et al. selected eight of the 10 states that had achieved a seatbelt use rate above 90% to use as models for the program. The researchers then selected a list of data and variables that could be used in the model. Conversations with state officials exposed outcome data ready for model building, which included statewide annual observations of seatbelt use, unbelted fatalities, and fatalities in general. This feasibility study showed the availability of both quantitative data and qualitative data. The overall conclusion is that the evidence may point to potential feasibility; however, it is not clear whether or not the input variables would provide sufficient precision to create a useful predictive model. Data are needed pertaining to seatbelt use within the deaf or HOH obese population using the SEM, as opposed to other theories, such as the social cognitive theory, the health belief model, or the transtheoretical model. Unlike the other models, the SEM involves addressing public policy and community factors, which are necessary to support positive social change.

Research Gap and Necessity of Study

The exhaustive literature review revealed that research in the deaf community is minimal; furthermore, research aimed solely at seatbelt use by individuals who are deaf or HOH was not apparent. Seatbelt reminder systems are a primary motivator for drivers to use seatbelts (Kidd, 2012; Williams et al., 2002; Young et al., 2008), but they may not be effective within deaf or HOH populations because the primary reminder method is auditory. This lack of research on the deaf or HOH populations is part of a larger issue in public health research. According to the National Center for Deaf Health Research (2019), little is known about the trends in diseases, attitudes within the culture, or health behaviors among the deaf or HOH population because it is understudied and underserved.

An exhaustive search of literature did reveal the deaf or HOH have a higher morbidity or mortality rate when involved in a motor vehicle accident (Edwards et al., 2016; Gordon & Pearson, 2016). What is not known is whether there is a lower or higher likelihood of seatbelt use in this segment of the population compared to the hearing population. To assess deaf or HOH driver safety, Gordon and Pearson (2016) called for researchers to examine seatbelt use specifically among deaf or HOH populations. This research may be especially important among those who are deaf or HOH and obese, as obesity influences seatbelt use (Bhatti et al., 2016; Jehle et al., 2014).

The data for the present study are from the BRFSS 2017 database. The BRFSS is the nation's system for the collection of data by telephone survey about individuals' health-related risk behaviors. Included in this survey are data from all of the states in the union, the District of Columbia, and three U.S. territories (CDC, 2019). The survey includes adults aged 18 and older who live in private homes. It does not include those living in dormitories, jails, hospitals, or nursing homes (State of New Jersey Department of Health, 2019).

Strengths and Weaknesses

Promotion, intervention, education, and prevention are ways researchers in public health have historically approached the problem of seatbelt use in the obese deaf or HOH population. The strengths inherent in this approach are that laws, campaigns, and public policy can be affected positively. Mandatory laws and public awareness with an interdisciplinary approach play a major role in minimizing morbidity and mortality in the target population. Weaknesses in this approach are that individuals must self-report their use or nonuse of seatbelts; likewise, height and weight are self-reported. Inherent disadvantages exist regarding self-reported data, such as responses may be exaggerated (e.g., an exaggeration of frequency of seatbelt use); individuals may be embarrassed to report their true weight, which would negatively affect the results recorded for BMI; and personal and social biases may influence the study.

Definitions

Access to healthcare: ease by which individuals can obtain needed medical services and consultation or screening for risk factors, such as seatbelt use and weight management (Rand, 2019). Access to health care is defined by the BRFSS question asking respondents if they have any kind of health care coverage, including health insurance, prepaid plans (e.g., HMOs), or government plans (e.g., Medicare or Indian Health Service).

Behavioral Risk Factor Surveillance System (BRFSS): a U.S. health survey for determining health-related behavioral risk factors, chronic health conditions, and the use of preventive services (CDC, 2017).

Body Mass Index (BMI): a weight-to-height ratio calculated by dividing one's weight in kilograms by the square of one's height in meters. The BMI provides an indicator of obesity or underweight (CDC, 2019d), as discovered by self-report in this study

Community: a group of people living in the same place or having particular characteristics in common linked by social ties, common perspectives, and engagement in combined actions in the same geographical location or settings (MacQueen et al., 2001).

Deaf: lacking the ability to hear or having impaired hearing; a deaf individual often uses sign language to communicate (DeafTec, 2019), as discovered by self-report for this study. Deaf or HOH status is defined by the BRFSS question asking respondents if they are deaf or have serious difficulty hearing.

Ecological perspective: a concept that refers to knowing how organisms interact with their environment. The ecological perspective emphasizes both individual and contextual systems and the interdependent relations between the two (McLaren & Hewe, 2005).

Education: the process of giving or receiving systematic instruction, especially at a school or university ("Education," 2019). Education level is defined by the BRFSS question asking respondents to report the highest grade or year of school they completed.

Hard-of-Hearing (HOH): refers to an individual who has a mild-to-moderate hearing loss and who may communicate using sign language, spoken language, or both (DeafTec, 2019) as discovered by self-report for this study. Deaf or HOH status is defined by the BRFSS question asking respondents if they are deaf or have serious difficulty hearing. The survey question pertains to the respondents' use of the seatbelt as a driver or passenger.

Health literacy: the knowledge, motivation, and set of abilities required to access, understand, process, evaluate, and use health information to make judgments regarding the three-fold health domains of health care, disease prevention, and health promotion (Naseribooriabadi, Sadoughi, & Sheikhtaheri, 2017).

Health promotion: the process of enabling people to increase control of, and improve, their health. This promotion is more than individual behavior and also focuses on a wide range of social and environmental behaviors (World Health Organization, 2011).

Marital status: a person's state of being single, married, separated, divorced, or widowed ("marital status," 2019). Marital status is defined by the BRFSS question asking respondents to report if they are married, divorced, widowed, separated, never married, or a member of an unmarried couple (BRFSS 2017).

Morbidly obese: a serious health condition that exists when an individual is 100 or more pounds over his or her ideal weight or has a BMI of 40 or more (University of Rochester Medicine, 2019).

Motor vehicles: a road vehicle powered by an internal combustion engine; an automobile ("Motor Vehicle," 2019).

Obese: when a person has a weight higher than what is considered a healthy weight for a given height, or a BMI higher than or equal to 30 (CDC, 2019c).

Positive social change: improvement of human and social conditions for the betterment of society. Ideas and actions with real-world implications drive this type of change (Morris, 2017).

Seat belt: a belt or strap securing a person to prevent injury, especially in a vehicle ("Seat belt," 2019).

Assumptions

Key Assumptions of SEM

The use of the SEM requires that I make several assumptions,. the first is that some obese people do not use seatbelts because they choose not to for a myriad of reasons that have nothing to do with their size or their need for seatbelt extenders. Therefore, an intervention is more effective through coordination at multiple levels than it would be if only one level was employed (School of Social Ecology, 2019). The SEM allows examination of links or relationships among factors affecting health, and it also allows multiple theories from different fields to be mapped onto the model. Therefore, the assumption that an intervention can be more effective through coordination at multiple levels supports that the SEM was the best framework for this study as opposed to other single-level models. Still, the SEM requires some additional assumptions regarding the context of the study.

For example, the community-level assumption that use or nonuse of seatbelts in the deaf community can be explained by research on this topic in the hearing community may be erroneous. In particular, there are dynamics within the deaf community that are not an issue in the hearing community, which iterates the need for focused research in the deaf community. According to McKee, Schlehofer, and Thew (2013), significant cultural and social differences within the deaf community create a host of barriers and ethical dilemmas that researchers who work within this minority, underserved, and vulnerable population must consider. The researchers noted that few health researchers understand the cultural values ingrained within the deaf community nor do they know American Sign Language (ASL). Specifically, at an organization level, researchers who work with the deaf community may not understand deaf culture or communicate using ASL.

Also, the interpersonal and intrapersonal assumption that seatbelt use or nonuse by parents and adults can be projected onto minors is a necessary assumption. This assumption highlights that minors are not "little-adults;" this population has issues specific to their youth that are necessary to consider (e.g., age, knowledge deficits, judgment) when exploring their use or nonuse of seatbelts. In terms of a policy-level consideration, seatbelt laws do not apply to minors because it is the adult's responsibility to protect them. However, children who grew up watching their parents use seatbelts are more likely to use them when they become drivers (National Highway Traffic Safety Administration, 2019). Therefore, an assumption is that a relationship exists between children's use of seatbelts and their parents' use of seatbelts.

Secondary Data and Related Assumptions

Conducting this research required several key assumptions regarding the use of secondary data.

- Using secondary data will not reduce the generalizability of research findings.
- Survey respondents are honest and without biases when they reply to survey questions.
- Using secondary data does not compromise the reliability and validity of the research findings.
- The sample size is adequate.

These assumptions were necessary because they help to explain why research on this topic and within this population is necessary and beneficial to society. The data for the present study did not allow me to assess the exact reasons that people do not use seatbelts, but rather allowed for determining if a correlation exists among obesity, deaf or HOH, and nonuse of seatbelt. A final assumption pertains to the generalizability of the secondary data and accuracy of respondents' self-report; these factors are necessary because secondary analysis of existing data is an advantageous method of health research. Researchers conducting studies using secondary data must be able to trust the methods used and the obtained outcomes.

Scope and Delimitations

Obesity is one aspect of the problems addressed in this study. I chose this population for evaluation because obesity is an epidemic and is on the rise (American Cancer Society, 2018). Obesity is a public health issue and therefore research specific to this population and the use or nonuse of seatbelts in those who are obese and deaf or

HOH will help fill a gap in the research. Internal validity is a form of quality assurance, ensuring that the study effectively measures what it is supposed to measure. However, because this study was a quantitative cross-sectional secondary design, as opposed to primary experimental or investigative research, decreasing the possibility of confounding was necessary to assure internal validity. Possible confounding variables that I controlled included an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care). The independent, dependent, and confounding variables examined in this study were delimited to variables measured in the BRFSS 2017, limiting the scope of the study to variables available in this secondary dataset. I found no issues with the data set. However, I planned to address missing values in the dataset by excluding cases with more than 5% missing data and imputing missing values for all other cases. Using secondary data increases statistical power and external validity because it is a larger sample size and therefore offers a more diverse respondent pool than a smaller sample size (Davis-Kean, Jager, & Maslowsky, 2015).

Boundaries of the Study

Populations included in the study. Understanding the boundaries of this study helps to assure the external validity of the study. The boundaries of this study include individuals who participated in the BRFSS 2017 survey from both the hearing population and the deaf or HOH community. Adults 18 years of age and older who live in private homes could participate in the original BRFSS 2017 study because the primary purpose of the study was to examine behavioral risk factors and chronic condition associated with death or disability among adults residing in the United States (State of New Jersey

Department of Health, 2019). According to Davis-Kean et al. (2015), secondary data analysis is a standard method used to answer complex questions regarding behavior.

Populations excluded from the study. Another boundary was that the original BRFSS 2017 occurred in the United States in spoken English. Non-English speakers, those who use English as a second language, and sign language users are at a disadvantage. They may not have understood the questions asked or they may have misinterpreted what was asked; therefore, individuals who did not have telephone access or did not speak English were excluded from this study. Individuals who reside outside of the United States also were excluded from this study. Individuals who reside in dormitories, jails, hospitals, or nursing homes were excluded from this study (State of New Jersey Department of Health, 2019).

Theories and conceptual frameworks not investigated. The social cognitive theory, health belief model, and transtheoretical/stages of change model were potential conceptual frameworks for this study, but the SEM proved to be the appropriate framework for this study. All four frameworks address a person's needs at the intrapersonal level. Unlike the other frameworks, though, the SEM addresses a person's needs at five levels: intrapersonal, interpersonal, organizational, community, and public policy. Other behavioral theories, such as the theory of planned behavior (TPB) and diffusion theory, were not as well suited because they do not address the various levels and constructs that the SEM offers.

Generalizability or Transferability

I employed statistical methods in this quantitative research to ensure validity and reliability. I maintained generalizability of the study by including a sample of the population consistent with the population of the United States and by following the guidelines for population inclusion and exclusion noted in the BRFSS 2017. The BRFSS collects data in all 50 states as well as the District of Columbia and three U.S. territories. Secondary data available to the public through federal, state, or local data sets are typically large and include subjects from varied geographical areas; thus, they tend to be generalizable (Dunn, Arslanian-Engoren, DeKoekkoek, Jadack, & Scott, 2015).

Significance, Summary, and Conclusions

Significance

The findings of this study may help develop or modify awareness campaigns to promote the use of seatbelts and seatbelt extenders. At the policy level, findings may lead to policy changes, such as requiring manufacturers to offer seatbelt extenders. Furthermore, findings from this study may inspire improvement of the current restraining system used in vehicles, such as requiring flashing lights or vibrating seats as a reminder to deaf or HOH occupants to use their seatbelts. Potential implications for positive social change are that individuals who are obese and deaf or HOH will recognize their increased risk for injury or death when they are behind the wheel and fail to use seatbelts or seatbelt extenders. In response, this population will be more committed to using seatbelts or seatbelt extenders and require their passengers to use seatbelts as well. Finally, findings from this study may help health care practitioners and public health practitioners realize the need to support individuals in the deaf community to become more aware of health risk behaviors by using ASL videos to communicate health information. Findings from this study may allow public health practitioners to recognize the disparities that exist in the deaf culture that would allow practitioners to include deaf-friendly planning in health outreach events. The goal of this study was to affect positive social change by providing information that may lead to action on the individual, community, and policy levels.

To elaborate, findings may be invaluable to vehicle manufacturers, car dealers, consumers, and the general public. For example, the findings may help stakeholders develop or modify awareness campaigns to promote seatbelt and seatbelt extender use. The findings may also lead to policy changes, such as requiring manufacturers who do not offer seatbelt extenders to do so (Vanderbilt University, 2019). The findings may also inspire improvement of current restraining systems (seatbelts) and the development of new safety features for those who are deaf or HOH and obese. By increasing seatbelt use and improving the effectiveness of restraining and alerting systems, I hope that the individual, economic, and societal effects of motor vehicle crashes—estimated to be more than $63 billion a year (CDC, 2019g)—will be significantly reduced by decreasing the severity of injuries and mortality from a lack of seatbelt use in this population.

Summary

Several potential implications existed for this study. Potential contributions of this study include the advancement of knowledge in public health as well as for public health practitioners, community leaders, car manufacturers, and other stakeholders to become aware of an understudied and under-represented population. Therefore, those involved may increase campaigns and other efforts to inform and improve health behaviors of individuals who are deaf or HOH and obese. Potential contributions of this study include advancement of practice or changes or adoption of policy to include marginalized communities, such as deaf or HOH, as opposed to generalizing findings from research in mainstream America to the deaf or HOH community.

Major Themes in Literature

Obesity is an epidemic in this country such that, there is no shortage of articles in the literature that points to obesity as being a major problem in the United States. Obesity is in epidemic proportions and continuing to rise. For instance, adult obesity has continued to significantly increase during the past 10 years. For example, in 2018 the CDC reported that obesity among adults has risen from 33.7% to 39.6% and morbid obesity has increased from 5.7% to 7.7% (American Cancer Society, 2018). Moreover, this could be a contributing factor as to why decreased seatbelt use is linked to obesity. Furthermore, Jehle, Doshi, Karagianis, Consiglio, and Jehle (2014) found that normal weight individuals use seatbelts 67% more often than obese and morbidly obese individuals. Moreover, enforcement of seatbelt laws is a recurring theme in the literature and the Governors Highway Safety Association (2019) discussed the types of seatbelt laws (primary or secondary) in each state. This designation is significant because researchers have recognized nonuse of seatbelts as a citable offense; yet, some obese and morbidly obese individuals refrain from using their seatbelt. Obese individuals living in deaf communities are at risk for health disparities and people living with other disabilities (such as physical limitation and blindness) are also are at risk for health inequity, health disparities, and decreased health literacy (Krahn, Walker, & DeAraujo, 2015). Unfortunately, although the need exists to address these health inequities and disparities a need also exists to educate health care workers about deaf culture and the disparities therein. The core mission of public health is to improve the health of all populations (Krahn et al., 2015). To do so, more qualified sign language interpreters with training in health care and the needs of deaf or HOH individuals and their families are needed in the

United States (Adams, 2018). Also, research in the deaf community is lacking. Many deaf people have low English-language and reading skills; therefore, they are often excluded from medical research and health surveillance (Pollard, 2019). Because of the lack of research in this underserved population, this study solely pertained to the deaf or HOH community.

Conclusion

Public health practitioners are aware of the causes and consequences of obesity (Hruby, et al., 2016). Trained workers know that obesity is on the rise in the United States (Abraham, 2019). Public health practitioners know that obesity is a global public health challenge (World Health Organization, 2019). Researchers at Harvard School of Public Health recognizes the increasing effects of obesity on society such as increased morbidity and mortality (Harvard School of Public Health, 2019). Healthcare professionals and public health practitioners know that obesity is associated with poorer mental health and a reduced quality of life and is the leading cause of death in the United States (CDC, 2019h). However, public health practitioners are not able to discern the proportion of health improvement behaviors, such as seatbelt use or weight loss, that can be attributed to medical intervention (Agency for Healthcare Research and Quality, 2019). Many health care providers are unaware of low health literacy among their deaf or HOH patients; therefore, they often overestimate the knowledge base their patients have to make appropriate health-related decisions (Naseribooriabadi et al., 2019). Many health care providers are unaware of the significant challenges deaf or HOH individuals have in communicating their health needs or acquiring new knowledge in order to attain the highest standard of health (such as health care) that is fundamental to every human being

(Kuenburg, Fellinger, & Fellinger, 2016). It is unknown to health professionals that disparities exist in research and health care in the deaf community (Pick, 2013).

Throughout this study, I addressed a gap in the literature. By combining the three variables—obesity, seatbelt use or nonuse, and deaf or HOH—I worked to fill the gap in research pertaining to this population. Significant research in the literature pertains to obesity and seatbelt use or nonuse; however, no available research exists on seatbelt use or nonuse in the deaf community. This study addressed the need for the deaf community to have health professionals practice with their needs in mind. Pick (2013) noted that language barriers and lack of cultural intelligence place deaf individuals at a high risk for poor health knowledge and unequal access to medical and behavioral care in the U.S. health system. I, thus aimed to establish if any differences in seatbelt use occurred in the deaf or HOH and obese or morbidly obese population. Trained professionals are responsible for providing inclusive programs designed to inform and educate the public. Health equity in the deaf community cannot be achieved without deliberate actions of public health practitioners and professionals to take deliberate steps to include this community and their linguistic needs in program planning.

Connecting the Gap in Practice

Deaf or HOH and obese or morbidly obese individuals and their use or failure to use seatbelts were the three main variables in this study. I used these variables in this quantitative cross-sectional study using secondary data from the BRFSS 2017 to study whether a relationship existed between the characteristics of BMI, marital status, education, and whether individuals have access to health care. Also, I examined whether a difference existed in seatbelt use between these three variables and the same individual-level characteristics (BMI, marital status, education, and access to health care).

Section 2: Research Design and Data Collection

Introduction

The purpose of this quantitative cross-sectional research study was to examine the association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and seatbelt use among the deaf or HOH individuals. The purpose of this study also was to examine the difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for the previously listed factors. BMI refers to the measure of body fat based on height and weight that applies to adult men and women. Calculation of a BMI entails using a person's height and weight. The formula for BMI = kg/m^2 where kg is a person's weight in kilograms and m^2 is that person's height in meters squared. When using English measurements, the formula to calculate BMI is 703 X weight in pounds divided by height in inches. A BMI of 25.0 or more is overweight, while the healthy range is 18.5 to 24.9 (CDC, 2019). Interpersonal factors refer to relationships or communication between people ("Interpersonal," 2019).

Degrees of severity of hearing loss vary from person-to-person. Mild hearing loss ranges from 25–40 A-Weighted Decibels (dBA). With this degree of hearing loss, an individual has trouble keeping up with communication between multiple people or when they are in a noisy environment. Sounds within this range (25–40 dBA) can be likened to the noise level of a faint bird call (Audio Advantage Hearing Aid Centers, 2019). Moderate hearing loss ranges from 40–70 dBA. With this degree of hearing loss, an individual has trouble understanding speech in a quiet environment and when communicating one-on-one. Sounds within this range (40–70 dBA) can be likened to the sound of normal speech from about three feet away (Audio Advantage Hearing Aid Centers, 2019). Severe hearing loss ranges from 70–90 dBA. With this degree of hearing loss, an individual has trouble understanding a conversation with one person in a quiet room and often rely heavily on lip reading. Sounds within this range (40–70 dBA) can be likened to the noise generated by a garbage disposal at 3 feet away (Audio Advantage Hearing Aid Centers, 2019). Profound hearing loss occurs at 95 dBA or higher. With this degree of hearing loss, individuals are hearing impaired. Individuals with this level of hearing loss often rely on sign language to communicate. Sounds at this level (95 dBA or higher) can be likened to the sound of a food processor or louder (Audio Advantage Hearing Aid Centers, 2019).

In this section, I detail the methodological issues and procedures of the study. The section includes the research design and rationale for the selected design. Following sections then detail the population, sample, and research instruments, followed by the data analysis plan. Finally, I discuss threats to validity and ethical considerations.

Research Design and Rationale

This study followed a quantitative cross-sectional design using secondary data from the BRFSS 2017. The independent variables in this study were deaf or HOH status, BMI, marital status, education, and access to health care. The dependent variable in this study was seatbelt use. A quantitative cross-sectional design connected to the research question because cross-sectional designs assess a particular condition of a population at a specific point in time. The research questions prompted the examination of seatbelt use of a sample population at one point in time rather than across multiple periods of time, making a cross-sectional design appropriate for this study. This design allowed for the examination of the relationship between the dependent and independent variables. Time constraints consistent with cross-sectional designs are limited with extended access to participants. Resource constraints are that deaf or HOH face lower health literacy levels, knowledge deficits, and limited access to infrastructure. While, Rakesh (2016) asserted that research is a process for acquiring new knowledge. He noted that research is a systematic approach involving deliberate planning and interventions for the acquisition of new information. The selection of a cross-sectional design for this study was deliberate. The use of survey questionnaires by the original researchers presented another constraint because it limited the types of research questions that could be asked. This design choice was consistent with research designs needed to advance knowledge in the discipline of public health by focusing on different regions around the country and to empower people in the various regions to take innovation in their own hands. Researchers widely use descriptive studies to estimate the occurrence of risk factors in a segment of the population using the characteristics of age, sex, race, or socioeconomic status (Alexander, Lopes, Ricchetti-Masterson, & Yeatts, 2015).

Methodology

Population

The target population for this study was noninstitutionalized adults aged 18 years or older who reside in the United States or its territories and who are deaf or HOH. According to the Annie E. Casey Foundation Data Center (2017), approximately 252,063,800 adults aged 18 and older reside in the United States. Approximately 37.5 million of these adults report having hearing deficits.

Sampling and Sampling Procedures

The participants in this study were respondents to landline and cell phone surveys reported by the CDC BRFSS 2017. I used secondary data originally collected by the BRFSS. The original sampling procedure used in the BRFSS was probability sampling via random digit dialing of all households with telephones in each state. The sampling frame for this study included noninstitutionalized adults aged 18 and older who have access to a cell phone or landline to respond to a series of questions on a telephone survey. State health personnel or contractors administered the telephone surveys, which lasted an average of 18 minutes each. The BRFSS 2017 dataset is publicly available and accessible through the CDCs BRFSS 2017 web page (https://www.cdc.gov/brfss/annual_data/annual_2017.html). These data are available for free and there are no special procedures or permissions required to gain access to the data.

I conducted a power analysis using G*Power to determine the minimum sample size needed for this study. Conducting a power analysis involved a logistic regression with an assumed medium effect size (OR = 2.47; Chinn, 2000; Cohen, 1988), a medium correlation between predictor variables ($r = 0.3$), and power level of 0.8. The results of the power analysis indicated that this study required a minimum sample size of 60.

Instrumentation and Operationalization of Constructs

The CDC developed the BRFSS in the late 20th century to address the issues related to the causes of chronic diseases. Researchers identified growing evidence in the 1970s that identified personal behaviors, such as tobacco use, physical activity, diet, routine health check-ups, and screening exams, as culprits that contribute to chronic diseases identified as leading killers in the United States (Utah Department of Health, 2019). Researchers designed the BRFSS survey to collect information from adult participants about their health-related knowledge, attitudes, and practices. Topics included health status and access to care, tobacco and alcohol use, diet (consumption of fruits and vegetables), physical activity, human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS), women's health, injury control (seat belts, bicycle helmets), and demographic information. Researchers asked core component questions in all states with optional sets of questions on specific topics chosen by individual states (Utah Department of Health, 2019).

The BRFSS was appropriate for this study because it remains the gold standard of behavioral surveillance. I sought to examine the behaviors of the target population by using a database known for its behavioral surveillance data. Data from the BRFFS can be trusted. The year 2019 marked 36 years that the BRFSS had been in use. Currently, all 50 states, the District of Columbia, American Samoa, Palau, Puerto Rico, the U.S Virgin Islands, and Guam collect data monthly, working closely with state and territorial partners to ensure that the data collected from the surveys remain relevant and useful (CDC, 2018a). Accessing a database with such a large reach as the BRFSS was ideal for this study. Many researchers have examined the validity and reliability of the BRFSS as well as the system's ability to provide valid national estimates within and across states (CDC, 2019b). The CDC (2019b) confirmed the BRFSS is a reliable and valid source of health-related information.

The variables in this study were BMI, deaf or HOH, and seatbelt use. I measured the variables according to the BRFSS codebook and affirmed by self-report. Access to the Internet facilitated a search for videos designed to help select the best statistical tests to use, how to clean data for analysis, how to run ordinal regressions, how to conduct an ANOVA, and various correlational tests using SPSS Statistics software. Gertsman's (2015) *Basic Biostatistics* textbook guided me as needed, to clarify statistical terms and output results. I also consulted a tutor skilled in quantitative statistics for support with using the aforementioned statistical software. The following YouTube videos guided the research process.

- Data Cleaning in SPSS
- How to Clean SPSS Data Choosing Which Statistical Test to Use
- Conducting Ordinal Regression in SPSS
- Conducting an ANCOVA in SPSS
- Types of Statistical Tests Threats to Validity

Some threats to validity when using the BRFSS are self-report and methods errors. For instance, individuals may falsely report their weight or BMI to provide answers that they feel are socially acceptable. A methods error occurs if an individual misinterprets or does not understand the question and thereby gives an inaccurate response. Montenegro (2013) spoke to the generalizability of the BRFSS data, stating that given the breadth of the survey, enough random samples have been captured to make it generalizable to the broader U.S. population.

Ethical Procedures

Mann et al. (2014) noted that researchers rely on data from the BRFSS to gain an understanding of and address the health status of persons with disabilities. Furthermore, they recognized that the BRFSS survey data have only limited definitions of disabilities, which delivers imprecise inferences about the particular nature of a disability. Mann et al. recommend it is important to understand how health varies among people with different types of disabilities so that interventions can be tailored for improving health and eliminating disparities in the disabled. Ethical considerations could arise because the BRFSS questions the deaf or HOH population using the same methods as addressing the hearing population. There is no evidence that any consideration is given to the fact that ASL may be the first and chosen language of the deaf or HOH. Researchers must consider the nature of a participant's disability and adjust research tools, designs, and interventions to accommodate those with disabilities. For instance, ASL and Braille could be used to target the deaf or HOH or blind or visually impaired participants.

Ethical considerations came into play when handling and securing the data used in this study. I considered the privacy of participants by not using any identifying information when collecting data. Furthermore, all collected information is stored on a password-protected device. I will store data no longer than 1 year from the time it was downloaded.

Summary

This quantitative cross-sectional study using secondary data from the BRFSS 2017 entailed examining at seatbelt use in obese deaf or HOH and hearing individuals using marital status, education, and access to health care as covariates. Threats to validity when using the BRFSS were self-report and methods error. Strengths of using a cross-sectional study are that they are quick and relatively inexpensive and one can study multiple variables at the same time. Weaknesses are that causality is difficult to determine and this type of study is susceptible to several kinds of biases (e.g., responder bias, recall bias, interviewer bias). Ethical considerations are that the deaf or HOH population is a special population; therefore, special considerations must be made to assure that their linguistic and cultural needs are met, relevant to the survey. Boness (2016) stated that to provide appropriate and ethical services, the need to understand culture among diverse populations is essential.

Analysis occurred using SPSS. I conducted a power analysis using G*Power to determine the minimum sample size needed for this study. Conducting the power analysis supported a logistic regression with an assumed medium effect size (OR = 2.47), a medium correlation between predictor variables ($r = 0.3$), and a power level of 0.8. The results of the power analysis indicated that this study required a minimum sample size of 60.

Section 3: Presentation of the Results and Findings

Introduction

The primary purpose of this study was to examine the difference in seatbelt use between the deaf or HOH individuals and hearing individuals. It is possible that the deaf or HOH population may with higher frequency fail to use their seatbelts. Also included in analysis was seatbelt use among the obese deaf or HOH because they may be less likely to use their seatbelts than their normal weight, hearing counterparts.

The following research questions and hypotheses guided the study.

Research Question 1: What is the association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and seatbelt use among the deaf or HOH individuals?

$H_0$1: There is no association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and the use of seatbelts among deaf or HOH individuals as measured by the BRFSS.

H_a1: There is a statistically significant association between an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and the use of seatbelts among deaf or HOH individuals as measured by BRFSS.

Research Question 2: Is there a difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic

(BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care)?

$H_0 2$: There is no difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) as measured by the BRFSS.

$H_a 2$: There is a statistically significant difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) as measured by the BRFSS.

Using SPSS version 25, I analyzed these research questions using a quantitative cross-sectional design and logistic regression. I discuss the data collection and preparation process in this section. This section also contains analysis of data.

Data Collection of Secondary Data Set

In this study, I calculated summary statistics for each interval and ratio variable. Calculations of frequencies and percentages was done for each nominal and ordinal variable. The 2017 BRFSS data set provided the data for this study. The obtained data were from respondents to a telephone survey conducted in the United States, the District of Columbia, and three U.S. territories. This dataset contained de-identified patient ID numbers, demographic information, and coded responses to a telephone survey. Respondents to the landline telephone survey were 428,310 (n = 428,310); while, 326,640 (*n* = 326,640) respondents participated in the telephone survey using their cell phones.

Descriptive Statistics

The 2017 BRFSS is a large data set. The data are in excess of 450,000 respondents; therefore, cases with missing data were dropped. The majority of those sampled reported that they were not deaf or HOH (*n* = 399,198, 89%). Most of those sampled reported their educational level was college graduate (*n* = 168,390, 37%). Among the deaf or HOH, the most common level of education was high school graduate (*n* = 12,290, 33%.) Most of those sampled noted they did have health insurance (*n* = 412,502, 92%). The majority of deaf or HOH individuals also reported having health insurance (*n* = 35,559, 94%). Most of those sampled reported they were married (*n* = 23,2891, 52%). Married also was the most common marital status for deaf or HOH individual (*n* = 18,023, 48%). The majority of those sampled reported they always use their seatbelt (*n* = 360,558, 80%). This proportion was the same for deaf or HOH individuals (*n* = 30,324, 80%). Table 1 presents the frequencies and percentages.

Table 1

Frequency Table for Deaf or Hard of Hearing (HOH) Status, Education, Health Insurance, Marital Status, and Seatbelt Use

Variable	*N*	%	Cumulative %
Deaf/HOH			
Yes	37768	8.39	8.39
No	399198	88.71	97.10
Do not know	1007	0.22	97.33
Missing	12029	2.67	100
Education level			
No school or only kindergarten	629	0.14	0.14
Elementary	10434	2.32	2.46
Some high school	21624	4.81	7.26
High school graduate	122577	27.24	34.50
Some college	124655	27.70	62.20
College graduate	168390	37.42	99.62
Missing	1693	0.38	100
Health insurance			
Yes	412502	91.67	91.67
No	35743	7.94	99.61
Do not know	1073	0.24	99.85
Missing	684	0.15	100
Marital status			
Married	232891	51.75	51.75
Divorced	61437	13.65	65.41
Widowed	54633	12.14	77.55
Separated	9426	2.09	79.64
Never married	73939	16.43	96.07
Unmarried couple	14544	3.23	99.30
Missing	3132	0.70	100
Seatbelt use			
Always	360558	80.12	80.12
Nearly always	27960	6.21	86.34
Sometimes	10843	2.41	88.75
Seldom	4608	1.02	89.77
Never	6453	1.43	91.20
Do not know	283	0.06	91.27
Missing	39297	8.73	100

Note. Due to rounding errors, percentages may not equal 100%.

The BRFSS 2017 is a large database with in excess of 450,000 cases. I I treated responses of “don’t know” or “refused” as missing values and dropped those cases. According to Kang (2013), it is not uncommon to have missing data in a study. Kang noted that the most common approach to dealing with missing data is to omit those cases.

Summary statistics of the observations for BMI across the entire sample had an average of 28.16 (*SD* = 6.28, Mdn = 27.20, Mode = 26.63, Skewness = 1.34, Kurtosis = 4.01). Individuals who were deaf or HOH had an average BMI of 28.68 (*SD* = 6.37, Mdn = 27.60, Mode = 26.63, Skewness = 1.29, Kurtosis = 3.83). According to Westfall and Henning (2013), when the skewness is higher than 2 in absolute value, the variable is considered asymmetrical about its mean. The researchers also stated when the kurtosis is higher than or equal to 3, then the variable’s distribution is markedly different than a normal distribution in its tendency to produce outliers. Table 2 presents the summary statistics.

Table 2

Summary Statistics Table for Body Mass Index (BMI)

Variable	*M*	*SD*	*N*	*Mdn*	Mode	Skewness	Kurtosis
BMI	28.16	6.28	413570	27.20	26.63	1.34	4.01

Note. Mdn = median.

Data collection for the BRFSS 2017 occurred continuously throughout the year. The BRFSS 2017 researchers conducted random telephone surveys on individuals residing in all 50 states, the District of Columbia, and three U.S. territories (Puerto Rico, Guam, and the U.S. Virgin Islands; CDC, 2018a). The response rates for landline users was 45.3% and the response rate for cell phone users was 44.5% (CDC, 2018b).

Respondents calculated their BMI by dividing their weight in kg by their height in meters-squared. According to the “Calculate variables in the 2017 Behavioral Risk Factor Surveillance System Data File,” a BMI between 18.5 kg/m^2 and 24.9 kg/m^2 was normal weight. A respondent with a BMI between 25 kg/m^2 and 29.9 kg/m^2 was classified as overweight. When a respondent’s BMI was higher than 30 kg/m^2 the person was classified as obese (CDC, 2018b). Respondents who had missing values for their height or weight were treated the same as those with values missing, for “refused,” or “don’t know;” I dropped those cases.

This quantitative cross-sectional design using secondary data included both landline and cell phone surveys. Individuals living in private residences or college dorms qualified to be respondents to this survey. Persons living in nursing homes, barracks, prisons, and the like did not qualify as respondents; however, those living in their vacation homes for more than 30 days did qualify for inclusion. The instrument used for data collection was a multi-question telephone questionnaire. The data included deidentified participants’ identification number, type of residence, state of residence, level of education and other demographics, BMI, seatbelt use, access to health insurance, and ability to hear. Factors assessed by the BRFSS 2017 included, health status, healthy days or health-related quality of life, health care access, exercise, inadequate sleep, chronic health conditions, oral health, tobacco use, e-cigarette use, alcohol consumption, immunization, falls, seatbelt use, drinking and driving, breast and cervical cancer screening, prostate cancer screening, colorectal cancer screening, and HIV/AIDS knowledge. Telephone sampling frames are commercially available. These systems can call random samples of telephone numbers; however, doing so requires specific protocols. The BRFSS 2017 sampling frame is in the Telecordia database of telephone exchanges. For example, the phone numbers 617-492-0000 to 617-492-9999 could be used. The BRFSS 2017 divided the telephone numbers into frames of telephone numbers and then drew one 10-digit telephone number at random. The target population consisted of persons 18 years or older who reside in a private residence or college dormitory and who have a working cell phone or landline (CDC, 2018c).

Results

Ordinal Logistic Regression for Research Question 1

I conducted an ordinal logistic regression (n = 33,411) among deaf or HOH individuals in the sample to determine if the odds of observing each response category of seatbelt use could be explained by the variation in education level, health insurance, marital status, and BMI. An ordinal regression describes data and explains the relationship between one dependent variable and two or more independent variables (Statistics Solutions, 2019). In this study, seatbelt use was the dependent variable and the independent variables were education level, health insurance, marital status, deaf or HOH, and BMI. I conducted a test for multicollinearity between predictors. Multicollinearity is a correlation or multiple correlations of sufficient magnitude to potentially, adversely affect regression estimates (Johnston, Jones, & Manley, 2018). To check for the presence of collinearity or multicollinearity, I calculated variance inflation factors (VIFs). A VIF of 2.5 or higher indicates considerable collinearity, suggesting difficulty in discerning the individual contribution of the variables (Johnston et al., 2018). There is not universal concurrence with the statement that VIFs of 2.5 is problematic. Some authors note that VIFs higher than 5 are cause for concern, whereas VIFs of 10 should be considered the maximum upper limit (Menard, 2009). All predictors in the regression model in this study had VIFs less than 10. Table 3 presents the VIF for each predictor in the model.

Table 3

Variance Inflation Factors for Deaf, Education, Health Insurance, Marital Status, and Body Mass Index (BMI; n *= 33,411)*

Variable	VIF
Education level	1.03
Health insurance	1.02
Marital status	1.02
BMI	1.00

Note. VIF = variance inflation factor.

I evaluated this study at an alpha level of 0.05. The findings were significant, χ2(12) = 555.66, $p < .001$, suggesting the null hypothesis can be rejected. Observed effects of education level, health insurance, marital status, and BMI on seatbelt use were unlikely to occur under the null hypothesis.

Coefficients

Table 4 shows the ordinal logistic regression results for education, health insurance, marital status, and BMI predicting seatbelt use. The results indicated that for elementary education (reference: college graduate), findings were significant, $B = 0.56$, $\chi^2 = 41.23$, $p < .001$, suggesting that a 1-unit increase in elementary education would increase the odds of observing a higher category of seatbelt use by 1.74 times. The regression coefficient for some high school education (reference: college graduate) was significant, $B = 0.69$, $\chi^2 = 111.5$, $p < .001$, suggesting that a 1-unit increase in some high school education would increase the odds of observing a higher category of seatbelt use by 1.98 times. The regression coefficient for completion of a high school education (reference: college graduate) was significant, $B = 0.62$, $\chi^2 = 198.78$, $p < .001$, suggesting that a 1-unit increase in high school education would increase the odds of observing a higher category of seatbelt use by 1.86 times. The regression coefficient for some college education (reference: college graduate) was significant, $B = 0.44$, $\chi^2 = 91.83$, $p < .001$, suggesting a 1-unit increase in some college education would increase the odds of observing a higher category of seatbelt use by 1.55 times. The regression coefficient for having health insurance [yes] was significant, $B = -0.34$, $\chi^2 = 28.67$, $p < .001$, suggesting that a 1-unit increase in having health insurance [yes] would lessen the odds of having a higher category for the use of seatbelts by 0.71 times. The regression coefficient for marital status of married (reference: unmarried couple) was significant, $B = -0.29$, $\chi^2 = 7.40$, $p = .007$, suggesting a 1-unit increase in marital status of married would decrease the odds of observing a higher category of seatbelt use by 0.75 times. The regression coefficient for marital status widowed (reference: unmarried couple) was significant, $B = -0.54$, $\chi^2 = 23.78$, $p < .001$, suggesting an increase of 1- unit in marital status widowed would lessen the odds of observing a higher category of seatbelt use by 0.58 times. The regression coefficient for BMI was significant, $B = 0.03$, $\chi^2 = 117.43$, $p < .001$, suggesting a 1-unit increase in BMI would increase the odds of noticing a higher category of seatbelt use by 1.03 times. Table 4 presents these regression coefficients.

Table 4

*Ordinal Logistic Regression Results for Education, Health Insurance, Marital Status, and Body Mass Index (BMI) Predicting Seatbelt Use (*n *= 33,411)*

Predictor	*B*	*SE*	95% CI	χ^2	*p*	*OR*
Seatbelt use [Always]	2.36	0.14	[2.08, 2.63]	287.51	< .001	
Seatbelt use [Nearly always]	3.11	0.14	[2.84, 3.38]	495.48	< .001	
Seatbelt use [Sometimes]	3.77	0.14	[3.50, 4.05]	715.16	< .001	
Seatbelt use [Seldom]	4.26	0.14	[3.98, 4.53]	889.22	< .001	
Education [No school]	-0.33	0.52	[-1.34, 0.69]	0.39	.532	0.72
Education [Elementary]	0.56	0.09	[0.39, 0.72]	41.23	< .001	1.74
Education [Some high school]	0.69	0.07	[0.56, 0.81]	111.50	< .001	1.98
Education [High school]	0.62	0.04	[0.54, 0.71]	198.78	< .001	1.86
Education [Some college]	0.44	0.05	[0.35, 0.53]	91.83	< .001	1.55
Insurance [Yes]	-0.34	0.06	[-0.46, -0.21]	28.67	< .001	0.71
Marital [Married]	-0.29	0.11	[-0.50, -0.08]	7.40	.007	0.75
Marital [Divorced]	-0.18	0.11	[-0.39, 0.04]	2.49	.115	0.84
Marital [Widowed]	-0.54	0.11	[-0.76, -0.32]	23.78	< .001	0.58
Marital [Separated]	-0.14	0.14	[-0.42, 0.14]	0.91	.341	0.87
Marital [Never married]	0.02	0.12	[-0.21, 0.25]	0.04	.842	1.02
BMI	0.03	0.00	[0.02, 0.03]	117.43	< .001	1.03

Note. VIF = variance inflation factor.

Results

Ordinal Logistic Regression for Research Question 2

I conducted an ordinal logistic regression to determine if the odds of observing each response category of seatbelt use could be explained by the variation in deaf, education level, health insurance, marital status, and BMI. In this study, seatbelt use was the dependent variable and education level, health insurance, marital status, deaf or HOH, and BMI were the independent variables. I conducted a test for multicollinearity between predictors. To check for the presence of collinearity or multicollinearity, I calculated VIFs. All predictors in the regression model had VIFs less than 10. Table 5 presents the VIF for each predictor in the model.

Table 5

Variance Inflation Factors for Deaf, Education Level, Health Insurance, Marital Status, and Body Mass Index (BMI; n = *380,892)*

Variable	VIF
Deaf	1.01
Education level	1.05
Health insurance	1.04
Marital status	1.03
BMI	1.01

I evaluated this study based on an alpha level of 0.05. The findings were significant, $\chi^2(13) = 7736.14$, $p < .001$, suggesting that the null hypothesis can be rejected. The observed effects of deaf, educational-level, health insurance, marital status, and BMI on seatbelt use were unlikely to occur under the null hypothesis.

Coefficients

The regression coefficient for deaf [yes] was significant, $B = 0.20$, $\chi^2 = 138.26$, $p < .001$, suggesting a 1-unit increase in deaf [yes] would increase the odds of observing a higher category of seatbelt use by 1.22 times. The regression coefficient for elementary education (reference: college graduate was significant, $B = 0.46$, $\chi^2 = 177.56$, $p < .001$, suggesting a 1-unit increase in elementary education would increase the odds of observing a higher category of seatbelt use by 1.58 times. The regression coefficient for some high school education (reference: college graduate) was significant, $B = 0.55$, $\chi^2 = 565.44$, $p < .001$, suggesting a 1-unit increase in some high school education would increase the odds of observing a higher category of seatbelt use by 1.73 times. The regression coefficient for high school education was significant, $B = 0.56$, $\chi^2 = 1867.63$, $p < .001$, suggesting a 1-unit increase in high school education would increase the odds of observing a higher category of seatbelt use by 1.75 times. The regression coefficient for some college education was significant, $B = 0.39$, $\chi^2 = 885.63$, $p < .001$, suggesting a 1-unit increase in some college education would increase the odds of observing a higher category of seatbelt use by 1.47 times. The regression coefficient for health insurance [yes] was significant, $B = -0.38$, $\chi^2 = 512.98$, $p < .001$, suggesting a 1-unit increase in health insurance [yes] would decrease the odds of observing a higher category of seatbelt use by 0.69 times. The regression coefficient for marital status married (reference: unmarried couple) was significant, $B = -0.40$, $\chi^2 = 241.87$, $p < .001$, suggesting a 1-unit increase in marital status [married] would decrease the odds of observing a higher category of seatbelt use by 0.67 times. The regression coefficient for marital status divorced (reference: unmarried couple) was significant, $B = -0.23$, $\chi^2 = 66.08$, $p < .001$, suggesting a 1-unit increase in marital status divorced would decrease the odds of observing a higher category of seatbelt use by 0.80 times.

The regression coefficient for marital status widowed (reference: unmarried couple) was significant, $B = -0.61$, $\chi^2 = 424.81$, $p < .001$, suggesting a 1-unit increase in marital status widowed would decrease the odds of observing a higher category of seatbelt use by 0.54 times. The regression coefficient for marital status separated (reference: unmarried couple) was significant, $B = -0.23$, $\chi^2 = 31.36$, $p < .001$, suggesting a 1-unit increase in marital status [separated] would decrease the odds of observing a higher category of seatbelt use by 0.80 times. The regression coefficient for marital status never married (reference: unmarried couple) was significant, $B = 0.08$, $\chi^2 = 8.08$, $p = .004$, suggesting a 1-unit increase in marital status never married would increase the odds of observing a higher category of seatbelt use by 1.08 times. The regression coefficient for BMI was significant, $B = 0.03$, $\chi^2 = 2071.38$, $p < .001$, suggesting a 1-unit increase in BMI would increase the odds of observing a higher category of seatbelt use by 1.03 times. Table 6 presents these regression coefficients.

Table 6

*Ordinal Logistic Regression Results for Deaf, Education Level, Health Insurance, Marital Status, and Body Mass Index (BMI) Predicting Seatbelt Use (*n *= 380,892)*

Predictor	*B*	*SE*	95% CI	χ^2	*p*	*OR*
Seatbelt use [Always]	2.60	0.04	[2.53, 2.67]	5342.95	< .001	
Seatbelt use [Nearly always]	3.52	0.04	[3.45, 3.59]	9567.09	< .001	
Seatbelt use [Sometimes]	4.23	0.04	[4.16, 4.31]	13366.89	< .001	
Seatbelt use [Seldom]	4.80	0.04	[4.72, 4.87]	16288.46	< .001	
Deaf [Yes]	0.20	0.02	[0.17, 0.23]	138.26	< .001	1.22
Education [No school]	-0.02	0.18	[-0.37, 0.34]	0.01	.935	0.99
Education [Elementary]	0.46	0.03	[0.39, 0.53]	177.56	< .001	1.58
Education [Some high school]	0.55	0.02	[0.50, 0.59]	565.44	< .001	1.73
Education [High school]	0.56	0.01	[0.53, 0.58]	1867.63	< .001	1.75
Education [Some college]	0.39	0.01	[0.36, 0.41]	885.63	< .001	1.47
Insurance [Yes]	-0.38	0.02	[-0.41, -0.34]	512.98	< .001	0.69
Marital [Married]	-0.40	0.03	[-0.46, -0.35]	241.87	< .001	0.67
Marital [Divorced]	-0.23	0.03	[-0.28, -0.17]	66.08	< .001	0.80
Marital [Widowed]	-0.61	0.03	[-0.67, -0.55]	424.81	< .001	0.54
Marital [Separated]	-0.23	0.04	[-0.31, -0.15]	31.36	< .001	0.80
Marital [Never married]	0.08	0.03	[0.02, 0.13]	8.08	.004	1.08

BMI	0.03	0.00	[0.03, 0.03]	2071.38	< .001	1.03

Summary

I evaluated Research Questions 1 and 2 at an alpha level of 0.05, $p < .001$, which suggested that the null hypotheses in both queries should be rejected. An ordinal regression assisted in answering both of the research questions. I conducted an ordinal regression in an effort to predict an interaction between the independent variables and the dependent variable for both research questions. Analysis of descriptive statistics occurred using SPSS Version 25. The frequencies showed that 89% of those surveyed were hearing, 92% had health insurance, 37% were college graduates, and 52% were married. Seatbelt use was common among those surveyed; 80% report they always use their seatbelts. Based on the results of the summary statistics for BMI, the distribution is asymmetrical and has a normal tendency to produce outliers.

Results for Research Question 1 suggest that a statically significant association between the level of education, marital status, health insurance, and BMI on seatbelt use. Results suggest a positive correlation associated with the level of education and seatbelt use. The results also suggested a negative correlation or inversely proportional relationship between those with health insurance who were married and widowed. The null hypothesis was rejected.

Results for Research Question 2 suggest a statistically significant association between deaf individuals and their use of seatbelts after adjusting for BMI, education, marital status, and access to health care. Results suggest a positive correlation with being deaf and use of seatbelts. The null hypothesis was rejected.

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

Introduction

The primary purpose of this study was two-fold. First, I sought to discern if an association exists between the use of seatbelts in deaf or HOH individuals and an individual-level characteristic (BMI), an interpersonal factor (marital status), a community-level factor (education), and a policy-level factor (having access to health care). Second, I examined the difference in seatbelt use between the deaf or HOH individuals and hearing individuals. I conducted this study because various factors involving automotive design, policies, and characteristics of the deaf or HOH community meant it was possible the deaf or HOH population may, with higher frequency, fail to use their seatbelts. Also, I examined seatbelt use among the obese and deaf or HOH because obese individuals, in general, were typically less likely to use their seatbelts than those who maintained a normal range BMI (Jehle, 2014). The nature of this study was a quantitative cross-sectional study using secondary data. A quantitative method was best suited because the variables of interest were objectively quantifiable and my aim was to investigate the statistical associations between the variables of interest (i.e., BMI, deaf or HOH status, marital status, access to health care, and educational level) and seatbelt use. I used a cross-sectional design because the research questions examined the association between variables at the same point in time and involved the observation of a sample, or cross section, of a population (see Babbie, 2017).

Key findings were that for both research questions, I accepted the alternative hypothesis in lieu of the null hypothesis. Significance ($p < .001$) was found for both research questions using ordinal regression. Research Question 1 asked: What is the association between an individual-level factor (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and seatbelt use among the deaf or HOH individuals? The alternative hypothesis stated there is a statistically significant association between an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) and the use of seatbelts among deaf or HOH individuals as measured by BRFSS. Research Question 2 asked: Is there a difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care)? The alternative hypothesis stated there is a statistically significant difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level factor (marital status), community-level factor (education), and policy-level factor (having access to health care) as measured by the BRFSS.

Interpretation of Findings

I conducted summary statistics, which allowed for a comparison of BRFSS 2017 respondent data and that of the general population for the purpose of determining the generalizability of these research findings. Analysis of the BRFSS 2017 data showed 89% of the respondents reported they were not deaf or HOH (11% of the respondents were deaf or HOH). The National Institute of Deafness and Other Communication Disorders (2019) reported approximately 15% of adults aged 18 and older have trouble hearing. Therefore, the sampling in the BRFSS 2017 dataset is somewhat lower than the general U.S. population.

This representation gap for the deaf or HOH population supported the findings of previously published literature that indicated a limited amount of research exists on deaf or HOH individuals and communities. For instance, only 8.4% (n = 37,768) of the respondents in this study reported they are deaf. Edwards et al. (2017) noted vision is considered the main sense used when driving but hearing plays an important role in providing information about traffic, such as approaching vehicles, road hazards, and problems with the vehicle. The researchers noted it is problematic that few researchers have explored the relationship between hearing and driving. This problem is not new, however. In 1978, scientists like Booher (1978) noted that the call has gone out for decades to conduct future research relating to deaf or HOH. This call supports the notion that research targeting the deaf community has been overdue. Alper (2018) pointed to disparities in health information of those living with disabilities in general. The BRFSS population indicated there may be an underrepresentation of those with hearing impairments, which leads to a lack of effective information and intervention in supporting this populations. Future researchers concerned with studying the habits of the deaf or HOH should consider targeting the deaf community and using qualitative interviews to get a strong sense of factors within the deaf or HOH community, as opposed to studying the mainstream population and generalizing the findings to deaf or HOH individuals.

Additionally, some other factors from the descriptive statistics are worth noting in interpreting this study. Analysis of data from the BRFSS 2017 showed that 37% of the respondents were college graduates. According to the U.S. Census Bureau (2019), 33.4% of Americans older than the age of 25 are college graduates. These statistics are helpful in knowing which segment of the population should be targeted for research or to promote health education; for instance, because only 37% of the respondents to the BRFSS 2017 survey were college graduates, the student population can be targeted for health education or future research studies. Furthermore, 92% of respondents reported they had health insurance. The U.S. Census Bureau (2019) reported 91.2% of Americans have health insurance coverage; therefore, the findings of the present study may not generalize to individuals who are uninsured, which constitutes a minority population, but nevertheless a vulnerable population worthy of attention. Respondents to the BRFSS 2017 also overrepresented the married population, with 52% of respondents indicating married status compared to the U.S. Census Bureau's (2019) reporting that 45.2% of Americans older than 18 years are single (54.8% were married). Further research should pertain to finding a more representative sample of married individuals, or targeting specific vulnerable populations, like those who do not have health insurance or those who do not use their seatbelts.

A slight discrepancy occurred regarding reported seatbelt use between previous studies and the BRFSS. The BRFSS 2017 data showed 80% of respondents reported they always use their seatbelts, whereas the National Highway Traffic Safety Administration (NHTSA, 2019) found 89.6% of Americans reported using their seatbelts. Kidd et al. (2013) found that 91% of respondents in their study report they always used their seatbelts. These inconsistencies suggest that the population sampled may influence understanding of the rates of seatbelt use. Slight discrepancies exist in the general reporting of seatbelt use. For instance, the population surveyed using the BRFSS 2017 reported lower rates of seatbelt use than both the research conducted by the NHTSA and Kidd et al. These discrepancies are noteworthy. The CDC (2017) explained these discrepancies by reporting differences in seatbelt use by geography, race, income, age, education, and other demographics. Table 7 presents a vertical comparison of percentages for the nominal and ordinal variables. Based on these comparisons, despite slight variations, the BRFSS 2017 sample data are representative of the population and are therefore generalizable to the mainstream population.

Table 7

Vertical Comparison of Percentages

	Deaf or HOH (%)	College graduate (%)	Health insurance (%)	Married (%)	Seatbelt use (%)
BRFSS 2017	11	37	92	52	80
Population	15	33.4	91.2	54	89

Note. HOH = Hard-of-Hearing participants; BRFSS = Behavioral Risk Factor Surveillance System.

Summary statistics for BMI show the majority of respondents were overweight. Furthermore, the results showed the distribution of data was not normal and its skewness was asymmetrical. Nevertheless, it is not necessarily good practice to generalize findings to the deaf or HOH community. Kiley-Brown (2018) stated it is best to collect data directly in the primary language of the participants (in this case, ASL) using a sign-only environment. More health education and public health campaigns aimed at the deaf community, using only deaf or HOH people in the sample-set, are needed so that the research findings can be representative of the target population (the deaf or HOH). The following section presents the findings of the present in line with the research questions and hypotheses.

For Research Question 1, I hypothesized there was no association between an individual-level characteristic (BMI), interpersonal-level characteristic (marital status), community-level characteristic (education), policy-level characteristic (having access to health care), and the use of seatbelts in the deaf or HOH as measured by the BRFSS 2017 data. In this study, the null hypothesis for Research Question 1 was rejected and the alternative hypothesis was accepted. The findings showed there was a statistically significant association in seatbelt use in deaf or HOH individuals and BMI, marital status, education, and having access to health care.

These findings indicated similar variables to the previously published literature. Jans et al. (2015) listed several factors found to influence seatbelt use. These factors included, risk perception, gender, age, race, socioeconomic status, marital status, locale, personality constructs, personality characteristics, insurance incentives, social norms, and enforcement of seatbelt laws. This study used the variables education level, access to health insurance, marital status, and BMI. Through regression analysis of Research Questions 1 and 2, I determined there were statistically significant findings in the relationship for seatbelt use in the deaf or HOH for the variables of health insurance and marital status.

The results revealed a higher BMI increased the chances that an individual did not use their seatbelt. This finding was consistent with previous researchers who examined seatbelt use among individuals who are obese. Jehle, Doshi, Karagianis, Consiglio, and Jehle (2014) noted obese individuals use seatbelts less often than normal-weight individuals. This study supports those findings. Understanding the seatbelt use rate among obese individuals is important because obese individuals may sustain more damage when they are in accidents. Hartka et al. (2018) found seatbelts worn by obese individuals in a vehicle collision are likely to move up and forward, posing a threat to internal organs as opposed to lying across the pelvic bone. Interpreting these studies from a different perspective can help determine the type of recommendations that can be made for future studies. Shi et al. (2015) studied the effects of obesity (increased BMI) on occupant responses in a vehicle collision. The researchers found higher injury risk was a result of increased body mass and poorly fitting seatbelts as a result of increased amounts of adipose tissue in occupants who are obese. Durgun et al. (2016) conducted a study on trauma patients during a 1-year period. These researchers noted unrestrained motorists have a higher injury severity score than motorists who were restrained. Joseph et al. (2017), using a multivariate logistic regression, conducted a retrospective analysis using the National Trauma Data Bank from 2007–2010. The researchers found motorists who were morbidly obese had a higher risk of death than those who were not morbidly obese. These findings are significant and have implications to what future researchers can study; for instance, it points out that the obese and morbidly obese are a vulnerable and understudied demographic. It would be beneficial to public health if public health practitioners initiate research projects aimed at this population.

In Research Question 2, I hypothesized there is no difference in seatbelt use between deaf or HOH individuals and hearing individuals after adjusting for an individual-level characteristic (BMI), interpersonal-level characteristic (marital status), community-level characteristic (education), and policy-level characteristic (having access to health care) as measured by the BRFSS 2017 data. In this study, the null hypothesis for Research Question 2 was rejected and the alternative hypothesis was accepted. A statistically significant difference in seatbelt use existed among deaf or HOH individuals and hearing individuals.

The findings in this study supported the claims that deaf or HOH used their seatbelts less often than their hearing counterparts. Arrive Alive (2018) noted some individuals who are deaf or HOH may not be able to hear the seatbelt reminder alarms that are equipped in most vehicles, thus they are less likely to wear their seatbelts. The notion that overweight deaf or HOH individuals are less likely to use their seatbelts than their normal-weight hearing counterparts was supported by this study. The findings of this study indicated more should be done to design better seatbelts and improved efforts at preventing the nonuse of seatbelts by those who are deaf or HOH and those who are obese. Moreover, more research is needed on individuals who are deaf or HOH and who are active in the deaf community. Research published by Jehle et al. in 2014 confirms that obese drivers in fatal crashes were less likely than their normal-weight counterparts to wear seatbelts and they are likely to suffer higher injury severity. What is not clear is whether these findings can be generalized to the deaf community. Seatbelts are a primary means of reducing injuries and death in motor vehicle collisions; thus, they should be given primary consideration for improving safety and conducting studies that include the deaf or HOH as the target population. In this study, I aimed to examine this problem and discern means by which to contribute to safety for deaf or HOH drivers and encourage positive action from vehicle designers as well as future researchers who could study the marginalized population of the deaf or HOH.

The present study supported the influence of the SEM when used to study the problem of seatbelt use. At the individual level (BMI), the individual must decide whether to use their seatbelt as is (uncomfortable or not) or whether to ask the dealer for a seatbelt extender. At the interpersonal level (marital status), the couple must take action to not be negatively influenced by their partner. Studies conducted by the CDC, 2019a expressed that if the driver puts on his or her seatbelt, then the passengers are more likely to put on their seatbelts. Seatbelt use by passengers varied from 92% when the drivers were wearing a seatbelt to 42% when drivers were not wearing a seat belt. The couple must actively put forth an effort to not let the failure of their partner to use a seatbelt influence their own decision toward seatbelt use. At the community level (education), health educators must target this population to reduce knowledge deficits regarding seatbelt use. Finally, at the policy level, individuals must be attuned to the various laws and regulations that govern the use of seatbelts.

In prior literature, researchers have studied seatbelt use and the SEM. Stokols (1996) noted that lifestyle modifications focus on behavior at the individual level. Establishing and maintaining a healthy environment is a community-level factor of the SEM. At the policy level of the SEM, Stokols (1996) noted that oftentimes, health promotion programs lack a clearly stated theoretical foundation. Golden and Earp (2016) acknowledged the SEM recognizes individuals as part of a larger social system with characteristics that are interactive and that underlie health outcomes. For example, researchers have supported the influence at the individual level on seatbelt use. Han (2017) discussed the influence drivers' attitudes about seatbelt use have on their passengers, specifically that 92.6% of passengers wore their seatbelts when the driver wore theirs. This reflected the individual level of the SEM. At the individual level, Young et al. (2008) indicated that for seatbelt reminder systems to be effective, they must address the motivational and behavioral factors that contribute to the reason why an individual may or may not wear their seatbelt. A person may choose not to use their seatbelt as a matter of personal choice or they may forget to put on their seatbelt.

This study extended the body of research on the influence of the SEM in finding significant factors that relate to seatbelt use. Interpretation of research findings in the context of the SEM presented findings at the individual level (BMI), the interpersonal level (marriage), the community level (education), and at the policy level (access to health care). At the individual level, I discovered whether BMI influences seatbelt use. At the interpersonal level, I examined whether one's marital status influenced seatbelt use. The findings indicated being married increased the odds that one would use their seatbelt compared to the increased odds of not using their seatbelt if unmarried. At the community level, the results showed that having a college education increased the chances an individual would use their seatbelt compared to the increased odds of not using a seatbelt for individuals who had an elementary school education. At the policy level, I found that those who had access to health care were more likely to use their seatbelt than those who did not. These findings suggest that at all levels of the SEM, important factors exist that can guide public health practitioners towards areas in health education where they can have the highest influence. At the individual level, I found individuals with a higher BMI are less likely to use seatbelts than those with a lower BMI. A public health practitioner can use that information to target the segment of the population that is at risk. Likewise, with the other levels of the SEM, the public health practitioner can use these significant finding to plan public health education programs and projects.

Limitations of the Study

The limitations of this cross-sectional design involving secondary data were that I could not analyze the behavior of participants. An inability to control the environment where the respondents were when they answered the survey questions was another limitation. This type of research does not lend itself to determining cause and effect. Finally, the sample taken may not be representative of the population (see Setia, 2016). In this study, specific potential issues with representation include marital status among the deaf or HOH population. Limitations pertain to generalizability of the findings to the deaf community. Only 8.4% (n = 37,768) of the respondents reported they are deaf. Advantages of this cross-sectional design are the ability to prove or disprove assumptions associated with the hypotheses, the design is quick and inexpensive, and researchers can assess multiple variables (Setia, 2016).

Furthermore, the limitations of this quantitative cross-sectional study using secondary data are that the original dataset may include the biases of the original researchers. The accuracy of the original data is not known. For instance, it cannot be determined what methods the original researchers used to minimize the amount of missing data. Careful planning and careful collection of data can minimize the amount of missing data (Kang, 2013). A further limitation with this secondary dataset is that the original researchers were not able to control the environment where the respondents provided answers to the questions posed during the survey. Therefore, there is no way of knowing if a respondent was distracted and unable to give their full attention to what they were being asked, thus they may not have provided the “best” answer to the questions they were being asked. Missing data can potentially be problematic because it presents various problems. According to Kang (2013), the absence of data reduces statistical power, which increases the possibility of the null hypothesis being rejected. Also, lost data can cause biases in the estimation of parameters. Missing data can reduce the representativeness of the samples (Kang, 2013). The SEM has limited variables, which may have limited the analysis through this framework. In addition, a limitation associated with this framework was that I could not see who was deaf and obese because of the use of secondary data.

Recommendations

Future researchers should target the deaf community, more specifically deaf or HOH American Sign Language users for research aimed at improving public health matters for deaf people as opposed to extracting those who are deaf from a sample of hearing individuals. To eliminate the limitations of using secondary data, future researchers exploring seatbelt use in the deaf community should consider using primary qualitative data. This research may provide additional factors to consider in subsequent quantitative analysis, as well as the opportunity to engage with the deaf or HOH population specifically. This study may therefore also prompt those who gather large datasets regarding seatbelt use to focus on recruiting those drivers who are deaf or HOH to an extent representative of the general population of the United States.

The SEM was the framework used in this study; future researchers studying the deaf community should examine the research questions using this framework from a different cultural perspective (e.g., deaf culture). Researchers can consider looking at this research problem using other theoretical frameworks as well. Although the SEM appears to be the best framework at this time, the social cognitive theory, health belief model, and the transtheoretical model are worthy of consideration as a framework for this research problem. According to Cottrell, Girvan, Seabert, Spear, and McKenzie (2017) Bandura's social cognitive theory considers observational learning, imitation, and modeling of primary importance for learning to take place. This model could be suitable because drivers who always wear their seatbelts would be modeling desired behavior for their passengers. The passengers would imitate the behavior they observed thereby engaging in the major constructs of the social cognitive theory. Social psychologists, Rosenstock, Hochbaum, Kegeles, and Leventhal developed the health belief model in the 1950s for the purpose of explaining and predicting health-related behaviors, such as a person's perception of the threat, their willingness to take preventive action to avoid the threat, and one's confidence in their ability to take the actions necessary to avoid the threat (Cottrell et al., 2017). Researchers should consider applying the key constructs of this model to this research problem. The key constructs of this model should be exhibited when drivers and passengers in the vehicle become aware of the threat not using seatbelts poses to their personal safety. After the drivers and passengers become aware of the threat, they would then go through the various predictors of the health belief model, thereby engaging in the major constructs of this model. The transtheoretical model takes the individual through various stages of change from precontemplation of what a change in health behavior means to their overall health to the termination stage, a place where the individual has changed their behavior and has zero temptation to return to previous behaviors regarding the health issue (Cottrell et al., 2017). Researchers can apply this theoretical framework by presenting how the individuals should go through the various stages of first learning about the importance of seatbelt use to using their seatbelts whenever they travel in a vehicle.

Implications for Professional Practice and Social Change

The implications this study has for professional practice is that it can shed light on the need to have more research conducted on deaf people who live, work, and play in deaf communities. Furthermore, this study sheds light on the fact that differences exist in seatbelt use by obese individuals and individuals who are not obese. These insights provide important public health issues that can help public health practitioners plan campaigns for community-based participatory action research projects aimed at affecting change in the behaviors of those who are deaf and those who are obese. Furthermore, I aimed to affect positive social change by providing information that may lead to action on the individual, community, and policy level. The findings may be invaluable to vehicle manufacturers, car dealers, consumers, and the general public. For example, these stakeholders could help develop or modify awareness campaigns to promote seatbelt or extender use. The findings may also lead to policy changes, such as requiring manufacturers who do not offer seatbelt extenders to do so (Vanderbilt University, 2019). The findings may also inspire improvement of current restraining systems (seatbelts) and development of new safety features for deaf or HOH and obese individuals. By increasing seatbelt use and improving the effectiveness of restraining and alerting systems, I hope the individual, economic, and societal influence of motor vehicle crashes (estimated to be higher than $63 billion a year; CDC, 2019c) may be significantly reduced by a decrease in severity of injuries or a decrease in mortality. Without the findings of this research, an important segment of the U.S. population would continue to be overlooked. Program planning, policies, and other public health matters often fail to include these individuals. Policymakers and health professionals must recognize the disparities that exist in segments of the population who are not mainstream so that this demographic can be included in programs implemented and policies established that relate to increasing the use of seatbelts in the overall population. Social change can occur by focusing national attention on this public health issue, providing public health education, and improving consumer understanding of the role health education plays in the promotion of public health issues.

Policymakers can use these research findings to make changes or create new public policy aimed at improving the safety of drivers and passengers, especially those who are obese and deaf or HOH. Furthermore, policymakers could recognize and embrace the need to address the disparities that exist in marginalized communities, such as the deaf community and others dealing with disabilities (e.g., the blind and physically handicapped). These research findings and previously published literature suggest people with a high BMI are less likely to use their seatbelts than those with a lower BMI because the seatbelts are uncomfortable (National Highway Traffic Safety Administration, 2018). Policymakers can intervene and improve the odds for obese people to wear their seatbelts by requiring automakers to make seatbelts longer to accommodate the larger drivers and passengers. Automakers and engineers can take notice of these findings and take the initiative to make seatbelts larger without waiting for policymakers to mandate the change (University of Virginia, 2019).

Moreover, some changes to policy and manufacturing could be made to accommodate deaf or HOH drivers and passengers (National Association of the Deaf, 2019). Motor vehicles come equipped with seatbelt reminders in the form of a lighted icon on the instrument panel, auditory alerts (beeps), and the shutdown of the entertainment center (the radio shuts off until everyone has buckled their seatbelt). These reminders have proven effective in reminding the hearing to buckle-up; however, they are not as effective for the deaf or HOH (Lerner et al., 2015). Vehicle manufacturers can take the initiative to include flashing lights and vibrating seats to catch the attention of the deaf or HOH, reminding them to fasten their seatbelt; this, in turn, would model behavior for the passengers of a deaf or HOH driver. Researchers have already established that passengers are more likely to buckle up if the driver does so (Han, 2017). Legislators, law enforcement, the general public, public health practitioners, and health care workers can all weigh in as stakeholders. Stakeholder involvement is necessary to have an effective program for changing behaviors (Agency for Healthcare Research and Quality, 2019). Practitioners from a wide range of disciplines who work in collaboration towards the same end-goal (i.e., increasing the use of seatbelts in the target population) is essential for the overall success of this undertaking. These stakeholders must master the ability to work together to improve the understanding and support needed to make use of the common safety priorities of seatbelts.

All drivers should know the risk factors associated with an individual's likelihood of using or not using seatbelts when traveling in a vehicle (Jensen, 2019); therefore, an implication for practice would be for public health practitioners to collaborate and share resources with other disciplines and explore the reasons some individuals fail to buckle-up. Another implication for practice revealed by this study was the need to promote positive social change not only for deaf or HOH individuals but also for other disabled populations (i.e. the blind, those with mobility impairments, and mental illnesses). Public health practitioners could launch a community-based participatory action research project dedicated to educating these communities on the importance of using seatbelts. This final implication for practice stems from the bringing together of individuals from different marginalized communities. Public health practitioners can recognize the benefit of combining the resources of these diverse entities to work towards a common goal (Graffunder & Sakurada, 2016). Public health interventions should be designed to make these vulnerable communities aware of factors that contribute to nonuse of seatbelts in the hopes of encouraging increased seatbelt use.

Conclusion

I used a quantitative method to address two research questions aimed at exploring seatbelt use in deaf or HOH individuals. Through the first question, I sought to examine the association between BMI, marital status, education, and having access to health care and seatbelt use among deaf or HOH individuals. Through the second research question, I I sought to determine if a difference exists in the use of seatbelts between deaf or HOH individuals and hearing individuals after adjusting BMI, marital status, education, and having access to health care. The null hypotheses was rejected for Research Questions 1 and 2 and the alternative hypotheses were accepted. Analysis of regressions showed significance at $p < .001$, evaluated at an alpha level of 0.05. An inversely proportional relationship occurred between BMI and seatbelt use. The results suggest the higher the BMI, the higher the odds of nonuse of seatbelts.

The key goals of this study were supported by the notion that civil society and the way it functions plays an important role in the enhancement of social capital, which is needed for social stability, voluntary associations, and social networking (Eriksson, 2011). Inclusion of deaf or HOH communities in research is a critical factor in insuring positive social change in this vulnerable, overlooked segment of our society. Social networking is one main factor that determines the success and failures of an entity. To recognize the marginalization of a group of people (i.e., the deaf or HOH) and to actively participate in activities that will include them (such as involving them in research in their communities), is the responsibility of public health researchers and other community leaders and should not be ignored.

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Appendix

The following YouTube videos were accessed for this study.

- Data Cleaning in SPSS: https://www.youtube.com/watch?v=EDK-g8xJrWY
- How to Clean SPSS Data: https://www.youtube.com/watch?v=Ik4Dyn8e8vA
- Choosing Which Statistical Test to Use: https://www.google.com/search?sxsrf=ACYBGNSwcEnfP-uZabbSBZqlzc3Dz_HqYQ%3A1569979429446&ei=JfyTXaHsGsW3ggfmwJDICg&q=how+to+choose+which+statistical+test+to+use&oq=How+to+choose+which+stat&gs_l=psy-ab.1.0.0l3j0i22i30l7.9187.38283..42091...0.4..0.195.1828.21j3....2..0....1..gws-wiz.......0i71j35i39j0i67j0i273.2_wvcdFyZa4#kpvalbx=_G_2TXYi2Jazv_QbnoZ-QCw21
- Conducting Ordinal Regression in SPSS: https://www.youtube.com/watch?v=ioNr9o8v5o0
- Conducting an ANCOVA in SPSS: https://www.youtube.com/watch?v=_uYASFVUNpQ
- Types of Statistical Tests: https://cyfar.org/types-statistical-tests