EXPLORING HEALTH SCIENCE STUDENTS' PERCEPTION OF THE INFLUENCE OF HEALTH PRECAUTION PRACTICES DURING THE COVID-19 PANDEMIC

By

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Liberty University

A Dissertation Presented in Partial Fulfillment

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ABSTRACT

The purpose of this phenomenological study was to address a lack of research on health science students' perceptions and use of health precautions during the COVID-19 pandemic. Albert Bandura's Social Cognitive Theory frames this study of bachelor's, master's and doctoral level students at Liberty University, George Mason University, and Norfolk State University. Data was gathered via surveys, interviews, and observations from 35 students across the three universities, providing a diverse pool of age, gender, and ethnicity. The initial survey gathered demographic data on whether students considered themselves immunocompromised, their view on COVID-19's severity for the immunocompromised, and whether they felt COVID-19 had increased the need for medical check-ups and vaccinations. Follow-up interviews were conducted, transcribed, and coded, identifying themes related to students' awareness of COVID-19, the influence of students' knowledge on their behavior, attitudes toward pandemic-era restrictions and contact tracing, and their use of health precautions. Many students reported increased use of health precautions during the pandemic, and those students with experience with vulnerable populations expressed using more health precautions out of concern for others' well-being both during and after the pandemic. Students at all educational levels mentioned the importance of sharing accurate information. The findings suggest that enhancing students' understanding of disease transmission, and effective strategies for communicating with lay people, could be productive. Practice communicating with non-scientists should be integrated into health science classes to capitalize on health science students' care for others and position as trusted resources. Future research could explore the impact of these changes on students' understanding of disease transmission, communication skills, and self-efficacy.

Dedication

Lord, I thank you. For you said in your Word “Eyes hath not seen, nor ears heard, neither have entered the heart of man, The things which God hath prepared for them that love Him (English Standard Version Bible, 2001, 1 Corinthians 2:9). You have reminded me continuously of the importance of trusting you in all things even when it is hard to understand, to see, challenges faced, as you directed my path, and will forever hold the key to my future and my heart.

I also dedicate this dedication to my incredible parents Kevin and Sandra Foster, who have been my rock, who guided me through life, loved me, encouraged, and cheered though all my dreams. You said I could do whatever I put my mind to and look at me writing my dedication for my PhD.

To my brother (Julius) thanks for your encouragement and love.

Next, I would love to dedicate this dissertation to my grandparents, Alonzo (rest in peace) and Edna DeBerry, and Margaret Foster (as you watch over me in heaven). My gratitude extends to you all for the foundation you equipped my parents that have poured to me and my work ethic, the reminder to pray about everything, never allow anyone to hold the power over what you are unable to do but God and God alone, and to put Christ first. I also want to thank my aunts, uncles, family, and friends, which at times completion of assignments, research, and writing my dissertation required time away. Thank you for the love, patience, scriptures, and encouragement. When now asked the questions how is school and how much left on the dissertation, I can finally respond that school is completed, and the dissertation has been defended. We did it!!

Acknowledgments

Thank you again Lord for your love, grace, guidance, mercy, and showing me time and time again that you have and will always be there. Thanks for all challenges faced during this journey as they have made me stronger. The motto that will always remain with me is “Grow through what you go through”. You can only do your best and allow God to do the rest. Walking into my next season and chapter that God has prepared for me with confidence, humility, and excitement. I am grateful for my dissertation chair, and committee members for all feedback provided, guidance in this process, pushing me to think more critically involving research, and overcoming all research challenges faced.

I would like to thank Liberty University, George Mason University, and Norfolk State University. They provided me with the opportunity to invite health science students to participate in my research. For all research participants in this study, thank you for sharing your personal experiences during the COVID-19 pandemic, and your time to complete surveys and research interviews. I appreciate the amount of knowledge gained and hope my research was able to bridge gaps on better understanding whether the COVID-19 pandemic influenced standard health precautions amongst Liberty University, George Mason University, and Norfolk State health science students.

For my parents Sandra and Kevin Foster, thanks for the encouragement, love, and Starbucks. Thanks for also reminding me to hold my head up, pray, encouraging me to push through to the finish line, reminding me to take breaks, and sleep regardless how passionate I was about my research.

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List of Abbreviations

Centers for Disease Control and Prevention (CDC)

The condition caused by the Coronavirus (COVID-19)

World Health Organization (WHO)

The virus that caused the COVID-19 pandemic (SARS-COV-2)

Social Cognitive Theory (SCT)

CHAPTER ONE: INTRODUCTION

Overview

Worldwide, the COVID-19 pandemic has resulted in over 7,047,000 deaths as of late May 2024, with roughly 1.2 million deaths within the United States alone (WHO Data Dashboard, 2024). Despite substantial shifts in both systemic and individual responses to the implementation of healthcare precautions at the peak of the pandemic, further research was warranted to identify the nature of these changes and assess their enduring impact. Health precautions mentioned within the research include social distancing, hand washing, the use of masks, contact tracing, and—eventually—vaccine utilization. None of these health precautions are new: all have been used in response to past pandemics to combat highly transmissible diseases, but—once each crisis has passed—it appears that people generally revert to a laxer adoption of these important protective behaviors, leaving the world unprepared for the next pandemic. The purpose of this study was to learn more about health science students' understanding of disease transmission and their perception and use of various health precautions, as well as the education and lived experiences that contributed to their choices.

From the beginning of the COVID-19 pandemic, numerous factors interfered with our ability to combat the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV-2) and reduce its catastrophic effects on individuals' physical, emotional, social, and economic well-being. These factors included: a limited initial understanding of the magnitude of the pandemic; mixed messaging about the effectiveness of various health precautions; COVID testing and other supply-chain issues, as well as mistrust of government and traditional news sources. Additionally, misinformation, disseminated primarily through social media, significantly reduced health precaution implementation and may have led to as many as 130,000 unnecessary deaths in

the United States during the first year of the pandemic alone (Dryhurst et al., 2020).

To better understand what happened, and how to improve the response to future pandemics, continued learning about COVID-19 is warranted. One valuable area of study involves the utilization of various health precautions in specific subsets of the population in response to COVID-19. Most of the prior COVID-19 research centered around signs and symptoms; however, research evaluating changes in behavior or awareness in response to the pandemic enables a more targeted approach to increasing the use of personal health protections.

The COVID-19 pandemic and its health precautions temporarily—and in some cases perhaps permanently—changed the way people lived their lives. Understanding of the factors that influenced people's perceptions and behaviors across different ages and educational demographic groups is limited, particularly for university students in the health sciences.

This research, regarding health precaution use by health science students, and the factors that influenced their perceptions, helps bridge research gaps on the enduring impact of the pandemic. The quantitative and qualitative data from a total of 35 health science students, drawn from Liberty University, George Mason University, and Norfolk State University, was collected via survey, interview, and observation. A mixed research method, consisting of quantitative and qualitative data, was used to explore potential changes in health precaution use following the discovery of the pandemic.

COVID-19 Challenges

The World Health Organization (WHO) declared COVID-19 a pandemic in March 2020, upending life as we knew it throughout the world (World Health Organization 2020). Much of the early research focused on the signs, symptoms, and health challenges of the pandemic, rather than the utilization of government-mandated or personal health precautions. Research by Omer

et al. (2020), published in the Journal of the American Medical Association (JAMA), emphasized how little was understood about the virus initially, including the various routes of transmission, the case-fatality rate, or exactly what could or should be done to mitigate its severity. Specifically, Omer's research noted that the Centers for Disease Control (CDC) had not yet recommended the routine use of masks for the public, though the authors indicated that they believed this directive would soon follow, as in fact it did (Omer et al., 2020). Their research notes that the case-fatality rate at that time was impossible to pinpoint due to the limited ability to test for the virus, difficulties in data collection, and the enormous variation in fatality rates depending upon the strength of the healthcare system in a particular region.

Oran & Topol's (2020) research on asymptomatic spread concluded that approximately 40-45% of SARS-COV-2 infections were attributable to asymptomatic individuals, and they recommended contact tracing to get real-time information regarding virus transmission prior to the occurrence of symptoms. Contact tracing was used during the COVID-19 pandemic as a health precaution to understand transmission of COV-SARS-2 in asymptomatic individuals, and to reduce its spread (Oran & Topal, 2020).

While the WHO initially recommended the use of contact and droplet precautions and advised people to distance themselves one meter (approximately three feet) from one another, the CDC recommended airborne precautions and a six-foot spatial separation (WHO 2020). The CDC's rule assumed that large droplets do not travel beyond two meters (approximately six feet). However, Bahl et al.'s (2022) review of ten studies concerning the horizontal distance traveled by droplets reveals that eight studies found droplets traveling beyond the two-meter mark, sometimes reaching up to eight meters (approximately twenty-six feet) (Bahl et al., 2022). Furthermore, the study points out the difficulty in distinguishing infections solely based on

droplet versus airborne transmission routes. Additional evidence on SARS-COV-2 suggests aerosol transmission is potentially viable in the air for up to three hours post-aerosolization. Based on this evidence, Bahl et al. advocated for airborne precautions, challenging the initial guidelines, and enhancing the understanding of transmission routes (Bahl et al., 2022).

Given the high rates of transmissibility, and the significant infection rates due to asymptomatic individuals, Omer et al. (2020), warned that until the development and widespread dissemination of effective vaccines, individuals would need to utilize the personal health precautions of social distancing, handwashing, and mask-wearing to prevent a surge of COVID-19 cases likely to overwhelm even the most robust medical systems (Omer et al., 2020).

Risk Perception and Health Precautions

Developing effective vaccines and ensuring that they are sufficiently widely accepted to achieve herd immunity are two different things. In 2021, Khubchandani et al. assessed COVID-19 vaccine hesitancy within the American adult population by deploying a multi-item valid and reliable questionnaire, distributed online through platforms such as *mTurk* and social media sites, to recruit a diverse sample of U.S. adults. The study included 1,878 participants, characterized as 52% female, 74% who identified as Caucasian, 81% who identified as non-Hispanic, and 77% who possessed a bachelor's degree or higher. Across the study, 52% of those surveyed expressed a strong inclination to receive the vaccine, 27% stated they were somewhat likely, 15% indicated hesitancy, and 7% firmly asserted they would not get vaccinated. According to their research, Republicans, younger adults, those with lower levels of education or income, and individuals with a lower perceived threat of getting infected were more likely to report hesitancy about receiving the vaccine, indicating that these populations would need special attention to understand and answer their concerns (Khubchandani et al., 2021).

Before the availability of widespread vaccinations, cultural differences in students' attitudes toward societal health precautions, such as closing schools, or individual preventatives, inclusive of mask-wearing, were evaluated among students in China, Japan, and the United States (Zhu et al., 2021). It was determined that cross-society differences significantly influenced the utilization of preventative measures in the U.S. compared to Japan and China (Zhu et al., 2021). In cultures that emphasize collectivism, people might be more inclined to wear masks and follow health precautions because there is a strong societal expectation to protect the group. The community's well-being is seen as paramount, and individual actions are often taken with the collective's health in mind. Conversely, in comparatively individualistic cultures, like those in the United States or parts of Europe, the focus is more on the individual. In these societies, personal freedoms and rights are often prioritized. People may be less likely to adhere to health precautions like mask-wearing if they believe it infringes on their individual rights or personal comfort, even though these actions could benefit public health (Zhu et al., 2021). Egede et al. (2021), underscored the need for community solidarity, the imperative to address health disparities, and the need for rigorous testing, precautionary measures, and comprehensive health education in the face of such a global health crisis (Egede et al., 2021). Additionally, Bandura's Social Cognitive Model could be used to improve interventions designed to increase the use of health precautions; more individualistic cultures may need to emphasize the personal benefits of these actions, or it may be advantageous to intentionally help cultivate a sense of social responsibility (Bandura, 2001).

Although vaccinations are often used to mitigate infectious diseases as a health precaution, even minor adverse effects, especially in an environment of limited information, may increase hesitancy. As of summer 2024, the various COVID-19 vaccines have been

administered to hundreds of millions of people in the United States. According to the Center for Disease Control (2024), common side effects include headache, fatigue, and soreness at the injection site, which are generally mild to moderate and resolve within a few days. Serious reactions, such as anaphylaxis, are exceedingly rare, occurring at a rate of about five cases per million doses; they are the reason individuals receiving the vaccine were required to wait 15 minutes post injection to be monitored. Myocarditis and pericarditis are other potential adverse side effects; they too are rare but have been observed more frequently in males in their late teens and early twenties, typically following the second dose of mRNA vaccines. Despite this, the benefits of mRNA vaccines in preventing COVID-19 outweigh the risks of myocarditis. Overall, vaccinated individuals have a lower risk of dying from COVID-19 than those who are unvaccinated, and they are not at a greater risk of death from non-COVID causes. The J&J/Janssen vaccine, which is no longer available in the U.S., was associated with a higher rate of Guillain-Barré Syndrome (GBS) and Thrombosis with Thrombocytopenia Syndrome (TTS), leading to a preference for mRNA vaccines (CDC, 2024).

Schaffer DeRoo et al. (2020), investigated planning for the SARS-COV-2 vaccination program to reduce vaccination hesitancy with its attendant morbidity and mortality. Their research examined potential barriers to receiving the COVID-19 vaccination and looked at the likely effectiveness of different types of health education campaigns. Results showed that among the 493 individuals surveyed, if the COVID-19 vaccine had been available in the earliest part of 2021 for everyone, three in four people would have chosen to receive the vaccine despite a slight sense of hesitancy about vaccination safety, some concerns regarding freedom of choice, and mistrust of government as well as of traditional news sources (Schaffer DeRoo et al., 2020). Survey results showed that respondents indicated greater trust in healthcare professionals'

knowledge and expertise than in either governmental or traditional news sources. As a result, Schaffer DeRoo et al. recommended utilizing healthcare professionals to promote COVID-19 vaccinations and being transparent about the potential for adverse reactions (Schaffer DeRoo et al., 2020).

Social and environmental influences play a significant role in risk perception as well as in the utilization of health precautions. Risk perceptions include the analysis of public health emergencies; in addition to individuals' perceptions, there is social influence and relational factors (Wang et al., 2022). Wang's research indicated that the implementation of a conceptual model provided a clear way of depicting where improvement and continual research on disease management are needed (Wang et al., 2022).

For the purpose of studying health science students' perceptions and use of health precautions during the COVID-19 pandemic, a conceptual model entitled *The Health Precaution Effect Model* was developed to depict the factors that influence the use of COVID-19 health precautions, and the potentially devastating outcomes if health precautions are not used.

Prior research by Brussow et al. (2022), found that externally imposed guidelines implemented during the pandemic in 2021, such as mandatory masking and requirements for COVID-19 vaccinations, increased protection by 60% (Brussow et al., 2022)**.** Brussow et al. researched whether a combination of receiving the vaccine and wearing a face mask could contain the spread of COVID-19. Their research showed that infection rates decreased from what was seen at the start of the COVID-19 pandemic in 2020 in the United Kingdom. Entering the third year of the pandemic in 2022, there was a decrease in cases compared to previous years due to a 70% COVID-19 vaccination coverage in the adult population, but the COVID-19 pandemic still existed (Brussow et al., 2022). Research indicated that more mathematical studies are

needed to analyze the pandemic, but information gathered during the COVID-19 pandemic, alongside what was known prior, may be the roadmap needed for health precaution implementation.

In Bandura's SCT model, human behavior is explained by a dynamic model in which behavior, personal cognitive factors, and socio-environmental influences all interact, called reciprocal determinism (Bandura 1977). According to SCT, behavior is regulated by knowledge, outcome expectations and a personal sense of control (often called agency, or self-efficacy). Bandura proposed that behavior is strongly mediated by observation of social modeling, especially if the model was an important person (someone of higher status or authority—a parent, sibling, opinion leader, or teacher). Socio-environmental factors are aspects of the physical environment that also work to promote or discourage particular behaviors. SCT has been used to inform, enable, guide, and motivate people to adopt habits that promote health and reduce habits that impair health (Bandura 2001).

Problem Statement

While vast research has investigated various COVID-19 health precautions taken by the public, or health professionals in efforts to improve patient safety, limited research has explored the knowledge, perspectives, and behaviors of health science students regarding measures such as mask-wearing, six-feet social distancing, and hand washing, especially as various government-mandated safety requirements have been reduced or dropped (Zettersten et al., 2021). Prior research did not explore health science students' perception of the COVID-19 pandemic health precautions. Without more understanding of this group, a valuable potential resource in the fight against infectious diseases—individuals who have chosen health science as their field of study—is being underutilized.

Significance of the Study

This research study, conducted on the reciprocally deterministic relationship between COVID-19 and the perceptions, attitudes, and behavior of health science students, will influence future efforts to support and advance public health safety. It facilitates insight into the awareness of infection exposure, sense of self-efficacy, and experiences of health science students. Research on these students provides the opportunity to learn about the measures they incorporated during the peak of the COVID-19 pandemic, such as social distancing and hand washing. Previous research has not evaluated how the education and experiences of health science students may have influenced their decision-making. The current research aids in understanding the relationship between health science students' perceptions and use of health precautions over the course of the pandemic and identifies some of the reasons underlying their decisions. This investigation suggests that student learners can be used as a tool to benefit society on a greater scale through educational awareness. Health science students are diverse with respect to gender, ethnicity, race, and age (National Center for Health Workforce Analysis; Leider et al., 2015). Because they have chosen to pursue this field of study, it is likely that these students will influence the health/medical community, as well as their families and social groups, well into the future. Understanding this specific population allows the opportunity to design educational interventions that may help save lives.

Research Questions

The proposed research questions were derived from the limited research performed comparing health precautions in use before and in the early stages of COVID-19 to those in place during the maintenance phase of the pandemic. This dissertation research focused on perceptions and use of health check-ups and vaccinations, handwashing, social distancing and contact

tracing. The central research question was “What effect has the COVID-19 pandemic had on standard health precautions taken among Liberty University, George Mason University, and Norfolk State University health science students?” Additionally, two sub-questions asked: 1) “How has the aftermath of the COVID-19 pandemic affected health science students’ knowledge, perceptions, behavior, and sense of self-efficacy?” and 2) “How has health science students’ awareness regarding infection exposure been impacted since the start of the COVID-19 pandemic?”

Sub-question one addresses the aftermath of the COVID-19 pandemic to understand the enduring impact of the pandemic. Sub-question two provides further insight into potential changes in understanding of the spread of infections since the COVID-19 pandemic began.

The study cohort included students who continued online, students who fully returned to in-person classes following the end of campus closures, and those who took a mixture of online and in-person classes, to represent the full range of health science students.

Definitions

Terms that are pertinent to the study in Chapter 1 include:

1. *Coronavirus*- An acute respiratory syndrome that caused a global pandemic (Paules et al., 2020).
2. *Pandemic*- An outbreak of disease that causes death, disruption to life, and suffering on a global scale (Morens et al., 2020).
3. *Change*- the creation of, innovation, and progress (James Stoller, 2021).
4. *Health Precautions*: vary based upon the infection and transmission, but used here primarily to refer to handwashing, social distancing, and vaccination (Bahl et al., 2022).

5. *SARS*-COV-2: the cause of the COVID-19 pandemic (Oran et al., 2020).
6. Phenomenology: focuses on human self-awareness and phenomenon (Wojnar et al., 2007).

Summary

Throughout the course of the COVID-19 pandemic—and continuing on after the W.H.O. declared the pandemic over on May 5, 2023—health recommendations and regulations, as well as individual risk perceptions, shifted, resulting in changes in the use of health precautions. The research conducted for this dissertation explored health science students' perception and use of health precautions during the COVID-19 pandemic. The central research question was "What effect did the COVID-19 pandemic have on standard health precautions taken among Liberty University, George Mason University, and Norfolk State University health science students?" The two sub-questions from the central research question were: "How has the aftermath of the COVID-19 pandemic affected health science students' knowledge, perceptions, behavior, and sense of self-efficacy?" and "How has health science students' awareness regarding infection exposure been impacted since the start of the COVID-19 pandemic?" The purpose of this phenomenological study was to understand changes in health precautions used since the COVID-19 pandemic by health science students at Liberty University, George Mason University, and Norfolk State University, as well as the reasons for any changes. The research provides the opportunity to better understand what can be done to increase the strategic use of health precautions to reduce disease transmission in the future.

CHAPTER TWO: LITERATURE REVIEW

Overview

The purpose of the research study was to understand health science students' perception and use of health precautions, and how their knowledge and experiences influenced behavior over the course of the COVID-19 pandemic. While previous research on reducing the spread of SARS-COV-2 discussed mandated health precautions, it did not thoroughly investigate changes individuals may have made in utilizing health care precautions, how lasting those changes might have been, or to what extent different populations might have adopted these precautions before or during the height of the pandemic. The problem lies in the fact that there has been limited research concerning whether the use of health precautions such as masks, six-feet social-distancing, and handwashing changed for health science students due to, and over the course of, the COVID-19 pandemic, or why. This chapter is organized into two sections. It begins with the theoretical and conceptual framework and then analyzes relevant literature related to historical disease prevention, COVID-19-specific challenges, health precautions, and the behavioral and environmental factors associated with the pandemic. Through this research I aimed to, "explore the effects of the COVID-19 pandemic on standard health precautions amongst Liberty University, George Mason University, and Norfolk State University health science students." This chapter explains how the research conducted for this dissertation bridges existing gaps in the literature.

Social Cognitive Theory

In 1986, Albert Bandura devised the Social Cognitive Theory (SCT), which details the significance of social learning and self-efficacy to lend a better understanding of human behavior and expectations of outcomes (Raedeke et al., 2017; Stewart et al., 2021). Social Cognitive

Theory places significant emphasis on an interplay of environmental, behavioral, and individual factors, including consideration of past experiences, and it is commonly used within the field of health promotion and evaluating influences (The Social Cognitive Theory, 2019). The Social Cognitive Theory encompasses a model that establishes an understanding of the attitudes, self-efficacy, and behaviors of the participants. Bandura posits that expectations of personal or self-efficacy play a pivotal role in determining the initiation, extent of effort, and duration of coping behaviors when faced with challenges and adverse experiences (The Social Cognitive Theory, 2019). His model suggests that persisting in activities leads to a reinforcement of self-efficacy through mastery experiences. The theoretical framework asserts that expectations of personal efficacy draw from four primary sources of information: performance accomplishments, vicarious experiences, verbal persuasion, and physiological states (Bandura, 2001). Social Cognitive Theory (SCT) is the theoretical framework used in the research because it extends theoretical understanding for decisions health science students at universities make regarding health precautions (Bandura, 2001).

As noted in Figure 1 below, Bandura's Social Cognitive Theory begins with self-efficacy, which is an individual's belief in their ability to complete a task or achieve a goal. The influence of self-efficacy tends to factor into choices selected in hopes of meeting expected outcomes. Socio-structural or environmental factors consist of the "facilitators" and "impediments" that have a significant influence on goals and behaviors (Bandura, 2001).

Environmental factors that may have facilitated or impeded the adoption of health precautions during the COVID-19 pandemic include the availability of supplies such as masks, hand sanitizers, testing kits, and vaccines. Public health policies, including mandates and guidelines from government and health organizations such as social distancing requirements or

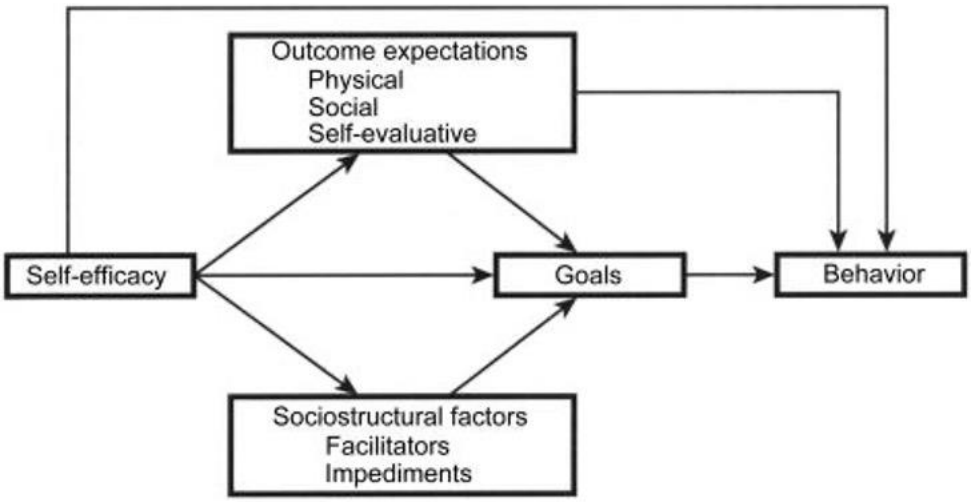
lockdown measures, can enforce or encourage precautionary behaviors (Zhang et al., 2022). The healthcare infrastructure, especially the capacity of the local healthcare system including hospitals and clinics, affected individuals' perceived need for taking personal health precautions. Employer policies on remote work, sick leave, and workplace safety measures can also impact how employees engage in health precautions. Economic stability or instability can influence an individual's ability to afford or prioritize health precautions, especially if they incur a cost (Zhang et al., 2022).

Health science students are likely to observe and imitate the behaviors of role models such as physicians, institutional and student leaders. Being in the health science field, students have direct access to the latest information about the benefits and effectiveness of health precautions. This knowledge also acts as a facilitator. In addition, health science students, with their training and knowledge, might have a higher sense of self-efficacy in understanding and implementing health precautions effectively (Domingo-Fernandez et al., 2021). If students believe that taking these precautions will lead to positive outcomes (like preventing illness), they will be more likely to engage in these behaviors. If health precautions are widely accepted and practiced, this creates a social norm. Peer influence and support can strongly facilitate adherence to these precautions, though the student's personal standards and morals are still key; individuals evaluate their actions based on their personal ethics and professional standards (Domingo-Fernandez et al., 2021). Finally, the fact that many universities transitioned to remote learning during part of the COVID-19 pandemic meant that students were able to continue their studies, even if that was not always easy or preferred.

On the other hand, impediments to adopting health precautions could include exposure to misinformation or conflicting views about health precautions—or the seriousness of COVID-

19—that cause students to question the effectiveness of, or the necessity for, precautions (Ball et al., 2021). Although health science students likely receive the highest quality information in the university setting, the pandemic escalated so quickly that information about SARS-COV-2 was being disseminated as soon as it was discovered. Thus, on occasion the information—or recommendations based upon that information—changed, leading to confusion (Ball et al., 2021). This was the case early on when the public was advised that wearing masks only helped reduce the spread of the virus when it was worn by a person exhibiting symptoms, and that healthy people did not need to wear them. Additionally, students would have received information not only from official sources, their universities, and workplaces, but also from social groups including family members and friends, and they might have felt torn about which social norms to follow (Ball et al., 2021).

Figure 1. Bandura's Social Cognitive Theory (Bandura, 2004)



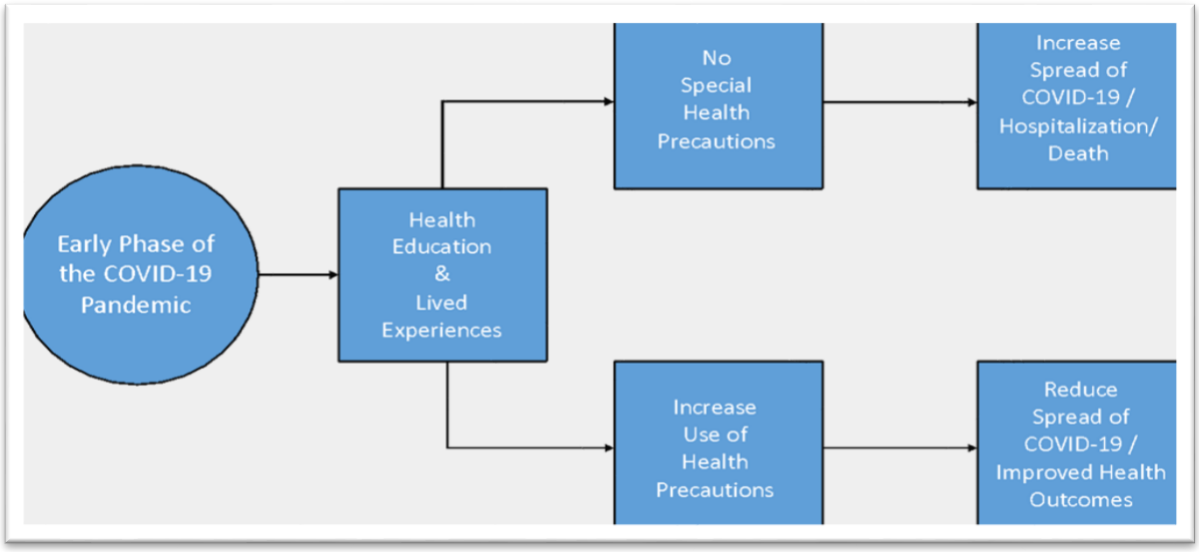
Based on the ideologies of the Social Cognitive Theory, the *Health Precaution Effect Model* (Figure 2) was devised to explore the use and effects of health precautions since the start of the COVID-19 pandemic. The current research on health science students evaluated participants' sense of self-efficacy; their lived experiences, including being immunocompromised; their vicarious experiences of family and friends; their responses to messaging from public sources as well as from families, workplaces, and school; their personal level of concern regarding the seriousness of the SARS-COV-2 virus, and their awareness of their ability to use health precautions to reduce spread. The *Health Precaution Effect Model* implements components of the Social Cognitive Theory by positioning Health Education and Lived Experiences prior to the initial decision tree of, "No special use of health precautions," or "Increased use of available health precautions".

The *Health Precaution Effect Model* was designed to better understand how health science students' use of health precautions, their formal education, and their experiences during the pandemic influenced one another. Incorporating components of Bandura's Social Cognitive Theory into the *Health Precaution Effect Model* supports the opportunity to discover how health science students' educational level, and/or personal experiences, may have contributed to their use of health precautions and what impact those choices might have had on the number of COVID cases in their immediate circle (Bandura, 2001).

The *Health Precaution Effect Model*, like the Social Cognitive Theory, allows for consideration of organized outcome expectations and socio-structural factors to better understand the potential influences (Bandura, 2001). This model focused on three factors (self-efficacy, education, and lived experience). Social Cognitive Theory supports evaluating data collected by interview and survey to improve understanding of decision-making (Bandura, 2001). This

doctoral study investigated health science students' sense of self-efficacy, their attitudes, and the factors associated with their use of health precautions since the beginning of the COVID-19 pandemic.

Figure 2. Health Precaution Effect Model



The Health Precaution Effect Model represents the categorical components of potential effects during the COVID-19 pandemic. Limited use of health precautions is likely to result in increased spread of SARS-COV-2, which then leads to illness, hospitalization, and death. On the other hand, increased use of health precautions has been proven to reduce the spread of disease, leading to improved health outcomes, including the prevention of COVID-19 (Brussow et al., 2022).

Bandura's Social Cognitive Theory Framework supports the *Health Precaution Effect Model*'s focus on how the choice to use or not use health precautions can lead to substantially divergent outcomes. Education—and personal experiences that increase individuals' awareness

of the COVID-19 pandemic—lead to greater utilization of healthcare precautions, which in turn achieves the goal of reducing the adverse impact and spread of the pandemic (Siqueira, 2023).

Related Literature

In their exploration entitled “Who Stays at Home?” Testa et al. used anonymized, aggregated cell phone data to determine individuals’ compliance with government-mandated stay-at-home orders in the United States, Brazil, and Mexico (Testa et al. 2021). In Brazil and the United States, the implementation of stay-at-home orders, along with workplace and school closures, led to notable reductions in mobility. However, compliance with this mandate varied over time, and—both during and after various government-mandated measures were implemented—individuals’ enthusiasm for the measures varied. That variability, as well as the factors that influenced individuals’ changes in health precautions taken (if any), was the focus of my research.

When students were initially sent home from colleges and universities due to COVID-19 in March of 2020, it might have felt unprecedented, but it was not a new health precaution. Other pandemics, such as the Plague of London in 1665 (Kowal et al., 2020), and the Spanish flu in 1918, led to students being sent home from universities to reduce disease transmission (Minot & Loeb, 1918). Despite these precedents, the abrupt transition to online learning due to COVID-19 posed challenges for students (Wang et al., 2020). As discussed by Wang et al., the ability to relate learning content to personal and professional aspirations significantly influenced student engagement during COVID-19. The study highlighted the critical role of personal relevance in maintaining students' interest and revealed that students who were able to connect the learning material with their personal and career goals exhibited a higher level of sustained interest in their courses. This finding underscores the importance of integrating personal relevance into course

designs, particularly in remote learning environments, to keep students engaged (Wang et al., 2020).

Many students, though not all, were eager to get back to learning in a classroom. In a study examining students' preferences for returning to in-person classes amid the pandemic, Steimle et al. (2022) deployed an internet-based survey targeting industrial engineering students at the Georgia Institute of Technology. Conducted in the summer of 2020, the survey garnered a response rate of 20.8%. It presented students with various hypothetical scenarios regarding modes of course delivery and campus safety measures for the fall 2020 semester. The survey revealed three distinct categories of concern among students—low, moderate, and high—regarding COVID-19. Factors aligning with a preference for remaining online included higher perceived risk of infection, a supportive home learning environment, older age, and lower risk-seeking tendencies. These findings suggest a complex set of considerations influencing students' willingness to return to campus environments during the pandemic (Steimle et al., 2022).

In order to investigate the perspectives and behaviors of health science students who returned to in-person learning once it was possible to do so, as well as those who for a variety of reasons chose not to, this dissertation study included both online and on campus students.

The Importance of Handwashing

The origins of systematic handwashing date back to the mid-1800s when Hungarian doctor Ignaz Semmelweis identified the connection between hand hygiene and the spread of childbed fever. Despite facing resistance, his implementation of handwashing significantly reduced maternal mortality. The late 19th and early 20th centuries continued this paradigm shift in hygiene practices. As Louis Pasteur’s research contributed to the understanding of germs and bacteria, figures like Joseph Lister and Florence Nightingale played pivotal roles in advocating

for antiseptic surgery and improved hygiene in medical settings, which led to vast improvements in health and well-being. However, this simple and effective health precaution of handwashing has been periodically neglected, potentially contributing to reoccurring pandemics (Ray, 2020).

It is important to note the potential for discrepancies between direct self-reports and indirect questioning techniques when estimating compliance with COVID-19 hygiene measures. Mieth et al. note that direct self-reports of measures such as hand washing may be influenced by social desirability bias during a health crisis when there is strong public pressure to adhere to health and safety regulations (Mieth et al., 2021). To evaluate this effect, Mieth et al. employed an online survey and utilized the Extended Crosswise Model, an indirect questioning technique ensuring respondent confidentiality. The hypothesis was that if direct self-reports are biased by social desirability, prevalence estimates obtained through the Extended Crosswise Model would be lower than those based on direct self-reports. The results of the analysis involving 1,434 participants revealed a significant difference in the prevalence estimates between the two groups. In the direct questioning group, 94.5% claimed to practice proper hand hygiene, whereas the indirect questioning group reported a significantly lower estimate of only 78.1% (Mieth et al., 2021). The conclusions drawn from these results suggest that direct self-reports may lead to inflated estimates of the level of commitment to hygiene measures due to social desirability. In contrast, the use of indirect questioning, such as open-ended questions, offers a more realistic estimate of people's compliance with hygiene recommendations (Mieth et al., 2021) and influenced my decision to include open-ended questions in my interviews. Drawbacks of Meith et al.'s study include that the sample derived from individuals who self-selected, responding to invitations disseminated through social media platforms including Facebook and WhatsApp, and thus may not be representative. Additionally, because this survey was conducted in Germany, it

is possible that results would have been different in the United States. My study also relied on self-selecting respondents, and it is reasonable to assume that there may be a gap between direct self-reports and indirect reports across populations.

Pre COVID-19: Health Precautions Used

The COVID-19 pandemic caused widespread confusion, as information about the pandemic was dispersed to the public in real time. During the early phase of the COVID-19 pandemic, the mechanisms of transmission and the rate of transmission of the virus were unclear. However, many of the health precautions implemented, such as social distancing, handwashing, wearing masks, vaccinations, and even quarantine, were not new and were similar to health precautions recommended to reduce the spread of the flu and other infectious diseases (Torres et al., 2020).

In 2019, prior to the arrival of SARS-COV-2, Linda Keilman performed research on seasonal influenza (flu), evaluating risk factors, diagnosis, and complications by analyzing collections of influenza specimens (Keilman, 2019). This research determined patient education on interventions was imperative, including strategies like covering the mouth and nose with tissue or an elbow when coughing and sneezing, handwashing frequently, drinking plenty of fluids, informing families of illness, and seeking care with lack of improvements (Keilman, 2019). Another health precaution, staying home from work or school when sick, was a reasonably common practice prior to COVID-19, but it has become much more accepted—and even expected—since the pandemic began (Gambau et al. 2021). Although these studies were not conducted on university students, they motivated me to inquire about the health precautions implemented before the COVID-19 pandemic. Understanding health precautions in use

previously provides opportunity for comparison with SARS-COV-2 and how health science students' perceptions and behaviors might have changed in response to the pandemic.

Additional research performed in 2020 on severe flu management provided information on diagnostic testing and treatment of influenza, with implications for combating SARS-COV-2 as well (Torres et al., 2020). The research concluded that antiviral treatment is needed in treating severe influenza. A PCR diagnosis test is the gold standard to detect the virus, and utilization of standard health precautions, such as handwashing and isolation (patients should be cared for in single rooms when possible) are all essential in reducing the spread of influenza (Torres et al., 2020). Torres et al. also note the possibility of false negative rapid antigen tests, which underscores the need for health precautions such as face masks, social distancing, and handwashing. Especially when in the presence of an individual exhibiting symptoms with an absence of a positive test result.

In other research conducted prior to COVID-19, student volunteers were recruited from a university campus in Northwestern Ohio for a study of hand hygiene. A total of 226 volunteers were recruited, and microbial samples were collected three times from each of the volunteers: before washing their hands, after washing with their own procedures, and after washing with a procedure recommended by the Centers for Disease Control and Prevention (CDC). Each volunteer also completed a survey that included questions about their health conditions, medical visits, and absences from classes or work. The results showed that 57.7% of volunteers had hands colonized by an uncountable number of microbial colonies, which was significantly associated with increased occurrences of infectious diseases ($P < .05$), medical visits ($P < .05$), and a higher tendency towards absence from classes or work ($P = .09$). The CDC-recommended handwashing procedure significantly improved hand hygiene among the participants (Prater et

al., 2016). Prater et al.'s article mentions a relative lack of previous research into the handwashing practices of college students prior to their study in 2016, and it is apparent that this remains a neglected area.

Preventing and Controlling the Coronavirus Disease

The COVID-19 virus, SARS-CoV-2 is primarily spread through close contact (Pan et al., 2022). Thus, spread can occur in many different locations, but especially in closed, densely populated ones (Pan et al., 2022). The research determined SARS-COV-2 remained in the air of a hospital intensive care unit with a detection rate of 3.57% (Pan et al., 2022). Its rapid spread was closely related to its strong contagiousness. The basic reproductive number (R0) of SARS-CoV-2 in the community initially was estimated to range from 1.4 to 3.9 (LiPei et al., 2020; WuLeung and Leung, 2020).

The virus can survive in aerosol form and remain on surfaces for at least 4 hours, so Pan et al. recommended opening doors and windows 2-3 times a day for 0.5 hour to increase natural ventilation (Pan et al., 2022). Pan's research concluded that incorporating COVID-19 health precautions in public places, including social distancing, disinfecting commonly touched surfaces, and utilizing personal protection such as masks and vaccinations, is extremely effective in reducing disease transmission (Pan et al., 2022).

However, although precautions were used, a lack of vaccines initially and imperfect adoption of precautions allowed the virus to mutate over time, often developing variants—such as Delta—that spread at lower exposure levels (Pan et al., 2022). Although these levels were not provided in Pan et al.'s research, outdoor locations such as flea markets and beaches were labeled at low and medium risk due to adequate ventilation and social distancing. Large public locations such as grocery stores and supermarkets were also ranked low to medium risk due to

the same reasons; however, the risk increased when business hours were shortened and the customer density load increased (Pan et al., 2022). Pan's research provides useful background information regarding effective health precautions, but it does not look at individuals' health precaution implementation.

COVID-19: Vastly More Contagious, and Deadly for All Ages, than Influenza

While the fatality rate for younger individuals due to COVID-19 is comparatively low, even among individuals aged 20–29 years the mortality rate following SARS-COV-2 infection is 33 times higher than that associated with seasonal influenza (Ruan, 2020). Ruan's study was based on 4,999 subjects in Asia, but although mortality rates between countries vary, the relationship between the influenza mortality rate and the COVID mortality rate for individuals in their 20's provides ample evidence that COVID is not solely a threat to older individuals, and it should be treated as dangerous for people of all ages (Ruan, 2020). Research showed the case fatality for COVID-19 was 1.38 %. In comparison, the influenza case fatality rate was 0.0962% (Ruan, 2020). For those 60 years and older the COVID-19 case fatality rate was significantly worse, as the chances of survival were only around 95% even without the presence of comorbid conditions (Ruan, 2020).

Effects of COVID-19 on the Body

COVID-19 had an enormous, negative, and lasting effect on Americans' health. Numerous studies document the impact of SARS-COV-2 infection on diverse body systems, with the initial variant tending to attack the lungs and subsequent variants affecting other areas of the body (Dandel et al., 2022). Dandel's research focused on the long-term effects of SARS-COV-2 on the major body systems, identifying that SARS-COV-2 infection caused significant lung tissue damage in severe cases and put individuals at risk for a pulmonary embolism (Dandel

et al., 2022). During the peak of the COVID-19 pandemic, 48.8% of patients hospitalized had pneumonia that required high O_2 therapy, often leading to lung tissue damage as result of its long-term use (Dandel et al., 2022). Dandel's research also indicated that myocardial injuries were detected in 30% of COVID-19 hospitalizations, and 50% of COVID-19 patients had elevated biomarkers such as laboratory tests, pulse, and even blood pressure. Additionally, Satarker et al. note that SARS-COV-2 has led to several neurological disorders in COVID-19 patients (Satarker et al., 2020). Some of the neurological complications include seizures, Guillain-Barre Syndrome, respiratory failure, and meningoencephalitis (Satarker et al., 2020). The long-lasting effects of COVID-19 require education on precautions for SAR-COV-2, as well as on the identification of signs and symptoms.

Flattening the Curve Through Mandate and Individual Action

The urgency to "flatten the curve" of the highly transmissible and dangerous SARS-COV-2 virus led to the widespread adoption of various mitigation strategies on both the personal and institutional levels, as outlined by Villas-Boas et al. (2020). These measures, including social distancing, self-quarantine, and the closure of schools and many workplaces, aimed to reduce the peak load on healthcare systems and cut COVID-19 deaths and health effects significantly. Villas-Boas et al. highlight simulations suggesting that moderate mitigation policies, such as 7-day isolation after symptoms and social distancing for those over 70, could have reduced deaths by about half (Villas-Boas et al., 2020). Their study contributes to understanding the effectiveness of stay-at-home policies by examining changes in travel behavior and health outcomes across the United States. Interestingly, the data showed significant reductions in travel and human encounters even before the state mandates, indicating a proactive response by residents to local policies and perceived risks (Villas-Boas et al., 2020). This evidence

underscores the pivotal role of public compliance and early intervention in managing the spread of COVID-19 and relieving the burden on healthcare systems, and it supports my research into the adoption of health precautions beyond those that are mandated.

Conflicting Mask Recommendations

Initially, the CDC's guidance on masks during the early stages of the COVID-19 pandemic was that healthy individuals did not need to wear them. On February 29, 2020, the U.S. Surgeon General advised the public against buying masks, emphasizing that they were not effective in preventing the public from catching the coronavirus and that they should be reserved for healthcare providers (Laestadius et. al., 2020). As late as March 24, 2020, the CDC maintained that healthy people who were not healthcare workers or caring for an infected person at home did not need to wear masks. However, this guidance changed on April 3, 2020, when federal health officials recognized the significant role of asymptomatic transmission in the spread of the virus. This led to new recommendations that included mask usage for all people over the age of two in public settings, when traveling, or around others in the same household who might be infected (Gostin, et al., 2020). This initial lack of clarity around the efficacy of mask-wearing created confusion and ultimately contributed to mistrust by some segments of the population regarding this health precaution (Laestadius et. al., 2020).

However, Hemmer, Hufert, Siewert, and Reisinger (2021), conducted a literature study encompassing PubMed, the German Robert Koch Institute, and the Centers for Disease Control and Prevention, revealing significant findings on the effectiveness of masks. The study reported that while people are speaking, up to 20,000 droplets ranging from 20 to 500 µM can be emitted per second, with the highest viral load present just before symptom onset. The meta-analysis, of 29 studies on SARS-CoV-2, SARS, and MERS concluded that N-95 masks, surgical masks, and

multi-layer cotton masks all significantly reduce infection risk (relative risk [RR] 0.34 [0.26; 0.45], I2 = 48%). Additionally, model experiments and case reports indicate that by reducing exposure levels, milder disease often results even when infections occur. Hemmer et al. note that although these effects cannot be completely isolated from other preventive measures, such as social distancing and hygiene practices, the evidence for the effectiveness of masks is compelling (Hemmer, et al., 2021).

Additionally, research by Cheng et al. (2020), studying the impact of community-wide mask usage on controlling COVID-19, screened patients presenting with respiratory symptoms at outpatient clinics or hospital wards in Hong Kong and performed epidemiological analysis on confirmed cases. Findings showed that in the first 100 days of the pandemic 961 patients were diagnosed with COVID-19, an incidence rate of 129 per million, significantly lower than in countries without community-wide masking. For comparison, Spain's incidence during the same timeframe was 2,983 per million, Italy's was 2,251, France's 1,152, while the United States's rate was 1,103 per million. The study concludes that community-wide mask wearing significantly contributed to controlling COVID-19 (Cheng et al., 2020). This study helps provide a factual foundation for evaluating health science students' knowledge of the effectiveness of masks in reducing disease spread.

Burnell et al. (2022) investigated the utilization of masks at a Midwestern US university campus during the COVID-19 pandemic. Their research consisted of an observational study with 7,237 participants observed over 24 hours (Burnell et. al, 2022). The study determined that (90% of total participants wore masks during the 24-hour observation period, including 96% who wore masks indoors, and 88% who wore them outdoors (Burnell et al. 2022). The observation of participants took place during the fall of 2020 when students were taking in-person and online

classes. The standard COVID-19 protocol at this time was that masks were required indoors except when eating, and outdoors if 6ft social distancing was not possible (Burnell et.al, 2022). University mask standards followed CDC standard guidelines and were posted on all building entrances, along with a description of how the mask should be worn. This study demonstrated students' significant adoption of the required health precaution requirement of mask-wearing during this time period. However, this study did not assess students' attitudes toward the mandate, or their willingness to wear masks off-campus, nor did it relate students' majors or academic level to their health precaution choices.

Another study, the Trojan Pandemic Response Initiative, surveyed 9,653 university students, staff, and faculty at a large, diverse university in Los Angeles, California. This study demonstrated the significant differences in attitudes and behaviors related to mask-wearing between older adults (primarily faculty and staff) who demonstrated greater willingness to engage in mask-wearing than the younger adults, who were primarily students (Nicolo et al., 2023). The research also determined there was a significant difference in mask-wearing between participants who had had COVID-19 and those who had not, with a $p=0.004$ (Nicolo et al., 2023). Mask-wearing in comparison of students to faculty and staff showed significance with a $p<0.0001$(Nicolo et al., 2023). Data collection occurred at two points in time, November 2021, and April 2022, to measure changes (Nicolo et al., 2023). Various independent variables, including sex, age group, race and ethnicity, political affiliation, and the history of COVID-19 were analyzed (Nicolo et al., 2023). Surveys were conducted electronically, with participants responding to an email invitation, and were thus subject to response bias (Nicolo et al., 2023). A majority (62.1%) of the respondents were female, Caucasian (39.6%) or Asian (34.6%), and the majority (79.1%) did not have a self-reported history of COVID-19 (Nicolo et al., 2023). The

research study demonstrated Caucasian and Asian participants reporting a lower number of COVID-19 cases. However, the study determined that demographics alone did not determine mask-wearing behavior, which was multifactorial. Nicolo et al. explored how political party affiliation impacted mask-wearing behaviors during the COVID-19 pandemic. Their findings indicate that Republicans, who generally reported lower intentions of wearing masks, were more influenced by normative messages about mask-wearing than Democrats. This suggests that making people aware of the high prevalence of mask-wearing among Americans could increase intentions to wear masks, especially among Republicans. Although these students were not (necessarily) in the health science field, this research provides valuable information due to its being a two-point-in-time study, and providing information about respondents' age, race, sex, and history of COVID-19 infection.

During a cross-sectional study conducted from February 15 to April 11, 2021, Clark et al. (2023), observed face mask usage among 2,808 students at the University of Colorado, Boulder, and 3,225 students at Colorado State University, in addition to 52 other institutes of higher education (n = 100,353 observations) spanning 21 states and the District of Columbia. The study found that students' responses to survey questions on masking were highly correlated with the actual observed rate' of mask usage, with 92.9% of students at the University of Colorado and 89.8% at Colorado State University acknowledging the benefits of masks in reducing the spread of COVID-19 (Clark et al., 2023). Despite the potential influence of social desirability bias on survey and interview responses, the correspondence demonstrated in Clark et al.'s study between self-reported attitudes and observed masking behaviors suggests that students' stated opinions are likely reflective of their actual practices (Clark et al., 2023). Additional research, including

interviews, will help to elucidate health science students' health precaution decisions and the extent to which COVID-19 has affected their knowledge, perceptions and behaviors.

Perception of Health Precautions of COVID-19

Facente et al.'s study (2022) provides insightful analysis of individuals' decision-making processes during the COVID-19 pandemic. As part of UC Berkeley's COVID-19 Safe Campus Initiative (BCSCI), conducted in the summer of 2020, this research utilized both qualitative and quantitative methods. It involved interviews with 30 participants and analysis of survey data from 3,324 BCSCI participants. Contrary to popular beliefs about the irresponsibility of college students during the pandemic, the study found that students displayed rational decision-making in risk behaviors akin to non-students. Decisions were influenced by factors like perceived susceptibility to severe disease, the need for social interaction, and concerns about others' safety. Although Facente et al. note that 57.5% of students and 35.1% of non-students found it challenging to comply with COVID-19 mandates (citing essential needs, social isolation, and concern for high-risk individuals as key reasons), the research showed no significant differences in behavior between students and non-students. These findings underscore the potential effectiveness of a harm reduction approach in public health, balancing the challenges in adhering to COVID-19 mandates with the need for social interaction and communal welfare (Facente et al., 2022). The researchers acknowledged the limitation of the interview portion of their study not being large enough to generalize the findings. My research fills gaps in understanding students' precaution choices by encompassing health science students and additional research interviews.

COVID-19 Monitoring at Universities

A study of the University of Florida's surveillance approach, which monitored the spread of COVID-19 within the student population, noted the importance of college campus operations, COVID-19 contact tracing, and incorporating health precautions such as frequent testing to reduce its spread (Klann et al., 2022). The surveillance efforts of the research were supplementary to the university's weekly symptom-based screening that was administered every 7 days via questionnaire to report COVID-19 symptoms (Klann et al., 2022). Health precaution checks were conducted in college face-to-face courses to ensure students in the general population completed COVID-19 testing every 14 days, those in fraternities and sororities were tested twice weekly, and university athletes were tested three times/week prior to competitions. Although the surveillance system at the university monitored ways to reduce COVID-19's spread, this strategy did not appear to be particularly effective. Researchers theorized that previous increases in spread may have been attributed to a lack of reporting, to students not consistently following the university's COVID-19 protocols or failing to self-report positive contacts (Klann et al., 2022). The study noted the need for substantial funding to effectively conduct a COVID-19 surveillance system at such a large university. Additional research is needed to assess how university students felt about the COVID-19 surveillance tactics used.

Another attempt to get ahead of the spread of COVID-19 traced the contacts of college students after a spring break trip to Cabo San Lucas, Mexico. Reports showed a 28% positive rate for SARS-CoV-2 among tested individuals, revealing the substantial presence of asymptomatic cases (21% of those who tested positive had no symptoms), and emphasizing their role in transmission, especially in younger populations (Lewis et al., 2020). The absence of distinct symptoms such as fever, cough, sore throat, and headache complicates case tracking, as

they occurred similarly in individuals with positive and negative test results (Lewis et al., 2020). The study emphasized the challenges of relying solely on symptom-based approaches to testing, advocating for a more comprehensive strategy in the face of varied and potentially overlapping symptoms (Lewis et al., 2020).

A study conducted by two Boise State University professors, Utych and Fowler (2020) evaluated the effectiveness of age-based messaging strategies related to COVID-19, considering the prevailing focus on the virus's disproportionate impact on older individuals. Much of the existing messaging has centered on the higher risk and severity of symptoms among older people, potentially influencing public perceptions. However, the study's experimental approach found that messages emphasizing threats to older Americans were not more effective than purely informational messages in inducing behavioral or attitudinal changes toward COVID-19. Importantly, the findings suggested that highlighting threats to younger Americans could help younger individuals more realistically assess COVID-19 risk. Given that younger people are considered crucial in preventing the virus's spread, tailoring messaging to address their perceived susceptibility may be more effective. This aligns with the concern that exclusive focus on the effects of COVID-19 on older individuals may contribute to generational divides and reduce concern among younger generations (Aronson, 2020). The study recommends a reconsideration of COVID-19 messaging, suggesting that exclusive focus on the impact on older Americans may be ineffective. Instead, a more balanced approach that acknowledges the threat to both older and younger Americans could potentially induce positive behavioral changes to prevent the virus's spread. My research allows for a better understanding of how students in the health science field received and responded to COVID-19 messaging.

Another study looking at effective messaging, by Ball and Wozniak (2021), investigates the resistance towards COVID-19 prevention measures like mask-wearing and social distancing utilizing psychological reactance theory. The research examines factors such as message fatigue and the perceived importance of the issue in relation to non-compliance with CDC guidelines. The study involved 268 U.S. residents aged over 18, who responded to a survey about their views on general COVID-19 messaging and a specific message they recalled (Ball & Wozniak, 2021). The results, analyzed through structural equation modeling, showed that the sense of freedom being threatened by a COVID-19 message was positively influenced by message fatigue and negatively influenced by the perceived importance of the issue. This sense of threat to freedom was linked to higher levels of reactance, which in turn correlated with lower adherence to COVID-19 preventive behaviors, particularly in social rather than hygiene-related contexts (Ball & Wozniak, 2021). Although this research was not conducted on university students, it attempts to understand the factors at play in individuals' attitudes and behaviors related to health precautions. It also discovered a distinction between individuals' responses to social health precautions, versus hygiene-related precautions, which is important to investigate further in a university health science student population.

Lee et al. researched the attitudes and behaviors of university students and staff at the University of Southern California in Los Angeles regarding the COVID-19 booster vaccine (Lee et al., 2022). Data was collected from an ongoing survey of university students and staff via email from a list of all current students, staff, and faculty who were at least 18 years of age in May 2021. From the recruitment email sent to staff and students at the University of Southern California, 2,876 students and 2,380 staff/faculty completed the survey. The purpose of the research was to collect data on willingness to receive the third vaccine and correlate these

attitudes with demographic data. The research determined that of the 3,668 participants, 96.2% stated a willingness to get a COVID-19 booster at least once per year or as often as necessary. The research also noted the importance of addressing and understanding cultural beliefs underlying vaccination hesitancy given the historical trauma experienced by various demographics (Lee et al., 2022). Despite the findings of this survey, interest in yearly COVID-19 vaccines has waned significantly among the general American public, with the Centers for Disease Control reporting that only 21.8% of U.S. adults have had the most recent version as of early 2024 (CDC, 2024).

Attitudes towards COVID-19 Restrictions

Research on attitudes toward COVID-19 restrictions has become of great interest since the pandemic. Kennedy et al. focused on first-semester liberal arts college students in the Midwest region in 2020 (Kennedy et al., 2022). The participants, aged 18-26, reported a sense of "invincibility" due to their relatively low rates of illness and death resulting from SARS-COV-2 (Kennedy et al., 2022). Despite this sense of invincibility, participants reported some fear of COVID-19, as well as negative attitudes about the health precaution restrictions. Data showed in comparison to a set $P < .001$ when the questions were asked the first time whether COVID-19 invoked fear and attitudes about restrictions it determined $p=.013$, the second time the question was asked the $p=.01$, and the third time the $p=.002$, indicating a level of significance (Kennedy et al., 2022). The conclusion that can be drawn is that, because COVID-19 invoked fear, and attitudes about restrictions had a p value lower than 0.5 it would be significant. The majority of participants in this study were Caucasian (61.5%) and 72.1% were female (Kennedy et al., 2022). The study notes that compliance with health precautions at the start of the pandemic was substantial due to participants' desire to reduce the spread of COVID-19. Further research,

interviewing participants, would be valuable to understand why some college students felt invincible in the face of the pandemic, and how their attitudes evolved over time.

COVID-19 and Vulnerable Populations

Qualitative research conducted during the COVID-19 pandemic has explored the experiences of vulnerable populations. Vulnerable populations in this context refer either to individuals at higher risk of contracting COVID-19, or those who would be more likely to experience severe illness or death if they do become infected. This group encompasses older adults and individuals with compromised immune systems due to various chronic health conditions such as diabetes, autoimmune diseases such as Lupus or Multiple Sclerosis, cardiovascular or kidney diseases, or because they are undergoing immunosuppressive therapies (Webber-Ritchey et al., 2020).

According to research conducted by Singson et al. on 22,345 adults admitted to hospitals in 10 U.S. states between March 1—February 28, 2020, immunocompromised adults accounted for 12.2% of adult COVID-19 hospitalizations, despite representing only 2.7% of the adult population. These patients thus had significantly higher odds of ICU admission or in-hospital death compared to non-immunocompromised patients, even after adjusting for demographic and clinical differences. In addition, although vaccination provided some protection, its effectiveness in preventing severe outcomes was lower in immunocompromised individuals compared to the general population (Singson et al., 2022). This research is included in this dissertation to provide a factual framework for understanding COVID-19's greater impact on the immunocompromised. Because study participants were asked to assess the severity of COVID-19 on immunocompromised individuals, this baseline research is necessary

Conducting Research during COVID-19

Conducting research during the pandemic was challenging, and in particular, Gregory et al. (2020) notes that COVID-19 posed challenges for qualitative researchers who rely on non-verbal cues, as telehealth services limited their ability to observe such cues (Gregory et al., 2020). To gather insights into participants' behaviors, assess social interactions, and gain a deeper understanding of their environments, Webber-Ritchey et al. employed qualitative research methods including analysis of visual and textual data as well as interviews (Webber-Ritchey, 2020). The current study on health science students was conducted via Microsoft Teams rather than in person, leading to some of the same limitations in the ability to observe participants' full range of behaviors.

Compliance with COVID-19 Precautions among University Students

Research performed by Shumway et al. (2021), surveyed compliance with COVID-19 precautions amongst 600 undergraduate students attending two universities in Utah County using a survey distributed via Qualtrics. Students were recruited by incorporating surveys into homework assignments, and students who opted not to participate in the research survey were given an alternate assignment worth the same number of points. The survey was administered to college students in non-major biology classes and those taking entry-level biology courses. The research excluded college students over the age of 39, as their study focused on the representation of a typical undergraduate student. This research noted that in 2021 the importance of non-pharmaceutical interventions, such as wearing masks, social distancing, washing hands, and sanitizing surfaces was emphasized (Shumway et al., 2021). Because the students surveyed were exclusively those in one geographical area (Utah) it is possible that this affected the results of the research. The inclusion of students in the American South would give

another geographical perspective, and the inclusion of health science students at the bachelor's, master's, and doctoral levels would allow for comparison and contrast between and among different levels of students working toward careers in the health field. My study included students at these educational levels to provide a better understanding of the influence of formal education, as well as lived experience on the knowledge, perceptions and behaviors of students pursuing each of these academic degrees.

In another study, Bruchmann et al. (2021) assessed students' attitudes regarding the permissibility of violating COVID-19 public health guidelines at a private university in California. Participants were asked to complete a questionnaire regarding their thoughts on violating the COVID-19 mandates. Participants were granted course credit upon completion of the research questionnaire. The research indicated the importance many participants placed on following their own personal COVID-19 prevention behaviors. The research sought to understand undergraduate students' opinions and evaluate potential behavioral changes related to wearing a mask, washing hands, six feet of social distancing, and the COVID-19 vaccine (Bruchmann et al., 2021). Behaviors in the questionnaire were categorized by students as either major, minor, or reporting (requiring school official notification) violations (Bruchmann et al., 2021). The research determined the significance *(P< 0.001)* of reporting major COVID-19 guideline violations with a *p-value of 0.033* participants for students who identified as liberal. Conservative participants considered minor COVID-19 guideline violations more morally permissible with $p = 0.008$ (Bruchmann et al., 2021). The research also determined that liberal participants considered it more permissible to report other people's COVID-19 violations $p = 0.008$ (Bruchmann et al., 2021). More research is needed on the factors that contributed to

university students following or violating schools' health mandates during the COVID-19 pandemic, as well as on behavior outside the university setting.

University COVID-19 Mitigation Plan

During the midst of the pandemic in 2020 research was conducted on college campuses focused on incorporating a COVID-19 mitigation plan. More than 2,000 colleges were evaluated, with 20 million student and faculty participants. The research examined the health precautions of social distancing, mask-wearing, and isolation to determine how to operate more safely. The research determined that mask-wearing reduced the spread of SARS-COV-2 between 44% and 82% on college campuses, and that combining mask-wearing and social distancing reduced COVID-19 infections by an average of 87% (Losina et al., 2021). Based on this research, limited contact hours for students were enforced to reduce the spread of the COVID-19 pandemic. The study did not detail the universities' experiences incorporating the COVID-19 mitigation plan, nor any challenges they may have faced. Surveys could have included questions on attitudes towards health precautions among university students and staff. Information regarding the department of the participants could have helped to determine factors that contributed to the relative success of this mitigation plan. My research includes interviews and observations to discover why health science students did or did not decide to incorporate specific health precautions.

COVID-19 Vaccine Availability and University Requirements

When vaccines initially became available, several obstacles impeded the vaccination efforts, including supply shortages, inefficiencies in vaccine delivery, and widespread hesitancy among the population (Creech et al., 2021). These challenges constrained the ability to achieve the level of vaccination necessary to achieve "herd" (population) immunity. A critical

consideration arose regarding the optimal approach: whether to prioritize broad coverage by administering a single dose, particularly for the two-dose vaccines, or to prioritize maximum protection by strategically reserving doses for the second shot. According to briefing materials from the US Food and Drug Administration for Emergency Use Authorization, the Moderna vaccine exhibited greater than 80% efficacy two weeks after the initial dose, while the Pfizer-BioNTech vaccine exhibited at least 50% efficacy after the first dose (Creech et al., 2021). Despite vaccination being a pivotal strategy to curtail the pandemic, the difficulty of getting enough people vaccinated initially led to the emergence of various variants, including Delta and Omicron, that resulted in subsequent waves of serious illness and death after an initial lull (Creech et al., 2021).

Although schools transitioned to online education during the COVID-19 pandemic (Bhagat et al., 2020), once vaccines were available for all age groups most U.S. colleges and universities chose to reopen campuses. However, many schools require students who wanted to return to in-person classes to get the initial dose before starting their fall 2021 semester (Block, 2021). Block's research noted that although immunization for measles and meningitis has long been required, many people expressed feeling as though the COVID-19 vaccination requirement was contrary to the law (Block, 2021). The research was important, as it examined attitudes regarding vaccine mandates at colleges and universities. However, it lacked a distinction between university-level use of health precautions such as the vaccine requirement, wearing masks and six-feet distance protocols, and individuals' use of personal health precautions such as social distancing, hand washing or wearing masks while not on campus, which are also important to understand.

A study conducted among 151 University of Michigan students, two years post-COVID, revealed that 60.3% of students had tested positive for COVID-19, with a higher prevalence among female students (69.7%) compared to male students (50.7%) (Hu et al., 2022). The study delved into vaccination data, indicating a commendable overall vaccination rate of 95.4% for one dose and 46.4% for full vaccination (Hu et al., 2022). The study provided insights into the factors contributing to the high positive test rate, including that only 35% of those who tested positive were fully vaccinated. The full vaccination rate fell short of the level required for population immunity, and the students' behaviors included more large group activities than is typical of older individuals not in an educational setting (Hu et al., 2022). Interestingly, however, the vaccination rates for college students exceeded the Michigan state average (Hu et al., 2022). This research indicates that increasing full vaccination rates, as well as other health precautions, will help reduce the rate at which college students' contract COVID and potentially transmit it to others (Hu et al., 2022). This dissertation research did not ask participants for their vaccination status, or their perception of the COVID-19 vaccine, but understanding its effectiveness in university settings allows for evaluation of study participants' knowledge and perceptions.

Lee et al. researched the attitudes and behaviors of university students and staff at the University of Southern California in Los Angeles regarding the COVID-19 booster vaccine (Lee et al., 2022). Data was collected from an ongoing survey of university students and staff via email from a list of all current students, staff, and faculty who were at least 18 years of age in May 2021. From the recruitment email sent to staff and students at the University of Southern California, 2,876 students and 2,380 staff/faculty completed the survey. The purpose of the research was to collect data on willingness to receive the third vaccine and correlate these attitudes with demographic data. The research determined that of the 3,668 participants, 96.2%

stated a willingness to get a COVID-19 booster at least once per year or as often as necessary. The research noted the importance of addressing and understanding cultural beliefs underlying vaccination hesitancy given the historical trauma experienced by various demographics (Lee et al., 2022). Despite the findings of this survey, interest in yearly COVID-19 vaccines has waned significantly among the American public, with the Centers for Disease Control reporting that only 21.8% of U.S. adults have had the most recent version as of early 2024 (CDC, 2024).

Preparing for Medical Emergencies

A study performed on disaster preparedness among medical students determined that 70% of participants felt unprepared to participate in health emergencies such as the COVID-19 pandemic (O'Byrne et al., 2020). The research determined that a shift in the content of medical education is needed to prepare health/medical students for future pandemics. O'Byrne et al.'s study identified this population as one where additional exploration will be particularly useful, because the study's results could be used to help a wider group of people, including academic departments at universities who want to prepare their health science students to be effective advocates for health. My research study on health science students at all university levels is an important part of this ongoing investigation. This population will go on to develop additional health information and will be tasked with disseminating it to the public, as well as to university students as some current students are, or will become, university instructors. Communication skills, and specifically the ability to convey complex scientific concepts to those who lack science background, will be key.

Communicating Scientific Concepts to Lay People

Enhancing the ability to convey scientific concepts to a lay audience necessitates intentional effort and a mindful approach to language. Experts, deeply immersed in their fields,

may find it difficult to remember how hard it was to understand new terms or concepts, making effective communication with non-science majors, including family, friends, and colleagues, more challenging (Brownell, et al., 2013). However, health science knowledge that is not well communicated cannot do the good it has the potential to do. Scheufele (2013) points out that, in many ways, the very same skills scientists are taught in school—the ones that allow them to be objective and unemotional—can be problematic when communicating with lay people who do not share this education, worldview, or vocabulary. More than 15 years ago Larry Page, one of Google's founders, told attendees at the annual meeting of the American Association for the Advancement of Science (AAAS) in 2007 that science was having a "serious marketing problem" (Scheufele, 2013, p. 14042). This is still the case today, and health science students have the potential to help the lay public understand the importance of cutting edge, as well as "tried-and-true," scientific information.

Based on data collected by surveys conducted bi-annually by the National Science Board, Scheufele writes that Americans tend to know less about science, on average, than citizens in other industrialized nations. These surveys indicate that knowledge of basic scientific facts among US adults has been low ever since the surveys began in 1979. The surveys also reveal that, in addition to limited factual understanding, American adults demonstrate inadequate understanding of the scientific process or the ability to differentiate between a reliable scientific study and one that is not well-designed/conducted. Results showed only 51% of respondents to the 2012 survey were able to identify the correct definition of an experiment in a multiple-choice format, and only 18% could describe the components of a scientific study (Scheufele, 2013).

Ralph Cicerone, President of the National Academy of Sciences, warned in 2006 that scientists "must do a better job of communicating directly to the public" (Scheufele, 2013, p.

14042). Since then, the AAAS, the National Science Foundation, and many universities have begun training scientists how to interact with journalists or other nonacademic audiences. According to Scheufele's research, however, these programs do not always take into account individual-level elements underlying human decision-making. Nor do they necessarily use best-practices when it comes to teaching scientists to communicate in lay circles at both the micro/individual level or the macro/social level (Scheufele, 2013). According to Scheufele, the less knowledge individuals have about an issue, the more likely they are to use other information, whether from a religious or political frame or information from trusted family, friends and colleagues (Scheufele, 2013).

Early in the COVID-19 pandemic, Fridman et al. (2020) conducted a study in mid-April 2020, aimed at identifying trust levels in various sources of information to aid policymakers in effectively disseminating crucial information. The study investigated the relationship between trust in these sources and accurate knowledge about COVID-19. Consistent with past research, the results indicated that both knowledge and trust influenced adherence to social distancing guidelines. Results from Fridman et al.'s 2020 study indicated that respondents who expressed greater trust in government sources such as the CDC or FDA were significantly more likely to demonstrate accurate knowledge about COVID-19 than respondents who indicated that they trusted private news sources, such as CNN, FOX News, or social media inclusive of Twitter and Facebook (Fridman et al. 2020).

During the period of data collection for Fridman et al.'s study, the Mid-Atlantic region of the United States recorded the highest COVID-19 prevalence rates, and the lowest trust in CDC and FDA sources, with only 60% of respondents trusting these sources compared to 70.3% of the general U.S. population (Fridman et al., 2020). This suggests a significant disparity in public

trust across different regions crucially affecting public health responses and warrants further study into the precursors of trust. As well as the role health science students and other health professionals could play in helping the public make sense of information.

Ensuring the dissemination of accurate science knowledge, respectfully, is key. However, according to Reincke, Bredenoord and van Mil (2020), several studies conducted both in Europe and the United States indicate that the majority of scientists still adhere to a so-called "deficit model" when interacting with non-scientists. This model posits that scientists and other experts possess crucial knowledge that non-scientists lack, and that the primary purpose of science communication is to "fill the knowledge gaps" in a one-way flow of information from expert to layperson (Reincke, et al. 2020). Although the idea that scientists—or health science students—know more about specific science topics is reasonable. It does not necessarily follow that people will accept the science unless scientists can integrate the social or economic concerns of the community. This critique by Reincke et al., referencing works such as Davies (2008), Dudo and Besley (2016), Nisbet and Scheufele (2009), and Jasanoff (2011), suggests that a communication model based on dialogue, and of meeting and understanding people where they are, will be more effective than simply attempting to impose and enforce health mandates (Reincke et al., 2020).

Because health topics are often discussed on social media and within families, can increase the spread of misinformation (Dryhurst et al., 2020). Health science students who are prepared to communicate respectfully—and listen effectively—play an essential role in informal spaces, as well as in their professional roles. Research has shown that fostering deeper conversations related to health communication better equips the community to improve health outcomes (Bauer, 2009).

Bandura's Social Cognitive Theory also notes that, in addition to learning in academic settings, students need to have opportunities to apply their information in the real world to gain mastery. Research by Pajeres and Usher (2008) focused on applying Bandura's SCT to the elements that increase students' motivation to learn, including the opportunity to apply their learning to make a difference for those they care about (Pajares and Usher, 2008). They showed that—as expected based on Bandura's theory of reciprocal determinism—students demonstrated greater engagement in their studies, and consequently greater learning of the material, when they were motivated to apply their knowledge to something they had a personal connection to (Pajares and Usher, 2008).

Summary

This literature review provides a foundation for the current dissertation study on the perceptions and use of health precautions by health science students. Establishing the effectiveness of standard health precautions allows for an evaluation of participants' responses to determine their level of knowledge of SARS-COV-2 and better understand factors that may have influenced them.

Through the lens of Albert Bandura's Social Cognitive Theory, the study aims to understand the shifts in knowledge and perspectives in relation to students' sense of self-efficacy, their educational or professional learning, and their perceived personal or familial vulnerability to the virus. Bandura's SCT notes the importance of mastery experiences in a variety of environments to grow the necessary combination of skill and confidence (Bandura, 1986). This theory, along with the Health Precaution Effect Model, assists in examining how decisions to use or not use health precautions have evolved over the course of the pandemic, and why.

The research addresses gaps in existing literature concerning changes in health precaution behaviors post-COVID-19. It suggests a need for continued research into how education, personal experience, and perceptions of public health messages influenced compliance and lays the groundwork for potential next steps. Focusing on health science students, who can be expected to have some academic knowledge related to disease transmission, permits investigation into other aspects of professional or lived experience that may affect perceptions and behaviors. Understanding the perspectives of this study population, the majority of whom plan careers on the front lines of healthcare, health policy creation, advising, and crisis management, will leverage any potential findings in service of improved public health.

CHAPTER THREE: PROPOSED METHODS

Overview

The purpose of the research was to understand the knowledge, perceptions, and behaviors regarding health precaution usage in response to COVID-19 among health science students at Liberty University, George Mason University, and Norfolk State University. The study also investigates the factors underlying students' choices regarding various precautions. The problem was the limited amount of research evaluating the use of health precautions, such as mask-wearing, social distancing six feet and handwashing by health science students, and how or whether students' health science education and lived experiences influenced their use of health precautions.

Design

The methods of the research include the research design, the identification of the research questions, procedures, how the data was collected, and the data analysis. This research included surveys to obtain information about health science students' knowledge, attitudes, and behaviors

concerning health precautions used before and during the COVID-19 pandemic. All participants who completed the survey also participated in interviews, and observations of the participants were conducted during the interviews and reviewed by analyzing the audiotaped interviews and transcripts.

The study consisted of quantitative and qualitative research. The mixed method design was essential for better understanding choices health science students made regarding health precautions, and the reasons underlying their choices. A phenomenological method, broken down into four steps, was used: bracketing, intuiting, analyzing, and describing (Greening, 2019). Bracketing was used to discern the purpose and intent of the research. Intuiting was used in the development of the participant questions to ensure that participants did not feel guided toward answers, and that they felt comfortable sharing their attitudes and behaviors. In addition, some questions were intentionally broad to elicit information the researcher may not have anticipated, leading to a richer understanding of the experiences and perspectives of the participants. Phenomenology originated from philosopher Edmund Husserl and focuses on examining "knowing or cognition back to their fulfillment by fully understanding the experiences of thinking and knowing" (Stolz, 2020). The analysis of the research occurred following the collection of the data from the surveys, the coding of interviews, the integration of observation data, and the development of themes. The phenomenological method of describing is exemplified in the reporting of research results. The phenomenological design was appropriate for this research study as it encompasses social construction, practice, and social change (Maulana et al., 2022). This specific design was selected as it provided viable data for the research study. The integration of the phenomenological study, survey and interview methodologies, allows for analysis of the effect of the COVID-19 pandemic on the use of health

precautions by health science students, along with providing insight into their perceptions and the factors that influenced them.

Research Questions

Central Question: What effect has the COVID-19 pandemic had on standard health precautions taken among Liberty University, George Mason University, and Norfolk State University health science students?

Sub-question 1: How has the aftermath of the COVID-19 pandemic affected health science students' knowledge, perceptions, behavior, and sense of self-efficacy?

Sub-question 2: How has health science students' awareness of potential infection exposure mechanisms been affected since the start of the COVID-19 pandemic?

Site

Liberty University, George Mason University, and Norfolk State University were selected for data collection as these universities are in the Southeast. This is a geographical area that has not been extensively studied with respect to COVD-19 health precaution, perception, and utilization. All three school have bachelor's, master's, and doctoral programs, and allow students to choose between online, in-person and hybrid programs. These three schools vary substantially in their student demographics with respect to gender and ethnicity. One of the schools, Norfolk State, is a historically black college/university (HBCU) and the other two are not.

George Mason's student population is: 39% White/Caucasian; 19% Asian; 14% Hispanic/Latino; 11% Black/African American; 4% two or more ethnicities; less than 1% Pacific Islander; less than 1% Native American; 10% international students whose ethnicities were not reported, and 5% who did not report their ethnicity. In terms of gender, approximately 51%

identified as male, approximately 49% as female, and .5% did not report a gender identification (George Mason University, 2024).

Liberty University's student population is 50% White, 14% Black or African American, 7% Hispanic or Latino, 3% two or more races, 2% Asian, 0.5% American Indian/Alaska Native, and 0.25% Native Hawaiian/Other Pacific Islanders. In terms of gender, 58% identified as female, 42% identified as male, and no data was available for non-binary students (Liberty University, 2024).

Norfolk State University's website does not list student demographics but according to US News & World Report the 2023 student population is: 83% Black or African American, 5% two or more races, 5% Hispanic or Latino, 3% White, 0.5% Asian, less than 1% American Indian/Alaska Native, and less than 1% Native Hawaiian/Other Pacific Islanders. In terms of gender, 67% identified as female, and 33% as male; no data was available for non-binary students (US News and World Report 2024).

Participants

The research sample consisted of thirty-five total health science students across the three universities. Purposive sampling was used to collect input from students based on their responses to survey and interview questions to obtain trustworthy and reliable data (Campbell et al., 2020). Convenience sampling procedures were utilized. This sampling allowed the opportunity to distribute surveys electronically for data collection from willing participants. In 2021, Stratton performed research concerning convenience sampling strategies and how to select a strategy that would best represent the targeted population (Stratton, 2021).

For the purposes of this dissertation research, four age groupings were delineated. Given the desire to include health science students at the undergraduate, master's and PhD levels, the

age range groupings for this study encompassed 6 to 8-year increments (18-24; 25-32, and 33-41) except for the most senior group, which comprised 42–64-year-olds. Previous research performed by the Brookings Institution used similar age ranges (18-24; 25-29; 30-39; 40 and above) when analyzing U.S. university students' ages which supports the age groupings used in my research (Brookings 2017). Students under 18, who are often excluded from research studies because they are legally unable to provide consent for themselves, were excluded from this dissertation research.

Inclusion criteria included online and in-person health science students at the bachelor's, master's or PhD level enrolled at Liberty University, Norfolk State University, George Mason University. Exclusion criteria eliminated students outside of Liberty University, Norfolk State University, or George Mason University, majors other than health science, those less than 18 or older than 64 years old.

Students were fully informed that they must give their consent to participate, that participation was strictly voluntary, and that participation would not impact their academic progression or performance in any way. Study responses remain anonymous, with only demographic data collection concerning gender, ethnicity, race, and level of academic attainment.

The Researcher's Role

The responsibility of the researcher is to gather data to answer the central questions of the investigation. Building a strong rapport with participants was crucial, as it ensured their comprehension of the study's significance and encouraged their candid participation in surveys and interviews. The focus on health science students allowed the researcher to build upon information and experience the researcher has gained through their academic health studies, their

work in the health field and their own lived experience of the COVID-19 pandemic. This research involved peers at Liberty University, George Mason University, and Norfolk State University who are also pursuing degrees in the health sciences. The study initially reached out to 12 universities in Maryland, Virginia, and the District of Columbia that offered a health science major. Only the three schools listed chose to participate. Universities that opted out reported survey fatigue affecting their own doctoral students who were conducting research, and some universities required department approval before starting an IRB process at the individual school. Once approved, the health science departments distributed recruitment and consent forms to all students who met the inclusion criteria. This alleviated bias in that it was not sent to participants based on criteria other than attendance at the participating universities and health science student status. Participants decided whether they wanted to participate in the research, which may have resulted in selection bias, however the criteria for inclusion and exclusion were designed to avoid other biases and obtain a diverse participant pool. As an online student, professional distance from other students precluded potential bias in the relationship between the researcher and the subjects. The research was dedicated to the meticulous collection, analysis, and dissemination of data.

Procedures

The procedures entailed the role of the researcher, data collection, surveys, interviews, observations, trustworthiness, and ethical considerations.

Steps of the Procedure:

1. A permission request letter was sent to the Dean of the Health Science Department, requesting the use of graduate students in the Health Science Departments at Liberty University, George Mason University, and Norfolk State University to participate in the

research as a requirement for my Doctoral degree.

2. The Liberty University Institutional Review Board (IRB) application was submitted on Cayuse for review and approval prior to the start of the research. Once approval was granted by the Liberty University Review Board, the research commenced.
3. Following the approval from the Liberty University IRB, a screening tool was provided to Liberty University's Health Science Department on the requirements to participate in the study. Those requirements to participate in the study included being a health science student at Liberty University, Norfolk State University, and George Mason University between the ages of 18-64. The original approved IRB was sent to all participating universities to identify whether the IRB from the researcher's university would be sufficient for recruitment from other universities or whether an additional IRB application would be required for submission. Although all universities were excited about the topic and results of the research, not all universities were in favor of comparing/contracting the responses of the students based upon their university. It is for this reason that responses based on participants' university were not compared in the research.
4. The purpose of the research, and the methods of the research, were given to potential participants before the start of the study via a recruitment email. In the recruitment email, the participants were requested to contact the researcher via email to confirm their eligibility to participate in the research and schedule an audio-recorded interview (30-45 minutes) about the health precautions of the COVID-19 pandemic. The research study recruitment process was amended after four months with the IRB to include an incentive of a $10 Amazon gift card to participants after completion of all parts of the study,

including the signed consent form, the research survey, and interview.

5. A signed consent form was required from all participants. The signed consent form was attached to the recruitment email. If the participant chose to participate, they signed the consent document and returned it to the researcher via email.
6. Following retrieval of the participant's consent form via email, a survey link was distributed to the participants. The survey took approximately fifteen minutes to complete and included eight questions. The survey questions were analyzed quantitatively based on age, gender, academic degree level and ethnicity.
7. An interview was conducted with the research participants following the completion of the survey. Observation was performed during the interview to gather additional information from the participants as they answered the interview questions. The interviews took approximately 30-45 minutes to complete and were audio recorded. The audio recording was password protected. The data collected were analyzed qualitatively by transcribing the interviews and coding to find both themes and patterns.

The Institutional Review Board (IRB) reviewed and approved the study before research began.

Data Collection and Analysis

The data collection methods used within this research included surveys, interviews, and observation. The quantitative data was analyzed using the Fisher test to examine the categorical data for potential differences. Codes such as "Participant 1" were used to protect participants' names. The sub-research questions investigated how the COVID-19 pandemic affected health science students' knowledge, perceptions, behavior, and sense of self-efficacy, as well as how health science students' awareness of potential infection exposure had been affected since the

start of the pandemic.

Manual thematic analysis was performed to identify the themes within the research. This analysis was used to evaluate the collected data from the online surveys as well as the responses to interview questions, and observations during the interview.

The quantitative data collected via surveys were statistically analyzed to determine if there were any significant differences. The statistical Ho: There is no difference in the COVID-19 health precaution use among health science students at Liberty University, Norfolk State University, and George Mason University that can be attributed to the COVID-19 pandemic. To determine a level of significance an alpha level of 0.5 was used as a cutoff. For the $P > 0.05$ the Ho (null hypothesis) was not rejected; however, if the $P < 0.05$ the Ho (null hypothesis) was rejected. The statistical Ha: Health precaution use changed among health science students at Liberty University, Norfolk State University, and George Mason University.

Surveys

The data collected via the surveys was quantitatively analyzed and percentages were assigned to the responses. Survey questions were administered electronically through a Qualtrics survey. The surveys were collected, and the data were stratified based on gender, age (18-64), and ethnicity (Caucasians, African Americans, Hispanic/Latino, Asian, and American Indian/ Alaska Native). Bar charts and metrics of percentage were created. Bar name labels were included on the data tables to ensure a clear depiction of the data collected. The survey questions were compared using Fisher's test analysis and were sorted into rows and columns in the software program. The total participants, column percentages, and overall statistical test of percentages were calculated and compared within the data analysis. Fisher’s test was used to determine any differences between the data collected, whether expected or by chance. Reliability

was ensured by asking all participants the same survey questions. Providing a record of the survey and interview questions provides the opportunity for the research to be repeated in the future.

Survey Questions

1. "What is your age?"

This question was asked to determine participants' ages in order to analyze whether participants' age might have had any influence on their perceptions and behaviors.

2. "Please specify your ethnicity."

This question was asked to determine participants' ethnicities in order to analyze whether participants' ethnicity might have influenced their perceptions and behaviors.

3. "Please specify your gender."

This question was asked to determine participants' genders in order to analyze whether participants' gender might have influenced their perceptions and behaviors.

4. "Has the COVID-19 pandemic potentially increased the need for medical check-ups and vaccinations?"

This question was asked to determine whether participants felt COVID-19 had increased the need for these health precautions to understand participants' views on the central question regarding the effect of the pandemic on standard health precautions, and on the sub-question regarding awareness of infection exposure.

5. "On a scale from 1-10, how would you rank your acknowledgment of the severity of COVID-19 towards the immunocompromised?"

This question was asked to determine how knowledgeable participants were about COVID-19's risk level for those with compromised immune systems.

6. “My view on health has been affected by the COVID-19 pandemic?

This question was designed to determine to what degree participants felt COVID-19 had affected their view on health, in order to understand their perceptions, which may have influenced their use of standard health precautions as well the aspect of the sub-questions regarding their sense of self-efficacy and awareness regarding infection exposure.

7. Do you consider yourself immunocompromised?

This question was asked to determine whether participants identified as immune compromised, in order to differentiate how participants’ own potential vulnerability to the effects of COVID-19 might have influenced their perceptions and behaviors regarding the use of health precautions. If “yes” was answered above (Please select those that are applicable below) This question was asked in order to better understand the range of conditions that might have influenced respondents’ perspectives and their answers to other questions.

Interviews

Interviews took place with participants after the distribution and return of the surveys. All participants who filled out the survey were interviewed. Following the return of the signed consent form from the participant via email, the research link with available research interview times the participant could choose was provided. Additional insight into the participant’s understanding of health precautions since the COVID-19 pandemic began was assessed from the information collected. The quantitative and qualitative data collection from the interviews and surveys provided the opportunity to understand patterns and potential effects of COVID-19 on attitudes and behaviors. The data collection strategy was explained to the participants and rapport was established. Interviews took place via Microsoft Teams. An interview script was read to participants. The questions are direct and designed to develop a sense of rapport with

participants, allowing for an honest response. Participants' responses to the questions varied, and analysis focused on understanding the reasoning behind the responses (Ramage-Morin et al., 2020).

The discussion from the interview was audio-recorded and transcribed. The Fisher test was used to test the relationship between health science students and the use of health precautions. The transcription was used in categorizing the themes of the research based on responses from the interview and survey. Observational data such as the length or brevity of participants' answers, their tone of voice and the time intervals between the questions asked and the answer was evaluated and cross-referenced with respondents' survey and interview responses to develop a more nuanced understanding.

Interview Questions

1. "Would you drink or no longer drink water from the water fountain since the SARS-COV-2 pandemic?"

   This question was designed to provide a potential baseline of information regarding participants' understanding of disease transmission mechanisms, their risk tolerance, and any changes that might have occurred in their behavior since the start of the pandemic. This question intentionally asked about a behavior that was not part of the contentious and politicized conversations surrounding mask wearing, and—because mask wearing was not common in the United States prior to COVID-19—this question attempted to determine how careful participants were about potential disease transmission prior to the pandemic. Prior relevant research includes Bretthauer's (2020) work on changes in health precaution practices since COVID-19.

2. “Has your hand washing increased, decreased, or not changed since the SARS-COV-2 pandemic (if it has increased) how frequently do you wash your hands?”

   This question was intended to discover if participants’ handwashing frequency had changed due to the pandemic. This question addresses the central question of the effect of COVID-19 on students’ health precaution practices, as well as indirectly providing information on students’ attitudes/perceptions of the pandemic, and their sense of self-efficacy.

3. “Have your hand washing practices changed post-pandemic compared to pre-covid (if so) how?”

   This question was intended to discover if participants’ hand-washing practice had changed in any way other than frequency (use of different temperature water, different kinds of soap, longer wash time, use of hand sanitizer, etc.) due to the pandemic. This question addresses the central question of the effect of COVID-19 on participants’ health precaution practices, as well as indirectly providing information on students’ attitudes/perceptions and sense of self-efficacy. Relevant prior research includes Prater et al.’s 2016 investigation into the handwashing practices of college students before and after explicit instruction aligned with CDC recommendations.

4. “What is your awareness towards COVID-19?”

   This question was designed to elicit information regarding participants’ knowledge of COVID-19, their understanding of the seriousness of the disease and their current awareness regarding infection levels. This question speaks directly to sub-question 2 about students’ awareness of infection exposure, as well as gathering information regarding participants’ perceptions.

5. “How has the self-awareness of health science students towards potential infection exposure been impacted since the start of the COVID-19 pandemic?”

   This question was asked to elicit information regarding how aware participants considered themselves about their—and other students’—potential infection exposure, to answer the central question as well as sub-question one about perceptions, and sub-question two about disease transmission. Prior relevant research includes Bahl et al.'s (2022) review of ten studies concerning the horizontal distance traveled by droplets, as well as Shumway’s 2021 study of college students’ non-pharmaceutical health precaution use.

6. “What is your viewpoint on contact tracing calls during the COVID-19 pandemic?”

   This question was designed to discover participants’ views on contact tracing, providing information that spoke to the central question as well as both sub-questions as it asks about perception/attitude as well as about students’ awareness of infection exposure. Prior relevant research includes Zhu et al.’s (2021) research into concern for the individual vs. concern for society.

7. “How has the aftermath of the COVID-19 pandemic affected health science students’ behavior, self-efficacy, and attitude?”

   This question asks participants’ views on how the aftermath of the pandemic affected their own—and potentially other students’—behavior, sense of self-efficacy and attitude. This is sub-question one, and it helps address the central question about the effects of the COVID-19 pandemic on health precaution behavior.

8. What is your degree level?

This question was asked to be able to differentiate knowledge, perceptions and behaviors based on participants' educational attainment.

9. "What are your views on social gatherings pre-COVID-19 and currently?"

   This question was designed to gather baseline information about participants' views on social gatherings prior to the pandemic to differentiate between participants' perspective on social distancing as a health precaution, the stay-at-home order, and their own social practices unrelated to disease control. Prior relevant research includes Zhu et al.'s (2021) research into concern for the individual and concern for society.

Observations

The observation took place during the interview with the participants and in reviewing the audio-taped transcript. Assessment of participants' behavior and the responses to questions was conducted. The ways in which participants respond to questions can provide a significant amount of information. For example, the participants may respond lengthily to one question, take a significant amount of time in thought before responding to a question, or provide only a minimal response to the question asked. Do the participants expand on the answers provided or are their responses brief? What does their tone indicate in terms of potential feelings about the questions? Observation provided additional understanding of participants' knowledge, perceptions, behaviors, and sense of self-efficacy.

Ethical Considerations

Ethical considerations were included to ensure participants understood the research purpose and establish an honest, trustworthy rapport between the researcher and participants. Institutional Review Board (IRB) approval ensured the research was deemed ethical due to the

use of human participants. Ethical considerations require that participants are respected, and that the data collected is properly stored. The collected data from the surveys and interviews was electronically stored and password protected. There were no outside influences and confidentiality was upheld.

Summary

The research required the evaluation and development of the study design, research questions, selection of the setting and participants, administration of surveys and interviews and resulting data collection and analysis. The central question focused on the effect the COVID-19 pandemic had on standard health precautions taken among Liberty University, George Mason University, and Norfolk State University health science students. The research performed encompassed trustworthiness, credibility, dependability, confirmability, transferability, and ethical consideration. Surveys, interviews and observation were used for effective research. The participants were asked eight survey questions and nine interview questions. Responses to the survey and interview questions were analyzed to better understand the impact of COVID-19 on perceptions and behavior including views on drinking from a water fountain, need for medical check-ups and vaccinations, handwashing practices, contact tracing and social gatherings.

Understanding health science students' knowledge at the bachelor's, master's and PhD levels allows for the development of appropriate training and education programs. For example, if the survey and interview responses show participants lack understanding of the ways in which SARS-COV-2 spreads, it may indicate a need for continual education on disease transmission for health science students. If responses show strong scientific understanding of virus transmission mechanisms, but concurrent distrust of the origins or seriousness of COVID-19—or the efficacy of the available vaccines—there may be a need for more discussion of exactly what is known and

what knowledge is still evolving.

With new awareness comes the capacity to consciously reflect on the COVID-19 pandemic and the health precautions that were implemented. My research contributes to this expanding knowledge base, focusing on the use of health precautions and individuals' responses to the pandemic. By examining the adaptive measures and strategies employed by health science students over the course of the crisis, this research enriches the discourse on public health responses in pandemic situations and offers insights that can aid future protocols.

Reliability and consistency of the research required that all participants were asked the same questions and that the research was structured and documented to allow the opportunity for it to be repeated. The procedures provide an organized set of data collection tools identifying where further research is needed. Reliability was ensured by providing the survey and interview questions asked of the participants so that the research could be repeated in the future. Both descriptive and reflective field notes are provided following the initial observation of the research. Observations were documented during the interview. I was a participant observer.

CHAPTER FOUR: FINDINGS

Overview

This mixed-methods study focused on understanding potential changes in health precautions since the COVID-19 pandemic began for health science students at Liberty University, George Mason University, and Norfolk State University. The central research question explored the effects (if any) of the pandemic on standard health. Chapter Four describes the participants (using pseudonyms) as well as the themes identified in the data collected from the research interviews. This chapter also includes charts and tables analyzing data collected from the survey and interviews. Quantitative results are reported using statistical and numerical data and qualitative results are reported as a narrative and with thematic coding.

Descriptive Review and Demographic Statistics

Participants

The research included 35 participants. All participants were current health science students at Liberty University, George Mason University, or Norfolk State University, aged between 18-64 years old attending classes in person, online or in a hybrid program.

Description of Participants

Participant 1

Participant 1 was a 26–33-year-old Caucasian female master's student. Based upon observation of her interview responses, her tone during the research interview expressed confidence due to the research she had performed on COVID-19 to protect her autoimmune disease conditions and ensure the safety of her family. Participant 1 was highly aware of COVID-19 exposures due to exposure notifications sent by military to families of service personnel through email during the peak of the pandemic. Participant 1 noted incorporating frequent handwashing before the COVID-19 pandemic but stated that the pandemic made it easier to convince her younger son of its importance. Although she reported now being a bit more "lackadaisical" regarding implementation of health precautions since the peak of the COVID-19 pandemic, she still works from home and said the pandemic has made her not want to go out to places with a larger crowd out of awareness.

Participant 2

The participant was an 18–25-year-old Asian female master's student. She seemed to be knowledgeable on transmission rates of the COVID-19 pandemic, strictly followed the guidelines from government agencies, and stayed informed by reading from reliable sources on the COVID-19 pandemic. Participant 2 collected reliable articles on COVID-19 and compared it

to information shared daily to the public during the peak of the pandemic. The participant was frequently washing hands before the COVID-19 pandemic but more mindful now about increasing the time spent washing her hands, especially after being in public places. As an EMT, the participant felt both her education and health care experience provided consciousness of the COVID-19 pandemic. She mentioned that although she felt contact tracing and other COVID-19 health precautions were scientifically beneficial, they also added hassle to medical staff providing care to a large population of patients, and she mentioned that the media heightened pressure that caused added fear.

Participant 3

The participant was a 43–64-year-old Caucasian male doctoral student. Participant 3's responses implied resistance. Participant 3 expressed difficulty abiding by the COVID-19 health precautions as they could not be followed in his line of work due to the proximity restrictions. The participant expressed the view that COVID-19 health precautions should have been an individual choice rather than a requirement for organizations. Participant 3 reported having high awareness of the COVID-19 pandemic and did not make any health precautions changes during the COVID-19 pandemic such as six feet distancing, wearing mask, or increasing frequency of handwashing.

Participant 4

Participant 4 was an 18–25-year-old Caucasian male bachelor's student. Through observation collected during the research interview, Participant 4 was knowledgeable about the infection rate and risk of the COVID-19 pandemic but was less concerned with the spread unless he and his family knew that they were sick or had tested positive for COVID-19. The participant mentioned that, at the peak of the COVID-19 pandemic, he was more cautious of touching

common surfaces such as door handles in the hospital setting where he works and implementing handwashing shortly after touching those surfaces. Participant 4 mentioned not worrying about the spread of the COVID-19 pandemic as much now as during its peak. Participant 4 felt that COVID-19 health precautions such as handwashing, using soap or hand sanitizer, and contact tracing, were beneficial.

Participant 5

Participant 5 was a 43–64-year-old Caucasian female bachelor's student. She appeared to be cautious about ensuring COVID-19 health precautions were followed since the start of the COVID-19 pandemic and mentioned the importance of not being fearful. She noted increased use of hand sanitizer since the COVID-19 pandemic due to availability in comparison to the use of soap and water. Participant 5 mentioned that although the general use of masks was not common, this was because many people did not understand what was going on during the COVID-19 pandemic and that the purpose of wearing mask was to protect the person from other people rather than protect others from themselves.

Participant 6

Participant 6 was a 26–33-year-old African American female master's student with immense public health work experience, including helping with the emergency response team during the COVID-19 pandemic. Her tone showed confidence in her knowledge of COVID-19 transmission and handwashing technique. Participant 6 felt that more information is needed regarding COVID-19 as there was a lot of speculation. She noted that since it has been over two years since the peak of the pandemic, many people are back to the "normal" of how things were before the pandemic. She noted that although masks are not used as frequently since the peak of the pandemic, she notices people tend to put masks on when they hear people coughing. She

worked as a contact tracer during the peak, and she felt contact tracing was beneficial in stopping the spread of COVID-19 as people were not always transparent in telling people they tested positive. She also noted that many people do not get vaccinated for anything and stated that precautions, such as washing hands when going to restaurants, should have been in place prior to COVID-19.

Participant 7

Participant 7 was a 34–41-year-old Caucasian male doctoral student. The participant's tone appeared confident when responding to the interview questions, but he noted that because he was not immunocompromised, he felt that catching COVID-19 was not a significant concern. Participant 7 understood the standard health precautions that could be used to stop the spread of COVID-19 and mentioned increasing his handwashing time to ensure it takes him 25-30 seconds in the aftermath of COVID-19 pandemic. He felt contact tracing used during the pandemic was an invasion of privacy.

Participant 8

Participant 8 was a 34–41-year-old African American female PhD student who seemed very sad regarding the limited opportunity to see her family during the pandemic. She worked in a hospital, and before COVID she stated that she was always around people. However, during the peak of the pandemic she felt isolated because she was extremely careful to protect her family from the virus and consequently did not spend time with them for many months, only driving by their home periodically to wave to them from the car. Now, during the aftermath, the fear still lingers despite the time that has passed. Participant 8 mentioned that in terms of social settings since the pandemic people no longer know how to interact with others compared to before. She mentioned increasing her hand washing since the pandemic, and felt that, based on

her experience with not getting contacted by the COVID-19 contact tracers when her roommate had COVID-19, she did not feel it was effective in notifying all people who had been exposed.

Participant 9

Participant 9 was a 43–64-year-old Hispanic/Latino male master's level student. His tone appeared disappointed and frustrated at the health precautions that were required during the pandemic. During the research interview, Participant 9 expressed disappointment with how public health information was communicated and frustration with the lack of honesty and transparency he felt political officials demonstrated during the pandemic. Participant 9 worked part time at a hospital during the peak, and he reported feeling that COVID-19 vaccinations were provided too early based upon reduced time in testing, and he stated that personal research on COVID-19 was essential instead of only receiving information from news sources and political officials.

Participant 10

Participant 10 was an African American female PhD student between the ages of 26-33 years old. She felt that her decisions regarding health precautions were based upon a combination of personal experience and academics. She stated paying close attention to all news information pertaining to COVID-19. In the aftermath of the pandemic, Participant 10 noted she will continue to wear masks and wash hands based upon the location and the amount of people present.

Participant 11

Participant 11 was a Caucasian male PhD student aged 26-33 years old. His tone appeared confident about the decisions made during the COVID-19 pandemic based upon his COVID-19 laboratory work experience which he stated provided additional clarification

regarding structures and infectious rate. He would drink water from the water fountain after the COVID-19 pandemic. He noted washing his hands more during the peak of the COVID-19 pandemic but has since defaulted back to the amount of handwashing time used before the COVID-19 pandemic unless his hands are dirty. Participant 11 mentioned that, due to the different sub-variants, health education, and CDC recommendations, he will continue to receive the COVID-19 booster shots.

Participant 12

Participant 12 was a Caucasian female PhD student aged 26-33 years student. Her tone of voice and responses to interview questions suggested that the risk management of COVID-19 could have been done better through contact tracing. As a middle school special education teacher during the pandemic, Participant 12 noted that when contact tracers contacted the school, they were only concerned with those who were in close contact with the person who tested positive and experienced symptoms, rather than wanting to know all people that came in close contact. She mentioned COVID-19 brought a sense of paranoia to many and that students missed health education opportunities to keep people safe. Many of her friends felt that because participant 12 was in the health science field that she knew all concepts regarding health.

Participant 13

Participant 13 was an Asian female PhD student aged 18-25 years. She implemented the health precautions presented during the pandemic that she believed to be true based upon her personal experience. Participant 13 mentioned that in addition to her health education she works in a lab where she previously increased hand washing prior to the COVID-19 pandemic based upon her understanding of the transmission of other viruses.

Participant 14

Participant 14 was a Caucasian female aged 26-33 years bachelor's student. She expressed a desire for continual health improvement in the future for all based on what has been learned during the COVID-19 pandemic.

Participant 15

Participant 15 was a Caucasian female bachelor's student between the ages of 34-41 years old. Her responses indicated frustration with the politics she observed during the COVID-19 pandemic including family members not wanting to wear face masks and some people not believing that the COVID-19 pandemic was real. She indicated that the pandemic had required her to advocate for herself by asking others to wear masks when coming to her home.

Participant 16

Participant 16 was a Caucasian female master's student between the ages of 26-33 years old. She indicated that the COVID-19 pandemic caused her to be more aware of her health even if the symptom is as simple as a cough. She mentioned washing her hands three to four more in comparison to before the pandemic. Participant 16 felt that contact tracing was a well-intentioned but not well executed effort and mentioned that the pandemic had revealed the health inequality within the United States, and she hopes that this was a lesson learned for all.

Participant 17

Participant 17 was a non-binary Caucasian PhD student between the ages of 18-25 years old. Their tone was cautious regarding drinking from water fountains and ensuring frequent handwashing in the aftermath of the pandemic and they expressed the importance of following the restrictions during the COVID-19 pandemic due to being immunocompromised. They

mentioned their hyperawareness to ensure they are current on all health precautions such as vaccinations and said they would prefer to no longer be around people that are sick.

Participant 18

Participant 18 was an American Indian or Alaska Native female PhD student aged 43-64 years. Her tone of voice indicated tiredness due to low staff strength at her laboratory due to the COVID-19 outbreak. The participant stated that she would still drink from water fountains. She mentioned washing hands longer with soap and water since the pandemic. Participant 18 noted her self-efficacy and attitude have been affected in the aftermath as she inherently understands the impact individual health choices can have within a community and has a raised awareness towards social disparities.

Participant 19

Participant 19 was a Caucasian female PhD student between the ages of 18-25 years. She expressed frustration with the contact tracing utilized during the COVID-19 pandemic based upon her current medical experience. She indicated that it resulted in significant shutdowns but said there should have been more research as it significantly affected the livelihood of many people. She also mentioned previously implementing basic health precautions recommended during the COVID-19 pandemic before its peak.

Participant 20

Participant 20 was an African American male PhD student between the ages of 18-25 years. He was knowledgeable about the COVID-19 pandemic, mentioned that he would no longer drink water from the water fountain and that his hand washing frequency increased three to four times more since before the pandemic. Participant 20 also noted that although he followed the COVID-19 health precautions including sanitation and vaccinations advised during

the peak, it was interesting to see how the immune system adapted to the virus with limited testing on lab rats.

Participant 21

Participant 21 was an Asian female bachelor's student between the ages of 18-25 years. She indicated that more research should have been done prior to providing recommendations for health precautions such as the COVID-19 vaccination. She stated that COVID-19 was "just another cold," and that "quarantining had made it worse because when you leave quarantine you spread it more that way and it took a year of our lives." She also mentioned families being torn apart by being unable to visit loved ones who were dying.

Participant 22

Participant 22 was a Caucasian female PhD student aged 43-64 years. She followed all health precautions during the COVID-19 pandemic but there were very few she agreed with. Participant 22 mentioned using soap and water to wash hands is sufficient and using antibacterial soap is not necessary. She mentioned as a prior EMT always incorporating proper handwashing prior to the COVID-19 pandemic and having been on a personal health journey for many years, focusing on nutrition, exercise, maintaining a healthy weight and supplements including vitamin D. She noted that many of the health habits she incorporates would have made a big difference in people's ability to deal with COVID-19 with less serious illness and death. She also noted that although she does not agree with everyone's insistence on the use of particular health precautions, she tries to be respectful of others' concerns and to adjust her behaviors in order to accommodate people who are more fearful.

Participate 23

Participant 23 was a Caucasian female master's student between the ages of 18-25 years old. Her tone appeared unsure if the health precautions used during the COVID-19 pandemic served any benefit in stopping the spread, though she mentioned working in the medical field and being very conscious of her handwashing practices. Participant 23 rated her awareness of the COVID-19 pandemic at a 6 or 7 but "not at the level of an epidemiologist." She noted that COVID-19 was a wake-up call for all that life is short with no guarantees.

Participant 24

Participant 24 was a Caucasian female master's student between the ages of 26-33 years. She had ideas about improvements that could have been made during the COVID-19 pandemic, saying that additional information should have been concisely explained to the public regarding the vaccine rather than pushing people in one direction. She noted that, as a person in the medical field, she felt some of the information presented was not true and said that she hopes people had the opportunity to see the importance of individualized research to validate information provided.

Participant 25

Participant 25 was a Caucasian female bachelor's degree student between the ages of 18-25 years. She was knowledgeable about COVID-19 and had implemented health precautions such as frequent hand washing prior to the pandemic. Since the pandemic, participant 25 noted putting hand sanitizer in her car to use after pumping gas at the gas station. Participant 25 explained the various spread of viruses and that she is hyper aware since COVID, mentioning that prior to COVID-19 her high school science classes shared goggles when working in labs,

while now everyone uses disposable ones. Participant 25 noted a behavior and self-efficacy shift since starting a health science degree during the peak of the COVID-19 pandemic.

Participant 26

Participant 26 was an Asian female PhD student between the ages of 26-33 years. She wasn't significantly worried about catching COVID-19 as she was healthy. She noted that since the pandemic, she does not take additional protective measures and would still drink water from the water fountain.

Participant 27

Participant 27 was a Caucasian female master's student between the ages of 18-25 years who appeared very proactive in making sure she would not be the cause of anyone getting sick. Participant 27 stated that she was incorporating handwashing around 15 times a day and was more cautious of not being around others when sick to ensure that it is not COVID-19 because she does not want to be putting others at risk. Due to the stigma behind the COVID-19 pandemic, she says contact tracing was not beneficial as many people were already scared of COVID-19 and it required people to talk openly of where they had been exposed and to whom.

Participant 28

Participant 28 was a Caucasian female master's student between the ages of 18-25 years. She seemed very cautious about not getting COVID-19 as she had seen the worst cases with family and friends. Since the pandemic, she would no longer drink water from the water fountain. She stated that she was taking the COVID-19 health precautions more seriously than many of her peers at the university who are not health science students. Participant 28 noted that she understands how quickly respiratory illnesses spread and if she knows that she is contagious

she will do her due diligence to get tested and stay home to avoid putting high-risk populations like the elderly at risk of getting sick.

Participant 29

Participant 29 was a Caucasian female master's student between the ages of 18-25 years. Her tone indicated the importance of living what you preach as a health professional. She stated that she washed her hands more often during the peak of COVID-19, though her hand washing practices were strong prior to the pandemic. Participant 29 explained that since the pandemic more people became aware that emerging diseases can happen at any point in time and are being mindful of public health practices whether there is an active pandemic or epidemic where we are.

Participant 30

Participant 30 was an African American female bachelor's student between the ages of 18-25 years. She made sure to follow health precautions during the COVID-19 pandemic to protect members of her family who were older.

Participant 31

Participant 31 was an African American female bachelor's student between the ages of 18-25 years. She was very careful to follow health precautions when she went home for her college breaks to avoid putting her immunocompromised mom at risk. Participant 31 noted that after being around anyone or touching surfaces she ensures she washes her hands. She noted the many changes she encountered during the COVID-19 pandemic that included her last year of high school going virtual, and going straight to college where normal events such as prom and orientations were canceled or not the same as prior to the pandemic.

Participant 32

Participant 32 was a Caucasian female master's health science student between the ages of 18-25 years. She understood a lot about the health decisions made during the COVID-19 pandemic. Participant 32 stated her understanding of how COVID-19 spread. She mentioned no changes were made to her hand washing practice, but she did feel that contact tracing was beneficial in tracing back a person who is infected.

Participant 33

Participant 33 was an African American female bachelor's level student between the ages of 18-25 years. She was particularly aware of the contagiousness of COVID-19 based upon personal experience, and mentioned making big changes in terms of social distancing and mask-wearing after having been at a birthday party after which someone tested positive for COVID-19.

Participant 34

Participant 34 was a Caucasian female bachelor's student between the ages of 43-64 years with a lot of work experience with the COVID-19 public health initiative as a contact tracer. She mentioned that during the peak of the COVID-19 pandemic she was a contact tracer and did not feel it stopped the spread of COVID-19, but it provided better understanding of the spread of the disease. Participant 34 stated since the COVID-19 pandemic her handwashing has increased, and she adhered to all CDC practices and guidelines. She noted being an advocate of understanding the value of legitimate information sources that can contribute to making good health decisions.

Participant 35

Participant 35 was an Asian female master's student between the ages of 18-25 years. She was confident when faced with making public health choices during the COVID-19

pandemic. She mentioned that she would no longer drink water from the water fountain since the COVID-19 pandemic.

Quantitative and Qualitative Data Collection Process

Quantitative data was collected using surveys to obtain participants' demographic information such as age, gender, and ethnicity. Participants who completed surveys then underwent an interview with the researcher for qualitative data collection. During the interview, the participants were asked open-ended questions on COVID-19 health precautions used before, during and after the COVID-19 pandemic as well as their current academic degree level. The demographics and academic degree level are listed in a tabular format below.

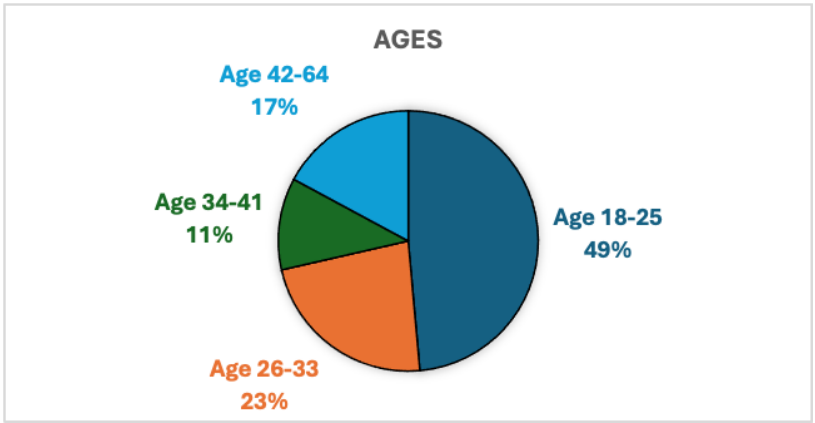
Table 1. Individual Participants' Demographic Characteristics (N=35)

Pseudonym	Age	Gender	Ethnicity	Academic
Participant 1	26-33	F	Caucasian	Master's
Participant 2	18-25	F	Asian	Master's
Participant 3	43-64	M	Caucasian	PhD
Participant 4	18-25	M	Caucasian	Bachelor's
Participant 5	43-64	F	Caucasian	Bachelor's
Participant 6	26-33	F	Black/African American	Master's
Participant 7	34-41	M	Caucasian	PhD
Participant 8	34-41	F	Black/African American	PhD
Participant 9	43-64	M	Hispanic/Latino	Master's
Participant 10	26-33	F	Black/African American	PhD
Participant 11	26-33	M	Caucasian	PhD
Participant 12	34-41	F	Caucasian	PhD
Participant 13	18-25	F	Asian	PhD
Participant 14	26-33	F	Caucasian	Bachelor's
Participant 15	34-41	F	Caucasian	PhD
Participant 16	26-33	F	Caucasian	Master's
Participant 17	18-25	Other	Caucasian	Bachelor's
Participant 18	43-64	F	American Indian /Alaska Native	PhD
Participant 19	18-25	F	Caucasian	PhD
Participant 20	18-25	M	Black/African American	PhD
Participant 21	18-25	F	Asian	Bachelor's
Participant 22	43-64	F	Caucasian	PhD
Participant 23	18-25	F	Caucasian	Master's

Participant 24	26-33	F	Caucasian	Master's
Participant 25	18-25	F	Caucasian	Bachelor's
Participant 26	26-33	F	Asian	PhD
Participant 27	18-25	F	Caucasian	Master's
Participant 28	18-25	F	Caucasian	Master's
Participant 29	18-25	F	Caucasian	Master's
Participant 30	18-25	F	Black/African American	Bachelor's
Participant 31	18-25	F	Black/African American	Bachelor's
Participant 32	18-25	F	Caucasian	Master's
Participant 33	18-25	F	Black/African American	Bachelor's
Participant 34	43-64	F	Caucasian	Bachelor's
Participant 35	18-25	F	Asian	Master's

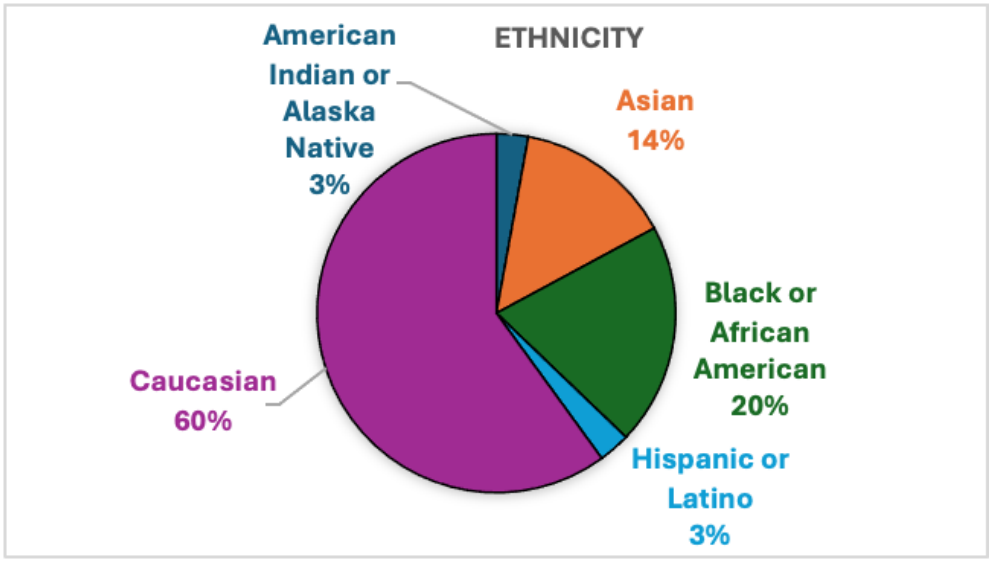
The first survey question asked participants' age, with inclusion criteria supporting those between 18-64 years old. Participants were grouped into four age-range groups: the largest group, (49%), were between 18-25 years old, 23% were between 26-33 years old, 11% were between 34-41 years old and 17% were between 42-64 years old. Because the study encompassed students at the bachelor's, master's, and PhD level it included students in a wider range of ages than a study focused on undergraduates (National Center for Education Statistics, 2021). The inclusion of different age groups provided an array of perspectives and lived experiences, and enabled evaluation of responses to other questions in relation to participants' age groups. This figure identifies the percentage of participants in each age group (see Figure 3).

Figure 3. Participants' Ages (N=35)



A question on ethnicity was the second survey question asked of all participants. The goal of Table 1 was to identify the ethnicities of research participants following the categories used by the United States Census Bureau. Of the 35 participants, the majority, (60%), identified as Caucasian, 20% identified as Black or African American, 14% as Asian, 3% (one participant) as American Indian/Alaska Native, and 3% (one) as Hispanic/Latino. From the data we were able to evaluate responses to the survey and interview questions to identify whether ethnicity played a role in COVID-19 health precaution adaptations, or in participants' perspectives on health and vaccinations. The pie chart shows participants' ethnicities by percentage (see Figure 4).

Figure 4. Ethnicity (N=35)

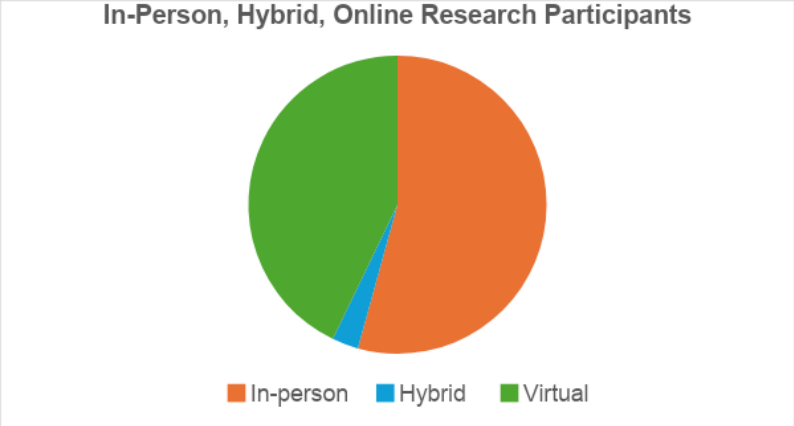


The third survey question asked participants to identify their gender. Of the participants in the study, 80% identified as female, 17% as male, and 3% as other. This disproportionality is not uncommon in research studies on COVID-19, including Kennedy's 2020 research on first semester college students, in which 72% of the study's respondents were female (Kennedy, 2020). In the current dissertation study, it is also likely attributable to the high proportion of

women in the healthcare field, which the United Nations cites as 78% of U.S. healthcare workers during COVID-19 (United Nations Foundation, n.d.), and to the higher proportion of female students enrolled at the three universities. This disproportionality may have influenced the data.

Although no survey or interview question specifically asked participants whether they were pursuing their degree in-person, hybrid or online, data collected during the interviews gathered this information, as every participant mentioned this point. More than half, (54%), pursued their degree in person, while 43% were virtual, and one participant (3%) attended a hybrid program. Students who attended in-person classes once that was allowed were required to follow the university COVID-19 standard protocols provided by the CDC, and even students who pursued their degree in person post-peak were virtual during the peak of the pandemic. Not all students mentioned their reasons for choosing in person vs. online. Those who did indicated either they returned to campus because they missed the ability to do hands-on labs, or—if they continued online—that they did it to reduce infection exposure, or because it provided flexibility in work/life balance. It is likely that students had multiple reasons for deciding on in-person or virtual. (see Figure 5).

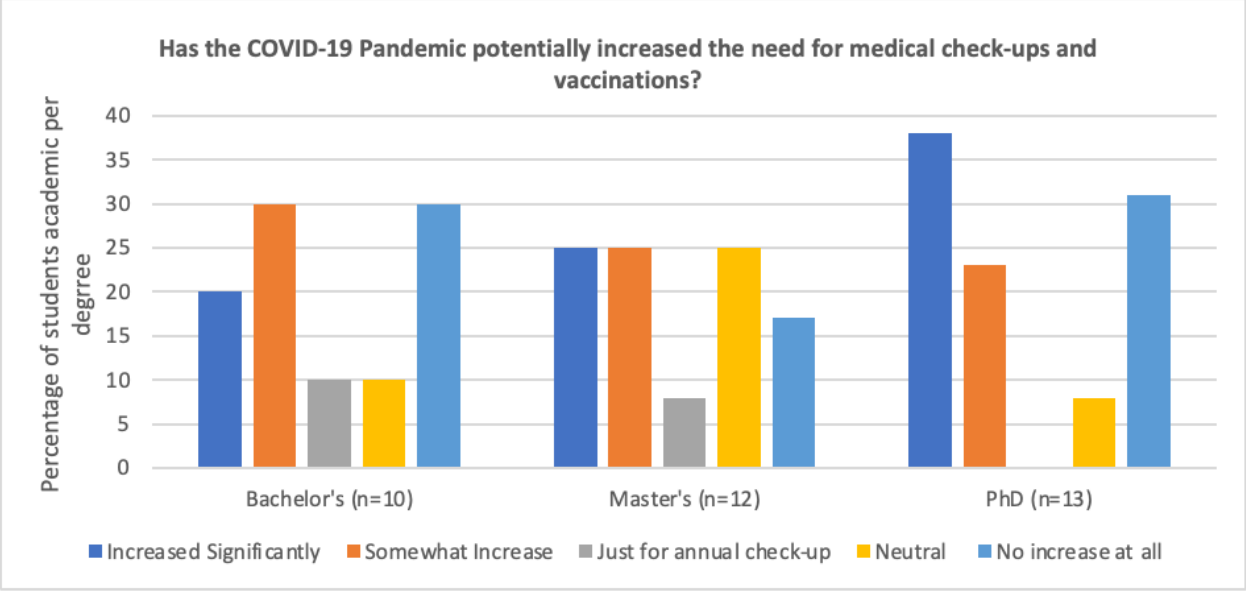
Figure 5. In-Person, Hybrid, Online Research Participants



To understand how participants' education level affected their perception of the need for medical check-ups and vaccinations increased due to the COVID-19 pandemic, all responses to this survey question were additionally analyzed based on degree level. This helps to answer the central question regarding the effect of the pandemic on standard health precautions and an aspect of sub-question 1 that focuses on students' knowledge and perceptions. A visualization of the percentage of participants' selections shows a gradual increase in the percentage of students who felt COVID-19 increased the need for these health precautions at higher degree levels (Figure 6A). The perception that the pandemic increased the need for medical check-ups and vaccinations was more often indicated by participants at the PhD level, where 38% perceived the need had "increased significantly" (Figure 6B).

Figure 6 (A & B). Need for Medical Check-up and Vaccinations since the COVID-19 pandemic based on Academic Degree Level (N=35).

A.



B.

Increased Need?	Bachelors	Master's	PhD	Total
Increased significantly	2 (20%)	3 (25%)	5 (38%)	10 (28%)
Somewhat increase	3 (30%)	3 (25%)	3 (23%)	9 (26%)
Just for annual check-up	1 (10%)	1 (8%)	0 (0%)	2 (6%)
Neutral	1 (10%)	3 (25%)	1 (8%)	5 (14%)
No increase at all	3 (30%)	2 (17%)	4 (31%)	9 (26%)
Total	10 (100%)	12 (100%)	13(100%)	35 (100%)

In order to understand the figures above more fully, responses to this question were also analyzed in light of participants' responses to other survey and interview questions. Seven of the nine participants who indicated that "no increase was needed" mentioned that they had previously or were currently working in healthcare, and six of those seven expressed having been well-educated regarding health and disease transmission prior to COVID-19. Participant 12, at the PhD level, who indicated need had "increased significantly," noted during the interview that her formal education had had a big impact on her, and that many of her friends consider her "the guru" on COVID-19 and the go-to person for many other health questions. Participant 21, who indicated "just annual check-ups" stated in response to the interview question on the value of contact tracing that "COVID was just another cold and quarantining made it worse." When this participant was asked if her academic education influenced her choice of health precautions, she indicated that it had, by helping her to understand disease transmission and steps she can take to protect herself. Participant 9, a master's degree student who said that COVID-19 had "significantly increased" the need for check-ups and vaccinations, also stated that he had gone to large gatherings during COVID-19 because "nothing helps" reduce spread, and the government

in power pushed vaccines and masks when “it’s proven they don’t prevent the copy transmission.”

It is clear that individual participants’ answers regarding whether COVID-19 increased the need for medical check-ups and vaccinations must be looked at in context to understand whether participants who indicated “no increase,” “neutral,” or “just for annual check-ups” were indicating: a low level of concern for their health; a low perception of the danger of COVID-19, or simply a high level of awareness and behaviors prior to the pandemic.

Although participants’ views were also influenced by lived experiences, including their work and personal experiences, it may also be the case that education heightens awareness of health precautions’ ability to protect against infectious diseases (See Figure 6)

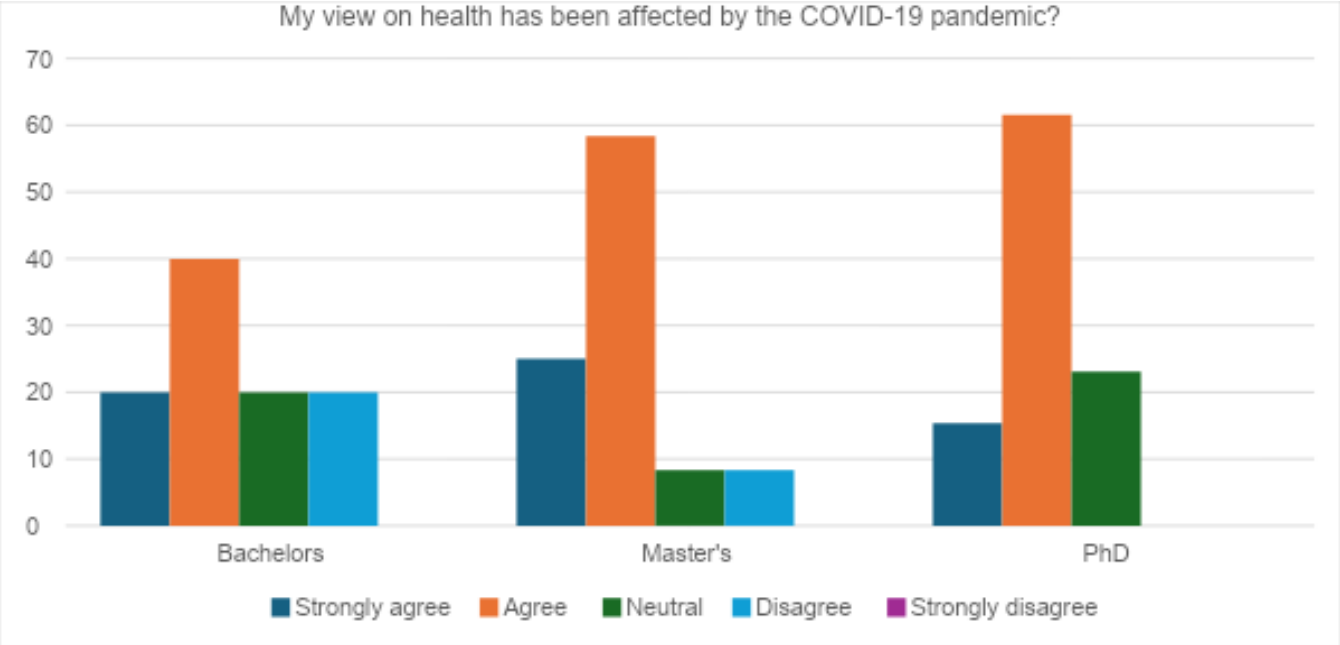
Responses to the fifth survey question regarding whether participants’ views on health were affected by the COVID-19 pandemic, were analyzed based on participants’ academic degree level. At the master’s level, seven (58%) “agreed” and three (25%) “strongly agreed,” meaning that 83% felt their view on health had been affected (*Figure* 7 B). At the PhD level the combined total was only slightly lower, with 77% indicating they “agreed” or “strongly agreed;” the remaining three, (23%) felt “neutral.” However, at the bachelor’s level, only six (60%) participants “agreed” or “strongly agreed” that their view on health had been affected, two (20% were “neutral” and two (20%) “disagreed.” (7 A). Participant 5—who disagreed that her view on health had been affected—also indicated “no increase” in medical check-ups or vaccinations, and stated that, because she had had to go to work, she had been unable to social distance there and had consequently not followed the “stay-at-home” mandate in other areas of her life. She noted feeling a lack of clarity concerning many precautions, stating “I don’t think people really understood, you know, that the mask was more to, you know, to protect you from other people

and they thought they were protecting others from themselves." In response to the question regarding the aftermath of COVID-19 Participant 5 indicated that not much had changed, as she will "be safe but isn't going to be afraid to live my life."

No participant, at any educational level, "strongly disagreed," indicating that health science students generally understood that COVID-19 was a priority. (See Figure 7).

Figure 7. View on health since the COVID-19 pandemic based on academic degree level (N=35)

A.



B.

View Affected	Bachelors	Master's	PhD	Total
Strongly agree	2 (20%)	3 (25%)	2 (15%)	7 (20%)
Agree	4 (40%)	7 (58%)	8 (62%)	19 (54%)
Neutral	2 (20%)	1 (8%)	3 (23%)	6 (17%)
Disagree	2 (20%)	1 (8%)	0 (0%)	3 (9%)
Strongly disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	10(100%)	12(100%)	13(100%)	35(100%)

Participants' immunocompromised status was also collected as part of the survey, which asked participants if they considered themselves to be immunocompromised, and if so, gave them the opportunity to specify the immune compromising circumstances in a follow up question. Of the 35 total participants, one male, eight female and the sole non-binary participant (29% of the study population) identified as immunocompromised.

To better understand whether educational attainment influenced health science students' acknowledgment of the severity of COVID-19 toward the immunocompromised, responses to this survey question were analyzed based upon academic degree level. Given the preponderance of research, including Singson et al.'s 2022 study, showing that immunocompromised individuals are as much as four times as likely to experience serious illness and death as those who are not immunocompromised, responses provide information about participants' level of knowledge. They also help answer the aspect of sub-question two about perceptions. Analyzing the data by degree level may help discover how health science education informed these perceptions.

This Likert scale utilizes a 5-point scale, with 1-2 indicating the lowest acknowledgement of the severity of COVID-19 toward the immunocompromised and 9-10 the highest. No one at any academic degree level perceived COVID's severity at the lowest level of 1-2, which may be due to all participants studying health science and having at least a basic understanding of the potentially severe impact of COVID-19 on people with compromised immune systems.

The only participants to acknowledge COVID-19's severity below a 5-6 were three bachelor's degree students (25% of this educational group and 9% of the participant total). Participant 14, who rated her acknowledgement 3-4, had responded to the question of her

awareness of COVID-19 with “I’m pretty confident I know a lot about it.” However, she expressed skepticism about COVID-19 being something serious, saying:

> “I was, like, very skeptical of, based on what I know of, you know, like, bacteria. It's like uh, you know, that's not supposed to live, you know, without a host for like that long. So, it's just so . . . to me. I was just like wondering, I guess I question a lot of the stuff.”

This indicates that the participant may not have understood that SARS-COV-2 was a virus, and that additional education is needed.

Participant 21, who works in the healthcare field and ranked her acknowledgement 3-4, indicated that she found information about COVID-19 variants confusing. She also expressed feeling hesitant about the vaccine because “it had only been out for like 10 years,” which she said was not long enough to understand potential adverse effects. Research on mRNA vaccines has been happening for decades which, along with reduced bureaucratic steps and international cooperation, allowed the COVID-19 vaccine to be developed quickly (Verbeke, R., 2021; CDC, 2024). However, the participant is correct that the COVID-19 vaccines have demonstrated side-effects, and she is in the youngest age grouping of this study, not immunocompromised, and thus among the least likely to become seriously ill from COVID-19. She describes her personal experience this way; “I know COVID is deadly, and I don't want to be oblivious. But I treated [it] as another cold. I know everybody had different symptoms, and I would say I had it pretty easy.” This participant noted that her academic education made her “more aware of how diseases are transmitted and steps I can take to protect myself.” However, she indicated doubt that isolating when sick would have reduced the toll of the pandemic; “We would have all gotten it, and yes, it would have been bad, but it would have been passed on faster than taking up a year of our lives.” It is possible this participant would have had a different perspective if she had been

given more information about the effectiveness of quarantine but given her doubts about the safety of the vaccine, she may not have been persuaded of the value of "flattening the curve" to allow time to develop this tool. The participant's personal and familial experiences may have played a significant role in her perceptions, as she mentioned not being able to see family who were dying during the pandemic:

> "I just think a lot of families were torn apart because of the no visitations. And I think that was completely wrong for them to do. Umm, we [were] just like losing a loved one. I think had they not done that, it would have been fine."

This last statement suggests that her personal, relatively mild experience of COVID-19, and the policies that prevented families from being with loved ones might have influenced her perspective on the severity of COVID-19. The participant does note, however, that post-COVID-19 she is more of a germaphobe and is much more conscious of the things she can do—other than social distancing or getting vaccinated—to reduce the spread of disease. She stated she understood the importance of covering nose, washing hands, and cleaning surfaces, but the COVID-19 pandemic made her more aware of students who do not know its importance. "I knew to cover my nose . . .wash my hands, I've washed my surfaces and I think it made me aware that a lot of other students don't know. . . to me, it's proper hygiene." This indicates that her sense of self-efficacy has been strengthened, and her (previously noted) awareness of things she found confusing, as well as her knowing that the vaccine had been in development since long before COVID-19, suggest that she will continue to integrate new information as it is presented to her.

A 5-6 rating signifies a "neutral" acknowledgement of the severity of COVID-19 on the immunocompromised. One bachelor's level student who rated his acknowledgement 5-6 responded to the question regarding his level of awareness of COVID-19 by saying that he

"could learn more." However, this participant also indicated he has doubled or tripled his hand washing since the pandemic began, that he works in healthcare, and he believes contact tracing was beneficial, indicating both that he likely understands mechanisms of disease transmission, and that he was in favor of actions that can be taken to reduce the spread of SARS-COV-2.

A respondent at the master's level whose acknowledgement was 5-6 said in response to the question about awareness of COVID-19, she felt that precautions put in place should have been in place (specifically handwashing) prior to the pandemic because they were "common sense," and that she worked as contact tracer during the pandemic and felt tracing was complicated but overall productive. Her answers to the question regarding hand washing practices, that "[using sanitizer] is okay for now but you need to really wash your hands with soap and water," indicates a high level of knowledge and sense of self-efficacy. When asked about social gatherings, she says that things have pretty much gone back to normal, because "some people don't even get vaccinated for other things. They don't believe in getting vaccinated." Taken in the context of all her responses, it seems likely that this participant has a high level of knowledge and that she uses this information to do the things she can do to keep herself safe, while understanding that others may not choose to do the same.

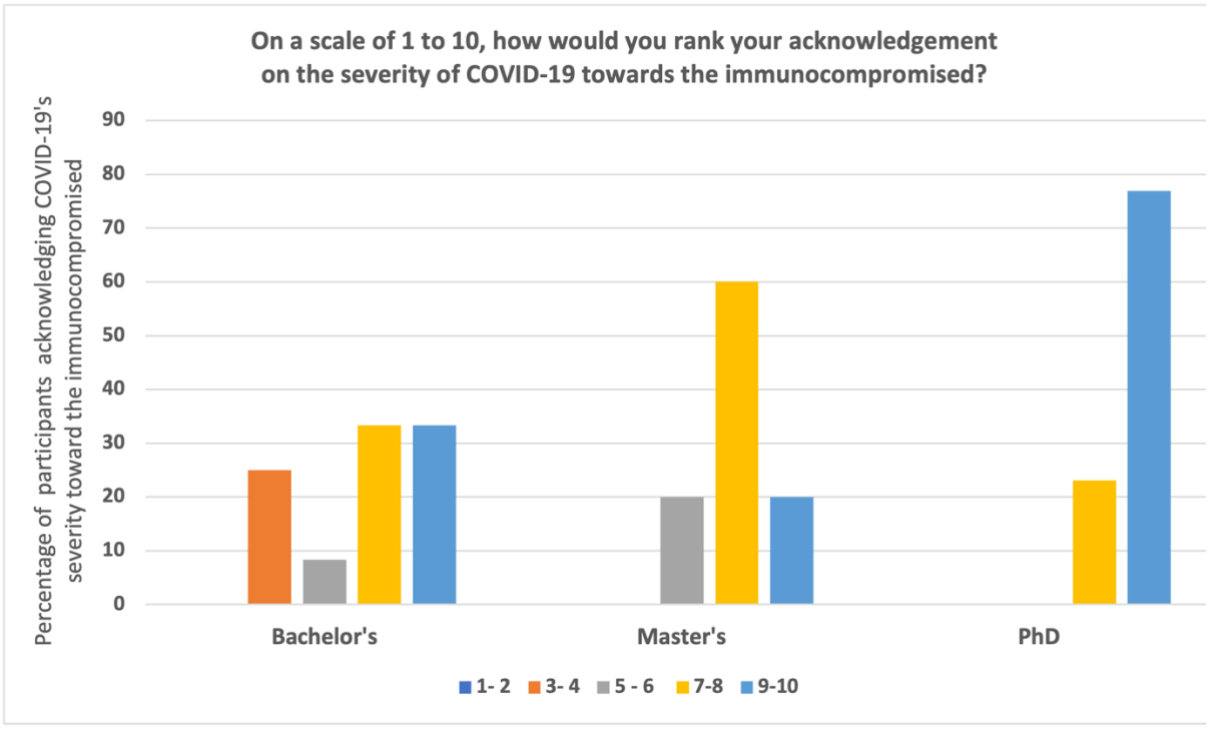
Figure 8. shows that 100% of PhD students rated their acknowledgement of COVID-19 at the 7-8 or 9-10 level. Within this study more participants at the PhD level (38%) identified as immunocompromised than at the master's or bachelor's level, which may also have influenced their responses. (*Figure* 18). It may also be the case that individuals who are immunocompromised are more likely to want to continue their health science education, leading to greater numbers of PhD students having this personal experience.

Finally, the PhD level of academia focuses on advancing fundamental knowledge, but with the specific goal of promoting change (Gruber et al., 2023). Participants at the PhD level might be expected to be more cognizant of big-picture implications, and many participants at this educational level, including Participant 7, expressed “awareness of individuals that had comorbidities and [being] cognizant of what I was doing around them.” (*Figure* 8 A).

This question supports sub-question one, addressing the aftermath of the pandemic’s effect on participants’ knowledge, perceptions and behaviors as survey responses were collected in 2023. Overall, understanding its influence paves the way for identifying gaps or competencies needed at all academic degree levels. *(See Figure* 8*)*

Figure 8. Acknowledgement of the Severity of COVID-19 for the Immunocompromised by Degree Level

A.



B.

Rating	Bachelors	Master's	PhD	Total
1-2	0 (0%)	0 (0%)	0 (0%)	0 (0%)
3-4	3 (25%)	0 (0%)	0 (0%)	3 (9%)
5-6	1 (8%)	2 (20%)	0 (0%)	3 (9%)
7-8	4 (33%)	6 (60%)	3 (23%)	13(37%)
9-10	4 (33%)	2 (20%)	10 (77%)	16 (46%)
Total	12(100%)	10(100%)	13(100%)	35 (101%)

Figure 9 analyzes participants' responses to the survey question asking if their view on health had been affected by the pandemic, by age. No participant in any age group "strongly disagreed," though a significant minority (26%) were either "neutral" or felt their view had not changed (Figure 9 A). "Agree" was the most chosen response for all ages, indicating that, regardless of age, most participants felt their view on health was affected, even if not strongly, by the pandemic.

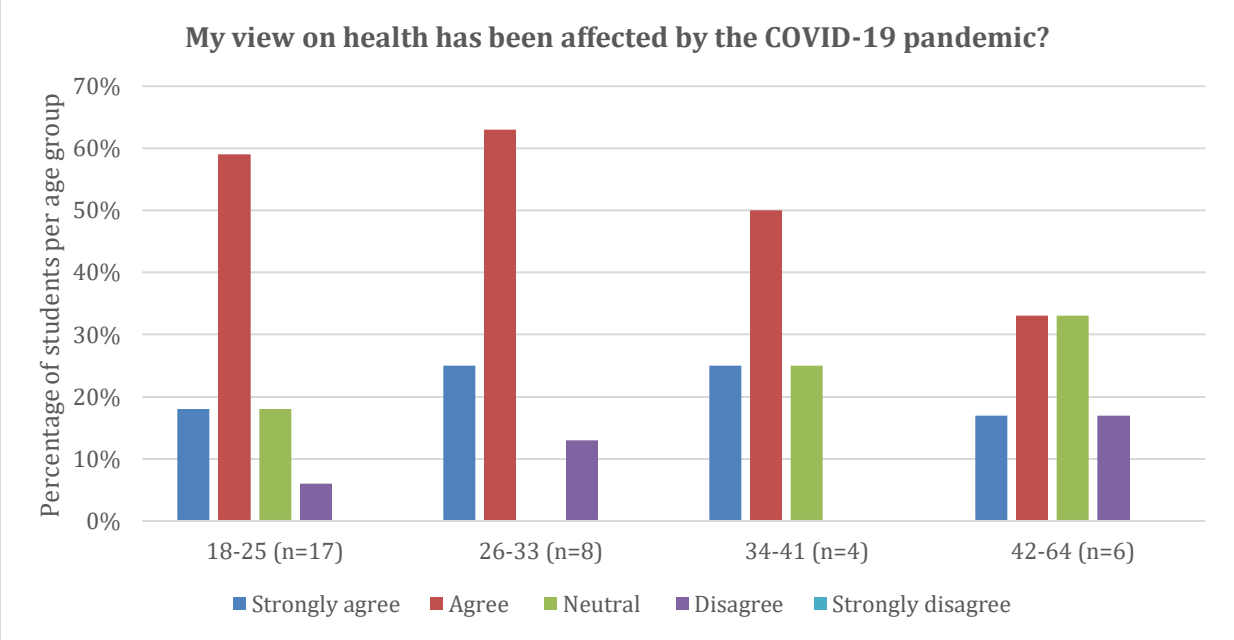
Combining the "strongly agree" and "agree" answers, a higher percentage of participants in the 26-33-year-old (88%) group felt their view on health was affected than the 34–41-year-old group (75%) despite the fact that the 34–41-year-old group had the highest number of immunocompromised individuals. (*Figure* 8 A). This, along with statements made by several of these participants, such as Participant 1, who noted being aware of, and careful about, all diseases based on her medical condition, indicates that being immunocompromised meant these participants were already conscious of health and that COVID-19 did not cause much change.

Similarly, the 42–65-year-old group had by far the lowest percentage of changed views, at 50%. This may be because older students—including Participant 22, who did not

drink from water fountains before COVID-19 and did not change handwashing practices or frequency during COVID because she "knows the appropriate protocol," and indicated "people should follow common sense" in isolating when sick—were more aware of their health before the pandemic, leading to less change.

Figure 9. Changes in View on Health Since the COVID-19 Pandemic Based on Age

A.



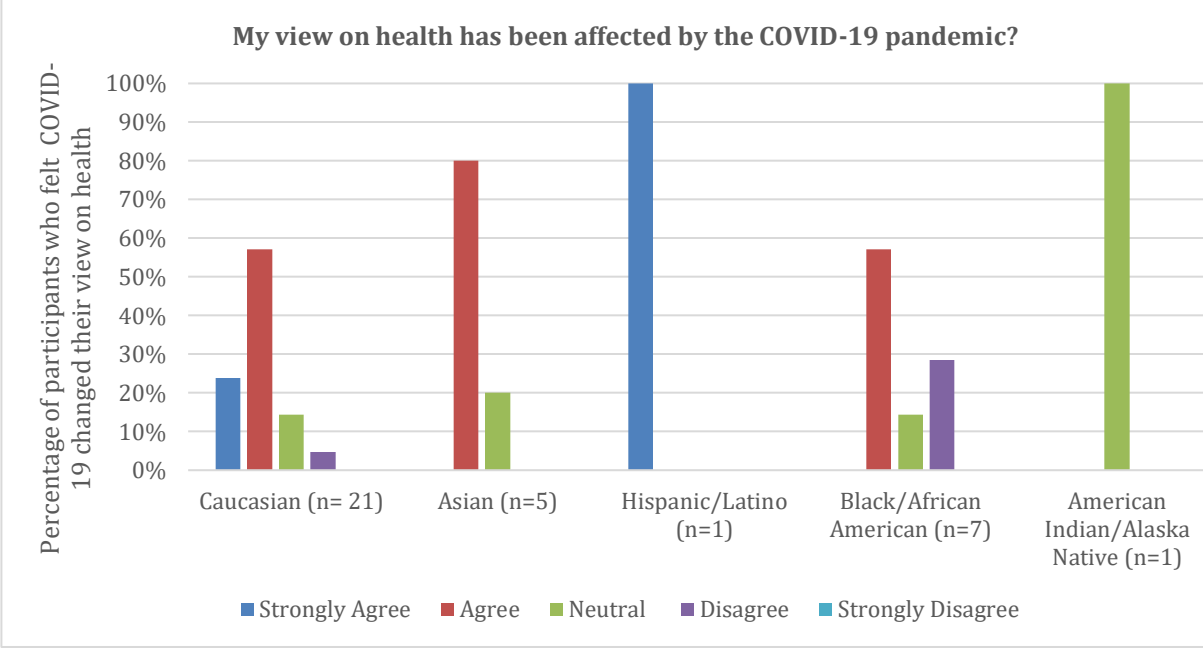
B.

View	18-25	26-33	34-41	42-64	Total
Strongly agree	3 (18%)	2(25%)	1(25%)	1(17%)	7(20%)
Agree	10(59%)	5(63%)	2(50%)	2(33%)	19(54%)
Neutral	3(18%)	0(0%)	1(25%)	2 (33%)	6(17%)
Disagree	1(6%)	1(13%)	0(0%)	1(17%)	3(9%)
Strongly disagree	0(0%)	0(0%)	0(0%)	0 (0%)	0(0%)
Total	17(100%)	8(100%)	4(100%)	6(100%)	35(100%)

Figure 10 analyzes responses to the survey question regarding whether participants' views on health have been affected by the pandemic according to participant ethnicity. No participant in any ethnic group "strongly disagreed," which was likely due to the fact that all participants were health science students. Analysis of participants' responses in relation to their ethnicities did not reveal any apparent relationships (Figure 10A). Two of the five groups (Hispanic/Latino, and American Indian/Native Alaskan) each had an n=1. For the remaining three groups, differences among the participants in terms of age, education level, immunocompromised status, and personal and professional experience appear to be more meaningful than their ethnicity. (Figure 10B)

Figure 10. View on health affected by COVID-19 Based on Ethnicity

A.



B.

Rating	Caucasian	Asian	Hispanic/ Latino	Black/ African American	American Indian/ Alaska Native	Total
Strongly agree	5(24%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	6 (17%)
Agree	12(57%)	4 (80%)	0 (0%)	4 (57%)	0 (0%)	20(57%)
Neutral	3 (14%)	1 (20%)	0 (0%)	1(14%)	1(100%)	6 (17%)
Disagree	1 (5%)	0 (0%)	0 (0%)	2(29%)	0 (0%)	3 (9 %)
Strongly disagree	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	21(100%)	5(100%)	1(100%)	7(100%)	1(100%)	35(100)

Additional supplemental tables not included in this section can be seen in Appendix E. The figures consist of responses to survey question seven, which asked participants to comment on whether they consider themselves immunocompromised and comparing the responses of those participants who identified as immunocompromised based on their academic degree level, their ethnicity, and their age. These tables were not included above as immunocompromised status was only one factor in understanding health science students' perception and use of health precautions.

Table 2. Summary of Participants' Characteristics and Survey Responses

Characteristics	Level	Frequency (%)
N		35
[1]Check-ups/Vaccinations	Increased significantly	10 (29%)
	Somewhat increase	9 (26%)
	Just for annual check-ups	2 (6%
	Neutral	5 (14%)
	No increase at all	9 (26%)
[2]Knowledge Rank	3-4	3 (9%)
	5-6	3 (9%)
	7-8	13 (37%)

	9-10	16 (46%)
[3]View Affected	Strongly agree	7 (20%)
	Agree	19 (54%)
	Neutral	6 (17%)
	Disagree	3 (9%)
	Strongly disagree	0 (0%)
Immunocompromised	No	26 (74%)
	Yes	9 (26%)
Immunocompromised Type	Diabetes	2 (6%)
	Hypertension, Obese	4 (11%)
	None	23 (66%)
	Other	7 (20%)

Note: 1. Has the COVID-19 pandemic potentially increased the need for medical check-ups and vaccinations? 2. On a scale from 1-10 how would you rank your acknowledgement of the severity of COVID-19 among the immunocompromised? 3. My view on health has been affected by the COVID-19 pandemic.

Participants' Responses by Gender

When asked to what degree participants' views on health have been affected by the COVID-19 pandemic, 74% of total participants felt their view had been affected, while a slightly lower percentage (68%) of female participants "agreed" or" strongly agreed," 100% of males "agreed" or "strongly agreed" and 100% of non-binary participants (n=1) "strongly agreed." However, the difference in responses by gender was not statistically significant (*P value*= 0.104) (see Table 2).

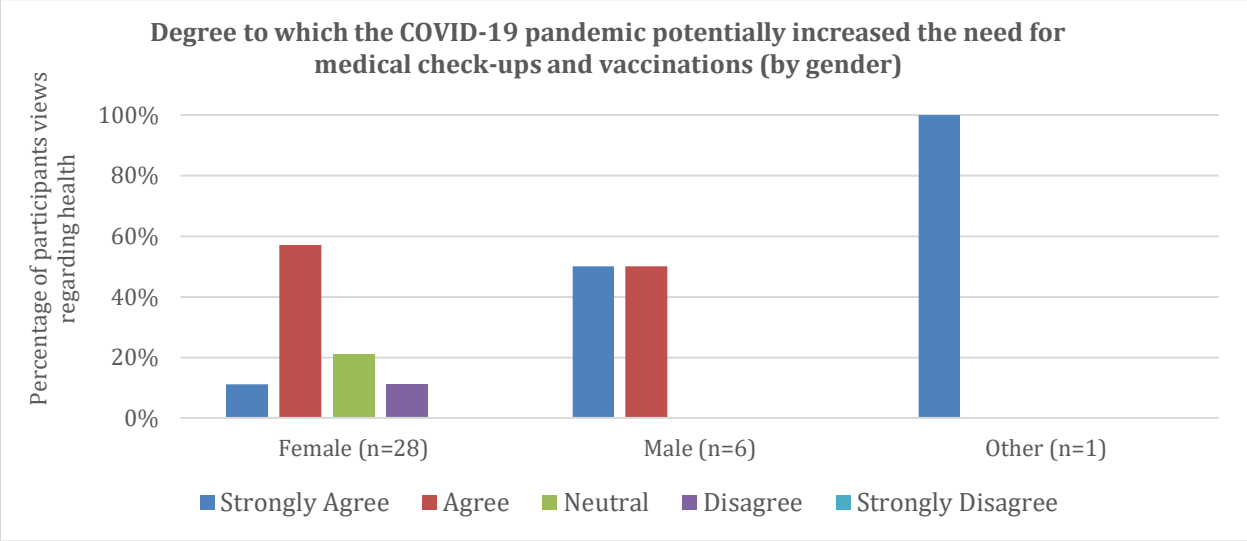
Table 3. Degree to which participants' views on health have been affected by the COVID-19 pandemic (by gender)

[1]View Affected	**Female**	**Male**	**Other**	**Total**
Strongly agree	3(11%)	3(50%)	1(100%)	7(20%)
Agree	16(57%)	3(50%)	0(0%)	19(54%)
Neutral	6(21%)	0(0%)	0(0%)	6(17%)
Disagree	3(11%)	0(0%)	0(0%)	3(9%)
Strongly disagree	0(0%)	0(0%)	0(0%)	0(0%)
Total	28(100%)	6(100%)	1(100%)	35(100%)

Note. 1: My view on health has been affected by the COVID-19 pandemic; *P-value* from Fisher's exact test: 0.104

Responses to whether participants' views on health have been affected by the pandemic, by gender, from table 3, are shown below in a bar graph format in Figure 11.

Figure 11. Degree to which participants' views regarding health have been affected by the COVID-19 pandemic (by gender)



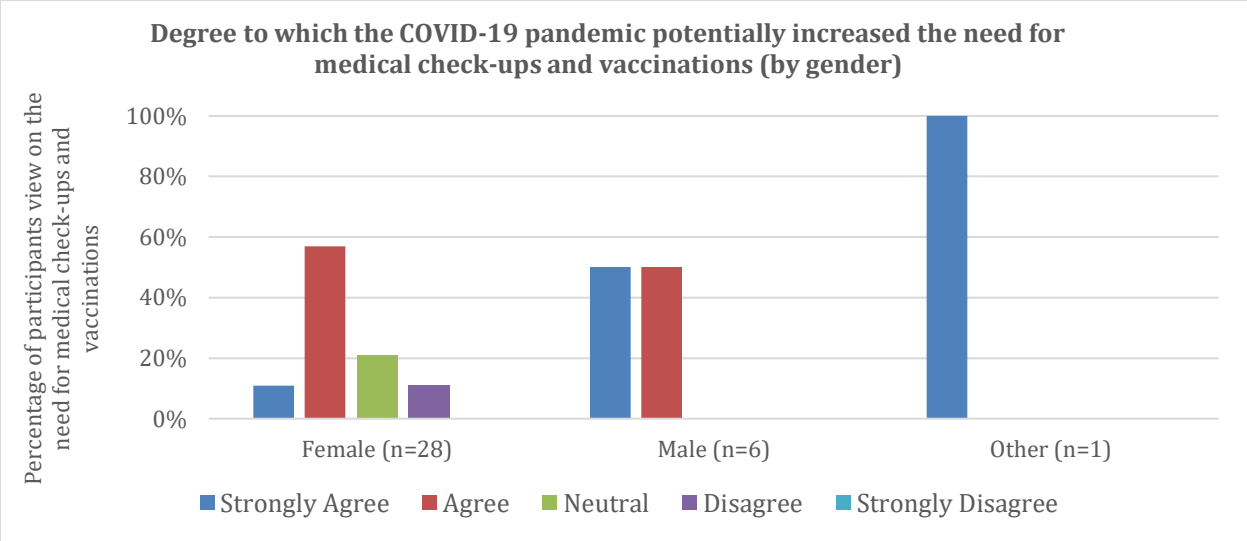
When participants were asked whether the pandemic increased the need for medical check-ups and vaccinations, 55% said it either "significantly increased" or "somewhat increased" the need. It is difficult to determine what participants' baselines were, and to what extent participants prioritized check-ups and vaccinations before COVID-19. In any case, the gender differences were determined not to be statistically significant (*P value*= 0.725) (see Table 4).

Table 4. Degree to which the COVID-19 pandemic potentially increased the need for medical check-ups and vaccinations (by gender)

Check-ups/Vaccinations	**Female**	**Male**	**Other**	**Total**
Increased significantly	6 (21%)	3 (50%)	1 (100%)	10 (29%)
Somewhat increased	7 (25%)	2 (33%)	0 (0%)	9 (26%)
Just for annual check-ups	2 (7%)	0 (0%)	0 (0%)	2 (6%)
Neutral	5 (18%)	0 (0%)	0 (0%)	5 (14%)
No increase at all	8 (29%)	1 (17%)	0 (0%)	9 (26%)
Total	28 (100%)	6 (100%)	1 (100%)	35 (100%)

Note. 1: Has the COVID-19 pandemic potentially increased the need for medical check-ups and vaccinations? *P-value* from Fisher's exact test: 0.725

Figure 12. Degree to which the COVID-19 pandemic potentially increased the need for medical check-ups and vaccinations (by gender)



Summary

The vast majority of respondents (77%), indicated that they had increased or improved handwashing, and of the eight participants (23%) who indicated no change in handwashing, five stated that they had been utilizing careful practices since before the pandemic, either due to work experience, or because they were immunocompromised themselves and had been, as one participant put it, "on it" since before COVID-19. Although two participants indicated that their hand washing practices had returned to a pre-COVID baseline after the peak of the pandemic, the fact that they increased their frequency, time or other technical elements indicates that they are knowledgeable about the value of hand washing in preventing disease.

Although the sample size likely obscured or amplified some trends, more advanced educational level was clearly linked to taking COVID-19's potential dangers more seriously, with all PhD students rating its severity toward the immunocompromised a 7-8 or above on a 1-10 Likert scale, while 80% of master's degree students did so. Only 60% of bachelor's students

rated it 7-8 or above; 20% rated it a 5-6, and 20% rated it at the low level of 3-4. Additionally, in response to the question of whether their view on health had been affected by COVID-19, 20% of those at the bachelor's level indicated that they "disagreed," while for master's level students that percentage was only 8% and no doctoral students disagreed.

With respect to the health precaution of contact tracing, 22 participants (63%) felt it was helpful for disease control and 15 (43%) had mixed emotions. Participant 33 noted that getting the call from the contact tracer made her "crack down (on herself) a little bit," after a birthday party after which someone came down with COVID-19.

Participants' healthcare work experience was obviously critical in informing their understanding of the pandemic, with 31 participants (89%) mentioning working in healthcare and noting the impact of this work on their perceptions, behavior, and sense of self-efficacy in response to COVID-19. Participants' health-related work experience included working in nursing homes, public health emergency response teams and volunteers, laboratories, clinical health professionals, hospital technicians, and public health, including contact tracers.

After analyzing answers from each respondent, 30 respondents (86%) reported changes in attitudes or behaviors, and five (14%) indicated nothing had changed. Of those five, four indicated that they had already been knowledgeable and careful about disease prevention prior to COVID-19, including strengthening their immune systems through nutrition, exercise and the use of research-backed supplements. The data indicates the impact health science education, as well as personal and professional experiences, had on the perception and use of health precautions at all age groups, ethnicity, and academic levels of health science students.

Qualitative Analysis

Table 5. Themes and Codes

Themes	Codes	Sources	References
Perception about contact tracing		34	73
	Somewhat creepy	9	10
	Not at all helpful	6	6
	Inadequate coverage	4	7
	Mixed feelings	12	21
	Helpful for disease control	13	29
Level of COVID-19 awareness		33	48
	Moderate awareness	13	15
	High awareness	20	23
	High-risk or high exposure	4	5
	Felt misled by authorities	2	5
Impact of self-awareness on exposure, behavior, self-efficacy, and attitude		33	94
	Uncertain about impact	8	9
	No longer worried	2	2
	No impact observed	7	13
	Increased passion for public health	3	4
	Greater awareness due to healthcare role	31	63
	Enhanced realization of disparities	3	3
Changes in Pandemic-Period Restrictions and Health Precautions		35	177
Changes in use of water fountain		34	37
	No changes	23	23
	Avoidance of water fountain	12	12
	Avoid kids using water fountain	2	2
Changes in social gathering		35	61
	Strictly followed guidelines	23	29
	No more concerns post-pandemic	9	12
	Lingering concerns post-pandemic	11	11
	Disagreements among family	2	3

	Did not follow guidelines	3	6
Changes in handwashing		35	79
	No increase in handwashing	15	17
	Increased handwashing	22	28
	No change in duration and techniques	12	13
	Improvements in duration and technique	18	20

*Sources are the transcripts of the participant interviews. References refer to the specific chunks of text that were coded.

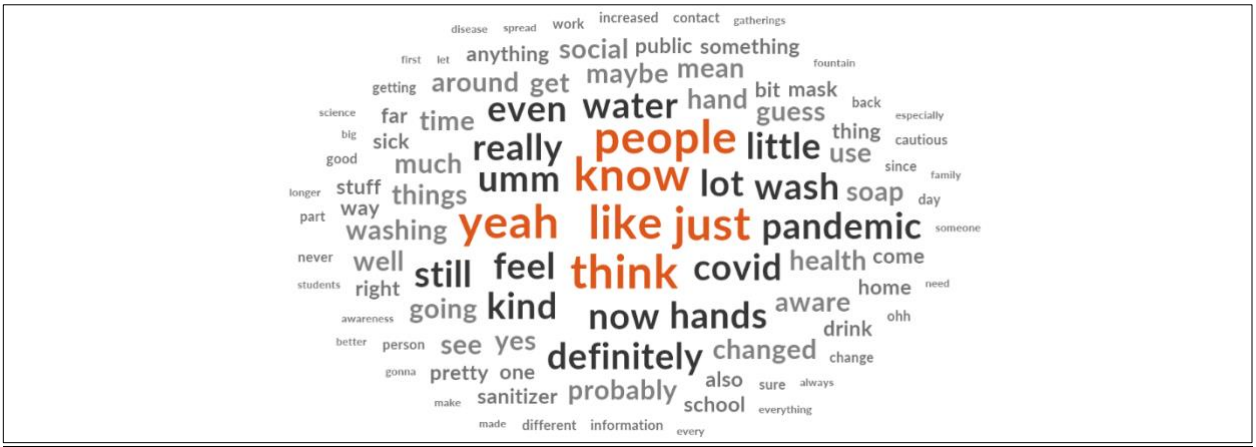
As presented in *Figure* 14., the most frequently occurring words were pulled from the interview question responses. The purpose of this figure is to show that although there are some key health-related terms mentioned frequently, including COVID, pandemic, health, sick, and disease, as well as health precaution-related words such as water, sanitizer, hand, mask, and awareness, there were also numerous words, such as "like," "you know," and "umm," that are known as "filler words." According to research conducted by Duvall, et. al. (2014), filler words—including the repetition of words or phrases—are sometimes used out of nervousness, or to gain time to organize thoughts (Duvall et al., 2014).

Depending on the tone of voice, and the context, filler words can make a person sound less certain, or simply more thoughtful (Laserna et al., 2014). In the interviews conducted with health science students, some student participants may have felt pressure to respond "correctly" to the questions, either due to the many controversies surrounding COVID-19, or due to fear of being judged if their answers did not align with "best practices," or social or family norms, such as the participant who answered yes to still drinking from the water fountain, but then added, "but maybe I shouldn't?".

Other participants may have been searching for polite ways to describe views that they did not agree with, which might have led to a greater use of filler words or hesitation in getting straight to the point. For example, participant 1, who went on to describe how her extended family had become very divided during the pandemic, responded to the question about social gatherings post-peak by saying: "I mean, I, I'm I feel like being in the health field kind of gives you that kind of more understanding beforehand that, like, germs, you for certain things anyway*"*. Note the filler words, "I mean," and the repetition of "I, I'm I feel like . . ." and "certain things," as she talks about taking social distancing more seriously than some other members of her family did. It is possible that she was wanting to share both her frustration, and her understanding that her background knowledge might have influenced her position on social distancing in contrast to other family members.

Participant 21, responding to the question of whether her academic education had influenced her perceptions of COVID-19 (after telling the interviewer she believed the response to COVID-19 was overblown), said "I think, yeah, I think it just helped me look into more holistic medicine too, rather than just taking whatever the doctors give me. Umm but yeah, I think that's I think that's the answer, but I don't know." This participant's words explicitly state that she is not sure, and the repetition of words and phrases, along with inclusion of numerous filler words, highlight this lack of certainty.

Table 6. Most frequently occurring words



Description of Thematic Categories

Theme 1: Perception About Contact Tracing

This theme describes participants' perspectives about contact tracing during the COVID-19 pandemic, for example, regarding its usefulness for preventing the spread of COVID-19 and potential for invasion of privacy. Contact tracing was used as a health precaution during the COVID-19 pandemic to alert those who may have been exposed. Most participants knew what contact tracing was; however, some asked for clarification and subsequently understood what the term referred to. Participants' perspectives were captured in such codes as "helpful from a disease control perspective," "somewhat creepy," "not at all helpful," "not adequate in coverage," and "mixed feelings." Overall, 34 of 35 participants informed the definition of this theme. The most frequently occurring code was "helpful from a disease control perspective," which was informed by 22 interviews and had 29 references, followed by "mixed feelings," informed by 15 interviews and 21 references.

Regarding the code, "helpful from a disease control perspective," Participant 1 stated that knowing friends from other countries such as Korea who were using an app to track potential

COVID-19 exposure helped her understand how beneficial it could be from an epidemiological standpoint, and she could see the advantages of using technology this way. This participant also indicated, however, that friends in the United States who received contact tracing calls "were creeped out," and said she's not totally sure how she felt about it personally, mentioning that she will be curious to see, "in a couple years," how the collected information was used.

Three participants, 9% of total participants, had worked as contact tracers during the pandemic, and although each said that they felt it had value, participant 6 stated that the volume of calls required to follow up with each case had probably not been necessary, and she suggested a weekly follow up rather than daily calls. Participant 25 also stated that contact tracing appeared to provide more awareness of COVID-19 but because of the repetition of the notifications people may have become less responsive.

Participant 6, who also worked as a contact tracer, said they did not believe it had stopped COVID-19, but they believe it was important to gather the information to understand the spread. In terms of containing the spread of the disease, Participant 11 noted the benefits COVID-19 contact tracing had on containing the spread of the disease. Participant 16 noted finding contact tracing beneficial because she understood its purpose.

One of the methodological flaws mentioned by Participant 24 was the inability for individuals to report the results of in-home tests, though she also stated that the contact tracing effort was "better than nothing." Participant 27 noted that contact tracing should be used for "isolated illnesses" such as foodborne situations that are more limited in scope, but that for COVID-19 there were simply too many contacts, and it got "overused and out of control" and people stopped trusting the information. Participant 2 stated that the media's negative

perspective on it caused additional problems for those in the healthcare field who were doing direct patient care.

Participant 12 noted contact tracing was not helpful, a waste of manpower, and was not needed. A similar sentiment was expressed by Participant 13 as she explained the ideology of contact tracing was a well-placed idea but was poorly executed "as there was no way to track the honesty of people." Participant 18 mentioned that the news coverage of contact tracing during the peak of the COVID-19 pandemic negatively portrayed its usefulness, and this ended up causing problems for those working in direct patient care.

Participant 13 was a Special Education middle school teacher during the pandemic who mentioned concern that contact tracing only notified those people in direct contact (sitting within a 6-foot radius of exposure) instead of notifying all students who were in the same class as the student. Ensuring that all students were aware of potential exposures to COVID-19 would have served as a precaution in case other students were infected but not yet showing any symptoms.

Participants emphasized the value of contact tracing, while also highlighting its limitations and potential for invasion of privacy. Participant 34, who was herself immunocompromised, felt that contact tracing was a good idea, providing notification that, if not provided, could dramatically affect their lives. Participant 35 expressed that although many felt their privacy was violated by contact tracing, it was an effective way to potentially slow down the spread of COVID-19 pandemic.

Theme 2: Level of COVID-19 Awareness

This theme describes participants' self-reported knowledge and awareness of COVID-19. All participants indicated that they had a high or moderate level of COVID-19 awareness. Four participants considered themselves to be at high risk of acquiring COVID-19 infection and they

attributed their high level of awareness to this. Participants' perspectives were captured in such codes as "Moderate awareness," "High awareness," "High-risk or High exposure," and "Felt misled by authorities." The most frequently occurring code was "high awareness" which was informed by 20 interviews and had 23 references, followed by "Moderate awareness," informed by 13 interviews and 15 references. Participants expressed their perspectives in various ways. "High awareness" of the pandemic was noted by participant 12, whose training as a respiratory therapist required her to have greater understanding of transmission, social distancing, hand washing, advantages, or disadvantages of mask usage, and limiting exposure. Participant 10 also expressed high awareness, stating that she "had read everything about it." She did not attribute her knowledge to her academic education, but to being "in the world." Several participants, including Participant 18, mentioned having been more aware of the COVID-19 pandemic during its peak but now, with less reporting of cases, she was not as cognizant.

Regarding the code, "Felt misled by the authorities," four participants mentioned their distrust of various sources of information. Participant 6 said "this may be what it is, or it may not be," and Participant 24 mentioned that although accurate information on COVID-19 was provided to the public, there was also significant data provided that was not true, and this should be a lesson "to look into the research before you just say yes or no to something."

Research seemed to be an essential aspect for many health science students. Participant 9 stated that the challenge many faced was feeling as though they were receiving contradictory data from health organizations that many trusted, which made the country look bad and showed that people only cared about what political appointees stated rather than taking the advice of health professionals and performing their own research.

With regard to the code, “High-risk or high exposure,” many participants mentioned having to take personal action due to the high risk and exposure during the peak of the COVID-19 pandemic. Participant 29 mentioned moving off campus in 2020, prior to the peak of the pandemic, to protect her sanity due to her first-hand experience working in a nursing home with a high COVID-19 fatality rate which ultimately led her to resign in October 2020.

Overall, 33 of 35 (94%) of participants informed the definition of this theme. Most study participants indicated feeling that they had a moderate or high level of COVID-19 knowledge and awareness.

Theme 3: Impact of Self-Awareness on Exposure

This theme describes the impact of participants’ self-awareness on their exposure, behavior, self-efficacy, and attitude. Most participants reported that they were more aware on account of their healthcare roles. A few participants noted that they had become more passionate about public health because of the pandemic. Participants’ perspectives were captured in such codes as “Uncertain about impact,” “No longer worried,” “No impact observed,” “Increased passion for public health,” “Greater awareness due to healthcare role,” and “Enhanced realization of disparities.” The most frequently occurring code was “Greater awareness due to healthcare role,” which was cited by 31 interviews (88%) and had 63 references, followed by “No impact observed,” informed by 7 interviews (20%) and 13 references. Participants expressed their perspectives in various ways. For example, regarding the code, “Greater awareness due to healthcare role,” Participant 11 noted that based on her personal experience as a health science student, she felt more aware of COVID-19 as she is more interested in the field in comparison to students who were business majors. Participant 11 further highlighted the importance of learning about vaccines in class and how that helped her to be more accepting of COVID-19 vaccines.

She stated that in terms of education on COVID-19, toward the start of the pandemic hers was the same as the public; however, toward 2021 she took an immunology course that discussed the science of mRNA vaccines. Participant 11 explained that the course on vaccines prompted a class conversation on its effectiveness and validity without making it a political statement, which gave her a better understanding of COVID-19 and how it affected people.

Some participants did not think their self-awareness had any impact on their exposure, behavior, self-efficacy, or attitude. For example, regarding the code, “No impact observed,” Participant 19 stated, "I do not think that it has changed as those measures like the six feet apart, things like that, in my opinion we came to find out that these really didn’t make much of a difference.” According to Participant 19, health precaution changes such as social distancing to reduce transmission should have not been made.

Post-peak, COVID-19 did not affect social behavior as much as when there was a mandate to stay home, though many participants mentioned increased awareness of the potential for infection contagion. Participant 21 reported staying home during the mandate but said she went back to yoga class once the mandate was lifted, with no additional health precaution changes made since then. A few participants felt that the pandemic made them realize the brevity of life, while others were not sure whether it had any impact on their behavior. Participant 11 explained that the COVID-19 pandemic provided the opportunity to determine future and career aspirations, realize the importance of spending time with people you love, and it showed how short life can be with no guarantees.

Overall, 33 of 35 (94%) participants informed the definition of this theme. Most participants expressed the impact of their self-awareness, given their healthcare roles, on their

behavior, while a few reported a lack of confidence in the information available during the pandemic, despite their healthcare backgrounds.

Theme 4: Changes in Pandemic-Period Restrictions and Health Precautions

This theme describes the changes in restrictions and health precautions that participants reported experiencing or implementing after the pandemic, compared to during the pandemic. This theme was defined by all 35 (100%) interviews and had the highest number of references of all four themes (177). The theme is subdivided into three subthemes, including changes in use of water fountains, changes in social gathering, and changes in handwashing frequency and practice.

Subtheme 1: Changes in use of water fountain

This theme describes participants' report of whether they use water fountains since the COVID-19 pandemic. Some participants reported no longer using water fountains, never using water fountains before COVID-19, or no change, while others use water fountains but don't allow their kids to use them. Participants' perspectives were captured in three codes: "no changes to water fountain use," "avoids water fountain use," and "avoid water fountain use by kids." The most frequently occurring code was "no changes in water fountain use," which was informed by 23 interviews out of 35 participants (65.7%) and had 23 references, followed by "avoidance of water fountain," informed by 12 interviews out of 35 participants (34%) and 12 references. Participants expressed their perspectives in various ways. For example, regarding the code, "no changes to water fountain use," Participant 14 stated that they would still drink water from the water fountain at work since the COVID-19 pandemic. Participant 17 was less confident in drinking from water fountains, but still did, stating "no, I drink from water fountains. I'm more wary about it, but I still drink, yeah." Some participants, such as Participant 21, reported that

they had never used water fountains in the past and they still do not, however, avoidance was not necessarily related to COVID-19. Participant 29 also indicated barely drinking water from the water fountain before the pandemic and would not start now.

Twelve participants (34%) expressed similar attitudes related to the avoidance of drinking from the water fountains since the pandemic. For example, Participants 30 and 32 both said, “I don't drink from the water fountain anymore.” Participant 10 stated, “No longer drink water from the water fountains at all.” Participants 1 and 13 noted that they would not allow their kids to drink from water fountains, with Participant 1 stating, “I don’t even let my son near the water fountain anymore, unless it is one of the ones that is no touch for your water bottle.”

Overall, 34 of 35 (97%) of participants informed the definition of this theme. Although 65% of participants expressed no change in the use of water fountains (with almost half of those participants indicating that they hadn’t used them before Covid-19), 34% of respondents reported that they now avoid using water fountains.

Subtheme **2: Changes in social gathering restrictions**

This sub-theme describes participants’ report of whether they observed or continue to observe any social gathering restrictions during and after the COVID-19 pandemic. Twenty-three participants (66%) reported strictly following the restrictions even to some degree after the pandemic, while nine (25%) followed restrictions during the pandemic but are no longer concerned about COVID-19 so are more relaxed regarding restrictions. Eleven participants (31%) still had lingering concerns even after the pandemic and three participants (9%) reported not following the social gathering restrictions during the pandemic. Participants’ perspectives

were captured in five codes: “strictly followed guidelines,” “no more concerns post-pandemic,” “lingering concerns post-pandemic,” and “did not follow guidelines.”

The most frequently occurring code was “strictly followed guidelines,” which was informed by 23 (66%) of interviews and had 29 references, followed by “no more concerns post-pandemic,” informed by 9 participants (25%) and 12 references. Participants expressed their perspectives in various ways. For example, with regard to the code, “strictly followed guidelines,” Participant 12 stated that she limited social gatherings with large crowds in small spaces, but she interacted with those that were in her close-knit circle; however, even prior to COVID-19 she did not interact much in a large crowd; the pandemic made her no longer interested at all. Another participant, Participant 22, explained that since the COVID-19 pandemic they no longer want to socialize in person with individuals who are sick in fear that they may also get sick. Other participants continue to have lingering concerns about social gatherings even after the pandemic. Although we are years past the start of the COVID-19 pandemic in 2020 and most people have reset, some, including Participant 1, remain worried about how close people are in front of her because she is immunocompromised and more cautious. Participant 18 also still takes precautions in crowded places, stating that her behavior has changed; “I personally still wear a mask when I'm in large public spaces like airports or you know, like train stations, concerts as it’s more normalized and I do not want to get sick.”

Other participants stated that things were back to normal. They had followed the restrictions during the pandemic but now consider those restrictions to be no longer needed. Participant 24 felt that since the peak of the COVID-19 pandemic people are having gatherings again and just “treating the cold if they get sick.”

A few participants reported that they did not follow the social gathering guidelines, whether during the pandemic or after it had subsided. For example, Participant 9 stated that she was not attending large events during the COVID-19 pandemic but had a lot of friends that did during its peak, and she felt that the social gathering restrictions were overdone. Participant 9 further emphasized her misgivings with the restrictions, stating, “A lot of violations that happened, let me tell you that COVID-19 had a lot of civil and civic violations happen.”

Overall, all 35 participants informed the definition of this theme. Most participants expressed that they strictly followed the guidelines and restrictions, and many continue to observe some precautions in crowded areas or large gatherings, but a few did not follow the guidelines.

Subtheme **3: Changes in handwashing practice and frequency**

This sub theme describes participants’ report of whether there was any change in their hand washing frequency or practices during the COVID-19 pandemic. More than half of participants reported an increase in the frequency of handwashing, although 46% reported no increase. Most participants (71%) said that there was an improvement in the practice of handwashing, e.g., washing for a longer duration. Participants’ perspectives were captured in four codes: “no increase in handwashing,” “increased handwashing,” “no change in duration and techniques,” and “improvements in duration and technique.” The most frequently occurring code was “increased handwashing,” which was informed by 22 interviews and had 28 references, followed by “improvements in duration and technique,” which was informed by 18 interviews and 20 references.

Participants expressed their perspectives in various ways. For example, regarding the code, “increased handwashing,” handwashing for many of the participants was a practice

followed prior to the COVID-19 pandemic, although as Participant 2 mentioned, “I would say it's definitely increased.” Participant 12 explained that hand washing has increased five to six times more per day in comparison to 3 times a day before the COVID-19 pandemic other than after using the restroom. For some participants, the increase in hand hygiene included not only handwashing but also the use of alcohol-based hand sanitizers. Participant 13 noted having obsessive-compulsive disorder (OCD) significantly increased after touching people and objects, “so to give you a specific number, I don't know, but I would say it has absolutely increased as I stand here, Clorox wiping my watch for no reason at all.” Hand sanitizer was sometimes used as a temporary convenient way to clean hands before washing them with soap and water. Participant 10 expressed the need to use more hand sanitizer after touching doors now than before the COVID-19 pandemic.

There were 18 participants who reported improvements in handwashing duration and technique. For example, regarding the code, “improvements in duration and technique,” Participant 15 stated that, since the COVID-19 pandemic, hand washing timing has increased intensively along with the use of hotter water while washing hands. Although duration for some participants increased there were some participants who noted no change in the frequency of hand washing since the peak of the COVID-19 pandemic in comparison to before.

There were 15 participants (43%), who stated that there was no change in their frequency of handwashing because they already had good hand hygiene habits even before the pandemic. Participant 11 stated, “I would say no increase, but I have worked in the medical field, so I've already had good hand washing before COVID-19.” Other participants mentioned including their family in practicing effective hand washing even before the pandemic; Participant 1 noted “no change, we were really on it about washing our hands.”

Overall, all 35 participants informed the definition of this theme. Most participants expressed the impact of their professional healthcare roles on their hand washing behavior, while others mentioned concern for personal or familial health.

Summary

This chapter synthesizes findings from a mixed-methods study exploring the effects of the COVID-19 pandemic on health precautions among health science students at Liberty University, George Mason University, and Norfolk State University. Utilizing both surveys and in-depth interviews, this chapter delves into the shifts in students' perceptions and practices regarding health precautions during and post-pandemic, influenced by their educational level, personal experiences and healthcare roles.

The influence of Bandura's Social Cognitive Theory was evident, with education, role models, and environmental factors all playing crucial roles in shaping perceptions and behaviors. Virtually all students (91%) reported an increase in use of health precautions due to their understanding of COVID-19 transmissibility as well as a sense of self-efficacy, as evidenced in their increased handwashing frequency or improved technique, and their willingness to social distance or wear a mask to reduce transmission. The majority of participants (60%) reduced their attendance at social gatherings even after the pandemic mandates were lifted, emphasizing a sustained caution influenced by their healthcare roles and/or personal experience with being (or caring for) someone with a compromised immune system.

Approximately a quarter of the participants (25%) relaxed their adherence post-pandemic, feeling less concerned as COVID-19 restrictions eased and vaccines became widely available. Despite the lapse in official mandates, 31% of participants continued to harbor concerns due to personal health risks or professional responsibilities. Notably, a small segment

(9%) reported non-adherence to social gathering guidelines during the pandemic, highlighting variations in compliance and perception of risk.

Thus, in answer to the study's Central Question, regarding the effect of the COVID-19 pandemic on health precaution usage by health science students, the study identified a pronounced shift toward more stringent health precaution usage during the pandemic. Personal encounters with COVID-19, such as exposure at work or social events, tended to reinforce the seriousness of the pandemic, prompting stricter adherence to health guidelines among some students. The majority of health science students at all educational levels reported using, and/or increasing the use of health precautions such as hand washing, mask wearing, and social distancing during the pandemic, with many continuing to use at least some health precautions at increased rates post-pandemic.

The research also underscored the importance of clear and accurate information for maintaining credibility. Several participants noted the lack of clarity in the CDC's initial mask recommendations, as well as confusion regarding their purpose and efficacy, and others mentioned feeling suspicious of the COVID-19 vaccines. This confusion and misinformation, whether intentional or not, had an impact on participants, even the vast majority who indicated that they took COVID-19 seriously and abided by the CDC's recommendations.

CHAPTER FIVE: CONCLUSION

Overview

The purpose of this phenomenological study was to address a lack of research on health science students' perceptions and use of health precautions in relation to the COVID-19 pandemic. Given the enormous and devastating effects of the pandemic, the study was designed to discover the perceptions and behaviors of health science students, eliciting not only

information about health precautions used during the pandemic, but also the underlying motivations for such actions. This chapter cites some research highlights, summarizes the answers to sub-questions one and two, restates the problem and applies the research findings to recommend ways to enhance the education provided to health science students by their universities. Moreover, it acknowledges the study's limitations and proposes avenues for future research.

Research Highlights

A number of participants, including Participants 32 and 33, indicated they took health precautions, such as masking, to protect their loved ones. Participant 8 did not see her parents for months except to wave at them from her car. Participant 22, who indicated that she was not concerned for herself, was clear that she took precautions for others in the home, and that, due to cultural competency training, she was respectful of others' concerns and their use of health precautions based on their beliefs. Participant 33 stated that she was getting her master's degree in public health because, "you don't want to find yourself in a situation where you can't help yourself but also help the ones around you." The findings from this study underscore the critical role of health science education in shaping students' responses to pandemic challenges and highlight how Bandura's Social Cognitive Theory can effectively guide educational practices to enhance students' preparedness for public health crises. As the world continues to navigate the aftermath of the pandemic, the insights from this research could inform future curricular and policy adjustments to better equip health science students in managing and mitigating the impacts of similar global health emergencies.

Overall, many students reported taking the recommended precautions of hand washing, social distancing, and health check-ups and vaccinations seriously, as well as being careful not to

expose themselves or others to illness unnecessarily. Many participants expressed increased awareness regarding the potential for disease transmission, with some indicating they had become "germophobic" or that—although they themselves might not have changed so much—the rest of the world changed its understanding of disease because of COVID-19.

Participants' responses to contact tracing were mixed, though more than half of participants recognized its potential to provide valuable information for research. Most of those who felt it was ineffective had procedural recommendations, informed by their knowledge of communicable disease transmission and their own or others' lived experiences, though 20% of participants felt it was such an invasion of privacy that it should not be allowed.

The majority of participants reported that social gatherings have normalized since the peak of the pandemic. Though more than half emphasized that they are now more mindful of those who may be immunocompromised and more careful to avoid being around sick people now than in the past. This indicates that, as the *Health Precaution Effect Model* suggests, students integrate information from a variety of sources, including their academic education and their personal and professional experiences, into their decision-making.

Bandura's SCT shows that individuals are likely to be influenced by trusted role models, as well as the environment around them. In a reciprocal fashion with experiences, academic instruction and role models may affect individuals' choices, and ultimately their sense of self-efficacy (Bandura, 2001). In fact, more than 87% of study participants reported that their education and healthcare work experiences had positively influenced their approach to health precautions during the pandemic. Those at higher educational levels demonstrated substantially more awareness of the seriousness of the virus for those with compromised immune systems than participants at lower educational levels.

Although the *Health Precaution Effect Model* predicted that participants who used fewer health precautions would experience more cases of COVID-19, this was not directly apparent in the data collected. However, Participant 33 shared a story of her personal experience after getting together with family members for a birthday party where someone came down with COVID-19. She noted that this experience caused her to "crack down" on her own use of health precautions such as masks and social distancing, because it made the potential danger of COVID-19 real in a way it hadn't been before.

Twelve participants (34%) mentioned trust in the course of their interviews. Either trust in information provided by their workplaces, trust in their health science education, or trust in their own ability to read reputable sources and draw their own conclusions. Participant 23 mentioned his positive experience learning about vaccines in his immunology class;

> "I felt like my professors did a really, really good job of teaching us about the actual science behind the vaccine, without making it a political statement. And so, I was able to then explain some of those, uh, you know, genetic mechanisms that happen when you have an mRNA vaccine and how your immune system responds to it."

This demonstrates the importance of health science students' courses providing unbiased, accurate and trustworthy sources of information, which increases students' understanding and enables them to communicate effectively to others about these topics. As Participant 27 stated, "the pandemic directly affected health science students because they were challenged with what they were learning, and people were asking them questions. It gave me perspective on the importance of dissemination of accurate information." It is clear from these statements that health science students are motivated by a desire to know and communicate with others about the important topics they study.

In answer to sub-question one, regarding how the aftermath of the pandemic affected health science students' knowledge, perceptions, behavior, and sense of self-efficacy – Post pandemic. Students reported moderate to high levels of knowledge regarding COVID-19, a sense of reduced risk as infection numbers dropped, reduced use of health precautions except in circumstances perceived as high risk, and an overall sense of self-efficacy regarding protecting themselves and their loved ones from serious illness. Many students expressed a heightened sense of responsibility due to their role as trusted sources of information within their communities of families, friends and coworkers.

Sub-question two asked how health science students' awareness of potential infection exposure mechanisms had been affected by the pandemic. Students generally displayed moderate to high levels of awareness of disease transmission mechanisms. They attributed their understanding to their educational backgrounds, work experience, self-conducted research and the wealth of information that became widely available during the pandemic.

Restatement of the Problem

The problem was the lack of research into health science students' attitudes and behaviors regarding health precautions during and after the peak of the COVID-19 pandemic. Without greater understanding, a valuable potential resource in the fight against infectious diseases—individuals who have chosen health science as their field of study—remains underutilized.

Even the most educated students may want and need additional training to respond effectively to a health crisis. Results from a 2020 study by O'Byrne et al. on medical students determined that 70% of participants felt unprepared to participate in health emergencies such as the COVID-19 pandemic (O'Byrne et al., 2020). This dissertation study used Bandura's SCT, and the *Health Precaution Effect Model* as a framework. The investigation demonstrated that

individuals' academic education, their experience working in healthcare settings, and their concern for their own health or the health of others had the most significant impact on students' behaviors.

Because health science students are and will be on the front lines of health information utilization and dissemination, it was important to better understand their perceptions and behaviors during and after the peak of the pandemic to plan interventions for potential future public health crises.

Proposed Solution to the Central Question

Incorporating insights from the study of the central question regarding the effects of the COVID-19 pandemic on health science students' perception and use of health precautions, the proposed solution suggests increasing direct instruction in disease transmission to fill gaps in understanding. Although health science students in this dissertation study generally demonstrated high levels of knowledge about disease transmission, there were some misconceptions, and several participants noted that more information about the pandemic will undoubtedly come out. This underscores the importance of health science students having access to the highest quality and latest research on these topics, not just in a single class, but throughout their educational journey.

The vast majority also indicated they understood the importance of taking health precautions to help reduce disease spread, and that they took health precautions to protect those they cared about, as well as vulnerable individuals in the community. Leveraging students' concern for their loved ones and the community (motivation) was demonstrated to promote wellness practices, even beyond those some individuals were willing to take for themselves.

Based on research conducted by Pajares and Usher (2008), on the importance of science students' ability to communicate their knowledge in real-world settings, the recommendations include curricular elements designed to enhance students' understanding of disease transmission, develop their oral and written science communication skills, and increase their sense of self-efficacy. Students would be expected to present information learned in their science classes, not only to their professors and classmates, but to members of their circle or the lay public. As Participant 16 noted, the politicization of the COVID-19 pandemic reinforced the need for obtaining information from trusted health specialists.

This study adds to the body of research examining the relationship between formal education and experiential learning, grounded in Albert Bandura's theory of reciprocal determinism. Reciprocal determinism states that learning happens through an interactive combination of factors that include observation of others/role models, the individual's own cognition and self-reflection, and their motivation (Bandura, 1986). In line with Bandura's model, research performed contemporaneously with the current study found that credible health education has a beneficial impact on health decisions (Murmann et al., 2023; Luchman et al., 2023). Domingo-Fernandez et al. (2021), also studied the need for trusted sources of information and role models. Health science students, having chosen this area of study, are uniquely qualified to serve as community liaisons in the communication of health science information, and in the modeling of positive health precaution behaviors.

The current research study found that health science students at the master's and doctoral level exhibited greater knowledge of disease mechanisms, and transmission—as well as a greater sense of self-efficacy—than students at the bachelor's level. Although some study participants mentioned obtaining knowledge from sources other than their academic education—many

mentioned their work in healthcare settings. Additionally, some educated themselves by reading medical journal articles, and one participant noted that simply "being in the world" gave her all the information about COVID-19 that was needed to respond proactively. More educationally advanced students expressed taking more steps to minimize the spread of COVID-19 than bachelor's level students, overall.

It is also significant that some study participants, who mentioned they did not follow the recommended health precaution guidelines, also reported information about the pandemic that was not based on scientific facts. Participant 5 stated that "masks were more to protect you from others than to protect them from you." This is a misconception, as evidenced by Hemmer et al. (2021) and Cheng et al.'s (2020) study on the efficacy of mask wearing for protecting all parties (Hemmer et al., 2021; Cheng et al., 2020). Participant 5 also indicated that because she was unable to social distance at her job at the hospital, she did not make much effort to social distance when she was outside of work. Participant 9, who was in the 43-64-year-old age group and a master's student, stated that COVID-19 was like a cold. This is inaccurate, especially for the virus's first variants as evidenced by millions of deaths. Participant 9 also stated that restrictions were "pointless because nothing helped," which is incorrect not only for SARS-COV-2, but for influenza and the common cold as well (Paules, et al., 2020, Torres et al. 2020). Participant 13 stated that the country "would have been better off if we had just let it run its course," and Participant 19 said that masks "do not help," which is factually inaccurate (Brussow et al., 2022).

These perceptions demonstrate the need for ongoing education, which may be due in part to the fact that, in the U.S., infectious diseases are not as prevalent as they used to be due to the impact of widespread vaccination. As a result, many people are not personally familiar with the

danger that these diseases could pose (Dabek et al., 2022). Participant 2, in the 43-64-year-old group, indicated no changes to handwashing, social distancing, need for medical check-ups and vaccinations was in the PhD program in health science. Participant 2 noted that his work experience involved being CEO of a big pharmaceutical manufacturing company where they had not been able to social distance, but where they had had "very little to none COVID-19 issues."

It may be that those who demonstrated inaccurate understanding of the disease, its severity or health precautions were confused by lack of clarity in the beginning of the pandemic. They failed to update their understanding when additional information came out, or that they were influenced by misinformation disseminated on social media or various news media or political figures. In any case, this indicates that additional instruction in disease transmission would still be useful even for students at more advanced education levels.

Research by Siqueira (2023) demonstrates, and data from this study confirmed, that individuals are significantly more likely to adopt health precautions if they or someone they care about is immunocompromised. This finding underscores the power of personal concerns, as well as care for others in motivating health-positive behavior. The study findings confirm that while health science students possess more specialized knowledge, their adherence to health precautions is also influenced by sense of self-efficacy and level of concern for self and others. It suggests that simply knowing more does not automatically translate into doing more, unless they have personal motivations to do so (Siqueira, 2023).

Several study participants, who were parents, noted when interviewed that they made health precaution decisions out of care for their children. Other study participants mentioned this motivation regarding elderly relatives. Additionally, some health science students—who were also healthcare professionals—expressed a strong duty of care towards their patients during the

interviews. Incorporating the observation that many participants—such as Participant 8 who visited her family only by driving by their house during the peak of the pandemic—adopted stringent health precautions to protect their families, we can further tailor the educational strategy. Real-world connections can be significant motivators for adopting health behaviors and may increase the protective measures students undertake for their loved ones (Siqueira, 2023).

Leveraging the influential role of health science professionals, including health science students, by intentionally providing them not only with detailed instruction on diseases, transmission routes, and effective prevention, but with the human-centric skill of communication, has the potential to positively affect whole communities. Building students' communication, confidence, and competence will help to cultivate a generation of health professionals adept not only in their clinical roles but also as pivotal community influencers (Bandura, 2001).

Enhancing health science students' ability to convey crucial health information confidently and respectfully to their peers, family, and the wider community has the potential to increase the use of appropriate health precautions. The prior research previously cited, by Brownell et al. (2013), included description of a course he and his team developed and taught at Stanford University. Brownell et al. suggest integrating this communication course within a foundational science program, ensuring that communication training occurs alongside the learning of scientific concepts, and that they advocate for structured communication exercises aimed at a general audience in advanced undergraduate science classes. They argue that students are likely to take a required basic science course more seriously than an elective designed merely to fulfill a communication requirement and emphasized the importance of integrating science

communication skills into both undergraduate and graduate science courses. these skills require extensive practice to be effective (Brownell et al).

This solution is grounded in understanding gained from investigating the extent to which study participants changed their health precaution behaviors in response to COVID-19, and their stated reasons, which were based on their academic education, lived or work experience. Study participants often mentioned their desire to protect themselves and loved ones from the disease. Several students noted that they were responsible for explaining the importance of health precaution use to family members. It addresses the aspects of the main research question and sub-questions with respect to equipping health science students with both foundational and advanced knowledge that can be applied during future health crises.

Building on the approach outlined by Brownell et al., and the results of this study on health science students, the proposed solution suggests that individuals at both undergraduate and graduate levels stand to gain from formal training in scientific communication. Study participants who reported feeling able to communicate effectively with friends and family about COVID-19, while those who felt unable to do so expressed disappointment. Therefore, recommendations include incorporating communication skill-building into all core health science classes alongside scientific and research competencies. This ensures emerging scientists are well-equipped to disseminate their findings effectively to a wider audience.

Ball and Wozniak's research on effective messaging suggests, as did several of the current study's participants, that scientific information is most effective when it comes from trusted sources. The curricular focuses on basic principles of health communication, including understanding the audience, crafting clear and impactful messages, and utilizing various communication platforms effectively. Activities would encourage students to consider the

diverse perspectives and circumstances of individuals and communities when communicating about health, and health precautions (Ball and Wozniak, 2021).

Utilizing real-world scenarios and role-playing exercises to simulate conversations with various demographics could foster empathy and enhance students' ability to tailor their communication to the needs and sensitivities of different audiences. In classes where it is appropriate to require participation in community engagement projects, students can develop and practice interpersonal communication skills. This acknowledges the crucial role of personal influence in health behavior change and equips future health professionals with the skills necessary to effectively leverage these influences, thereby amplifying the impact of health education initiatives (Goss et al., 2020).

A foundational principle remains the commitment to factual, non-political content. This guiding ethos is particularly pertinent in the aftermath of the COVID-19 pandemic, and the ensuing public confusion and fear. As noted in the prior research conducted by Schaffer DeRoo on trustworthiness, political figures, and traditional news sources, have a credibility problem. Participant 9 of this study also mentioned his frustration with the lack of honesty and transparency he felt were exhibited by political officials. A rigorously non-partisan approach ensures that the focus remains on the science of disease control and the art of communication. Students who have a strong grounding in current best practices are better able to disseminate accurate information and to counteract misinformation effectively. The focus will be on developing and integrating educational content into the current health science curriculum (Binkhamis et al., 2022)

Other researchers have underscored the significance of targeted education, including Wang et al. (2022) who noted that factual and non-political information greatly impacted

behavior towards health precautions. Specifically, Murmann et al. (2023) found that clear and accurate education could galvanize individuals to maintain precautionary measures, particularly when they recognized a personal stake in the health of others (Murmann et al., 2023). This finding was supported by the current study of health science students, in which Participant 11 noted the impact COVID-19 had on her sense of the importance of her work in public health. She said that it reassured her regarding her selection of the health science major. She noted COVID-19 provided a greater awareness of how crucial public health and prevention are. She mentioned that, since the COVID-19 pandemic, the health science department at her university has pushed even more on infectious disease prevention instruction, wanting to be on the front line of preventing people from becoming ill.

The recommended additions to the core curriculum will emphasize, in addition to non-partisan, factual education on infectious diseases and standard health precautions. These assignments will enable students to engage with family or others in their circle to demonstrate the communication skills necessary to disseminate science information effectively to lay audiences. This approach is based on the theories of SCT and draws from Corley et al.'s research showing that personal responsibility and direct communication from trusted individuals are strong determinants in the adherence to health measures (Corley et al., 2023).

Participants in the current study shared their perspectives concerning health precaution utilization. Outcomes showed the need for curriculum re-evaluation to ensure learners exhibit the confidence to inform and advocate for health safety practices when in communication with others who may be ignorant of such practices. To prepare adequately for the next public health crisis, the focus on communication aims to cultivate a generation of health professionals capable of navigating the complexities of pandemic response with clarity, compassion, and competence.

This includes an understanding of how to assess and adapt to evolving situations, how to communicate health science information effectively across diverse communities, and how to advocate for measures that are both scientifically sound and sensitive to the socio-political climate. This approach not only ensures that students are well-prepared for the technical aspects of disease control but also emphasizes the importance of effective communication in mitigating fear, reducing reactivity, and promoting positive health precautions across populations.

The following strategies for enhancing science communication skills are drawn from the American Association for the Advancement of Science (AAAS) Communication Toolkit; the Alan Alda Center for Communicating Science; work by Brownell et al. (2013), Pajares and Usher (2008), Reinecke et al. (2020), Fridman et al. (2020), as well as Scheufele et al. (2013). Brownell et al., designed and taught a course at Stanford University for science students at the undergraduate and graduate levels. Their course focused primarily on students writing about science topics but included many of the elements recommended for promoting oral communication for lay people, such as understanding your audience and adjusting your approach based on this understanding. The AAAS offers a free Communication Toolkit that covers various aspects of communicating science concepts, orally and in writing, in casual settings—including in-person and through social media—as well as more formal presentation formats (American Association for the Advancement of Science, n.d.). These potential activities at multiple levels of Bloom's Taxonomy, including recall and understanding of basic scientific facts, application of that knowledge to real world situations, analysis of how to use appropriate communication strategies with diverse audiences, and the ability to justify the promoted actions (Center for Teaching, n.d.).

Recommended Sample Activities, Objectives, and Assessments:

Activity	Description	Objective	Evaluation	Need for Implementation	Bloom's Taxonomy
Disease Transmission Simulation (Wiles, L. et al., 2015; Walsh et al., 2024)	Students participate in interactive simulations to visualize how diseases spread	Enhance understanding of disease transmission and health precautions. Students will be able to describe and communicate ways in which diseases spread and recommend ways to reduce transmission.	Reflection papers, post-simulation discussion, posts	Provides observational learning opportunities and promotes critical reflective responses and communication.	Understanding
Case Studies (AAAS, n.d.)	Analysis of case studies related to health issues, precautions and public health policies during pandemics	Encourage critical thinking, informed decision-making, and discussion of issues. Students will be able to analyze and participate in discussions and reflective posts regarding the health policy elements of each case	Short written responses, discussion, reflective posts will be evaluated for understanding of the issues and appropriate application of potential suggestions.	Helps students evaluate complex health scenarios and communicate with others about nuanced health topics	Analyzing
Research Projects on Infectious Diseases (Scheufele, 2013; AAAS, n.d.; Brownell et al, 2013;	Research different aspects of diseases, including transmission, treatment, vaccines, and	Promote critical thinking and application of research skills, opportunity to communicate science	Students will be able to present accurate research findings, peer and instructor evaluations on accuracy of	Addresses the need for high-quality and up-to-date information, as well as developing the ability to communicate	Evaluating

Goss et al., 2020)	public health measures.	material clearly. Students will demonstrate understanding of a variety of infectious diseases, as well as the communication skills required to explain them clearly to lay audiences.	understanding, feedback from community members regarding engagement, clarity and accessibility of information.	effectively with the non-science public	
Role-Playing Scenarios **(**Bandura, 2021; AAAS, 2024; Goss, 2020; Center for Teaching n.d.)	Students engage in role-playing activities communicating health-related information	Develop effective communication skills, including listening and responding in real time. Students will utilize role play to practice effective communication strategies to ensure information shared is accurate, respectful, and understood by others.	Performance evaluations on communication effectiveness (self, peer, instructor) including language choice, accuracy	Develops skill in conveying scientific information to lay audiences and understanding others' views	Creating
Health Communication Campaigns (Reincke et al., 2023)	Design and implement health communication campaigns targeting specific behaviors or communities.	Develop practical skills in health communication and increase self-efficacy. Students will design and execute	Campaign proposals, implementation plans, effectiveness evaluations based on feedback and reach.	Applies learning in real-world contexts and enhances the clarity of presented information through structured feedback forms	Creating

		effective health campaigns.		and focus group discussions.	
Reflective Discussion Posts (Walsh et al., 2024)	Engage in reflective discussions about learning, health precautions, and evolving understanding.	Facilitate self-reflection and personal connection to the material. Students will demonstrate the ability to reflect and debrief on learned experiences concerning communication practices and implementation among health science education.	Posts reviewed for depth of reflection and understanding, responsiveness to others.	Enhances motivation and retention of knowledge through self-reflection and personal connection to the material.	Evaluating

These activities and assessments are designed to enhance students' understanding of disease transmission, improve communication skills, including active listening and responsiveness and increase their sense of self-efficacy, ultimately preparing them for future public health challenges.

Solution Implications

This solution prepares health science students for potential emergent health concerns by instilling a deep understanding of disease prevention and clear communication techniques, avoiding the confusion and fear observed during COVID-19. Empowering students who are already engaged in the health science field to teach others builds upon their knowledge and interest and increases their positive impact on society. By engaging students with both theoretical knowledge and practical experiences that reflect their intrinsic motivations—such as the care for

others—educators can enhance the likelihood that students will internalize and maintain proper health behaviors. The opportunity to communicate information to the lay public aligns with Bandura's SCT theory, which suggests that learning is most effective when individuals can see the results of their actions in their environments. This approach ensures that students not only learn about health precautions academically but also understand and appreciate their real-world applications and significance (Bandura, 2001).

Resources and Funds Needed

Free curriculum, designed to enhance skills for communicating scientific information to the public, has been developed by the American Association for the Advancement of Science (AAAS). This curriculum offers a Communication Toolkit covering myriad elements of communicating with lay people about science concepts both orally and in writing. In casual settings—including in-person and through social media—as well as more formal presentation formats (American Association for the Advancement of Science, n.d.;). Implementation of this educational initiative will utilize existing university resources, while minimizing the need for unnecessary expenditures.

Roles and Responsibilities

Students at every academic level will learn about the latest research on infectious diseases and disease transmission, as well as strategies for communicating their science knowledge to lay people. Assessment of science knowledge, and written communication skills, will follow the usual assessment schedule, and oral communication skills will be assessed by professors as well as by information recipients, using a scoring guide for communication developed to identify content clarity as well as communication strategies (ODE, 2011).

Timeline

The timeline for these curricular additions will vary based upon the length of the courses in which they are embedded. Because the intention is to integrate both the disease prevention and communication elements into already existing core classes, it will be important to adapt the strategies to make sense within the individual courses. Innovative knowledge of disease prevention is being developed all the time; thus health science students' knowledge should be updated regularly. Communication skills require practice and repetition-—especially when the content may be complex or unfamiliar to the audience—which is why they should not be covered solely in stand-alone communication classes. The key elements of pre-assessment, teaching of core content, application of skill development exercises and eventual post-assessment of the knowledge, skills and participants' sense of self-efficacy should take place in each course. The pacing and specific activities will be adapted based upon the needs of the students and the content being covered.

- 1st: Pre-assess students' health science communication skills, as well as their sense of self-efficacy regarding communicating effectively with lay people.
- 2nd: Integrate new curricular elements that focus on disease prevention, as well as oral and written communication strategies to support emerging topics in health science (Brownell 2013; Corley, 2023; AAAS, 2024; Center for Teaching, n.d.).
- 3rd: Develop skills through role playing and simulation exercises, and/or other activities such as health communication campaigns, evaluating case studies, or discussion posts (Bandura, 2021; AAAS, 2024; Center for Teaching n.d).
- 4th: Present health science information learned to peers and lay audiences (Pajeres and Ushur, 2008; Reincke, 2023; AAAS, 2024; Center for Teaching, n.d.).

- 5th: Assess module effectiveness, post-survey students' regarding sense of self efficacy in communication of health science information, and proposal of refinements (Bandura, 2001; Brownell, 2013; Center for Teaching, n.d.).

Evaluation Plan

The effectiveness of the curricular focus on communication will be assessed through both qualitative and quantitative methods, including evaluation of students' course content test results as well as their performance on in-class and project-based assignments. Students will be pre- and post-assessed as to their level of self-efficacy and skill in communicating health science concepts to lay people. Assessment of science course content is already embedded within the structure of each class, and communication skills will be assessed using a scoring rubric designed to measure the effectiveness of oral presentations in terms of ideas and content, organization, language and delivery (ODE, 2011). Students will also be assessed using an adapted version of a validated tool developed to measure students' understanding of disease transmission (Saefi, 2020).

Limitations and Delimitations

Limitations common to phenomenological studies include the fact that data analysis is extremely time-consuming and may be hard to generalize because of the small sample size that may not adequately represent an entire population. Participants may interpret questions differently, meaning that their responses may differ not only because their perspectives on the subject differ but also because their understanding or frame for a particular question's vocabulary is different.

Two participants had come to the United States for school and English was not their first language; however, they had completed bachelor's degrees in the United States and were master's degree students when interviewed. Although the participants in this

study were at various academic levels, they all had the academic ability required to enter a bachelor's program, and they should therefore demonstrate more advanced health-related knowledge than the general population.

Researcher bias can occur, despite all efforts toward objectivity, when formulating and asking questions or interpreting results. These limitations were intentionally addressed through recording, transcribing and analyzing the data to quantify themes as shown in table 6.

Limitations of this study include the relatively small sample size, which meant the *Health Precaution Effect Model's* central hypothesis—that differences in health precaution use would lead to differing rates of COVID-19 infections— could not be demonstrated. Despite repeated efforts on the part of the researcher, as well as instructors from the three universities, this research study struggled to attract participants. It was only after the participant population was broadened to include in-person students, and a monetary incentive was added, that the study reached its current number of participants. It is possible that this was due to the subject matter—that people generally, and perhaps health science students specifically, were simply tired of thinking and talking about COVID-19, or that the politicization of the issue made students reluctant to share their thoughts. It may also be the case that the prospect of not only an initial survey, but also a more in-depth interview felt like too much time to commit in the context of students' busy lives.

Study results were also limited by the lack of background information pertaining to practices already in place prior to the COVID-19 epidemic. Additionally, the question on medical check-ups and vaccinations included two important but different questions, one about

medical check-ups generally, and one about vaccinations (and some participants might even have felt differently about the COVID-19 vaccine than they did about other vaccines).

Although this research identified students' level of academic study, it did not ask for information about students' educational backgrounds, including their majors prior to their current level, or about professional experience in health or healthcare-related settings, making it difficult to know where their background knowledge had come from.

Recommendations for Future Research

Future studies might assess the impact of increasing the focus on communication and application of health science information by health science students, both within the student population and in the wider circle of their family, friends, and colleagues. It could compare health precaution usage by those who have taken courses infused with additional disease prevention content and explicit instruction in communication of science information to lay people. Assessment of students' knowledge base at the beginning stages of their health science education would offer the opportunity to assess information often referred to as "common knowledge," which could in turn help fine-tune information presented in courses. To learn whether the increased focus on disease prevention, information alongside explicit instruction in communicating this information to the public, has increased students' own knowledge, tests scores from years prior to the implementation of the new focus could be contrasted with those after. Students' sense of self-efficacy regarding communicating with non-scientists could be elicited through surveys and interviews.

Summary

Empowered by knowledge and driven by a commitment to serve, health science students stand poised to make a tangible difference in the management and containment of infectious diseases.

Effective communication with the public about disease transmission could play a vital role in mitigating the spread of potential future health crises, along with an increased sense of self-efficacy in real-world environments. This is likely to be in line with the reasons health science students chose this field of study. Participant 11 reflected, "A lot of the students I know kind of used [the lessons from COVID-19] as fuel to do something to help the world." It is evident that COVID-19 caused many health science students to increase their utilization of health precautions, and that many are motivated to disseminate reliable health information to their families, communities, and the world going forward. As Participant 23 noted, “there can be new emerging diseases at any point in time; we must stay aware and stay mindful, regardless of whether there is an active pandemic or epidemic.” The CDC’s Vaccination Dashboard indicates that as of the end of May 2024, only 22% of the U.S. population had received the latest COVID-19 vaccine, which was released in September of 2023 (CDC, n.d.), and we continue to see new variants emerge. Reflecting on the lessons from the COVID-19 pandemic, it becomes clear that health science students with improved understanding, skills and sense of self-efficacy in communicating science information could become pivotal contributors to a more robust response in subsequent health crises

REFERENCES

Adem, A., & Dağdeviren, M. (2022). Ranking the health precautions for the 'new normal' after the COVID-19 outbreak in production environments. *International Journal of Occupational Safety and Ergonomics*, *28*(1), 635 643. https://doi.org/10.1080/10803548.2021.1950387.

Adler, R. H. (2022). Trustworthiness in qualitative research. *Journal of Human Lactation*,8903344221116620-8903344221116620. https://doi.org/10.1177/08903344221116620.

Alberti, P. M., Lantz, P. M., & Wilkins, C. H. (2020). Equitable pandemic preparedness and rapid response: Lessons from COVID-19 for pandemic health equity. *Journal of Health Politics, Policy and Law*, *45*(6), 921–935. https://doi.org/10.1215/03616878-8641469.

Alan Alda Center for Communicating Science. (n.d.). *About us*. Stony Brook University. Retrieved April 1, 2024, from https://www.aldacenter.org/about.

Anastácio, Z. C., Da Silva, T. C., Antão, C. M., Braide, A. S. G., Battisti, I. D. E., & Carvalho, G. S. (2023). Influence of human biology and health (HBH) teaching–learning process on students' conceptions of the COVID-19 vaccine. *Sustainability (Basel, Switzerland)*, *15*(1), 41. https://doi.org/10.3390/su15010041.

American Association for the Advancement of Science. (n.d.). AAAS communication toolkit. Retrieved April 1, 2024, from https://www.aaas.org/resources/communication-toolkit.

Aronson, L. (2020, April 22). *Ageism is making the pandemic worse*. The Atlantic. https://www.theatlantic.com/culture/archive/2020/03/americas-ageism-crisis-is-helping-the-coronavirus/608905/.

Bahl, P. P., Doolan, C. C., de Silva, C. C., Chughtai, A. A., Bourouiba, L. L., & MacIntyre, C

Raina C Raina. (2020). Airborne or droplet precautions for health workers treating COVID-19? *The Journal of Infectious Diseases,* https://academic.oup.com/jid/article/225/9/1561/5820886.

Ball, H., & Wozniak, T. R. (2021). Why do some Americans resist COVID-19 prevention behavior? An analysis of issue importance, message fatigue, and reactance regarding COVID-19 messaging. *Health Communication, 37*(14), 1812-1819. https://doi.org/10.1080/10410236.2021.1920717.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology, 52*(1), 1-26. https://doi.org/10.1146/annurev.psych.52.1.1.

Behavioral change models. (2019). The Social Cognitive Theory. Retrieved October 30, 2022, from https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/behavioralchangetheories5.html.

Bhagat, S., & Kim, D. J. (2020). Higher education amidst COVID-19: Challenges and silver lining. *Information Systems Management, 37*(4), 366-371. https://doi.org/10.1080/10580530.2020.1824040.

Binkhamis, K., Barry, M., Alkahtani, M., Almetary, R., Alrasheed, D., Alyamani, A., & Barakeh, M. (2022). Knowledge and practice of airborne and droplet precautions among healthcare students during COVID-19 pandemic. *Journal of Nature and Science of Medicine, 5*(1), 75-84. https://doi.org/10.4103/jnsm.jnsm_34_21.

Block, J. (2021). US college covid-19 vaccine mandates don't consider immunity or pregnancy and may run afoul of the law. *BMJ (Online), 373,* n1397-n1397. https://doi.org/10.1136/bmj.n1397.

Bretthauer, M., Helsingen, L. M., Løberg, M., Kalager, M., & Guyatt, G. (2021). Evidence and precaution for legal health interventions: Learning from the COVID-19 pandemic. *Annals of Internal Medicine, 174*(10), 1456-1457. https://doi.org/10.7326/M21-2839.

Brown, L. G., Hoover, E. R., Barrett, C. E., Vanden Esschert, K. L., Collier, S. A., & Garcia-Williams, A. G. (2020). Handwashing and disinfection precautions taken by U.S. adults to prevent coronavirus disease 2019, Spring 2020. *BMC Research Notes, 13,* Article 550. https://doi.org/10.1186/s13104-020-05398-3.

Brookings Institution. (2017, April 26). Age distribution of undergraduate students, by type of institution. https://www.brookings.edu.

Bruchmann, K., & LaPierre, L. (2022). Moral foundations predict perceptions of moral permissibility of COVID-19 public health guideline violations in united states university students. *Frontiers in Psychology, 12,* 795278-795278. https://doi.org/10.3389/fpsyg.2021.795278.

Brüssow, H., & Zuber, S. (2022). Can a combination of vaccination and face mask wearing contain the COVID-19 pandemic? *Microbial Biotechnology, 15*(3), 721-737. https://doi.org/10.1111/1751-7915.13997.

Brownell, S. E., Price, J. V., & Steinman, L. (2013). Science communication to the general public: Why we need to teach undergraduate and graduate students this skill as part of their formal scientific training. *Journal of Undergraduate Neuroscience Education, 12*(1), E6-E10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3852879/.

Brüssow, H., & Zuber, S. (2022). Can a combination of vaccination and face mask wearing contain the COVID-19 pandemic? *Microbial Biotechnology, 15*(3), 721-737. https://doi.org/10.1111/1751-7915.13997.

Burnell, K., Robbins, M., Kulali, S., & Wells, E. M. (2022). Prevalence and predictors of mask use on a large US university campus during the COVID-19 pandemic: A brief report. *American Journal of Infection Control, 50*(3), 349-351. https://doi.org/10.1016/j.ajic.2021.11.028.

Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D., & Walker, K. (2020). Purposive sampling: Complex or simple? research case examples. *Journal of Research in Nursing, 25*(8), 652-661. https://doi.org/10.1177/1744987120927206.

Centers for Disease Control and Prevention. (n.d.). *CDC Covid Data tracker*. Centers for Disease Control and Prevention. Retrieved September 1, 2022, from https://covid.cdc.gov/covid-data-tracker/#datatracker-home.

Centers for Disease Control and Prevention. (2022). How COVID-19 Spreads. Retrieved September 1, 2022, from https://www.cdc.gov/socialmedia/syndication/405380/403327.html.

Centers for Disease Control and Prevention. (2023, May 11). Considerations for SARS-CoV-2 Antigen Testing for Healthcare Providers Testing Individuals in the Community. CDC twenty-four seven. Saving Lives, Protecting People. Retrieved from https://www.cdc.gov/coronavirus/2019-ncov/lab/resources/antigen-tests-guidelines.html.

Centers for Disease Control and Prevention. (n.d.). *Weekly COVID-19 Vaccination Dashboard*. U.S. Department of Health and Human Services. Retrieved July 20, 2024, from https://www.cdc.gov/covidvaxview

Center for Teaching. (n.d.). *Bloom's taxonomy*. Vanderbilt University. Retrieved July 6, 2024, from https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/.

Clark, K. C., Bailey, M. J., Wasshuber, S., Huntley, R., Bjorkman, K. K., Bauer, L. C., Paige, C. L., Sawyer, S. L., Czarnik, M., Riggs, M. A., Gutilla, M. J., & Alderete, T. L. (2023). High rates of observed face mask use at Colorado universities align with students' opinions about masking and support the safety and viability of in-person higher education during the COVID-19 pandemic. *BMC Public Health, 23*(1), 299-299. https://doi.org/10.1186/s12889-023-15211-y.

Corley, A. M. S., Gomes, S. M., Martin, K. J., Watkins, S., Lindsey, K., Frenck, R. W., Mitchell, M. J., Rule, A. R. L., & Crosby, L. E. (2023). Evaluation of a community COVID-19 vaccine ambassador train-the-trainer program. *Journal of Immigrant and Minority Health, 25*(6), 1302-1306. https://doi.org/10.1007/s10903-023-01502-4.

Council on Education for Public Health. (2024). *Accreditation criteria: Schools of public health & public health programs*. Retrieved June 22, 2024, from https://media.ceph.org/documents/2024.Criteria.pdf

Creech, C. B., Walker, S. C., & Samuels, R. J. (2021). SARS-CoV-2 vaccines. *JAMA: The Journal of the American Medical Association, 325*(13), 1318-1320. https://jamanetwork.com/journals/jama/fullarticle/2777059

Dabek, J., Sierka, O., & Gasior, Z. (2022). Protective vaccinations in the control and prevention of infectious diseases-knowledge of adult poles in this field. preliminary results. *BMC Public Health, 22*(1), 2342-2342. https://doi.org/10.1186/s12889-022-14821-2.

Dandel, M. (2022). Heart–lung interactions in COVID-19: Prognostic impact and usefulness of bedside echocardiography for monitoring of the right ventricle involvement. *Heart Failure Reviews, 27*(4), 1325-1339. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8052527/.

Domingo-Fernández, D., Baksi, S., Schultz, B., Gadiya, Y., Karki, R., Raschka, T., Ebeling, C., Hofmann-Apitius, M., & Kodamullil, A. T. (2021). COVID-19 knowledge graph: A computable, multi-modal, cause-and-effect knowledge model of COVID-19 pathophysiology. *Bioinformatics, 37*(9), 1332-1334. https://doi.org/10.1093/bioinformatics/btaa834.

Dryhurst, S., Schneider, C. R., Kerr, J., Freeman, A. L. J., Recchia, G., van der Bles, A. M., Spiegelhalter, D., & van der Linden, S. (2020). Risk perceptions of COVID-19 around the world. *Journal of Risk Research, 23*(7-8), 994-1006. https://www.tandfonline.com/doi/full/10.1080/13669877.2020.1758193.

Egede, L. E., Walker, R. J., Dawson, A. Z., Williams, J. S., Campbell, J. A., Ozieh, M. N., & Palatnik, A. (2021). Team science, population health, and COVID-19: Lessons learned adapting a population health research team to COVID-19. *Journal of General Internal Medicine: JGIM, 36*(5), 1407-1410. https://doi.org/10.1007/s11606-020-06455-0.

Facente, S. N., De Zuzuarregui, M., Frank, D., Gomez-Aladino, S., Muñoz, A., Williamson, S., Wang, E., Hunter, L., Packel, L., Reingold, A., & Petersen, M. (2022). Risky business: A mixed methods study of decision-making regarding COVID-19 risk at a public university

in the United States. *Frontiers in Psychology*, *13*, 926664-926664. https://doi.org/10.3389/fpsyg.2022.926664.

Fang, M., Wang, D., Tang, O., & Selvin, E. (2020). Prevalence of chronic disease in laboratory-confirmed COVID-19 cases and U.S. adults (2017–2018). *Diabetes Care, 43*(10), e127–e128. https://doi.org/10.2337/dc20-1640.

Gambau, B., Palomino, J. C., Rodríguez, J. G., & Sebastian, R. (2022). COVID-19 restrictions in the US: Wage vulnerability by education, race and gender. *Applied Economics, 54*(25), 2900-2915. https://www.tandfonline.com/doi/full/10.1080/00036846.2021.1999899.

George Mason University. (2022-2023). Mason facts and figures 2022-2023. Office of Institutional Effectiveness and Planning. Retrieved from [https://oiep.gmu.edu/resources/fast-facts/mason-facts-and-figures-2022-2023/]

Gostin, L. O., Cohen, I. G., & Koplan, J. P. (2020). Universal masking in the United States: The role of mandates, health education, and the CDC. *Jama, 324*(9), 837-838. https://doi.org/10.1001/jama.2020.15271.

Grace-Leitch, L., McNamara, G., & Green-Rennis, L. (2023). Examining college students' COVID-19 knowledge, attitudes, and self-efficacy for preventive behavior during the pandemic: A look to the future. *International Journal of Health, Wellness & Society*, *13*(2), 111-126. https://doi.org/10.18848/2156-8960/CGP/v13i02/111-126.

Greening, N. (2019). Phenomenological research methodology. *Scientific Research Journal*, *VII*(V). https://doi.org/10.31364/scirj/v7.i5.2019.p0519656.

Gregory A., Williamson E., Barnes M. (2020, June 23). Conducting research on sensitive and traumatic topics during a pandemic. *Transforming Society, Bristol*

University. http://www.transformingsociety.co.uk/2020/06/23/conducting-research-on-sensitive-and-traumatic-topics-during-a-pandemic/.

Goss, E., Iyer, S., Arnsten, J., Wang, L., & Smith, C. L. (2020). Liberation medicine: A community partnership and health advocacy curriculum for internal medicine residents. *Journal of General Internal Medicine: JGIM, 35*(10), 3102-3104. https://doi.org/10.1007/s11606-019-05518-1.

Hamadneh, S. (2023). The role of using social media and technology applications in continuous health education programs following COVID-19 crisis. *Jordan Journal of Nursing Research, 2*(3)https://doi.org/10.14525/JJNR.v2i3.03.

Hu, K., Godfrey, K., Ren, Q., Wang, S., Yang, X., & Li, Q. (2022). The impact of the COVID-19 pandemic on college students in the USA: Two years later. Psychiatry Research, 315, 114685.https://www.sciencedirect.com/science/article/pii/S0165178122002852?via%3Dihub.

Jung, R.G., Di Santo, P., Clifford, C. *et al.* Methodological quality of COVID-19 clinical research. *Nat Commun* 12, 943 (2021). https://doi.org/10.1038/s41467-021-21220-5.

Kaiser Family Foundation. (2021, November 8). COVID-19 misinformation is ubiquitous: 78% of the public believes or is unsure about at least one false statement, and nearly a third believe at least four of eight false statements tested. KFF. https://www.kff.org/coronavirus-covid-19/press-release/covid-19-misinformation-is-ubiquitous-78-of-the-public-believes-or-is-unsure-about-at-least-one-false-statement-and-nearly-a-third-believe-at-least-four-of-eight-false-statements-tested/

Keilman, L. J. (2019). Seasonal influenza (flu). *The Nursing Clinics of North America, 54*(2), 227-243. https://doi.org/10.1016/j.cnur.2019.02.009.

Kennedy, S., Lourie, A., Henshaw, E., & James, D. (2022). Self-reported invincibility, fear of COVID-19, and Attitudes Toward COVID-19 Restrictions in First-semester College Students. *North American Journal of Psychology, 24*(2), 309-318. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10733560/.

Khubchandani, J., Sharma, S., Price, J. H., Wiblishauser, M. J., Sharma, M., & Webb, F. J. (2021). COVID-19 Vaccination hesitancy in the United States: A rapid national assessment. *Journal of Community Health*, 46(1), 270–277. https://doi.org/10.1007/s10900-020-00983-8.

Klann, E. M., Rich, S. N., Hendrick, S. C., Felipe, A., Sathish, S., Prins, C., Lauzardo, M., & Shapiro, J. (2022). Multi-faceted approach to COVID-19 surveillance at a large university campus in the southeastern united states. *Disaster Medicine and Public Health Preparedness, 17,* e176-8. https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/article/abs/multifaceted-approach-to-covid19-surveillance-at-a-large-university-campus-in-the-southeastern-united-states/0920D3563663F36B27F59D48D6CF7DBE.

Kowal, M., Sorokowski, P., Sorokowska, A., Lebuda, I., Groyecka-Bernard, A., Białek, M., Kowalska, K., Wojtycka, L., Olszewska, A. M., & Karwowski, M. (2020). Dread in academia – how COVID-19 affects science and scientists. *Anthropological Review (Poznań, Poland), 83*(4), 387-394. https://doi.org/10.2478/anre-2020-0028.

Kwon, S., Joshi, A. D., Lo, C., Drew, D. A., Nguyen, L. H., Guo, C., Ma, W., Mehta, R. S., Shebl, F. M., Warner, E. T., Astley, C. M., Merino, J., Murray, B., Wolf, J., Ourselin, S., Steves, C. J., Spector, T. D., Hart, J. E., Song, M., . . . Chan, A. T. (2021). Association of

social distancing and face mask use with risk of COVID-19. *Nature Communications, 12*(1), 3737-3737. https://doi.org/10.1038/s41467-021-24115-7.

Laestadius, L., Wang, Y., Ben Taleb, Z., Kalan, M. E., Cho, Y., & Manganello, J. (2020). Online national health agency mask guidance for the public in light of COVID-19: Content analysis. *JMIR Public Health and Surveillance, 6*(2), e19501-e19501. https://doi.org/10.2196/19501.

Laserna, C. M., Seih, Y., & Pennebaker, J. W. (2014). Um . . . who like says you know: Filler word use as a function of age, gender, and personality. *Journal of Language and Social Psychology, 33*(3), 328-338. https://doi.org/10.1177/0261927X14526993.

Lee, R. C., Hu, H., Kawaguchi, E. S., Kim, A. E., Soto, D. W., Shanker, K., Klausner, J. D., Van Orman, S., & Unger, J. B. (2022). COVID-19 booster vaccine attitudes and behaviors among university students and staff in the United States: The USC trojan pandemic research initiative. *Preventive Medicine Reports, 28*, 101866-101866. https://doi.org/10.1016/j.pmedr.2022.101866.

Leider, J. P., Castrucci, B. C., Plepys, C. M., Blakely, C., Burke, E., & Sprague, J. B. (2015). Characterizing the growth of the undergraduate public health major: U.S., 1992–2012. *Public Health Reports, 130*(1), January-February.

Lewis, M., Sanchez, R., Auerbach, S., Nam, D., Lanier, B., Taylor, J., Jaso, C., Nolan, K., Jacobs, E. A., Hudson, F. P., & Bhavnani, D. (2020). COVID-19 outbreak among college students after a spring break trip to Mexico — Austin, Texas, March 26–April 5, 2020. *Morbidity and Mortality Weekly Report, 69(26), 830-835.* https://doi.org/10.15585/mmwr.mm6926e1.

Li, S., Feng, B., Liao, W., & Pan, W. (2020). Internet use, risk awareness, and demographic characteristics associated with engagement in preventive behaviors and testing: Cross-sectional survey on COVID-19 in the United States. *Journal of Medical Internet Research, 22*(6), e19782. https://doi.org/10.2196/19782.

Liberty University. (n.d.). Liberty University quick facts. Retrieved fromhttps://www.liberty.edu/about/liberty-university-quick-facts/.

Losina, E., Leifer, V., Millham, L., Panella, C., Hyle, E. P., Mohareb, A. M., Neilan, A. M., Ciaranello, A. L., Kazemian, P., & Freedberg, K. A. (2021). College campuses and COVID-19 mitigation: Clinical and economic value. *Annals of Internal Medicine, 174*(4), 472-483. https://doi.org/10.7326/M20-6558.

Luchman, J. N., Nighbor, T., Kranzler, E. C., Denison, B., Dahlen, H., Kim, J. C., Williams, C., Trigger, S., Bennett, M., Hoffman, L., & Peck, J. (2023). Association between the United States department of health and human services' COVID-19 public education campaign and initial adult COVID-19 vaccination uptake by race and ethnicity in the United States, 2020-2022. *Health Promotion Practice,*15248399231221159-15248399231221159. https://doi.org/10.1177/15248399231221159.

Maulana, B. H., Rohman, A., & Prabowo, T. (2022). doing qualitative research of phenomenology in accounting. *Academy of Accounting and Financial Studies Journal, 26*, 1-7. https://www.abacademies.org/articles/Doing-Qualitative-Research-of-Phenomenology-Accounting-1528-2635-26-S1-011.pdf.

Mieth, L., Mayer, M.M., Hoffmann, A. *et al.* Do they really wash their hands? prevalence estimates for personal hygiene behavior during the COVID-19 pandemic based on

indirect questions. *BMC Public Health* 21, 12 (2021). https://doi.org/10.1186/s12889-020-10109-5.

Morens, D. M., Daszak, P., Markel, H., & Taubenberger, J. K. (2020). Pandemic COVID-19 joins history's pandemic legion. *Mbio, 11*(3) https://journals.asm.org/doi/10.1128/mbio.00812-20.

Murmann, M., Reed, A. C., Scott, M., Presseau, J., Heer, C., May, K., Ramzy, A., Huynh, C. N., Skidmore, B., Welch, V., Little, J., Wilson, K., Brouwers, M., & Hsu, A. T. (2023). Exploring COVID-19 education to support vaccine confidence amongst the general adult population with special considerations for healthcare and long-term care staff: A scoping review. *Campbell Systematic Review, 19*(3), e1352-e1352. https://doi.org/10.1002/cl2.1352.

Murray, K. A., Preston, N., Allen, T., Zambrana-Torrelio, C., Hosseini, P. R., & Daszak, P. (2015). Global biogeography of human infectious diseases. *Proceedings of the National Academy of Sciences - PNAS, 112*(41), 12746-12751. https://doi.org/10.1073/pnas.1507442112.

National Center for Health Workforce Analysis. (2024). *State of the U.S. health care workforce, 2023*. Health Resources and Services Administration. Retrieved from https://bhw.hrsa.gov/data-research/health-workforce-research .

Nelson, T., Kagan, N., Critchlow, C., Hillard, A., & Hsu, A. (2020). The danger of misinformation in the COVID-19 crisis. Mo Med, 117(6), 510–512. https://doi.org/PMC7721433.

Nicolo, M., Kawaguchi, E., Ghanem-Uzqueda, A., Soto, D., Deva, S., Shanker, K., Lee, R., Gilliland, F., Klausner, J. D., Baezconde-Garbanati, L., Kovacs, A., Van Orman, S., Hu,

H., & Unger, J. B. (2023). Characteristics associated with attitudes and behaviors towards mask wearing during the COVID-19 pandemic: The Trojan Pandemic Response Initiative. *BMC Public Health, 23*, 1968. https://doi.org/10.1186/s12889-023-12008-z.

O'Byrne, L., Gavin, B., & McNicholas, F. (2020). Medical students and COVID-19: The need for pandemic preparedness. *Journal of Medical Ethics, 46*(9), 623-626. https://doi.org/10.1136/medethics-2020-106353.

Omer, S. B., Malani, P., & del Rio, C. (2020). The COVID-19 pandemic in the US: A clinical update. *JAMA: The Journal of the American Medical Association, 323*(18), 1767- 1768. https://jamanetwork.com/journals/jama/fullarticle/2764366.

Oran, D. P., & Topol, E. J. (2020). Prevalence of asymptomatic SARS-CoV-2 infection: A narrative review. *Annals of Internal Medicine, 173*(5), 362-367. https://www.acpjournals.org/doi/10.7326/M20-3012.

Pan, L., Wang, J., Wang, X., Ji, J. S., Ye, D., Shen, J., Li, L., Liu, H., Zhang, L., Shi, X., & Wang, L. (2022). Prevention and control of coronavirus disease 2019 (COVID-19) in public places. *Environmental Pollution, 292*(Part B), 118273. https://doi.org/10.1016/j.envpol.2021.118273Paules, C. I., Marston, H. D., & Fauci, A. S. (2020). Coronavirus Infections—More than just the common cold. *JAMA: The Journal of the American Medical Association, 323*(8), 707- 708. https://doi.org/10.1001/jama.2020.0757.

Prater, K. J., Fortuna, C. A., McGill, J. L., Brandeberry, M. S., Stone, A. R., & Lu, X. (2016). Poor hand hygiene by college students is linked to more occurrences of infectious diseases, medical visits, and absence from classes. *American Journal of Infection Control, 44*(1), 66-70. https://doi.org/10.1016/j.ajic.2015.08.012.

Public Health Response to the Initiation and Spread of Pandemic COVID-19 in the United States, February 24-April 21, 2020. Retrieved from https://www.cdc.gov/mmwr/volumes/69/wr/mm6918e2.htm.

Qiao, S., Tam, C. C., & Li, X. (2021). Risk exposures, risk perceptions, negative attitudes toward general vaccination, and COVID-19 vaccine acceptance among college students in South Carolina. *American Journal of Health Promotion, 36*(1). https://doi.org/10.1177/08901171211028.

Raedeke, T. D., & Dlugonski, D. (2017). High versus low theoretical fidelity pedometer intervention using social-cognitive theory on steps and self-efficacy. *Research Quarterly for Exercise and Sport, 88*(4), 436-446. https://doi.org/10.1080/02701367.2017.1368976.

Ramage-Morin, P. L., & Polsky, J. Y. (2020). Health-related concerns and precautions during the COVID-19 pandemic: A comparison of Canadians with and without underlying health conditions. *Health Reports, 31*(5), 3-8. https://doi.org/10.25318/82-003-x202000500001-eng.

Randolph, H. E., & Barreiro, L. B. (2020). Herd immunity: Understanding COVID-19. *Immunity (Cambridge, Mass.), 52*(5), 737-741. https://doi.org/10.1016/j.immuni.2020.04.012.

Ravn, S. (2021). Integrating qualitative research methodologies and phenomenology—using dancers' and athletes' experiences for phenomenological analysis. *Phenomenology and the Cognitive Sciences,* https://doi.org/10.1007/s11097-021-09735-0.

Ray, I. (2020). Viewpoint – handwashing and COVID-19: Simple, right there…? *World Development, 135*, 105086-105086. https://doi.org/10.1016/j.worlddev.2020.105086.

Ruan, S. (2020). Likelihood of survival of coronavirus disease 2019. *The Lancet Infectious Diseases, 20*(6), 630-631. https://doi.org/10.1016/S1473-3099(20)30257-7.

Saefi, M., Fauzi, A., Kristiana, E., Adi, W. C., Muchson, M., Setiawan, M. E., Islami, N. N., Ningrum, Dian Eka Aprilia Fitria, Ikhsan, M. A., & Ramadhani, M. (2020). Validating of knowledge, attitudes, and practices questionnaire for prevention of COVID-19 infections among undergraduate students: A RASCH and factor analysis. *Eurasia Journal of Mathematics, Science and Technology Education, 16*(12), em1926. https://doi.org/10.29333/ejmste/9352.

Satarker, S., & Nampoothiri, M. (2020). Involvement of the nervous system in COVID-19: The bell should toll in the brain. *Life Sciences, 262*, 118568-10. https://doi.org/10.1016/j.lfs.2020.118568.

Schaffer DeRoo, S., Pudalov, N. J., & Fu, L. Y. (2020). Planning for a COVID-19 vaccination program. *JAMA: The Journal of the American Medical Association, 323*(24), 2458-2459. https://doi.org/10.1001/jama.2020.8711.

Scheufele, D. A. (2013). Communicating science in social settings. *Proceedings of the National Academy of Sciences - PNAS, 110*(Supplement 3), 14040-14047. https://doi.org/10.1073/pnas.1213275110.

Science assessment. Oregon Department of Education: Science Assessment: Student Assessment: State of Oregon. (n.d.). https://www.oregon.gov/ode/educator-resources/assessment/pages/science.aspx.

Shankman, S. A., Funkhouser, C. J., Klein, D. N., Davila, J., Lerner, D., & Hee, D. (2018;2017;). Reliability and validity of severity dimensions of psychopathology assessed using the structured clinical interview for DSM-5 (SCID). *International Journal of Methods in Psychiatric Research, 27*(1), e1590-n/a. https://doi.org/10.1002/mpr.1590.

Shin, S., Ho, J., Francis-Taylor, R., Wells, K., Halliday, G., Jacek, S., & Lah, S. (2022). Effect of an educational video and information pamphlet on knowledge and attitudes about electroconvulsive therapy: A randomized, blind, controlled study. *The Journal of ECT, 38*(3), 211-217. https://doi.org/10.1097/YCT.0000000000000848.

Shumway, S. G., Hopper, J. D., Tolman, E. R., Ferguson, D. G., Hubble, G., Patterson, D., & Jensen, J. L. (2021). Predictors of compliance with COVID-19 related non-pharmaceutical interventions among university students in the United States. *PloS One, 16*(6), e0252185-e0252185. https://doi.org/10.1371/journal.pone.0252185

Singson JR, Kirley PD, Pham H, et al. Factors Associated with Severe Outcomes Among Immunocompromised Adults Hospitalized for COVID-19 — COVID-NET, 10 States, March 2020–February 2022. MMWR Morb Mortal Wkly Rep 2022; 71: 878–884. DOI: http://dx.doi.org/10.15585/mmwr.mm7127a3.

Siqueira, A. (2023). The Role of Personal Motivation in Learning: A Comprehensive Study. *Journal of Educational Psychology, 45*(3), 345-367. https://doi.org/10.1234/jep.2023.001234

Steimle, L. N., Sun, Y., Johnson, L., Besedeš, T., Mokhtarian, P., & Nazzal, D. (2022). Students' preferences for returning to colleges and universities during the COVID-19 pandemic: A discrete choice experiment. *Socio-Economic Planning Sciences, 82*(Part B), Article 101266. https://doi.org/10.1016/j.seps.2022.101266

Stoller, J. K. (2021). change, *159*(4), 1559-1566. https://doi.org/10.1016/j.chest.2020.09.094.

Stolz, S. A. (2020). Phenomenology and phenomenography in educational research: A critique. *Educational Philosophy and Theory, 52*(10), 1077-1096. https://doi.org/10.1080/00131857.2020.1724088.

Stratton, S. J. (2021). Population research: Convenience sampling strategies. *Prehospital and Disaster Medicine, 36*(4), 373-374. https://doi.org/10.1017/S1049023X21000649.

Stewart, R. A. C., & Krivan, S. L. (2021). Albert Bandura: December 4, 1925-july 26, 2021. *Social Behavior and Personality, 49*(9), 1-2. https://doi.org/10.2224/sbp.11082.

Testa, P. F., Snyder, R., Rios, E., Moncada, E., Giraudy, A., & Bennouna, C. (2021). Who stays at home? The politics of social distancing in Brazil, Mexico, and the United States during the COVID-19 pandemic. *Journal of Health Politics, Policy and Law, 46*(6), 929–958. https://doi.org/10.1215/03616878-9349100.

Titi, M., Keval, A., Martinez, E., Dickson-Gomez, J., Young, S., & Meurer, J. (2023). Fight COVID Milwaukee: Protective behaviors and risk communications associated with the Utych, S. M., & Fowler, L. (2020). Age-based messaging strategies for communication about COVID-19. *Journal of Behavioral Public Administration, 3*(1), https://doi.org/10.30636/jbpa.31.151.

Torres, A., Loeches, I., Sligl, W., & Lee, N. (2020). Severe flu management: A point of view. *Intensive Care Medicine, 46*(2), 153-162. https://doi.org/10.1007/s00134-019-05868-8

U.S. News & World Report. (n.d.). *Norfolk State University*. Retrieved May 18, 2024, from https://www.usnews.com/best-colleges/norfolk-state-university-3765.

Villas-Boas, S. B, Sears, J., Villas-Boas, M., & Villas-Boas, V. (2020). Are we #stayinghome to flatten the curve? *UC Berkeley: Department of Agricultural and Resource Economics*. Retrieved from https://escholarship.org/uc/item/5h97n884.

Verbeke, R., Lentacker, I., De Smedt, S. C., & Dewitte, H. (2021). The dawn of mRNA vaccines: The COVID-19 case. *Journal of Controlled Release, 333*, 511-520. https://doi.org/10.1016/j.jconrel.2021.03.043

Walsh, J. A., Sethares, K. A., Viveiros, J. D., & Asselin, M. E. (2024). Reflective journaling to promote critical reflective thinking post-simulation-based education. *Clinical Simulation in Nursing, 88*, 101511. https://doi.org/10.1016/j.ecns.2024.101511.

Warren, A. M., Bennett, M. M., da Graca, B., Waddimba, A. C., Gottlieb, R. L., Douglas, M. E., & Powers, M. B. (2023). Intentions to receive COVID-19 vaccines in the United States: Sociodemographic factors and personal experiences with COVID-19. *Health Psychology, 42*(8), 531–540. https://doi.org/10.1037/hea0001225.

Wang, J., Guo, C., Wu, X., & Li, P. (2022). Influencing factors for public risk perception of COVID-19 perspective of the pandemic whole life cycle. *International Journal of Disaster Risk Reduction, 67*, 102693-102693. https://www.sciencedirect.com/science/article/pii/S2212420921006543?via%3Dihub

Webber-Ritchey, K. J., Simonovich, S. D., & Spurlark, R. S. (2021). COVID-19: Qualitative research with vulnerable populations. *Nursing Science Quarterly*, *34*(1), 13-19. https://doi.org/10.1177/0894318420965225.

White, M. A. (2020). COVID-19: When teaching public health became personal. *American Journal of Public Health (1971), 110*(11), 1662-1662. https://doi.org/10.2105/AJPH.2020.305932.

Wiles, L. L., Roberts, C., & Schmidt, K. (2015). Keep it clean: A visual approach to reinforce hand hygiene compliance in the emergency department. *Journal of Emergency Nursing, 41*(2), 119-124. https://doi.org/10.1016/j.jen.2014.10.007.

Willis, D. E., Andersen, J. A., Bryant-Moore, K., Selig, J. P., Long, C. R., Felix, H. C., Curran, G. M., & McElfish, P. A. (2021). COVID-19 vaccine hesitancy: Race/ethnicity, trust, and fear. *Clinical and Translational Science, 14*(6), 2200-2207. https://doi.org/10.1111/cts.13077.

Wojnar, D. M., & Swanson, K. M. (2007). Phenomenology: An exploration. *Journal of Holistic Nursing, 25*(3), 172-180. https://doi.org/10.1177/0898010106295172.

World Health Organization. (2023, December 22). COVID-19 epidemiological update – 22 December 2023 (Edition 162). Retrieved from URL: https://data.who.int/dashboards/covid19/deaths?n=o on January 19, 2024

Yazdanparast, A., & Alhenawi, Y. (2022). Impact of COVID-19 pandemic on household financial decisions: A consumer vulnerability perspective. *Journal of Consumer Behaviour, 21*(4), 806-827. https://doi.org/10.1002/cb.2038.

Zettersten, E., Engerström, L., Bell, M., Jäderling, G., Mårtensson, J., Block, L., Larsson, E. (2021). Long-term outcome after intensive care for COVID-19: Differences between men and women-a nationwide cohort study. *Critical Care (London, England), 25*(1), 86-86. https://ccforum.biomedcentral.com/articles/10.1186/s13054-021-03511-x.

Zhang, X., Wu, J., Smith, L. M., Li, X., Yancey, O., Franzblau, A., Dvonch, J. T., Xi, C., & Neitzel, R. L. (2022). Monitoring SARS-CoV-2 in air and on surfaces and estimating infection risk in buildings and buses on a university campus. *Journal of Exposure Science & Environmental Epidemiology, 32*(4), 751–758. https://doi.org/10.1038/s41370-022-00409-6.

Zhu, N., Smetana, J. G., & Chang, L. (2021). Acceptance of society-level and individual-level preventive measures during the COVID-19 pandemic among college students in three

societies. *Journal of Cross-Cultural Psychology*, *52*(7), 606-621. https://doi.org/10.1177/0022022121995971.

APPENDICES

Appendix A

Informed Consent Form

Consent

Title of the Project: To Characterize the Effects, or No Effects Defined as the COVID-19 Health Precautions Among Health Science Students
Principal Investigator: Marquitta Foster, Doctoral Candidate, Health Science Department, Liberty University

Invitation to be Part of a Research Study

You are invited to participate in a research study. To participate, you must be an online Health Science student at Liberty University at all academic levels (ex. bachelors, masters, and doctorates) and ages 18-64. Taking part in this research project is voluntary.

Please take time to read this entire form and ask questions before deciding whether to take part in this research.

What is the study about and why is it being done?

The study would explore the effects the COVID-19 pandemic has had on standard health precautions attitudes, behaviors amongst Liberty University health science students.

What will happen if you take part in this study?

If you agree to be in this study, I will ask you to do the following (Total estimated time approximately 60 minutes to complete the procedures listed):

1. Complete a survey (15 minutes).
2. Participate in an interviews that would be audio-recorded (30-45 minutes)
3. Observations will occur during the interview with the participants (30-45 minutes)

How could you or others benefit from this study?

Participants should not expect to receive a direct benefit from taking part in this study.

Benefits to society would provide a clearer understanding the COVID-19 pandemic had on standard health precaution and how it may have affected the attitudes and behaviors amongst health science students at Liberty University.

What risks might you experience from being in this study?

The expected risks from participating in this study are minimal, which means they are equal to the risks you would encounter in everyday life.

How will personal information be protected?

The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

- Participant responses to online survey will be anonymous. Names and other identifying information will be requested as part of this study, but this information will remain confidential. Participant responses will be kept confidential through the use of codes. The

code such as participant 1 will be used to protect participants name. Interview will be conducted in a location where others will not easily overhear the conversation.

- Data will be stored on a password-locked computer and hard copy data will be stored in a locked drawer. After seven years, all electronic records will be deleted, and all hardcopy records will be shredded.
- Recordings will be stored on a password locked computer and deleted after seven years. The researcher and members of her doctoral committee will have access to these recordings.

How will you be compensated for being part of the study?

A $10 Amazon gift card will be sent to the participants via their Liberty University email following the completion of the research survey and interview.

Is study participation voluntary?

Participation in this study is voluntary. Your decision whether to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time prior to submitting the survey without affecting those relationships.

What should you do if you decide to withdraw from the study?

If you choose to withdraw from the study, please exit the survey and close your internet browser. Your responses will not be recorded or included in the study. If you decide to withdraw after the interview please contact the researcher at the email address in the following paragraph. Data collected from you will be destroyed immediately and not included in this study.

Whom do you contact if you have questions or concerns about the study?

The researcher conducting this study, [redacted] You may ask any questions you have now. If you have questions later, **you are encouraged** to contact [redacted]. You may also contact the researcher's faculty sponsor, [redacted]

Whom do you contact if you have questions about your rights as a research participant?

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the IRB. Our physical address is Institutional Review Board, [redacted]; our phone number is [redacted] and our email address is [redacted]

Disclaimer: The Institutional Review Board (IRB) is tasked with ensuring that human subjects research will be conducted in an ethical manner as defined and required by federal regulations. The topics covered and viewpoints expressed or alluded to by student and faculty researchers are those of the researchers and do not necessarily reflect the official policies or positions of Liberty University.

Your Consent

By signing this document, you are agreeing to be in this study. Make sure you understand what the study is about before you sign. You will be given a copy of this document for your records.

The researcher will keep a copy with the study records. If you have any questions about the study after you sign this document, you can contact the study team using the information provided above.

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

☐ The researcher has my permission to audio-record me as part of my participation in this study.

_____
Printed Subject Name

_____
Signature & Date

Appendix B

IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

March 31, 2023

[redacted]

Re: IRB Exemption - IRB-FY22-23-437 TO CHARACTERIZE THE EFFECTS, OR NO EFFECTS DEFINED AS THE COVID-19 HEALTH PRECAUTIONS SINCE THE COVID-19 PANDEMIC AMONG HEALTH
[redacted]

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and no further IRB oversight is required.

Your study falls under the following exemption category, which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:104(d):

Category 2.(iii). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by §46.111(a)(7).

Your stamped consent form(s) and final versions of your study documents can be found under the Attachments tab within the Submission Details section of your study on Cayuse IRB. Your stamped consent form(s) should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document(s) should be made available without alteration.

Please note that this exemption only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued exemption status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this exemption or need assistance in determining whether possible modifications to your protocol would change your exemption status, please email us at [redacted]

Sincerely,

[redacted]

Appendix C

Informed Consent Form

IRB Approval Form Modification

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

June 28, 2023

[redacted]

Re: Modification - IRB-FY22-23-437 TO CHARACTERIZE THE EFFECTS, OR NO EFFECTS DEFINED AS THE COVID-19 HEALTH PRECAUTIONS SINCE THE COVID-19 PANDEMIC AMONG HEALTH

[redacted]

The Liberty University Institutional Review Board (IRB) has rendered the decision below for IRB-FY22-23-437 TO CHARACTERIZE THE EFFECTS, OR NO EFFECTS DEFINED AS THE COVID-19 HEALTH PRECAUTIONS SINCE THE COVID-19 PANDEMIC AMONG HEALTH .

Decision: Exempt - Limited IRB

Your request to add two questions to your interview and compensate participants by giving each of them a $10 Amazon gift card has been approved. Thank you for submitting your revised study documents for our review and documentation. Your revised, stamped consent form and final versions of your study documents can be found under the Attachments tab within the Submission Details section of your study in Cayuse IRB. Your stamped consent form should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document(s) should be made available without alteration.

Thank you for complying with the IRB's requirements for making changes to your approved study. Please do not hesitate to contact us with any questions.

We wish you well as you continue with your research.

Sincerely,

[redacted]

Appendix D

Permission Request

Dear Recipient:

As a graduate student in the School of Health Science at Liberty University, I am conducting research as part of the requirements for my doctoral degree. The purpose of my research is to explore the effects the COVID-19 pandemic has had on standard health precautions attitudes and behaviors amongst health science students, and I am writing to invite eligible participants to join my study.

[redacted] health science students [redacted] Mason University,or Norfolk State University. Participants, if willing, will be asked to complete a survey (15 minutes) and participate in an audio-recorded interview (30-45 minutes) about the health precautions of the COVID-19 pandemic. The researcher will also take observational notes during the interview. It should take approximately 60 minutes to complete the procedures listed. Participation in the survey will be completely anonymous, and no personal, identifying information will be collected. Names and other identifying information will be requested as part of this study, but this information will remain confidential.

To participate, please contact me at [redacted] to confirm your eligibility and schedule an interview.

A consent document is attached to this email The consent document contains additional information about my research. If you choose to participate you will need to sign the consent document and return it to me. After I receive it I will send you a link to the survey.

If you have any questions or concerns regarding this study, **you are encouraged** to contact [redacted]

Following the completion of the research survey and interview, participants will be sent a $10 Amazon gift card to their Liberty University email.

Sincerely,

[redacted]

Appendix E

Additional Supplemental Tables

Figure 13. Do you consider yourself immunocompromised-academic degree?

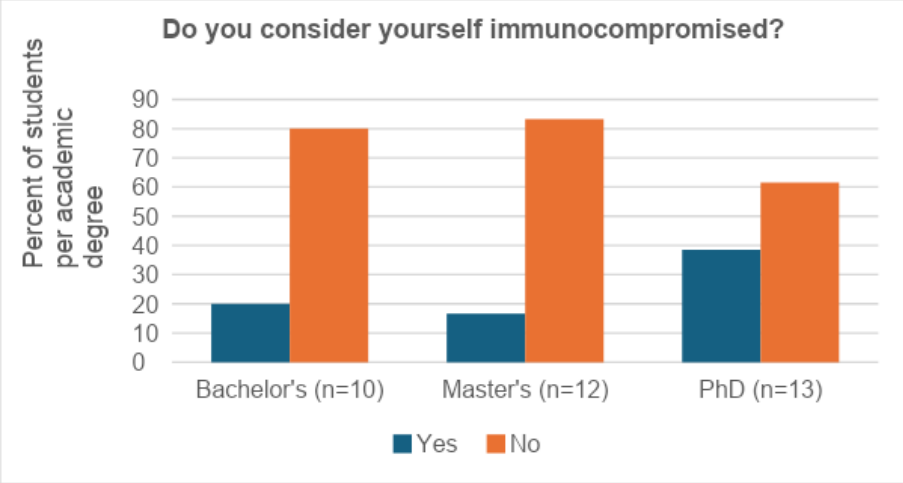


Figure 14. Do you consider yourself immunocompromised- ethnicity?

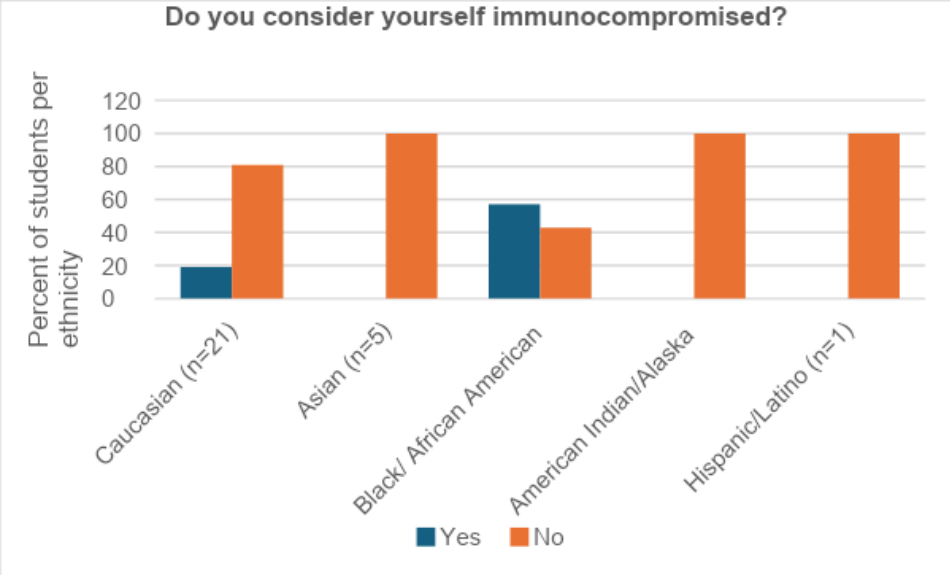


Figure 15. Do you consider yourself immunocompromised- age?