

A Study of Barriers to the Wearing of Face Masks by Adults in the US to Prevent the Spread
of Influenza

by

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ABSTRACT

In the United States, seasonal influenza is responsible for enormous medical costs and lost earnings as well as thousands of deaths. Medical masks are an effective non-pharmaceutical preventions for minimizing the spread of illness in the event of an influenza outbreak. However, people in the United States rarely wear face masks the way many people in Asian countries do.

In a previous study of public response to the 2009 influenza A H1N1 pandemic, 71% of United States respondents supported the recommendation to wear a mask during the flu outbreak, while only 8% of respondents reported they wore a mask in public to protect themselves from getting sick. What are the factors that cause this gap? The purpose of this exploratory study is to identify barriers to the wearing of masks among adults in the United States.

The research was conducted through an online survey of 84 American residents via the Survey Monkey Audience service to collect their opinions on influenza, mask-wearing, and the perceived barriers to wearing face masks for flu prevention. The results are presented in the descriptive analysis and the non-parametric analysis.

The results showed a barrier against social interaction is a significant factor ($p=0.003$) regarding the impact between flu experience and the perceived barriers. The participants believed mask-wearing may lead other people difficult to perceiving their feelings. Regarding the relationship between mask-wearing experience and the perceived barriers, there were significant differences in perceived benefits ($p=0.028$), perceived risks ($p=0.003$), and social value ($p=0.021$). Participants who have had worn masks had perceived higher benefits of mask-wearing, higher risks of catching the flu, and a higher agreement of importance to protect other people from getting the flu from them. The most common perceived barrier among the participants is product satisfaction. 85.71% of the participants agreed that wearing face masks is uncomfortable. 80.95% of the participants agreed with the importance to wear face masks as it protects other people from getting the flu from them, but only 37.5% of the participants with flu history had worn face masks.

By examining barriers to the wearing of masks for influenza prevention, this study can assess public willingness to adopt personal prevention behaviors and provide information for related policies in the future.

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CHAPTER 1

INTRODUCTION

Purpose of Study

In the United States, seasonal influenza is responsible for billions of dollars in medical costs and lost earnings as well as thousands of deaths. The Centers for Disease Control and Prevention (C.D.C) estimates that since 2010, influenza has resulted in 9.2 million to 35.6 million illnesses, 140,000 to 710,000 hospitalizations, and 12,000 to 56,000 deaths in the United States every year (CDC, 2018). Minimizing the spread of illness in the event of a future influenza outbreak is still a priority for infectious disease specialists worldwide (World Health Organization, 2018).

Influenza prevention includes the adoption of behaviors, such as vaccination and handwashing, or compliance with social distancing policies, such as recommendations to avoid mass gatherings (SteelFisher et al., 2012). Wearing medical masks is one of the more effective non-pharmaceutical interventions for personal protection (Mukerji, MacIntyre & Newall, 2015). For example, depending on the types of face masks, the protection rate varied from 33 to 100% in the expiratory emissions process (Lai, Poon & Cheung, 2011).

In a study of public response to the 2009 influenza A H1N1 pandemic conducted in five countries (Argentina, Japan, Mexico, United Kingdom, and the United States), the results showed that adopting mask-wearing as personal prevention behavior is not common in the United States (SteelFisher et al., 2012). While 63% of responders in Japan and 71% in Mexico reported they wore masks during a flu pandemic, less than 20% of people in the other countries reported they wearing masks. Notably, only 8% of United States responders wore a mask in public to protect themselves from getting sick, which is the lowest rate in the five countries. The difference between mask use in the US with other countries also was noted in several Asian news outlets (蘇, 2018; 阿波羅新聞網, 2012; マイナビニュース, 2017). To date, little is known about the reasons people in the US do not wear face masks to prevent the spread of influenza. The purpose of this research is to identify barriers to mask-wearing among adults in the United States.

Since non-pharmaceutical public health interventions may provide low-cost, simple, and effective ways of minimizing the transmission and impact of acute respiratory infections (Teasdale, Santer, Geraghty, Little & Yardley, 2014), examination of the barriers to the use of face masks for influenza prevention can provide information regarding public willingness to adopt personal prevention behaviors and can help guide related policies for the future.

Significance and Rationale

Seasonal influenza is a highly pathogenic viral infection (Putri, Muscatello, Stockwell & Newall, 2018). In the United States, it typically occurs from late fall to early-mid spring annually (Monto, 2008). Influenza infection is common in all age groups, with children infected most frequently. In most cases, influenza infection is a self-limiting disease from which individuals will recover without serious complications; nevertheless, it can result in severe illness and death (Wong et al., 2014). In the U.S, influenza cost an average of \$10.4 billion annually for medical spending such as hospitalizations in addition to \$7 billion in sick days and lost productivity (O'Brien, 2018; Paul, 2018). Due to the severe health and economic burden of influenza, prevention of infection and its complications is a serious public health concerns (Molinari et al., 2007).

Typically, vaccines are the first line of defense against influenza viruses (Germann, Kadau, Longini & Macken, 2006)., however, in the case of viruses vaccines may not be readily available and therefore limited in effectiveness. In addition to vaccines, public health departments encourage good hygiene habits to reduce the spread of influenza (Tracht, Del Valle & Edwards, 2012). Nonpharmaceutical interventions, such as hygiene and medical masks, are considered essential for the mitigation of pandemic and interpandemic influenzas (Cowling et al., 2009; Aiello et al., 2012).

Some studies have shown that using a medical mask could help prevent influenza, especially when combined with the use of alcohol-based hand sanitizer reduce the number of influenza-like illnesses (Sadique et al., 2007; CDC, 2016).

Although several studies (MacIntyre et al., 2008; Berger et al., 1993) have demonstrated the efficacy of face masks, a study by SteelFisher funded by the CDC showed that wearing masks was not widely-accepted as personal prevention behavior during 2009 H1N1 influenza outbreak in the United States (see Tables 1 and 2).

Table 1.

Public Approval of Social Distancing Policy Recommendations During the 2009 H1N1 Pandemic, by Country.

	Argentina (n=900)	Japan (n=900)	Mexico (n=900)	UK (n=900)	USA (n=911)
Recommendation to avoid places where many people gather	88%	81%	84%	50%	69%
Recommendation to close schools	82%	90%	79%	68%	80%
Recommendation to wear a mask in public	70%	91%	88%	51%	71%

Table 2. *Public Adoption of Influenza Prevention Behaviors in Response to 2009 H1N1 Pandemic, by Country.*

Personal Protective Behaviours	Argentina (n=900)	Japan (n=900)	Mexico (n=900)	UK (n=900)	USA (n=911)
More frequently washed hands or used hand sanitizer	89%	72%	86%	53%	72%
More frequently coughed or sneezed into elbow or shoulder	84%	33%	82%	25%	55%
More frequently cleaned or disinfected home or workspace	76%	27%	77%	34%	55%
More frequently covered mouth and nose with tissue when coughing or sneezing	64%	48%	77%	27%	61%
Wore a mask in public to protect themselves from getting sick	19%	63%	71%	11%	8%

Note. Adapted from "Public response to the 2009 influenza A H1N1 pandemic: a polling study in five countries" by SteelFisher, G., Blendon, R., Ward, J., Rapoport, R., Kahn, E., & Kohl, K. 2012, *Lancet Infect Dis*, 12, 845-50.

While 71% of United States respondents agreed with the recommendation to wear a mask during the flu outbreak, only 8% of respondents reported they wore a mask in public to protect themselves from getting sick. What are the factors that cause this apparent gap in the United States?

Since many important mitigation strategies will need public participation, this research aims to identify the barriers to applying medical masks in influenza prevention among adults in the United States. One of the policies of a previous study suggested that people should consider wearing masks, as is routinely done in several Asian countries, to prevent the spread of airborne viruses (Tracht, Del Valle & Edwards, 2012). Face masks are inexpensive and, easy to implement compared to most other mitigation strategies (Tracht, Del Valle & Edwards, 2012). Novel prevention and treatment strategies are needed to improve outcomes for people at highest risk if new strains of influenza virus emerge (Rothberg, Haessler & Brown, 2008). Widespread application of medical masks for prevention may assist in management strategies for future outbreaks.

Research Questions

What are the barriers to wearing medical masks for influenza prevention among adults in the United States?

Sub-question

1. What are overall perceptions of barriers to wearing face masks?
2. What is the relationship between perceived barriers to wearing medical masks and previous infection with influenza?
3. What is the relationship between perceived barriers to wearing medical masks and previous experience wearing a medical mask?

Scope and Limitations

The research focused on perceived barriers to wearing masks for prevention of influenza infections in adults residing in the U.S.

The study will use a quantitative design with a survey methodology. The sampling strategy is convenience sampling. A total number of 84 (N=84) United States residents above 18 years of age were recruited online to answer 24 questions.

Convenience sampling is relatively simple and low-cost, and data collection can be facilitated in a short duration of time (Creswell & Creswell, 2018). However, the use of convenience sampling has inherent limitations related to the generalizability of findings. It is highly vulnerable to selection bias and has a high level of sampling error. As a result, a professional survey distribution website, Survey Monkey, was used to reduce the sampling error by distributing the survey to a broad group of people with characteristics such as gender and location more representative of the US population as whole.

Online survey methodology also will reduce generalizability as participants will be limited to those with internet access, which may restrict some groups from participating in the study. The details of those limitations will be included in Chapter 3.

Summary

The study is designed to identify the barriers to wearing face masks for influenza prevention among adults in the United States. While mask-wearing is an effective non-pharmaceutical prevention for the flu, previous studies have shown that mask-wearing is not widely accepted as common personal prevention in the United States.

The results of this study may contribute to strategies that can increase the use of face masks to prevent influenza in the US.

CHAPTER 2

LITERATURE REVIEW

Introduction

This chapter provides a review of previous studies on influenza, influenza prevention, the efficacy of medical masks, mask-wearing in the United States, and the potential barriers to adoption of medical masks for the flu in the US.

Influenza Introduction

Influenza Incidence

In the United States, according to estimates of 6 seasons of influenza activity from 2010 to 2016, the incidence of influenza was approximately 8% during seasons of moderate severity and varied from 3% to 11% among the seasons. The median incidences were 9.3% for children 0–17 years, 8.9% for adults 18–64 years, and 3.9% for adults ≥65 years (CDC, 2017; Tokars, Olsen & Reed, 2017).

Influenza Symptoms & Complications

Influenza, subsequently referred to as “flu”, is a contagious respiratory illness caused by flu viruses. It is a well-established cause of seasonal illness, generally characterized by acute onset of fever, myalgias, and respiratory symptoms (Rothberg, Haessler & Brown, 2008). It can lead to mild to severe illness and even can cause death at times (CDC, 2018). Based on Rothberg's study (2008), influenza A (H1N1) seems to be the mildest, influenza B is intermediate, and influenza A (H3N2) is most severe, accounting for 66, 81, and 99 hospitalizations per 100,000 persons, respectively, with 80% of deaths due to influenza A (H3N2).

According to the CDC (2018), most people who get the flu will recover within two weeks. However, some people can develop complications that can be life-threatening and result in death. The most frequent severe influenza complications are pulmonary, which can result from either influenza virus infection alone or co-infection of bacteria with the flu virus. Other possible serious complications triggered by influenza can include sinus and ear infections, inflammation of the

heart (myocarditis), brain (encephalitis) or muscle (myositis, rhabdomyolysis), and multi-organ failure (kidney and respiratory failure).

Route of Infection

According to the CDC (2018), flu viruses are contagious and spread mainly by droplets made when patients (people with the flu) talk, cough, or sneeze. Patients can spread it to other people up to about six feet away. On other occasions, a person may also be infected by touching their nose after touching a surface with the flu virus on it.

The flu symptoms usually start one to four days after the virus enters the body. Most healthy adults may be able to infect other people beginning one day before symptoms develop and up to one week afterward. Children might be able to pass the virus for longer than seven days. However, asymptomatic individuals may still spread the virus to others (National Center for Immunization and Respiratory Diseases, 2018).

Much of the literature (Health and Human Services Department, 2004; Bridges et al., 2003; Tellier, 2006) consider three modes of transmission:

Table 3.

Three Modes of Influenza Transmission

Type	Droplet transmission	Contact transmission	Aerosol transmission
Definition	Virus particles from an infected person's sneeze or cough deposits directly onto a susceptible person's mucous membranes.	An infected person gets the virus on his hands and transfers this virus either directly, e.g., by a handshake, or indirectly by fomites, to the hands of a susceptible person, who then places his hand into his mouth, noses or eyes.	A susceptible person inhales droplet nuclei (e.g., evaporated virus-containing particles in the air).

Note. Adapted from "Quantifying the Routes of Transmission for Pandemic Influenza" by Atkinson & Wein, 2008, *Bulletin of Mathematical Biology*, 70, p. 821.

An observational study of the influenza A (H3N2) strain showed the connection between high illness rate and the airborne transmission routes of influenza in the setting of a nonfunctioning ventilation system (Moser, 1979).

Furthermore, a study from the University of Maryland revealed that the flu virus does not require a sneeze or a cough to become airborne and can spread simply through breath (Yan et al., 2018). Neither sneezing nor coughing is necessary for influenza virus aerosolization. In summary, the influenza virus is easily transmissible.

Impact of Influenza on Society

Any person, even a healthy one can get the flu, and serious problems related to the flu can happen at any age (CDC, 2018). According to a Mortality and Morbidity Weekly Report (Grohskopf et al., 2016), populations at high risk of severe illness from infection include children, adults aged over 50 years, pregnant women, and patients with comorbidities (e.g. asthma, cardiovascular disease, metabolic disorders).

In the United States, on average, more than 200,000 people are hospitalized with the flu each year, and about 36,000 people die from flu complications annually (CDC, 2008). From a 2003 study measuring disease burden and costs in the US population, seasonal influenza epidemics result in an average of 600,000 life-years lost, 3.1 million hospitalized days, and 31.4 million outpatient visits. The associated direct medical costs were estimated to be USD 10.4 billion, with lost productivity due to illness and death estimated to be \$16.3 billion (Molinari et al., 2007). In the 2016–2017 season, about 30.9 million people got sick with the flu, 14.5 million went to a health care provider, and an estimated 600,000 people were hospitalized (CDC, 2018). Influenza usually results in a substantial economic burden due to both medical care costs and productivity loss.

Influenza Prevention

There are many reasonably effective ways to reduce the transmission of influenza viruses, including good personal health and hygiene habits (World Health Organization, 2010). This section describes general flu prevention strategies and the role of medical masks.

Influenza Preventions

Influenza Vaccines

The cornerstone of influenza prevention is the annual vaccination with a trivalent killed virus vaccine (Rothberg, Haessler & Brown, 2008). In healthy adults and children, depending on the adequacy of the match with the circulating virus, influenza vaccine can prevent 50% to 80% of influenza illnesses (Jefferson et al., 2010). Yearly vaccines are recommended for children aged 6 to 59 months, all adults over 50 years, patients with chronic medical conditions, women who will be pregnant, immuno-suppressed patients, caretakers of high-risk patients, and healthcare workers.

Although the U.S. Advisory Committee on Immunization Practices (ACIP) recommends influenza vaccination for all people aged ≥ 6 months, less than 50 percent of the population is vaccinated for influenza each year (Centers for Disease Control and Prevention, 2018). Immunization rates remain substantially below the targets set in Healthy People 2020. For instance, in 2011-2012, only 33% of adults aged 18–64 were vaccinated while the target was 80% of the adults. Current US vaccination rates for all high-priority groups remain well below national goals (Grohskopf et al., 2016).

Due to the possibility of limited availability of vaccines and antiviral medications during pandemics and the potential for resistance, non-pharmaceutical measures for prevention of the flu have to be established and considered (Aiello et al., 2012).

Hand Hygiene

Studies have shown that hand hygiene, namely thorough handwashing, is effective reducing the transmission of infection in schools and the spread to household contacts (Papenburg et al., 2010). The CDC (2018) recommends that people wash hands with soap and

water for at least 20 seconds by, properly foaming hands, washing the soap off, and drying hands entirely. If a sink is not available, they recommend the use of a hand sanitizer when hands are not visibly soiled (Boyce & Pittet, 2002).

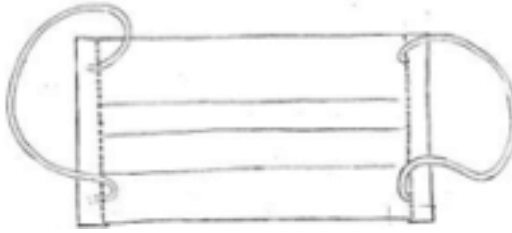
In an international study of public response to the 2009 influenza A H1N1 pandemic (SteelFisher et al., 2012), the most commonly adopted personal protective behavior was to wash hands or use hand sanitizer more often. However, the recommendations for proper hand washing are rarely carried out with high compliance in the general population. For example, almost 30 percent of travelers do not wash their hands after using public restrooms at airports (American Society for Microbiology, 2003). In a newer study (American Society for Microbiology, 2010), 85% of adults washed their hands in public restrooms. However, only 39% of Americans say they always wash their hands after coughing or sneezing. Hand hygiene needs to be widely adopted by the population if they are to mitigate influenza transmission effectively (Ekernas, 2010).

Medical Masks Introduction

In this study, medical face masks refer to the face masks designed for one-time use in medical situations, instead of N95 respirators. Face masks for infection prevention were introduced in the late 19th century. At the time only crude masks were used (Weaver, 1919). Today, there are several types of medical masks on the market. The following table illustrate the traits of medical masks. Medical masks have better bacterial filtration efficiency (80%) than other types of face masks (e.g. face masks to maintain hygiene during food preparation or carpentry) (Health Sciences Authority, 2014).

Table 4.

Type of Medical Masks

	Face Mask (Medical Mask)
Example	 Flat/pleated and affixes to the head with ear loops.
Purpose	To protect the environment by preventing large particles expelled by the wearer who is ill, from reaching the environment. To be used as a physical barrier to protect the user from large droplets of blood or body fluids.
Fit	Does not fit tightly.
Filtration Efficiency	Bacterial filtration efficiency above 80%.
Fluid Resistance	Yes.

Note. Adapted from <http://www.hsa.gov.sg/content/hsa/en.html>. Copyright (2014) by Health Sciences Authority.

According to the Food and Drug Administration (USFDA), face masks are not designed to be used more than once. If a mask is damaged, wet, soiled, or if breathing through the mask becomes difficult, the user should remove the face mask, discard it safely, and replace it with a new one (FDA, 2018).

Efficacy of Medical Masks

If worn properly, a face mask is meant to help block large-particle droplets, sprays, or splatter that may contain germs (bacteria and viruses) from reaching the mouth and nose. Face masks may also help reduce exposure of personal saliva and respiratory secretions to others (the Food and Drug Administration (FDA), 2018) Face masks can be an effective prevention strategy as barriers (Del Valle et al., 2010) that can decelerate and redirect exhaled air flows to prevent them from entering the breathing zones of other people (Tang and Settles, 2009). Medical masks block some large, virus-containing droplet particles that are emitted when a sick person sneezes

or coughs. Some evidence suggests that a mask worn by an infected person reduces the speed of the air expelled from the mouth or nose, limiting the distance traveled by large particles (Inouye, Matsudaira & Sugihara, 2006). More importantly, it makes it difficult for a healthy person to transfer virus particles from his or her hands to the nose and mouth, preventing secondary contact transmission (Fabian et al., 2008).

In 2008, a study (MacIntyre et al., 2008) published in the International Journal of Infectious Diseases concluded that face masks are highly effective in preventing the spread of viral infections when used correctly. In family members of children with flu-like illnesses, those who used the masks correctly were 80 percent less likely to be diagnosed with flu-like illness.

In a study conducted in 2009 at Ogumiyamae Elementary School in Arakawa Ward, Tokyo, only 2 % of the students who wore medical masks (3 out of 151) contracted influenza, compared to the infection rate of 9.7 % of students who did not wear masks (10 out of 103). The usual incidence of influenza in children for the same area was 8.2% (Japan Hygiene Products Industry Association, 2011).

Another study (Cowling et al., 2009) published in the Annals of Internal Medicine reported similar results. The researchers looked at 407 people who had the flu. The risk of getting the flu was reduced by 70 percent when family members washed their hands often and wore surgical masks.

There were also promising results outside of the household. For instance, one study (Aiello et al., 2012) was conducted with more than 1,000 students living in residence halls at the University of Michigan. The research team allocated the student to three groups: those who wore masks and practiced hand hygiene, those who only wore masks, and those who did neither. The results showed that those who wore masks and practiced proper handwashing reduced their risk of flu-like illness by 75 percent. Medical Mask may be combined with other preventions to boost the rate of flu prevention.

Mask-wearing in the United States

Use of Medical Masks by Medical Staff

Face masks and respirators are commonly recommended by health organizations to protect healthcare workers (HCWs) from healthcare-associated infections (MacIntyre & Chughtai, 2015). Influenza is one of the threats since healthcare workers are at increased risk of exposure due to contact with patients and work colleagues (Bernard, Fischer, Mikolajczyk, Kretzschmar & Wildner, 2009). Therefore, the CDC highly suggests healthcare personnel should wear face masks when coming in contact with influenza patients, such as when entering rooms of patients with confirmed or suspected influenza. Medical staff should have the patient wear a face mask as well if possible (CDC, 2018).

While the CDC has infection control recommendations for healthcare settings, it does not issue any requirements (CDC, 2018). The requirements for health care setting regarding infection control practices (wearing masks) usually vary among different state agencies. In an officially-declared flu outbreak scenario, some states (e.g. New York and Rhode Island) require healthcare workers who are not vaccinated against seasonal influenza to wear a surgical face mask during direct patient contact (Palmer & Vensel, 2018). Depending on facility policies, medical employees may be required to wear masks during flu season, which usually runs from the end of December to late April (Stapleton, 2017).

Historical Outbreak of Influenza in the United States

Spanish Flu (H1N1), 1918

The 1918 influenza pandemic (known as the Spanish pandemic) was an unusually deadly influenza pandemic involving the H1N1 influenza virus (Taubenberger & Morens, 2006), and it was widely perceived to be one of the most dangerous near-term public health threats in the world (Health and Human Services Department, 2004). The influenza pandemic was severe, resulting in the deaths of up to 50 million people worldwide, including an estimated 675,000 deaths in the United States (Crosby, 2003). The pandemic's most striking feature was the

unusually high death rate among healthy adults aged 15 to 34 years, which consequently lowered the average life expectancy in the United States by more than ten years (Glezen, 1996).

During that period, people relied on voluntary and forced social distancing measures to prevent the spread of disease, including the cancellation of public gatherings and the wearing of masks in public (Markel et al., 2006).



Figure 1. Police officers in Seattle wearing masks made by the Red Cross, during the influenza epidemic, December 1918. Reprinted from *Regional history from the national archives*, by National archives and records administration, 1974, Retrieved from <https://www.archives.gov/exhibits/regional-history/>. Copyright 1974 by National Archives and Records Administration.

Swine Flu (H1N1), 2009

The 2009 flu pandemic, referred to as "swine flu," was a strain of the Influenza A/H1N1 virus- which was associated with the 1918 outbreak known as the Spanish Flu (Morens, Taubenberger, Harvey & Memoli, 2010). In the United States, it began in California in the spring of 2009 (Nelson et al., 2016). Globally, it was estimated that 80 percent of H1N1 virus-associated deaths were in people younger than 65 years old, which was unusual in other typical seasonal

influenza epidemics (Karageorgopoulos, Vouloumanou, Korbila, Kapaskelis & Falagas, 2011). By mid-March 2010, just approximately one year after, the CDC estimated that about 60 million Americans had contracted the H1N1 virus, 275,000 were hospitalized as a result, and 12,000 people died (CDC, 2018).

The Department of Health and Human Services (HHS) estimates that the United States would need more than 27 billion of the simple surgical kind and 5 billion of the sturdier respirators to protect all Americans in the event of a serious epidemic (Schneck, 2009; Coombs, 2010). However, according to the Centers for Disease Control, the national stockpile contains only 119 million masks: 39 million surgical masks and 80 million respirators (CDC, 2009). This suggests the need for increased production assuming widespread adoption of masks during an epidemic.

Public Response to Mask-wearing in the United States

From the study of public response to the 2009 influenza A H1N1 pandemic, regarding mask-wearing (SteelFisher et al., 2012), there is a gap between the public approval of strategy and the adoption of preventive behaviors in the US. While the U.S public approval rate of masks as a social distancing policy recommendation was 71%, the public adoption rate of wearing a mask in public was only 8%, the lowest rate in the 5 countries studied (Japan, Argentina, Mexico, United Kingdom, United States). (See Table 2 & 3 in Chapter 1)

SteelFisher, Blendon, Bekheit and Lubells' findings showed that in the pandemic's first weeks, almost two-thirds (59 to 67%) of Americans said that they or their family member had begun to practice hand hygiene more frequently, while only 4 to 8% said they or family members had worn a face mask. These studies indicate that mask-wearing is not a typical personal prevention behavior in the United States.

Mask-wearing Outside the United States

In Japan, since the postwar period, the typical mask wearer was someone who had a cold and did not want to infect others (Gordenker, 2014). It is common for someone who is ill to

wear a face mask to avoid infecting others in public settings, and wearing a mask is considered a sign of consideration for other people and social responsibility (Burgess & Horii, 2012).

The 2009 swine flu outbreak increased acceptance in Japan for wearing masks in public. Studies showed in 2009 that around 48.7 percent of respondents reported using masks as protection against influenza, while 76.5 percent believed that masks could provide effective protection against influenza (Horii, 2014). Based on another study, the Japanese consumer's agreement with the statement "I do not like to wear a mask because others might think I am sick" dropped by two-thirds between 2008 and 2014. In other words, wearing a mask was more normalized (Gordenker, 2014).

The rate of mask use in Japan has continued to increase. In the Kobayashi Medicine Company of 1200 Japanese citizens (Noguchi, 2011), 18% of participants reported that they wore masks on a daily basis in 2008, increasing to 26.2% in 2009, 27.7% in 2010, and 30.6% in 2011.

Sales of surgical masks in Japan accompanied these increases in use. In 2011, 550 million home-use masks were sold; the average number of masks bought by each person was 4.4 per year (富士経済グループ, 2011). In 2014, consumers in Japan spent \$230 million on surgical masks (Yang, 2014).

Face masks also are used extensively in China. The poor air quality in city areas is one of the main reasons to wear a mask (Jie, 2014). In 2013, there were over 1,000 mask manufacturers in China. Annual mask production is currently estimated at 600 million, some 200 million of which is for civilian use. Estimates show that China has a demand for 800 million masks every year (Jie, 2014).

These studies from Japan and China show that mask-wearing is much more common in these countries than in the United States. These are growing markets with enormous potential.

Potential Barriers to Wearing Masks for Influenza in the USA

There are a number of potential reasons that individuals in the US do not report wearing masks during influenza outbreaks despite a majority supporting this intervention strategy (see Table 1 & 2). In the following section, a range of possible explanations is described.

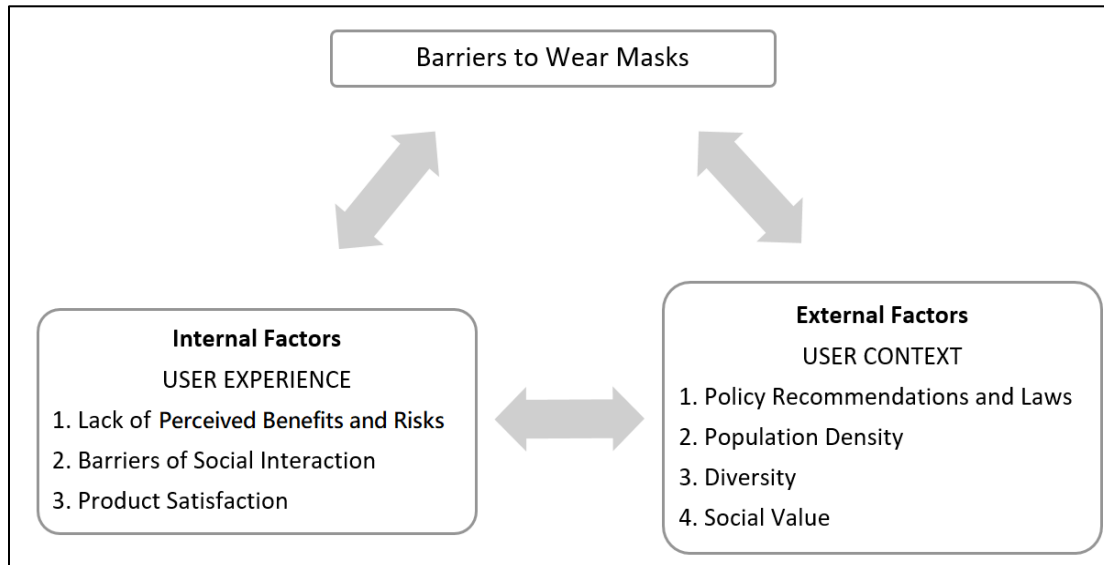


Figure 2. Conceptual Framework of Potential Barriers.

The framework divides the barriers into two categories: internal factors and external factors. Internal factors focused on the users themselves, such as the lack of flu-related knowledge, the negative user experience of wearing a mask in public, and the product feedback of face masks. The external factors included the user context: the policies, laws, and the features of society. These two categories may interact with each other. There might also be other factors not considered here.

Perceived Benefits and Risks

Lack of Knowledge about Perceived Benefits

Perceived benefit is the perception of the positive consequences caused by a specific action (Leung, 2013). In behavioral medicine, the term perceived benefit is usually used to explain an individual's motives for performing a behavior and adopting an intervention or treatment. Researchers and theorists believed that behavior is driven by an individual's cognition

regarding acceptability, motives, and attitudes toward such behavior, especially if positive (Leung, 2013). If an individual knows the benefits of wearing a mask during the flu pandemic, he or she may take action. In contrast, if individuals lack the knowledge of the perceived benefits of mask-wearing, they may overlook this personal prevention.

Attitudes toward influenza vaccination follow a similar pattern. In a study (Hashmi et al., 2016) of the impact of preventive strategies and policies on behavioral changes during the spread of the H1N1 pandemic in 2009, the perception toward influenza vaccinations and the effectiveness of preventive health policy strategies were surveyed within the Massachusetts Institute of Technology (MIT) students. The results showed more than half of unvaccinated students lacked knowledge about flu vaccinations. In this case, when the students were asked if they had received the flu vaccine during the 2009 H1N1 pandemic, the students who did not receive the flu vaccine were asked to explain their reasons. Their answers were coded as “lack of knowledge” when they mentioned something incorrect about the flu shot and its effects. It showed that most of the students (53% of undergraduates, 65% of graduate students, and 63% of business students) reasons for not being vaccinated were coded as lack of knowledge about flu vaccinations. The qualitative data analysis also showed that a lack of knowledge about flu vaccinations existed even in such a highly educated population (Hashmi et al., 2016).

Lack of Perception of Being at Risk

Studies on health behavior have identified the perception of being at risk as a prerequisite for behavior change (Weinstein & Nicolich, 1993; Brewer, Weinstein, Cuite & Herrington, 2004). It is believed that a high perceived risk of harm encourages individuals to take action to reduce the risk (Sadique et al., 2007). If the individual lacks awareness of the risk of influenza, he or she is not as likely to take preventive action. For example, a study of influenza vaccination in the U.S showed that individuals who self-reported less than excellent health tend to vaccinate more, regardless of accuracy (self-rated health vs. actual health status). In other words, the individuals who considered themselves in excellent healthy tend to vaccinate less (Budhwani & De, 2016). They believed that they are healthy so the prevention is not necessary.

Barriers to Social Interaction

Anxiety of Face-covering

The acceptance of mask-wearing may be related to the difficulty masks present in interpreting the emotions of the user (Fischer, Gillebaart, Rotteveel, Becker & Vliek, 2011). Perceiving emotions (Carroll & Russell, 1996) is a constructive process in which various facial cues are used recognize examples of specific emotional categories such as fear, anger, shame, or sadness (Ekman, 1993; Keltner, 1995).

Faces are important in the expression of emotion (Carroll & Russell, 1996). However, emotional facial cues are less available when a person wears a mask. Fischer studied the impact of removing emotional cues on the perception of emotions by conducting experiments covering the lower parts of the face. Women whose faces were covered and who displayed anger, shame, and happiness were perceived as more expressive of negative emotions and less expressive of positive emotions compared to women whose faces were fully visible. People may be perceived as less friendly while their faces are covered. Face-cover affects emotional signals, which play an important role in social interaction (Fischer & Manstead, 2008). In another study, the wearing of face masks by doctors had a negative effect on patients' perceptions of the doctors' empathy (Wong et al., 2013).

Since subliminal facial expressions can influence the viewer's emotional state, attitudes, and subsequent behaviors (Dimberg, Thunberg & Elmehed, 2000), wearing a mask and covering the face could be a barrier to social interaction.

Negative Side of Drawing Attention to Self

Sometimes, using non-pharmaceutical interventions may lead to social stigma and may cause embarrassment or discrimination, such as being perceived as overly fastidious with frequent hand-washing. Although mask wearing is seen by some as an effective precaution, there are concerns about discrimination due to the presence of a mask being seen (Teasdale, Santer, Geraghty, Little & Yardley, 2014).

Currently, there is no precise data on how many people have negative impressions of others wearing a mask. Comments by individuals from different disciplines suggest that potential negative impressions may be a barrier to wearing a mask (Teasdale, Santer, Geraghty, Little & Yardley, 2014). For example, Dr. Gajendra Singh, a surgeon, shared that wearing a mask makes it harder for him to talk to patients because patients would assume he was sick, step away from him, and even refuse to share an elevator with him (Stapleton, 2017).

In another instance, a college student in Ohio State wore a mask after being told he had swine flu. The student recalled that he felt isolated and felt that people treated him extremely cautiously (Schneider, 2009).

The third example is about a mask-wearer who had an autoimmune illness. Neils (2016) reported that she had to wear a mask on a daily basis. She suffered from the anxiety of being stared at and judged by the public. She did not feel comfortable with people being curious about why she was wearing a mask and possibly misunderstanding the situation (Neils, 2016).

In the cases above, there appears to be a kind of fear about drawing negative attention. The researcher hopes to explore further the impact this kind of fear has on wearing masks for flu prevention in the United States.

Product Satisfaction

Appearance and Fashion Trends

Although function and efficacy are the main priorities of masks, the appearance and design of masks might affect the willingness of people to wear or purchase them (Feng, Tao, Deng, Liu & Shi, 2015). This issue has been noticed by several industrial designers and manufacturers who have aimed to provide masks with stylish looking features for consumers (McCoy, 2010). From the marketing perspective, the sales of face masks with fashionable patterns and prints increased during the flu season. An online retailer, Ellessco, which sells masks in 20 different prints, reported that fears about the flu have contributed to an approximate 25 percent sales spike for the company (New York Post, 2018).

Comfort

One of the aspect of user feedback regarding face masks is that it is not comfortable to wear. In 2014, Morishima, Kishida, Uozumi & Kamijo explored user experiences with masks in Japanese university students. About 60% of mask-wearers self-reported feeling a problem with humidity, 51% of wearers experienced fogging of eyeglasses, 50% of wearers felt difficulty breathing, and 20% of wearers felt awkwardness when wearing a mask. There were other problems, such as removal of cosmetics, ear pain, feeling hot, poor fit, and distraction by the masks. Overall, individual wearers reported frequent problems related to the moisture, airflow, and thermal properties of the masks. Thus, the comfort of wearing masks might be a barrier to its application in personal prevention.

Policy Recommendations and Laws

CDC Policies on Flu Prevention in the United States

People are responsible for their behaviors, but individual lifestyles are also influenced by the policies adopted by communities, states, and national leaders (Brownell et al., 2010). On the CDC's general page for influenza prevention (CDC, 2018), mask-wearing was not listed as one of the preventions for personal protection. Instead, it only suggests people get the flu vaccine, wash hands, and cover their noses and mouths with tissues when coughing or sneezing. The CDC does provide several pages on their separate interim guidance page for the use of masks to control seasonal flu and other contagious diseases; however, these pages were mainly set up for healthcare workers.

CDC Policies Outside the United States

In comparison to the US, the disease control departments in Asian countries clearly recommend all people, not just healthcare workers, to wear masks for flu prevention. The China CDC (2017), Hong Kong Centre for Health Protection (2015), Taiwan CDC (2018), Singapore Ministry of Health (2018), and Japan Ministry of Health Labour and Welfare (2018) all clearly recommend on their websites that citizens should wear a mask when they have any respiratory

symptoms, regardless of the level of sickness or the location, especially during the flu season. Wearing masks is considered a part of maintaining good cough manners (Figure 3 & 4). The CDC of Singapore (2018) even has a slogan of “Be Socially Responsible: Stop the Spread of Diseases” that connects personal hygiene sense and civic responsibility.



Figure 3. Official Poster: Cough Manners, Japan. Reprinted from *Ministry of Health, Labour and Welfare Website*, by Japan Ministry of Health, Labour and Welfare, December 2017, retrieved from <https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000187997.html>. Copyright 2017 by Japan Ministry of Health, Labour and Welfare.

Figure 4. Official Poster: Maintain Cough Manner, Hong Kong. Reprinted from *Hong Kong Centre for Health Protection Website*, by Department of Health, September 2016, retrieved from https://www.chp.gov.hk/files/her/maintain_cough_manner.pdf. Copyright 2016 by the Hong Kong Department of Health.

Government agencies in Japan promote the use of masks along with frequent hand-washing and covering the face when sneezing to fight against influenza infection. Many schools

also ask students to come to school with masks during flu seasons (Japan Ministry of Health, Labour and Welfare, 2018).

Anti-mask Laws

On occasions, masks serve to conceal the identity of those committing crimes (Epstei, 2017). In the United States, it is illegal to wear a mask or cover your face in some states. Today, around a dozen states still have anti-mask statutes (See Figure 5). For example, the State Code of the District of Columbia (D.C.) clearly states, "No person over 16 years of age, while wearing any mask or hood, whereby any portion of the face is concealed as to conceal the identity of the wearer, shall appear upon any lane, walk, road highway, or another public way. " Other banned states also have similar codes and rules. If a person needs to wear a mask in the street, a prescription or instruction note from his or her doctor is needed ("CND: State Codes Related To Wearing Masks," 2015).

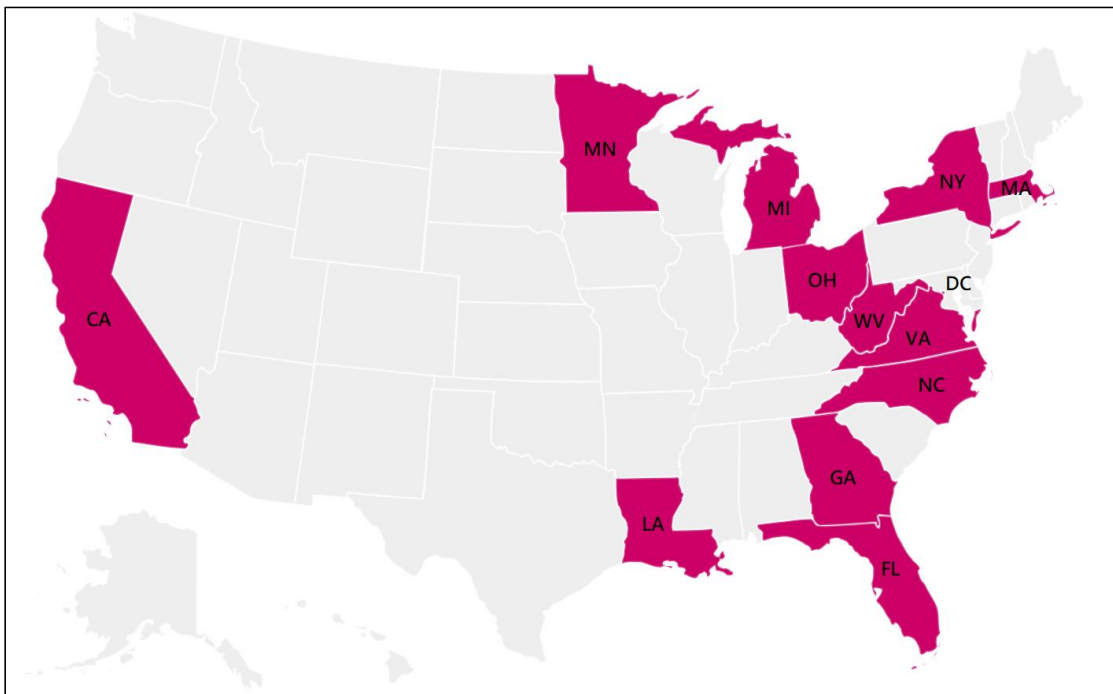


Figure 5. The States with State Codes Relating to Masks or Disguises. Adapted from State Codes Related To Wearing Masks by Melissa Kaplan, 2015, retrieved from <http://www.anapsid.org/cnd/mcs/maskcodes.html>. Copyright 2015 by Melissa Kaplan.

Anti-mask laws can be traced back to the mid-20th century when municipalities and states passed them to stop violent activities by the Ku Klux Klan whose members usually wore hoods of white linen to conceal their faces and identities (Goldberg, 1996). Although the Ku Klux Klan has mostly faded from mainstream American life, many of those laws have remained on the books (Epstei, 2017). In the 21st century, these anti-mask laws have usually been applied to political protesters or terrorism (Jacobson, 2010). There are similar anti-mask policies in other western countries, such as Canada, Denmark, France, and Switzerland (Winet, 2012).

State and local governments, to defend anti-mask laws, claim the objective of these laws is crime prevention, contending that individuals are more likely to commit crimes without them (Simoni, 1992).

Characteristics: The United States of America

The United States of America is a federal republic composed of 50 states, a federal district, five self-governing territories, and various possessions. It is the world's third-largest country by population and has near 328 million citizens from different races, cultures, and religious backgrounds (United States Census Bureau, 2018). Due to its complexity and regional differences, the factors that influence the public perceptions of wearing masks are complicated.

Population Density

The evidence from past influenza outbreaks linking higher population densities with higher mortality rates is mixed (Chandra, Kassens-Noor, Kuljanin & Vertalka, 2013). The United States of America is the third largest country worldwide by population, behind China and India. In 2018 (February), around 327.16 million people lived in a land area of 9,372,610 km² with an average density of 35 people/km². In comparison, the population density of China is 146 people/km², of India is 412 people/km², and of Japan is 337 people/km² (United Nations, 2017). The most populous state in the United States is California (39.5 million), and the most populous city is New York City (8.5 million) (US Census Bureau, 2018).

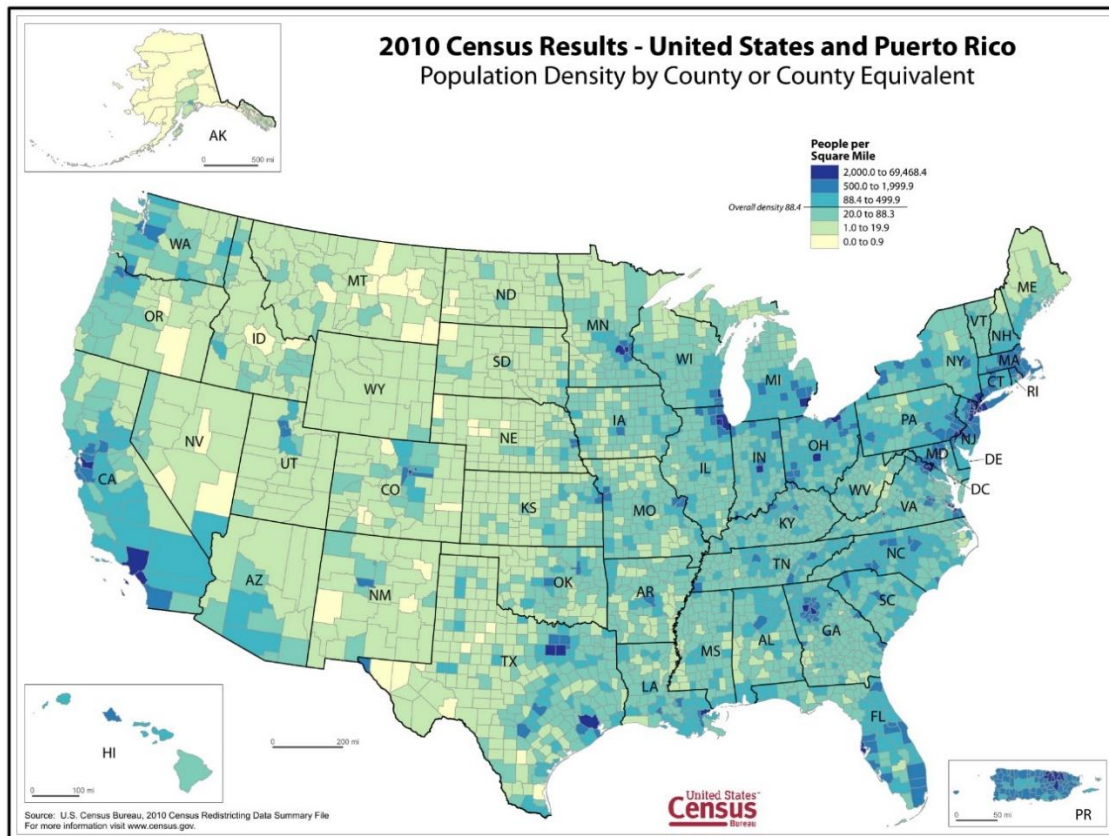


Figure 6. 2010 Census Results: the United States and Puerto Rico, Population Density by County or County Equivalent. Reprinted from *U.S. Census Bureau, 2010 Census Redistricting Data Summary File*, by United States Census Bureau, 2010. Retrieved from www.census.gov. Copyright 2010 by the United States Census Bureau.

The shaded map of population density of states (US Census Bureau, 2010) demonstrates a significant difference between city and rural areas. For example, a New York City resident has to share one square mile with 27,000 other people, while a resident of Cheyenne (the capital of Wyoming) only has to share one square mile with other 2,244 people, which is a lot less crowded than any metropolitan areas. From the study (Teasdale, Santer, Geraghty, Little & Yardley, 2014) of the H1N1 2009 pandemic, the public tends to evaluate their vulnerability to respiratory infection through perceived health status and their proximity to the origin of the outbreak (both in perceived differences and geographical distance in living areas). With rising population densities nationwide, the creation of big cities, and growing international connectivity,

the population density of the area may mislead residents regarding risk assessment and adoption of personal prevention behaviors.

Diversity

By 2017, the proportion of races in the United States was: White 76.6%, Black or African American 13.4%, Asian 5.8%, American Indian and Alaska Native 1.3%, Native Hawaiian and Other Pacific Islander 0.2%, Two or More Races 2.7%, Hispanic or Latino 18.1%, White alone (not Hispanic or Latino) 60.7% (United States Census, 2017)

A previous study (Budhwani & De, 2016) showed differences in influenza vaccination rates among racial and ethnic minorities in the United States, and also measured the impact of other contextual factors. The body of disparities research has typically focused exclusively on five racial and ethnic classifications: White, Black or African American, Hispanic, Asian/Pacific Islander, and Native American. The behavioral differences in sub-groups, such as Asian Indians, were usually overlooked. However, other factors in addition to race, ethnicity, and socio-economic status were statistically significant, including nativity, self-reported health, and health insurance coverage. In Budhwani's example, significant disparities were found between White Americans and Black Americans. Black Americans were less likely than White Americans to receive vaccinations. When examined independently from other Asians, the health insurance status of Asian Indians was found to be significantly correlated with flu vaccine uptake. The certain racial and ethnic groups' behaviors relating to vaccination is an individual characteristic also influenced by external factors, such as health insurance coverage, government policy, and healthcare access (Budhwani & De, 2016).

As mentioned in Chapter 2.3.4 and Chapter 2.4.4, while Asian countries are more familiar with wearing masks as personal prevention, there is little evidence to suggest this practice carries over to the Asian-American population. There are many possibilities regarding our research question from the cultural diversity angle. The United States includes several different regions, each with rich histories and cultural identities. Recognizing the distinct values of each region is essential to understanding the United States. (Garreau, 1981; Woodard, 2012). However, this

study focuses the mainstream tread. Our survey respondents may provide more detailed comments about cultural influence.

Social Value

The United States is one of the wealthiest nations in the world but far from the healthiest. Americans experience more injuries and illnesses and live shorter lives than people in other high-income countries. Even highly advantaged Americans may be in worse health than their peers in other countries (National Academies (U.S.) et al., 2013). The National Academies of United States (2013) proposed the idea that some character attributes of the typical American (e.g., dynamism, rugged individualism) are oftentimes invoked to the country's great achievements and may be associated with risk-taking and potentially unhealthy behaviors. Individual behaviors and opinions regarding public health policies are influenced by prevailing values and priorities (Goldberg, 2012). The previous researchers claimed that specific iconic American beliefs seem especially relevant, such as individual freedom and self-reliance, seem especially relevant (National Academies (U. S.) et al., 2013).

Individual Freedom

As expressed in the Declaration of Independence, Americans have strong beliefs regarding individual freedoms, especially the personal freedoms that carry special significance (Glantz and Annas, 2009), that remain potent drivers in modern America (Fairchild et al., 2010). Meanwhile, Americans struggle with the natural tension between the state's responsibility to safeguard public health and their sense of individual choice (Institute of Medicine, 2011).

Self-Reliance

Since the pioneers founded the nation, many Americans believed in the responsibility of individuals, not the state, to solve personal problems. In contrast, there is a consensus in many other high-income countries around solidarity and shared responsibility (Esping-Andersen, 1990);

this consensus may not be as pervasive in the United States (National Academies (U. S.) et al., 2013).

If these American beliefs (individual freedom and self-reliance) influence social values, Americans might value individualism (Vandello & Cohen, 1999) and personal responsibility more than shared public benefits. In Asian countries, which are usually considered more collectivist (Power, Schoenherr & Samson, 2010), mask-wearing is seen as a thoughtful way of demonstrating one's desire to protect self and others from infection (Siu, 2010). However, consensus in the United States might not be the same due to different social values.

Conclusion

In Chapter 2, we first went through basic information about influenza, several typical influenza preventions, and the efficacy of masks and its development. In the U.S, the impetus for mask-wearing has been applied to healthcare workers and health settings for years and only later for the general public during the past severe flu outbreaks. While most Americans approve the strategy of using masks as flu prevention, the rate of masks adoption is very low compared to other countries. There have been several potential barriers identified based on previous studies.

The barriers are categorized into two major categories: internal factors and external factors. Internal factors focus more on the personal side, such as the lack of perceived benefits of wearing masks and the lack of the perceived flu risk by the individual. When wearing a mask, one may feel obstacles to social activities because associated negative impressions (ill, un-trustworthy, unfriendly). In addition, they may not be satisfied with the comfort and appearance of face masks. The external factors included user context: the policies, laws, and features of society. There are evident rules, such as CDC policies encouraging only healthcare workers to wear masks and several anti-mask state laws that ban people from covering their face in public. In addition, the characteristics of the country are also important. The geographical distribution of the population and the diversity of the population that formed the U.S lead to the development of unique social values: individualism and self-reliance. Each of these factors, both internal and external, may create barriers to wearing masks in the US.

CHAPTER 3

RESEARCH DESIGN

Introduction

This study uses an exploratory quantitative design with survey methodology to identify barriers to mask use for influenza prevention in the US. This chapter describes the study design, methodology, data collection, and analysis used in the proposed research.

Study purpose and aims

The main purpose of the survey is to explore the barriers to wearing medical masks for influenza prevention among adults in the United States. The topics include:

1. What is the relationship between perceived barriers to wearing medical masks and previous infection with influenza?
2. What is the relationship between perceived barriers to wearing medical masks and previous experience wearing a medical mask?
3. What internal factors are the most common perceived barriers to wearing medical masks?

Design Methods

Quantitative Design

Quantitative research explains phenomena by collecting numerical data that are analyzed using mathematically based methods in particular statistics (Aliaga & Gunderson, 2005). Turning data into numbers is a process that helps researchers obtain the feelings and thoughts of research participants systematically (Robson, 2002).

Online Survey

In the proposed online survey design, Likert scales were applied (Likert, 1932) to represent the respondents' agreements and disagreements with the survey questions. One open-ended question is also included to give respondents an opportunity to identify additional barriers not included in the provided questions.

Sample

This research is mainly focused on the surveyed populations' general opinions within the United States. Convenience sampling is an efficient way to generate data in a short time. The convenience sampling method is a type of non-probability sampling method that uses the most easily accessible people to participate in a study. The advantages of convenience sampling are speed, ease of data collection, low-cost, and a readily available population of eligible participants (Henry, 1998).

Inclusion criteria for participants are:

1. Residence in the United States
2. Access to the Internet
3. Age above 18 years old.

Pilot Study

In a pilot study, the researcher conducted open-ended interviews with 10 people regarding their experiences of wearing masks. The participants were recruited through convenience sampling and snowball sampling via flyer distribution in The Design School at Arizona State University. All of the participants were students from Arizona State University, between the ages of 19 to 35 years of age, white, and living in the Phoenix area, Arizona.

The interview topics included previous mask use experiences, opinions about mask-wearers in the US society, and personal preferences on mask-wearing. The respondents gave several keywords describing potential barriers to wearing masks. Those keywords are as the following:

Table 5.

Keywords from the Interviews of the Pilot Study.

Concerns Type	Keywords that Respondents Used
Attention	<i>"If it became more of a trend so I <u>don't stand out</u> as much so people can stay out of my business."</i> <i>"..... but not in here, <u>people would watch and ask.</u>"</i>
Social Barriers	<i>"...you <u>can't tell people just from their eyes.</u>" (need to see a whole face)</i>
Doubts on Efficacy	<i>"I don't know. I don't think it (mask) is useful."</i>
Appearance	<i>"How about making them <u>cool looking</u>? Yeah. Like some fangs or something on the Net."</i> <i>"...Probably something <u>cool</u> but not pricey."</i>
Health Concerns	<i>"I would probably assume he was <u>sick badly.</u>"</i> <i>"What does he have that he's <u>not trying to spread</u> or something like that?"</i>
Society	<i>"So people around me <u>won't be panicked...</u>"</i> <i>"...we affiliate or we <u>associate masks with people that are like super sick</u> rather than just... preventing us from transferring germs."</i>

This list hinted at some of the potential barriers to wearing masks for flu prevention that were developed further for this study. The interview research questions were developed from these keywords and the findings from Chapter 2.

Survey (O'Leary, 2010)

The survey for the study consists of 24 questions (See Appendix). There are demographic questions about age, race, the US region lived in, and urban/rural characterization of their location of residence. There are two questions about flu experience in the past five years

and past experience wearing a medical mask. The time limit of five years was established to make recollection about having the flu and about mask wearing more current.

Following the demographic and flu experience questions, there are a series of agree/disagree statements referencing their perceived major internal barriers to wearing face masks that were lifted from the pilot study responses and the literature review. Each of these questions uses a 4-point Likert scale from strongly agree to strongly disagree. In addition, there is one open-ended question inquiring about any other forgotten reasons that might be barriers to wearing face masks for influenza prevention. Question responses are matched to each major barrier category in the conceptual framework for the study in Table 6.

Table 6.

Perceived Barrier Concept and Items.

Perceived Barrier Concept	Item
Perceived Benefit	Wearing a face mask reduces my risk of getting the flu
	I know when to wear a face mask
	I know how to wear a face mask
Perceived Risk	I have a high risk of getting flu during flu season
	I don't have to worry about flu
Social Barriers	Wearing a face mask covers my face and will make it difficult for others to see how I am feeling
	Wearing a face mask might make it more likely that people will misinterpret how I'm feeling
	Wearing a face mask would make me feel embarrassed
	Wearing a face mask might cause people to criticize me about being in public while ill
	Wearing a face mask makes me look unattractive
	Wearing a face mask might makes people think I am going

	to do something wrong or illegal
Appearance of face masks	The appearance of face masks is unpleasant
Comfort	Wearing a face mask is uncomfortable
External policy	It is important to wear a face mask because health experts recommend it
Social value/independence	It is important to wear a face mask because mask-wearing protects other people from getting my flu
	I don't need to wear a face mask if I have flu; other people should take care of themselves and avoid getting sick
Open-end Question	Are there other factors that prevent me from wearing a mask for flu prevention? What are they? A: _____

This survey requires participants to fill out all of the questions with no omissions allowed. There are no neutral or "refuse to answer" options in the survey.

Participants and Recruitment

A total of 80 United States residents whose ages are above 18 years old and who have access to the internet will be recruited as survey participants.

The survey will be distributed online across the United States via Survey Monkey Audience service. Survey Monkey is a professional survey and marketing research website that provides an interface for users to design their own questionnaires and also provides a response buying service (Survey Monkey Audience) that will distribute the survey for users.

As a survey company, Survey Monkey has the resources of website advertisements and a system for reaching out to the target audience nationwide. The qualified (see Table 7) respondents will have a chance to fill out the survey and become a valid respondent. The researcher will choose to distribute this survey requiring a standard of gender balance census

and age basic census: the Survey Monkey service will distribute the survey to qualified respondents in a ratio that is similar to the national census.

The Survey Monkey service will send out this study's survey to their sample of respondents anonymously nationwide. Through convenience sampling, the survey will be open to all United States residents with Internet access to cover a more varied population group of U.S. residents. The data collection process usually takes 1-3 working days. Survey Monkey charges a \$2 fee on each valid response, and the researcher will set the target of 80 valid responses from the Survey Monkey system.

Sample Target Options

The following table shows the target options for distributing the survey via the Survey Monkey Audience service. This study is based on convenience sampling with minimum requirements in order to collect a wider variety of responses nationwide.

Table 7.

Target Options for Survey Monkey Audience Recruitment

Location	United States
Gender	Gender balancing census
Age	18-100+ years old, basic census
Race	All races
Education	All levels
Income	All levels
Marital Status	All options

Data Collection

The Survey will be distributed by the Survey Monkey Audience service. The distribution duration starts on October 15, 2018, and it will continue until respondent numbers reach the target recruitment numbers. The estimated time to finish the entire survey process is 6 minutes per person.

Data Analysis

Each response will first be reviewed for completeness and amount of missing data. The amount of missing data for each item will be reported.

Descriptive analysis

This study will describe the respondents' demographic information, flu experience, and mask-wearing experience. It will tally frequencies and percentages for each response and its mean, median, range, and standard deviation for each interval level item. Since the survey is not intended to index a single concept, total scores will not be calculated. SPSS will be used to compare and analyze data.

The data analysis will be categorized into three sections:

- Demographic Data (Questions 1 to 5)
- Influenza Experience and Mask-wearing Experience (Question 6 and 7)
- Barrier Factors (Questions 8 to 24)

Demographic Data

In Table 8, Question 1 to 5 are demographic questions. The researcher will present them in a simple descriptive paragraph with a percentage table. The purpose of the section is to show basic information about the participants.

Table 8.

Data Analysis for the Demographic Questions.

Question	Demographic	Data Presentation
Q1	Gender	%
Q2	Age	%
Q3	Race	%
Q4	Region of Residence	%
Q5	Living Area	%

Influenza Experience and Mask-wearing Experience Data

The analysis table (Table 9) will show the percentage of participants who had influenza and wore face masks for flu prevention.

Table 9.

Data Analysis of the Influenza and Mask-wearing Experience Questions

Section	Influenza and Mask-wearing Experience	Data Presentation
Q6	Have flu experience in the past five years (Yes/No)	%
Q7	Have ever worn a face mask in public to prevent you from getting flu or exposing others when you had the flu (Yes/No)	%

As descriptive data, the analysis table (Table 10) will show whether the participants who had the flu wore face masks for flu prevention or not.

Table 10.

Cross Analysis for the Influenza and Mask Experience.

	Have worn a face mask (Masks Group)	Never worn a face mask (No Masks Group)
People who had Flu experience in the past five years (Flu Group)	%	%
People who did not have Flu experience (Healthy Group)	%	%

Barrier Factors

The questionnaire about perceived barriers was designed using the Likert-scale, composed of 6 sections of questions and one open-ended question. The options of the Likert scale were ranked Strongly Agree (score=1), Agree (score=2), Disagree (score=3), and Strongly Disagree (score=4). Data analysis for each question will be presented using mean and standard deviation. The bar graphs will also be included for presenting the proportion.

The categorical flu experience variables will be compared to the interval level data of barriers in non-parametric statistics. The categorical mask-wearing experience variables will also be compared to the interval level data of barriers in non-parametric statistics. The Mann–Whitney U test will be applied to statistically compare two dependent samples and assess for significant differences.

The following tables (Table 11- Table 21) show 6 sections on the topic of perceived barriers for analysis.

Table 11.

Data Analysis Sections of the Perceived Barriers: Perceived Benefit

Sections	Barriers Theme	Data Presentation
Section 1	Perceived Benefit	
Q8	Wearing a face mask reduces my risk of getting the flu	
Q9	I know when to wear a face mask	
Q10	I know how to wear a face mask	

Table 12.

Data Analysis Sections of the Perceived Barriers: Perceived Risk

Sections	Barriers Theme	Data Presentation
Section 2	Perceived Risk	
Q11	I have a high risk of getting flu during flu season	
Q12	I don't have to worry about flu	

Table 13.

Data Analysis Sections of the Perceived Barriers: Barriers to Social Interaction

Sections	Barriers Theme	Data Presentation
Section 3	Barriers to Social Interaction	
Q13	Wearing a face mask covers my face and will make it difficult for others to see how I am feeling	
Q14	Wearing a face mask might make it more likely that people will misinterpret how I'm feeling	
Q15	Wearing a face mask would make me feel embarrassed	

Q16	Wearing a face mask might cause people to criticize me about being in public while ill	
Q17	Wearing a face mask makes me look unattractive	
Q18	Wearing a face mask might makes people think I am going to do something wrong or illegal	

Table 14.

Data Analysis Sections of the Perceived Barriers: Product Satisfaction

Sections	Barriers Theme	Data Presentation
Section 4	Product Satisfaction	
Q19	The appearance of face masks is unpleasant (Appearance of face masks)	
Q20	Wearing a face mask is uncomfortable (Comfort)	

Table 15.

Data Analysis Sections of the Perceived Barriers: External Policy

Sections	Barriers Theme	Data Presentation
Section 5	External Policy	
Q21	It is important to wear a face mask because health experts recommend it	

Table 16.

Data Analysis Sections of the Perceived Barriers: Social Value

Sections	Barriers Theme	Data Presentation
Section 6	Social Value/Independence	
Q22	It is important to wear a face mask because mask-wearing protects other people from getting my flu	
Q23	I don't need to wear a face mask if I have flu; other people should take care of themselves and avoid getting sick	

Table 17.

Data Analysis Sections of the Perceived Barriers: The Open-end Question

Sections	Barriers Theme	Data Presentation
Section 7	Open-ended Question	
Q24	Are there other factors that prevent me from wearing a mask for flu prevention? What are they? A: _____	The responses from the final open-ended question will be coded by theme and presented in tables, as a supply list for potential barriers.

Limitations

Sampling Limitation

Convenience sampling is highly vulnerable to selection bias and sampling error. The results of the convenience sampling usually cannot be generalized to the target population because of the potential bias of under-representation of subgroups in the sample (Creswell & Creswell, 2018).

Online Survey Limitation

While the online survey has the potential to reach more diverse samples amongst different populations (Wright, 2006), only people who have internet access have access to the survey, which may restrict some groups.

Ethical Concerns and Participant Rights

Consent

All respondents will be notified of their rights in this research before starting the questionnaire. By clicking forward and participating in the questionnaire, the respondents agree to participate in the study.

Privacy and Confidentiality

The collected data will be protected confidentially through:

1. Anonymous Data Collection: The survey will be distributed anonymously via the Survey Monkey Audience service, which protects respondents' identity. The function of IP addresses collection on the Survey Monkey website will be disabled to protect the identity of participants.
2. Password protected systems: All of our data will require passwords to log in to the Survey Monkey service. This system will prevent unauthorized access to data.
3. Limited access to data: The online survey data will be stored in an Arizona State University Google Drive, which is only accessible to committee faculty members and the researcher.

IRB

An exemption was granted for this research. The Institutional Review Board (IRB) at Arizona State University determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 10/03/2018. A modification was approved on 10/15/2018.

References Format

APA (American Psychological Association, 2010) writing and format style was applied in the research. The full references will be included at the end of the thesis body.

CHAPTER 4

FINDINGS

Introduction

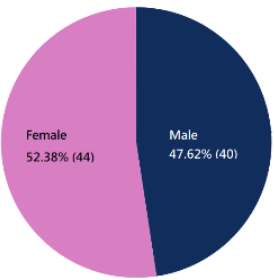
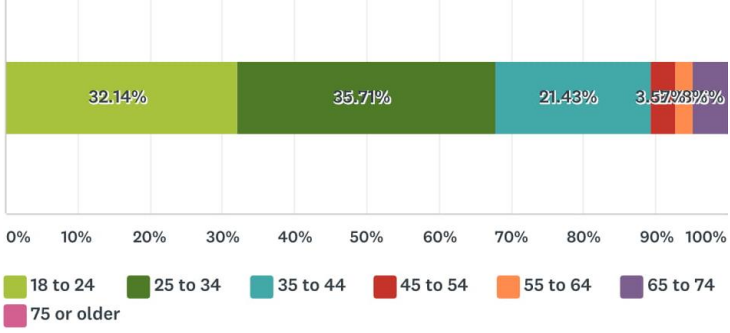
This chapter includes the presentation and analysis of data gathered by the researcher. This study aims to describe barriers to medical mask use and to explore the relationship between flu experiences, mask-wearing experiences, and perceived barriers to wearing face masks for flu prevention. The analytical procedures are arranged by the sequence of the survey questions and the research questions.

Demographic Data

There were 84 valid responses collected in October 2018. The target was set to 80 responses, but the Survey Monkey Audience sent the survey link to more than 80 qualified people, leading to an extra 4 responses. All participants completed the survey, no participant dropped out of the online survey so there was no missing data. The demographic distribution of the participating population is displayed in the following table.

Table 18.

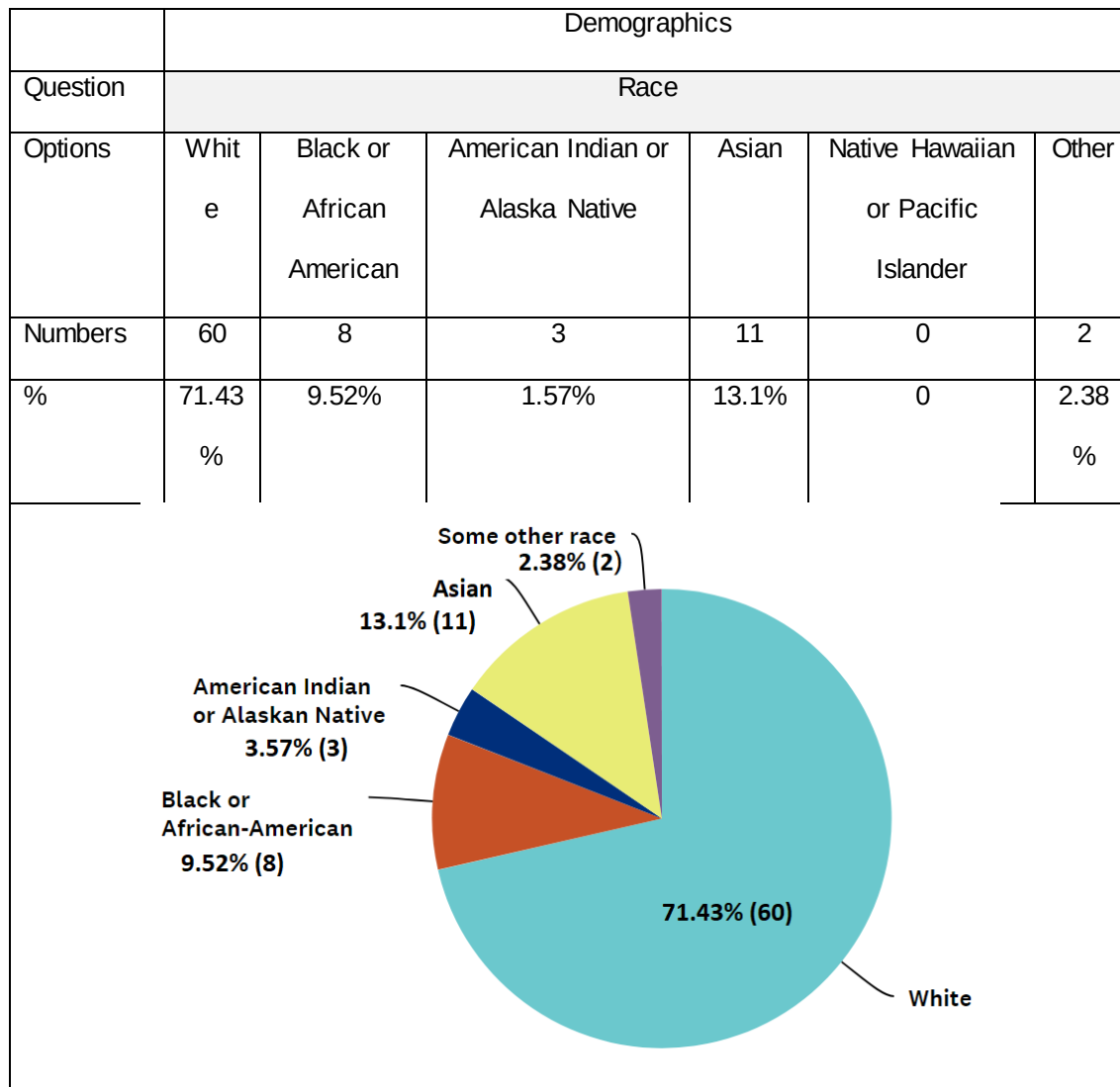
Demographic Data: Gender and Age

			Demographics							
Question	Gender		Age							
Options	Male	Female	18-24	25-34	35-44	45-54	55-64	65-74	75+	
Frequency	40	44	27	30	18	3	2	5	0	
%	47.62%	52.38%	32.14%	35.71%	21.43%	3.57%	2.38%	4.76%	0	
										

Forty male participants and 44 female participants responded to the survey. The most common age group was 25-34 year olds (35.71%), followed by the 18-24-year olds (32.14%), 35-44-year-olds (21.43%), 65-74-year-olds (4.76%), 45-54-year-olds (3.57%), and 55-64-year-olds (2.38%). No participants were above 75 years old. The sample was almost evenly divided by gender. Most of the participants were under 44 years of age (89%) with more than 2/3 between 18 and 34 years. The sample included a predominantly young group.

Table 19.

Demographic Data: Race



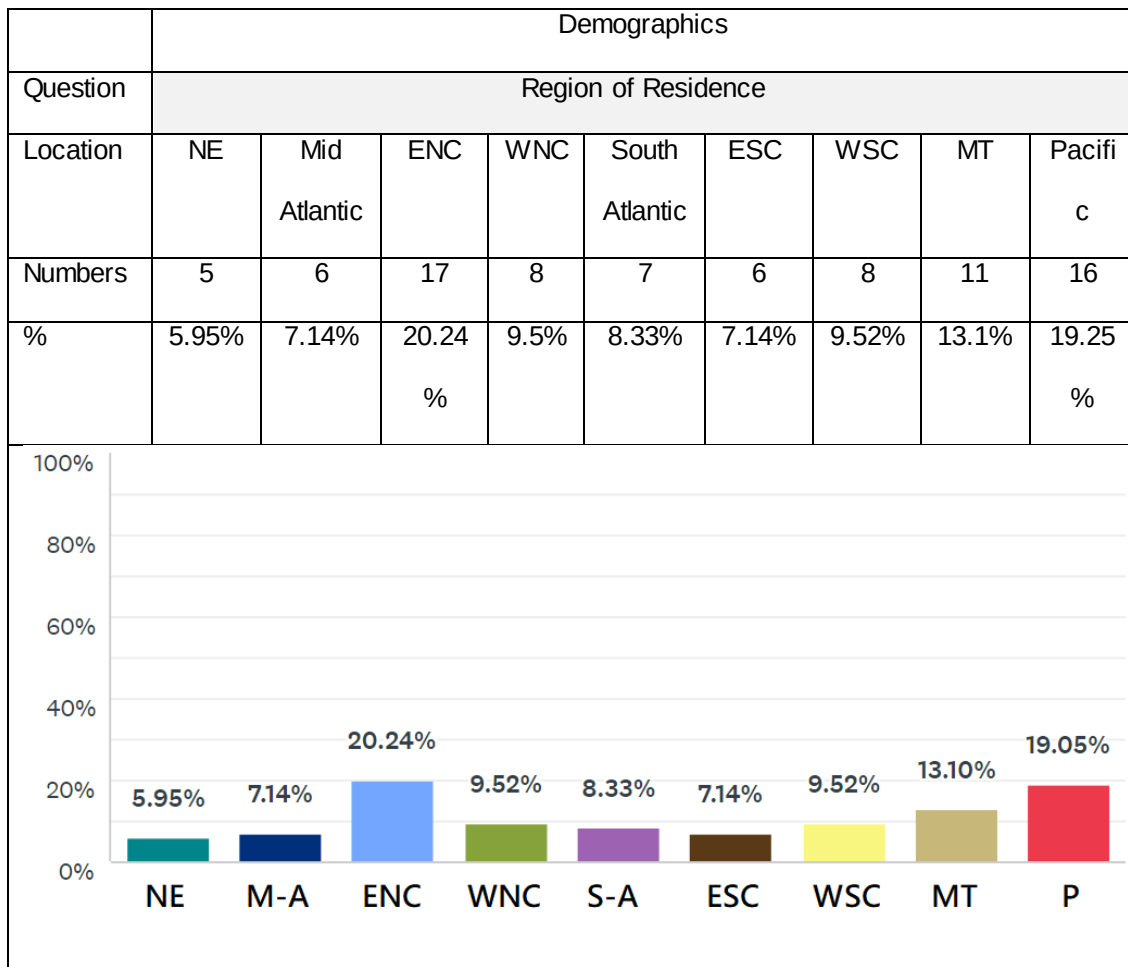
There were 60 White participants (71.43%), 8 Black or African American Participants (9.52%), 3 American Indian or Alaska Native (1.57%), 11 Asian (13.1%), and 2 participants from other races (2.38%). The participants from other races identified themselves as “Mixed” or “Hispanic”. No Native Hawaiian or Pacific Islander participated in the survey.

The sample consisted of primarily White Americans, followed by Asians as the second largest group, and Black or African Americans as the third largest group. These three races accounted for 94% of the sample, which is similar to the U.S. National census. In 2017, the

national census showed the data was White 76.6%, Black or African American 13.4%, and Asian 5.8%, leading to 95.8% of the national population (United Census Bureau. 2017).

Table 20.

Demographic Data: Region of Residence



Note. NE = New England; M-A = Mid Atlantic; ENC = East North Central; WNC = West North Central; S-A = South Atlantic; ESC = East South Central; WSC = West South Central; MT = Mountain; P = Pacific.

Of the respondents, 5.95% came from New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont), 7.14% came from Mid-Atlantic (New Jersey, New York, and Pennsylvania), 20.24% from East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin), 9.52% from West North Central (Iowa, Kansas, Minnesota,

Missouri, Nebraska, North Dakota, and South Dakota), 8.33% of the respondents from South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, District of Columbia, and West Virginia), 7.14% from East South Central (Alabama, Kentucky, Mississippi, and Tennessee), 9.52 from West South Central (Arkansas, Louisiana, Oklahoma, and Texas), 13.10% of the respondents came from Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming), and 19.05% from Pacific (Alaska, California, Hawaii, Oregon, and Washington).

The sample spread across various regions of the country, yet higher percentages were yielded from East North Central (20.24%) and Pacific (19.05%). Population of these two areas may be responsible for the higher percentages. For instance, based on the United States Census Bureau (2017), California is the most populous state (No.1) in the U.S, which was included in Pacific category. Illinois (No.6), Ohio (No.7), and Michigan (No.10) were included in East North Central category.

Table 21.

Demographic Data: Living Area

	Demographics		
Question	Living Area		
Options	Urban	Suburban	Rural
Numbers	25	41	18
%	29.76%	48.81%	21.43%

A pie chart illustrating the distribution of living areas. The chart is divided into three segments: a large light blue segment for Suburban (48.81%, 41), a medium dark blue segment for Urban (29.76%, 25), and a smaller olive green segment for Rural (21.43%, 18). Each segment is labeled with its category name, percentage, and count.

Living Area	Count	Percentage
Urban	25	29.76%
Suburban	41	48.81%
Rural	18	21.43%

Forty-one participants reported that they lived in suburb areas (48.81%), 25 participants live in urban areas (29.76%), and 18 participants in rural areas (21.43%). Nearly half of the participants lived in suburban areas, which is similar to the national distribution that about 54.8% of the American population live in the nation's suburbs and small metros (Pew Research center, 2018).

Influenza Experience and Mask-wearing Experience

In the following section, the results of flu experience and mask-wearing experience are presented as descriptive data.

Table 22.

Sample: Influenza Experience in the past 5 years and Mask-wearing Experience

	Population				
Question	Flu Experience in the past 5 years			Mask-wearing Experience	
Options	Yes	No		Yes	No
Numbers	48	36		26	58
%	57.1%	42.9%		30.5%	69.05%

Forty-eight participants (57.14%) have had the flu in the past five years, while the other 36 participants (42.86%) have not had the flu in the past five years. Twenty-six participants (30.95%) have worn face masks, while the other 58 participants (69.05%) have not. The results show more than half of the participants have suffered from the flu in the past five years. Nearly 70% of participants have never worn a face mask before.

Table 23.

Sample: Cross Analysis of Influenza and Mask-wearing Experience

		Mask-wearing Experience					
		Yes (n=26)			No (n=58)		
		Numbers	%	Total	Numbers	%	Total
Flu Experience	Yes (n=48)	18	37.5%	21.43% (18/84)	30	62.5%	35.72% (30/84)
	No (n=36)	8	22.22%	9.52% (8/84)	28	77.78%	33.33% (28/84)

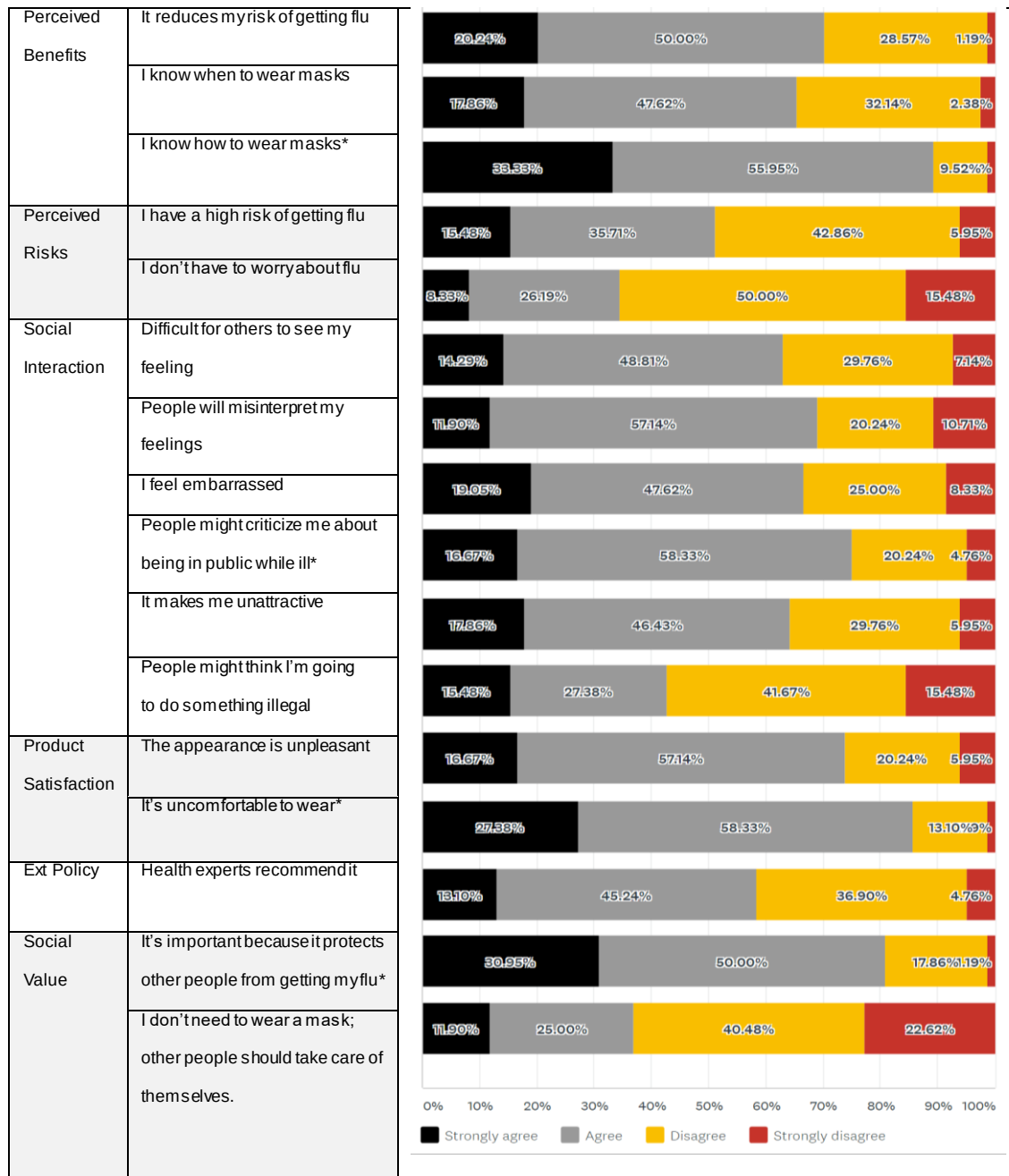
Of the participants, 37.5% of the participants who had flu previously had worn face masks (18/48); 22.22% of people who did not have flu but had worn face masks in the past (8/36). The pattern showed that people who had flu in the past almost twice as likely to wear face masks, in other words, the people who had flu were more likely to wear masks. Among the group who had never worn face masks, there was no differences whether they had or did not have a flu experience.

Research Question 1

What are overall perceptions of barriers to wearing face masks?

Table 24.

Summary of the Percentage of Participants for Each Barrier



The most widely-agreed factor are “Perceived Benefits”, “Product Satisfaction “, and “Social Interaction”. The perceptions of each barrier factors will be presented individually in the following sections.

Perceived Benefits

Question 8 to Question 10 were designed to determine if the participants were informed of the benefits and the correct ways to wear face masks, such as the timing and steps involved.

Table 25.

Results of Perceived Benefits in All Participants (n)

Q8				Q9			
It reduces my risk of getting the flu.				I know when to wear a face mask.			
Level	N	F	Chart	N	F	Chart	
SA	20.24%	17		17.86%	15		
A	50%	42		47.62%	40		
D	28.57%	24		32.14%	27		
SD	1.19%	1		2.38%	2		

Q10			
I know how to wear a face mask.			
Level	N	F	Chart
SA	33.33%	28	
A	55.95%	47	
D	9.52%	8	
SD	1.19%	1	

Note. SA = Strongly Agree (1); A = Agree (2); D = Disagree (3); SD = Strongly Disagree (4).

In Question 8, 70.24% (Strongly Agree 20.24%; Agree 50%) of the participants agreed that wearing masks reduces their risk of catching the flu. 65.48% (Strongly Agree 17.86%; Agree 47.62%) of the participants reported knowing when to wear masks. 89.28% (Strongly Agree

33.33%; Agree 55.95%) of the participants reported knowing how to wear masks. It revealed most participants know the benefits of wearing masks and basic instruction to wear face masks.*

Perceived Risks

Question 11 and Question 12 were designed to determine the extent to which participants believe they are at risk of getting the flu. Both results showed that more than half of the participants have concerns about getting the flu.

Table 26.

Results of Perceived Risks in All Participants (n)

		Q11			Q12		
		I have a high risk of getting the flu during flu season.			I do not have to worry about the flu.		
Level		N	F	Chart	N	F	Chart
SA		15.48%	13		8.33%	7	
A		35.71%	30		26.19%	22	
D		42.86%	36		50%	42	
SD		5.95%	5		15.48%	13	

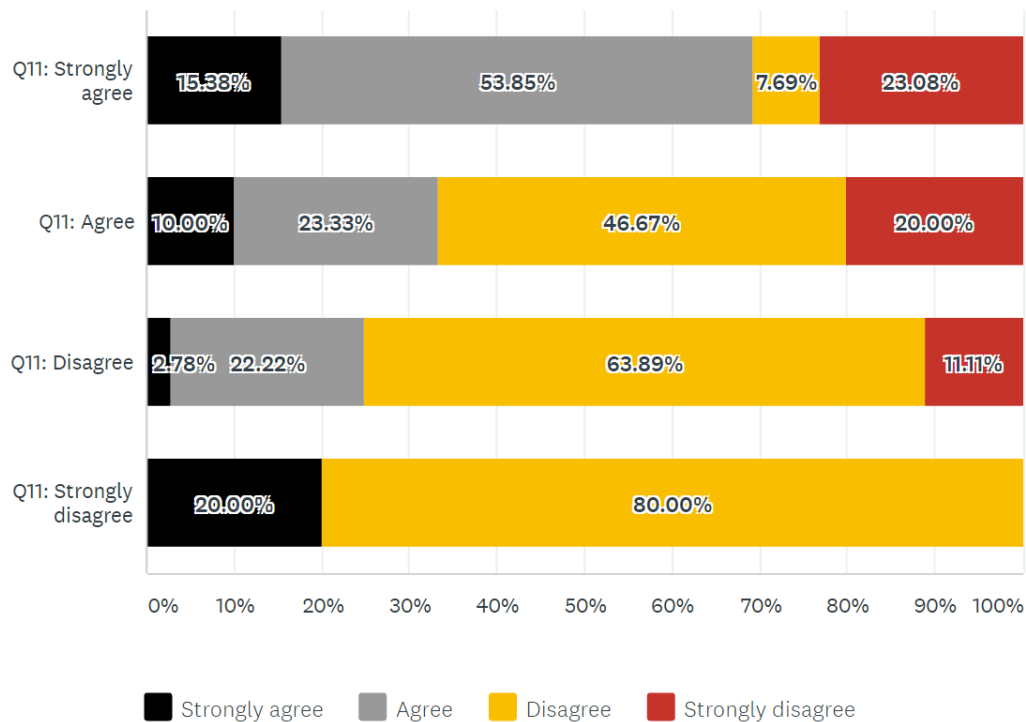
Note. SA = Strongly Agree (1); A = Agree (2); D = Disagree(3); SD = Strongly Disagree (4).

51.19% (Strongly Agree 15.48%; Agree 35.71%) of the participants agreed with the statement that they have a high risk of catching the flu during flu season, which is slightly higher than the participants who disagreed. 65.48% (Disagree 50%; Strongly Disagree 15.48%) of the participants disagreed that they do not have to worry about the flu.

A little over half of the participants thought they are at high risk of getting the flu during flu season. However, there were a bit discrepant that 34% of the participants said that they do not have to worry about flu. The researcher pulled out the data of the responses to these two questions as the comparison in Table 26.

Table 27.

Cross Analysis: High Risk of Getting the Flu (Q11) v.s. No Worries about the Flu (Q12)



In Question 11, 15.48% of the participants strongly agreed (n=13) with the statement that they have a high risk of catching the flu during flu season; however, 69.53% (SA 15.38%, A 53.85%) of the same population (n=13) also strongly agree that they do not have to worry about the flu. The pattern found here was that they may be more easily catch the flu but they were not worried about it. There might be some factors making them have this conclusion: one hypothesis is that this population had applied some preventive methods to reduce their risk of getting the flu, and therefore it was no longer a concern. For example, 61.54% of this population (8/13) had worn masks previously.

The “Disagree” and “Strongly Disagree” group in Question 11 also showed the discrepant pattern in Question 12. These patterns may result from the different levels of perceived risk. The level of worries in “High risk” of getting the flu (Q11) is probably different from the “Being worried about getting flu” (Q12), which sounds milder. Those people did not consider themselves have a high risk of getting flu but they still worry about the flu.

Barriers to Social Interaction

Question 13 to 18 were designed to see if the barriers against social interaction were part of the participants' perceived barriers.

Table 28.

Results of Barriers against Social Interaction in All Participants (n) -1

		Q13					Q14																	
		Wearing a face mask covers my face and will make it difficult for others to see how I am feeling.					Wearing a face mask might make it more likely that people will misinterpret how I am feeling.																	
Level		N	F	Chart		N	F	Chart																
SA		14.29%	12	<table><tr><td>SA</td><td>14.29%</td></tr><tr><td>A</td><td>48.81%</td></tr><tr><td>D</td><td>29.76%</td></tr><tr><td>SD</td><td>7.14%</td></tr></table>	SA	14.29%	A	48.81%	D	29.76%	SD	7.14%		11.9%	10	<table><tr><td>SA</td><td>11.90%</td></tr><tr><td>A</td><td>57.14%</td></tr><tr><td>D</td><td>20.24%</td></tr><tr><td>SD</td><td>10.71%</td></tr></table>	SA	11.90%	A	57.14%	D	20.24%	SD	10.71%
SA	14.29%																							
A	48.81%																							
D	29.76%																							
SD	7.14%																							
SA	11.90%																							
A	57.14%																							
D	20.24%																							
SD	10.71%																							
A		48.81%	41			57.14%	48																	
D		29.76%	25			20.24%	17																	
SD		7.14%	6			10.71%	9																	

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree.

Of the participants, 63.1% (Strongly Agree 14.29%; Agree 48.81%) agreed that wearing face masks covers their faces and will make it difficult for others to see how they are feeling. 69.04% (Strongly Agree 11.9%; Agree 57.14%) of the participants agreed that wearing masks might make it more likely that people will misinterpret how they are feeling.

Table 29.

Results of Barriers to Social Interaction in All Participants (n) - 2

Q15				
Wearing a face mask would make me feel embarrassed.				
Level	N	F	Chart	
SA	19.05%	16		
A	47.62%	40		
D	25%	21		
SD	8.33%	7		

Q16		
Wearing a face mask might cause people to criticize me about being in public while ill.		
N	F	Chart
16.67%	14	
58.33%	49	
20.24%	17	
4.76%	4	

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree.

Of the participants, 66.67% (Strongly Agree 19.05%; Agree 47.62%) agreed that wearing face masks makes them feel embarrassed, while 75% (Strongly Agree 16.67%; Agree 58.33%) of the participants agreed that wearing face masks might cause people to criticize them about being in public while ill.

Table 30.

Results of Barriers to Social Interaction in All Participants (n) - 3

Q17					Q18				
Wearing a face mask makes me look unattractive.					Wearing a face mask might makes people think I am going to do something wrong or illegal.				
Level		N	F	Chart		N	F	Chart	
SA		17.86%	15			15.48%	13		
A		46.43%	39			27.38%	23		
D		29.76%	25			41.67%	35		
SD		5.95%	5			15.48%	13		

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree.

Of the participants, 64.29% (Strongly Agree 17.86%; Agree 46.43%) agreed that wearing face masks makes them unattractive. Further, 42.86% (Strongly Agree 15.48%; Agree 27.38%) of the participants agreed that wearing a face mask might make people think they are going to do something wrong or illegal; however, 57.15% of the participants did not feel concerned about mask-wearing being associated with impressions of illegality.

Most participants believed wearing masks are barriers in social interaction, especially it might cause people to criticize them about being in public while ill (75%). Nonetheless, a barrier such as social criticism is not related to the impressions of the illegality for wearing masks.

Product Satisfaction

Question 19 to 20 were designed to determine the opinions of the participants on face masks via the perspective of actual products.

Table 31.

Results of Product Satisfaction in All Participants (n)

		Q19			Q20		
		The appearance of face masks is unpleasant.			Wearing a face mask is uncomfortable.		
Level		N	F	Chart	N	F	Chart
SA		16.67%	14		27.38%	23	
A		57.14%	48		58.33%	49	
D		20.24%	17		13.1%	11	
SD		5.95%	5		1.19%	1	

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree.

Of participants, 73.81% (Strongly Agree 16.67%; Agree 57.14%) agreed that the appearance of face masks is unpleasant, while 85.71% (Strongly Agree 27.38%; Agree 58.33%) of the participants agreed that wearing face masks is uncomfortable. Both results showed that most of the participants were not satisfied with the experience of wearing face masks, with considerations given to appearance and comfort.

External Policy

Question 21 was designed to determine if external policies, such as recommendations from health experts, were one of the factors influencing the participants.

Table 32.

Results of External Policy in All Participants (n)

Q21																								
It is important to wear a face mask because health experts recommend it.																								
Level		N	F	Chart																				
SA		13.1%	11	<table><tr><th>Level</th><th>N</th><th>F</th><th>Percentage</th></tr><tr><td>SA</td><td>13.1%</td><td>11</td><td>13.10%</td></tr><tr><td>A</td><td>45.24%</td><td>38</td><td>45.24%</td></tr><tr><td>D</td><td>36.9%</td><td>31</td><td>36.90%</td></tr><tr><td>SD</td><td>4.76%</td><td>4</td><td>4.76%</td></tr></table>	Level	N	F	Percentage	SA	13.1%	11	13.10%	A	45.24%	38	45.24%	D	36.9%	31	36.90%	SD	4.76%	4	4.76%
Level	N	F	Percentage																					
SA	13.1%	11	13.10%																					
A	45.24%	38	45.24%																					
D	36.9%	31	36.90%																					
SD	4.76%	4	4.76%																					
A		45.24%	38																					
D		36.9%	31																					
SD		4.76%	4																					

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree.

Of the participants, 58.34% (Strongly Agree 13.1%; Agree 45.24%) agreed that it is important to wear face masks because health experts recommend it, while the remaining 41.66% of the participants did not agree with that statement. Those people that found the health expert's recommendations to wear a mask compelling were slightly more than those who did not.

Social Value

Question 22 to 23 were designed to see if social values and independence were perceived barriers to wearing face masks for flu prevention.

Table 33.

Results of Social Value in All Participants (n)

Q22					Q23		
It is important to wear a face mask because mask-wearing protects other people from getting my flu.					I don't need to wear a face mask if I have the flu; other people should take care of themselves and avoid getting sick.		
Level	N	F	Chart		N	F	Chart
SA	30.95%	26			11.9%	10	
A	50%	42			25%	21	
D	17.86%	15			40.48%	34	
SD	1.19%	1			22.62%	19	

Note. SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree.

Of the participants, 80.95% (Strongly Agree 30.95%; Agree 50%) agreed that it is important to wear face masks because mask-wearing protects other people from getting the flu from them. Only 36.9% (Strongly Agree 11.9%; Agree 25%) of the participants agreed that they do not need to wear a face mask if they have the flu and other people should take care of themselves. In other words, 63.1% (Disagree 40.48%; Strongly Disagree 22.62%) felt that it is important to wear face masks as a protective measure for other people.

Most participants showed the sense of responsibility for protecting other people from getting their flu in contrast to their concern of social value (individual freedom and self-reliance) as mentioned in Chapter 2.

Research Question 2

What is the relationship between perceived barriers to wearing medical masks and previous infection with influenza?

Influenza Experience and the Perceived Barriers

In this section, the relationship between flu experience and the perceived barriers were analyzed through the p-value and the comparisons of mean.

Table 34.

Perceived Barriers: Flu Experience v.s. No Flu Experience

Questions	Total (N=84)		Flu (n=48)		No Flu (n=36)		Mann-Whitney
	Mean	SD	Mean	SD	Mean	SD	p-value
Perceived Benefits							
It reduces my risk of getting flu	2.11	0.72	2.02	0.69	2.22	0.75	.236
I know when to wear masks	2.19	0.75	2.15	0.71	2.25	0.79	.642
I know how to wear masks	1.79	0.66	1.83	0.59	1.72	0.73	.280
Perceived Risk							
I have a high risk of getting flu	2.39	0.82	2.29	0.82	2.53	0.80	.203
I don't have to worry about flu	2.73	0.82	2.63	0.86	2.86	0.75	.183
Social Interaction							
It's difficult for others to see how I am feeling	2.30	0.80	2.06	0.77	2.61	0.72	.002***
People will misinterpret my feelings	2.30	0.81	2.19	0.78	2.44	0.83	.218
I feel embarrassed	2.23	0.85	2.13	0.86	2.36	0.82	.164
People might criticize me about being in public while ill	2.13	0.74	2.06	0.69	2.22	0.79	.427
It makes me unattractive	2.24	0.81	2.10	0.82	2.42	0.76	.091*

People might think I'm going to do something illegal	2.57	0.93	2.52	0.98	2.64	0.85	.594
Product Satisfaction							
The appearance of masks is unpleasant	2.15	0.76	2.08	0.70	2.25	0.83	.347
It's uncomfortable to wear	<u>1.88</u>	0.66	1.81	0.63	1.97	0.69	.325
External Policy							
Health experts recommend it	2.33	0.76	2.25	0.75	2.44	0.76	.218
Social Value							
It's important because it protects other people from getting my flu	1.89	0.72	<u>1.77</u>	0.65	2.06	0.78	.100
I don't need to wear a mask; other people should take care of themselves.	2.74	0.94	2.63	0.90	<u>2.89</u>	0.97	.174

Note. SD = Standard Deviation; *p < 0.05, ** p < 0.01. Significance level is 0.05. Score 1 =

Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree.

There was only one significant association between those with experience with the flu and any perceived barriers in the agreement with the statement, "It's difficult for others to see how I am feeling", in "Social Interaction" with a p-value of 0.003. As an exploratory study, the researcher also looked into the factors with a p-value <0.10, which is the statement, "It makes me unattractive", in "Social Interaction" (p=0.091). The findings suggested that individuals who have experienced the flu also perceived more barriers against social interaction regarding mask-wearing. Participants who have had the flu usually have a lower mean score, which reflects greater agreement with the given statements. There is an exception for the statement, "I know how to wear masks", in "Perceived Benefits", where the mean from the flu group (n=48) is 1.83 and the mean from the healthy group (n=36) is 1.72. The lowest mean for the flu group is the statement, "It's important because it protects other people from getting my flu" (mean=1.77). The highest mean for the healthy group is, "I don't need to wear a mask; other people should take care of themselves." from the "Social Value" (mean=2.89).

Research Question 3

What is the relationship between perceived barriers to wearing medical masks and previous experience wearing a medical mask?

Mask-wearing Experience and the Perceived Barriers

In this section, the relationship between mask-wearing experience and the perceived barriers were analyzed through p-values and comparisons of the mean.

Table 35.

Perceived Barriers: Mask-wearing Experience v.s. No Mask-wearing Experience

Questions	Total (N=84)		Masks (n=26)		No Masks (n=58)		Mann-Whitney
	Mean	SD	Mean	SD	Mean	SD	p-value
Perceived Benefits							
It reduces my risk of getting flu	2.11	0.72	1.85	0.66	2.22	0.72	.028*
I know when to wear masks	2.19	0.75	1.88	0.80	2.33	0.68	.010**
I know how to wear masks	1.79	0.66	1.62	0.84	1.86	0.54	.028*
Perceived Risk							
I have a high risk of getting flu	2.39	0.82	2	0.83	2.57	0.75	.003**
I don't have to worry about flu	2.73	0.82	2.31	0.82	<u>2.91</u>	0.75	.003**
Social Interaction							
It's difficult for others to see how I am feeling	2.30	0.80	2.15	0.91	2.36	0.74	.399
People will misinterpret my feelings	2.30	0.81	2.19	0.96	2.34	0.73	.390
I feel embarrassed	2.23	0.85	2.35	0.83	2.17	0.85	.322
People might criticize me about being in public while ill	2.13	0.74	2.12	0.75	2.14	0.73	.939
It makes me unattractive	2.24	0.81	2	0.73	2.34	0.82	.097

People might think I'm going to do something illegal	2.57	0.93	2.38	0.92	2.66	0.92	.266
Product Satisfaction							
The appearance of masks is unpleasant	2.15	0.76	2.04	0.71	2.21	0.78	.355
It's uncomfortable to wear	1.88	0.66	1.85	0.77	1.90	0.61	.547
External Policy							
Health experts recommend it	2.33	0.76	2.19	0.92	2.40	0.67	.172
Social Value							
It's important because it protects other people from getting my flu	1.89	0.72	<u>1.65</u>	0.78	2	0.67	.021*
I don't need to wear a mask; other people should take care of themselves.	2.74	0.94	2.42	1.04	2.88	0.85	.054

Note. SD = Standard Deviation; *p < 0.05, ** p < 0.01. Significance level is 0.05. Score 1 =

Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree.

Regarding mask-wearing experience and the perceived barriers, there were significant differences in "Perceived Benefits", "Perceived Risks", and the statement, "It's important because it protects other people from getting my flu" from the "Social Value" category.

Perceived Benefits

The p-value of "It reduces my risk of getting flu" is 0.028, the p-value of "I know when to wear masks" is 0.01, and the p-value of "I know how to wear masks" is 0.028. Surprisingly, all of three statements about perceived benefits got significant association.

Perceived Risks

The p-value of "I have a high risk of getting flu" is 0.003 and the p-value of "I don't have to worry about flu" is 0.003. This data shows the statistically significant differences with the lowest p-value in the entire table. The association of perceived risks about getting the flu and mask-wearing experience is strong.

Social Value

The p-value of "It's important because it protects other people from getting my flu" is 0.021. The p-value of "I don't need to wear a mask; other people should take care of themselves." is 0.054. The results suggested the association on social values and whether people chose to wear masks. The participants who have worn face masks agreed more with the statement that wearing masks is intended to protect other people.

From the comparisons of mean in the table, participants who have experience in wearing masks are usually in greater agreement with all of the statements, with the exception of the statement, "I feel embarrassed", in "Social Interaction", where the mean from the mask group (n=26) is 2.35 and the mean from the no mask group (n=58) is 2.17. The participants who had never worn masks considered it embarrassing to wear masks.

The lowest mean for the mask group is "It's important because it protects other people from getting my flu" from the "Social Value" category (mean=1.65). The highest mean of the no-mask group is "I don't have to worry about flu" from the perceived benefits (mean=2.91).

Other Factors

There were 8 responses for the open-ended question (Q24). The responses were categorized by themes. If more than one factor was mentioned in the response, they were broken down into two sentences with different themes.

Table 36.

Data Analysis: Other Factors

Participant	Response	Theme
P#2	<i>"Vaccine"</i>	Alternative Prevention
P#28	<i>"I don't have a cultural reference for it; was not raised with wearing face masks as flu prevention; have never been taught when or how to use them"</i>	Lack of Perceived Benefits; 3 times
P#84	<i>"Not commonly done, not a common thing to buy or have at home"</i>	
P#46	<i>"From my limited research, masks don't work well to prevent you from infection. They are designed to stop the wearer from infecting others....."</i>	
P#46	<i>"... Also, it's hard to breathe while wearing if I don't need to."</i>	Comfort; 3 times
P#38	<i>"Glasses get fogged up from breathing"</i>	
P#30	<i>"It gets hot"</i>	
P#83	<i>"Cost of masks"</i>	Cost; 1 time
P#72	<i>"I don't want to draw attention to myself."</i>	Social Barriers; 1 time

Two new factors "Alternative Prevention" and "Cost" were provided from the participants. Other responses were related to the previous barrier factors.

CHAPTER 5

CONCLUSION

Introduction

The following chapter concludes this report. A summary of the research is presented, and the findings of this study are discussed and interpreted with recommendations for future research.

Internal Factors of Perceived Barriers

One of the research questions is to learn what factors are the most commonly perceived barriers to wearing medical masks. In this section, the results of each factor is presented.

Perceived Benefits

A majority of participants (70.24%) believed that wearing masks has perceived benefits. Most participants know when (65.48%) and how (89.28%) to wear face masks. It is important to note, however, that about 1/3 of the respondents do not think wearing masks reduces risk, despite research revealing the contrary (MacIntyre et al., 2008). More respondents knew how to wear masks than when to wear them. Most participants, as a rough representative of people who live in the United States, understand the benefits and basic information about wearing masks.

Perceived Risks

Around half of the participants (51.19%) agreed that they have a high risk of getting the flu during flu season, and 1/3 of the participants (34.52%) felt worried about catching the flu. The results showed that more than 2/3 of the participants were not concerned about catching the flu. This may result from the fact that most of the participants are in young adulthood (18-34-year olds 67.85%). The people of this age group are usually healthier and stronger, and therefore, may overlook the risk of the flu and the necessity to take precautions (Budhwani & De, 2016).

Barriers to Social Interaction

Around 2/3 of the participants agreed with the statements regarding barriers to social interactions, such as how face masks cover their faces and make it difficult for others to see how they are feeling leading people to misinterpret how they are feeling (Fischer, Gillebaart, Rotteveel, Becker & Vliek, 2011). Notably, 3/4 of the participants (75%) agreed that wearing face masks might cause people to criticize them about being in public while ill. The participants showed concerns about discrimination due to the presence of a mask being seen (Teasdale, Santer, Geraghty, Little & Yardley, 2014). This pattern is interesting because it shows that people want to hide their illness by avoiding face masks in order to prevent criticism from others. While many Asian countries considered wearing masks during illness is a good manner of showing responsibility and kindness to other people (Burgess & Horii, 2012), the U.S participants were afraid of being judged and criticized for wearing masks.

Furthermore, only 2/5 of the participants (42.86%) agreed that wearing a face mask might make people think they are going to do something wrong or illegal. Most participants did not associate mask-wearer with criminal activities, although anti-mask laws and the criminal activities involved with mask-wearing exist in contemporary society (Jacobson, 2010). The perceptions of the public regarding masks-wearers could be further studied in future research.

Product Satisfaction

Around 3/4 of the participants (73.81%) believed that the appearance of face masks is unattractive and 85.71% of the participants agreed that wearing face masks is uncomfortable. The average of the statement about discomfort had the lowest score (Mean=1.88), meaning it had the greatest agreement among the respondents. Both results show that most of the participants were not satisfied with the experience of wearing face masks, especially if it affects their comfort. It fits the conclusion from the previous study (Morishima, 2014) of the poor user experience of mask-wearing due to moisture, airflow, buildup, and thermal properties. Namely, most users do not feel comfortable wearing masks. The discomfort of wearing face masks may be one of the significant barriers to more widespread usage.

External Policy

A little over 1/2 of the participants (58%) agreed that it is important to wear face masks because health experts recommend it. However, this study did not explore external factors as deeply as internal factors. More details regarding the types of publicized recommendations, such as recommendations from healthcare institutions, government agencies, or schools, should be revealed in future research.

Social Value

A majority of the participants (80.95%) believed that it is important to wear face masks because mask-wearing protects other people from getting the flu from them. 63.1% of the participants agreed with the importance of wearing face masks as a protective measure for other people. Most participants believed that wearing masks is good for preventing other people from contracting their flu and it is important to protect others. The results seem contrary to the assumption proposed by literature that the beliefs regarding individualism and independence may reduce the willingness to adopt personal prevention to protect others (National Academies (U. S.) et al., 2013).

While participants agreed with the importance of wearing masks to protect other people, they did not adopt mask wearing. Most participants disagreed with the social value of being individualism. The participants cared about others and were afraid that other people might catch the flu from them if they are sick. However, wearing face masks for other people was not an option. A paradoxical pattern is seen when comparing the number of participants (80.95%) that agreed with the importance (Q22) and the number of participants (69.05%) who had never worn face masks. This pattern reveals that the participants understand the benefit of mask wearing (while ill) as a preventative for others, yet they choose not to wear masks. As the previous study stated, personal behaviors and opinions on public health policies are influenced by prevailing values and priorities (Goldberg, 2012). Perhaps, this choice to overlook the public's welfare is due to other factors including personal preferences. The following question arises: what is the difference between one's perception about public health vs the reality of actions taken to benefit

of public health? According to the previous study, individual behaviors and opinions regarding public health policies are influenced by prevailing values and priorities (Goldberg, 2012), then, where is the balance between adopting preventive measures to protect public health and one's sacrifice of personal comfort? That is a major point reflecting the significance of social value. The consequences of the relationship between balancing personal comforts and protecting the health of the public with social values may be further clarified through reframing questions and/or further data collection via supplemental methods in a future study.

Other Factors

Two ideas were found in the open-ended question. The existence of alternative prevention strategies and costs. One participant mentioned that he receives the influenza vaccine so that he does not need to apply other preventive measures, such as mask-wearing. Another participant mentioned the cost of masks as a potential barrier, although he did not give any information about the actual cost or a possible acceptable price for a face mask. These two factors could be added and examined in future research with more studies on rates of flu shots and retail price of face masks in the United States.

Perceived Barriers and Previous Influenza Experience

One of the research questions of this study was to describe the relationship between perceived barriers to wearing medical masks and previous infection with influenza. The only significant association between respondents who had the flu in the past five years and those that did not was the statement, "It's difficult for others to see how I am feeling", in "Social Interaction" at a p-value of 0.003. This association suggested that the participants who had flu experience had perceived more barriers against social interaction by mask-wearing.

According to previous studies, using non-pharmaceutical interventions may lead to social stigma and cause embarrassment or discrimination, such as being perceived as overly fastidious (Teasdale, Santer, Geraghty, Little & Yardley, 2014). It is a possibility that the participants who have had the flu had experienced similar struggles while sick. When sick, individuals identified

themselves as infectious patients, and the fact of being ill may be a barrier to social interactions. Wearing masks might reveal their "illness" to the public resulting in self-consciousness and anxiety of having people being stared at and judgments made by onlookers, regardless of the extremity of their ailment. They believed wearing masks would make it difficult for others to see how they are feeling. Those who had experienced the flu may be more familiar with this type of unease.

The participants who have experienced the flu usually agreed with the provided statements more than those who have not, with the exception of the statement, "I know how to wear masks," in "Perceived Benefits" where its mean was lower than the healthy group. Participants who have experienced the flu showed less confidence in the steps of mask-wearing but the specific reasons are unknown.

Perceived Barriers and Mask-wearing Experience

There are significant associations between respondents who had worn masks in the past and those who had not in "Perceived Benefits", "Perceived Risks", and a statement of "It's important because it protects other people from getting my flu" from the "Social Value" category.

The participants with mask-wearing experience had a higher awareness of perceived benefits ($p=0.028$, $p=0.010$), perceived risks ($p=0.003$), and the importance of protecting other people from their flu ($p=0.021$). Thus, participants with experience wearing masks considered face masks more helpful in preventing illness; further, they felt that they were at a greater risk of contracting the flu. These individuals felt a stronger sense of responsibility to protect others from their sickness. The perceived benefits and perceived risks are key factors in triggering participants to wear face masks to protect themselves, followed by their sense of social value to others. The perceived benefits and perceived risks are more individual-oriented factors that involved with an individual's benefits and potential risks, which explain an individual's motives for performing a behavior and adopting an intervention (Leung, 2013). To participants, choosing to wear masks is a decision that based on whether it would benefit them.

Participants with mask-wearing experience usually agreed with the perceived barriers statements more than those without mask-wearing experience. However, there was an exception with the statement, "Wearing masks makes me feel embarrassed", in "Social interactions". Those with no mask wearing experience believed that mask-wearing makes them feel embarrassed, and therefore, probably did not want to wear masks. It could be a hypothesis that these participants (no-mask group) were reluctant to wear masks because they considered its unfamiliarity that may cause them to feel unease. The embarrassment may result from their assumption rather than true experience. In contrast, individuals with mask-wearing experience felt less embarrassed about wearing masks. Although the cause of this type of embarrassment is beyond the scope of this study, it appears to be a strong enough barrier which deters individuals from wearing face masks as a preventative measure. Overall, the proposed perceived benefits, perceived risk, and social values are more associated with mask-wearing experience.

Conclusion

The goal of this exploratory study was to identify perceived barriers of wearing masks among adults in the United States. In a survey conducted with 84 United States residents, the participants were divided into groups based on flu experience and mask-wearing experience to see if flu experience and mask-wearing correlated with the perceived barriers. The perceived barriers were also collected from all participants.

The data gathered from all 84 participants generated comments regarding perceived benefits, barriers for social interaction, and product satisfaction that was widely supported by the respondents. In this study, about 1/3 of the participants did not think they are at high risk, and 1/3 of the participants did not know when to wear masks. There were very high perceived social barriers across the board, very high product discomfort. Regarding previous flu experience, there was not much difference in perceived barriers. Regarding previous mask wearing experience, there was a high correlation of benefit, high risk, and social value as perceived barriers.

Around 70% of the participants agreed on the perceived benefits of wearing masks, and most of the participants knew when (65.48%) and how (89.28%) to wear masks. Around 60% of

the participants agreed that mask-wearing may make social interaction difficult, and 75% of the participants feared that wearing masks might cause people to criticize them about being in public while ill. 73.81%-85% of the participants were not satisfied with the appearance of face masks and comfort levels. Regarding perceived risk, around half of the participants (51.19%) agreed that they have a high risk of getting the flu during flu season. Only 42.86% of the participants agreed that mask-wearing might make people think they are going to do something wrong or illegal. The results of the social values were opposite to the predicted responses given emphasis on individualism and independence by the U.S. population as noted in the prior literature. 80.95% of the participants, including most of the participants who never wore masks, agreed that it is important to wear face masks because mask-wearing protects other people from getting the flu from them.

The results showed that past flu experience had a significant association ($p=0.003$) in the social interaction factor. The participants who had flu experience agreed that mask-wearing makes it difficult for other people to see how they are feeling.

Regarding the mask-wearing experience, the results showed it was highly correlated with perceived benefits ($p=0.01\sim0.028$), perceived risks ($p=0.003$), and social value ($p=0.021$). Participants with mask wearing experience perceived stronger benefits of wearing masks, were more aware of the risks of catching the flu, and were more cognizant about protecting others from the flu. Two insights were gained from the open-ended question: alternative prevention and costs.

Discussion

The findings from this exploratory study suggested that several factors and relationships exist pertaining to the perceived barriers to wearing masks. Although most understood the benefits of mask-wearing and how to use them, the barriers to social interactions and poor wearing experiences may decrease their willingness to adopt face masks. Despite the effectiveness of mask usage against spreading and catching illnesses, such as the flu, individuals may feel reluctant to wear a face-mask: they may find the aesthetic to be embarrassing and/or

unattractive, find the mask uncomfortable, and they may be concerned about opportunities for others to misinterpret their condition.

The gap of wearing masks for flu prevention in this study is similar to results found in a prior study (SteelFisher et al., 2012). Of the participants, 70.24% agreed that wearing masks reduces their risk of catching the flu, and 80.95% of the participants agreed with the importance of wearing masks as a protective measure for other people. But only 30.5% of participants claimed they have used face masks for flu prevention. To be more specific, only 1/5 of participants with flu experiences had adopted mask-wearing for flu prevention. This creates a discussion: if people are aware of the benefits and social responsibility of wearing masks, why are they still reluctant to wear masks? How many compromises would it take to make people wear masks considering the perceived benefits and the social responsibility for public health is perceived as a positive motivator (it is good for users) and the poor product satisfaction and barriers to social interactions is perceived as a negative obstruction (it is bad for users)? For example, the most prominent factor in this study is the comfort of wearing masks. This factor should be a universal issue regardless of locations or social values. Wearing masks has never been a delightful and comfortable experience for most people. However, the fact that there has been a wide adoption of mask-wearing in many Asian countries (Gordenker, 2014) suggests that many have accepted the discomfort of masks and elected to continue wearing masks nonetheless. A conflict of positive and negative factors exists for mask wearing: will the stigma of mask-wearing change for the sake of illnesses containment? Will standard amongst countries continue to vary? Will this standard change based on the purpose of wearing face masks, such as to protect other people or just to protect mask-wearers? Based on the pilot study, some interviewees mentioned that they would wear face masks to protect their family members in their household; however, they would not do the same for the public - they would still go to work, school, and travel while sick without wearing a mask. Considerations for personal hygiene and other health behaviors intended to benefit the public are further key areas to be explored. If policymakers and healthcare providers want to increase the awareness of wearing masks in an

effort to protect people in the case of a future influenza outbreak, researching how to reduce the gap between "agree" and "adopt" will need to be a focus of future research.

Other opportunities for adoption may lay within the future of face mask design. As Morishima's study (2014) reports, users find face masks to be uncomfortable. Since forming social values and drafting public health policies are time-consuming, complex, and are further complicated by the broad diversities of society, the improvement of the face masks itself may prove to be an easier variable to control. A redesign resulting in an improved user experience may reshape the perception and use of face masks. If a customer is dissatisfied with a product, it is unlikely that they will purchase or use it. Progress may be made in promoting mask usage in new users if designers and manufacturers can enhance masks with new technologies, new forms, and new materials to make masks comfortable to wear.

One's experience with specific ailments and exposure to the public shape individual's perceptions about the threat of illnesses and the need to take preventative precautions. As the highlighted throughout this study, participants who had the flu may have dealt with more emotional feedback from society when they were sick. There were significant associations in the perceived benefits, perceived risks, and social value amongst mask wearers. The participants who lacked the perceived benefits either did not feel the threat of the flu, and/or were adverse to the social ramifications associated with public mask wearing tended to not wear face masks. Furthermore, the highest mean of the no mask group was, "I don't have to worry about flu" from the "Perceived Benefits" category (mean=2.91). This rationale supports the assumption in chapter two: these individuals believe that they are healthy, therefore, prevention is not necessary. However, will factors such as contracting the flu or an attempt to wear a face mask change their perception? The correlation between flu experience and mask-wearing experience could be discussed in future research.

Design Implications

This study, which focused on perceived barriers of mask-wearing, revealed that both the perception of social barriers and physical product comfort are significant factors in mask wearing.

Although most participants understood the personal and societal benefits of mask-wearing, the barriers of social interactions and physical discomfort of mask-wearing may decrease their willingness to adopt face masks. Thus, the researcher proposed considered to be weighted, by designers, in the redesign of the face-masks.

Social Barriers

The results revealed that participants were afraid of being misinterpreted by others; moreover, participants were specifically concerned about being criticized while being sick in public. Misinterpretation of the mask wearer stemmed from the concealment of their face, and thus, their emotion, which makes it difficult for mask-wearers to communicate with others. Visibility may be a solution: a see-through materials or structural design. If the facial features, expressions, and mouth of the mask-wearer can be read by others, the wearers will be able to express their mood, feelings, and words effectively.

To reduce the embarrassment of being ill while in public, it might be helpful to display statements and slogans on masks; thus, illustrating the efficacy rate of the masks via corresponding graphics. Public education, acceptance, and peace of mind may be achieved through a mask's displayed graphics; this can include information pertaining to the risks associated with contracting the flu, the mask's filter rate, and a cost comparison between the mask wearing and the flu. The direct benefactors would be both mask wearers and non-mask wearers. Currently, a lack of knowledge about flu interventions exists in American society (Hashmi et al., 2016). Perceived benefits and perceived risks were two key factors found regarding the masks-wearing experience in this study.

Discomfort

Most participants were not satisfied with the experience of mask-wearing. The comfort problems including poor fit, ear pain, removal of cosmetics, humidity, and difficulty breathing (Morishima, 2014). Currently, two common mask sizes are available for public purchase: a children's size and an adult's one-size-fits-all. Avoidance of mask wearing may be reconciled

through an offering of a multitude of mask sizes, which will increase comfort, and use, when fitted properly. Designers can further increase comfort and breathability with advanced innovative materials.

Limitations

This exploratory research is a small study of 84 participants drawn from various regions representing the U.S population. The scope of the conclusions is limited to the context and historical characteristics of the current survey. Therefore, the conclusions may yield incorrect assumptions if applied to other situations due to the studies' focus and specificity. To better reveal general trends involving people in the United States, the sample size must be enlarged in future studies. Conducting stratified sampling with a larger sample size is a better sampling method for future study. Once the researcher identifies the relevant strata and their actual representation in the population, a sufficient number of subjects will be selected from each stratum via random sampling. This method reduces sampling errors and a larger sampling size should be sufficient to represent the population reasonably. This method may better extract the true characteristics of the broader U.S. society. As an initial study, this researcher focused on internal factors of perceived barriers rather than external factors or the influence between two. If the sample size was large enough, the influence of the external factors such as the demographic data of residence, race, age, and the location differences between rural, urban, and suburban areas might be observable from the data.

Errors may exist among self-reported results due to misunderstandings in some definitions. For example, the statement, "I know how to wear a face mask", in question 10. Participants may wear face masks incorrectly but perceive that their method of wear is correct may have claimed they know how to properly wear a mask. If the correct method of mask-wearing could be explained prior to the survey questions, the participants may provide more precise and reliable self-reported data.

Future Research

Future studies should aim to verify that the participants' reported responses reflect the current trend. As this study utilized Likert questions to survey, the participants were not afforded an opportunity to explain their thoughts pertaining to their perceived factors. Further details about perceptions about mask wearing need to be exposed and synthesized to gain deeper insight. The survey questions can go extract further information by combining quantitative and qualitative research methods. For example, interviewing individuals who are currently experiencing the flu or wearing a mask may generate more precise perceptions. Similarly, conducting pre- and post-intervention studies that test how participants perceive mask-wearers and mask-wearing by themselves, followed by an in-depth data evaluation, may improve the accuracy of the current research. For instance, ask participants to describe the details of their perceived barriers on mask-wearing may yield more informed conclusions in a deeper context.

Furthermore, this study only explored the perceived barriers to wearing masks for flu prevention. There was a study that suggested that wearing face masks in public may be associated with other personal hygiene practices and health behaviors (Wada, Oka-Ezoe, & Smith, 2012). If the scope of this study can be further combined with other associations of personal flu prevention behaviors, such as hand-washing and the flu vaccine, as alternative preventions or combined preventions, the results may be more beneficial for designing comprehensive healthcare strategies and therefore, contribute to the public health welfare.

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APPENDIX A
IRB EXEMPT LETTER



EXEMPTION GRANTED

Donald Herring
The Design School
480/727-7338
Donald.Herring@asu.edu

Dear Donald Herring:

On 10/3/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	A Study of Barriers to Adults Wearing Face Masks in the US to Prevent the Spread of Influenza
Investigator:	Donald Herring
IRB ID:	STUDY00008973
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• HRP-503a_Mask.docx, Category: IRB Protocol; • Survey Questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • CONSENT DOCUMENT -online survey.pdf, Category: Consent Form;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 10/3/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: YU-WEN HUNG
YU-WEN HUNG



APPROVAL: MODIFICATION

Donald Herring
The Design School
480/727-7338
Donald.Herring@asu.edu

Dear Donald Herring:

On 10/15/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Modification
Title:	A Study of Barriers to Adults Wearing Face Masks in the US to Prevent the Spread of Influenza
Investigator:	Donald Herring
IRB ID:	STUDY00008973
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• HRP-503a_Masks.docx, Category: IRB Protocol; • Survey Questions, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • CONSENT 1015.pdf, Category: Consent Form;

The IRB approved the modification.

When consent is appropriate, you must use final, watermarked versions available under the “Documents” tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: YU-WEN HUNG
YU-WEN HUNG

APPENDIX B
INFORMATION LETTER

CONSENT

The purpose of this survey is to identify barriers to wearing face masks to prevent the transmission of influenza (flu). Please respond to each question. By completing this survey, you have indicated that you are willing to participate in this study.

Dear Participants,

I am a graduate student from the Herberger Institute for Design and the Arts at Arizona State University. I am conducting a research study to identify barriers to wearing face masks to prevent the transmission of influenza (flu) in the U.S. I am inviting your participation, which will involve 5 minutes, online survey for a topic of reviewing medical mask products and talking about using experiences of medical masks.

You have the right not to answer any question, and to stop participation at any time. Your participation in this study is voluntary. *Participants must be 18 and older.* If you choose not to participate or to withdraw from the study at any time, there will be no penalty, foreseeable risks, or discomforts to your participation. Your response will be used for a master thesis, in academic purpose only. The research team will stay assured of the complete privacy, security, and confidentiality of your data. Your responses will be anonymous. The results of this study may be used in reports, presentations, or publications but your name will not be used. You also can change your mind after the survey starts.

If you have any questions concerning the research study, please contact the research team at:

Researcher: Yu wen Hung, email: yhung9@asu.edu, 832-757-7158

Instructor: Professor Donald Herring, email: Donald.Herring@asu.edu, 480-727-7338

This study has been reviewed and approved by the Arizona State University Institutional Review Board. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Thank you for your participation!

(PRESS "OK" ON THE SCREEN TO MOVE FORWARD)

APPENDIX C
SURVEY

S: Face Masks and Flu Prevention

The purpose of this survey is to identify barriers to wearing face masks to prevent the transmission of influenza (flu). Please respond to each question. By completing this survey, you have indicated that you are willing to participate in this study.

Dear Participants,

I am a graduate student from the Herberger Institute for Design and the Arts at Arizona State University. I am conducting a research study to identify barriers to wearing face masks to prevent the transmission of influenza (flu) in the U.S.

I am inviting your participation, which will involve 5 minutes, online survey for a topic of reviewing medical mask products and talking about using experiences of medical masks. You have the right not to answer any question, and to stop participation at any time. Your participation in this study is voluntary. *Participants must be 18 and older.* If you choose not to participate or to withdraw from the study at any time, there will be no penalty, foreseeable risks, or discomforts to your participation. Your response will be used for a master thesis, in academic purpose only. The research team will stay assured of the complete privacy, security, and confidentiality of your data.

Your responses will be anonymous. The results of this study may be used in reports, presentations, or publications but your name will not be used. You also can change your mind after the survey starts.

If you have any questions concerning the research study, please contact the research team at:

Researcher: Yu-wen Hung, email: yhung9@asu.edu, 832-757-7158

Instructor: Professor Donald Herring, email: Donald.Herring@asu.edu, 480-727-7338

This study has been reviewed and approved by the Arizona State University Institutional Review Board. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Thank you for your participation!

(PRESS "OK" ON THE SCREEN TO MOVE FORWARD)

* 1. What is your gender?

- ☐ Male
☐ Female

* 2. What is your age?

- | | |
|--------------------------------|-----------------------------------|
| ☐ 18 to 24 | ☐ 35 to 44 |
| ☐ 25 to 34 | ☐ 45 to 54 |
| ☐ 55 to 64 | ☐ 75 or older |
| ☐ 65 to 74 | |

* 3. What is your race?

- ☐ White ☐ American Indian or Alaskan Native
- ☐ Black or African-American ☐ Asian
- ☐ Native Hawaiian or other Pacific Islander
- ☐ Some other race (please specify)

* 4. What region of the US do you reside in?

- ☐ New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) ☐ West North Central (Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota)
- ☐ Mid-Atlantic (New Jersey, New York, and Pennsylvania) ☐ South Atlantic (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, District of Columbia, and West Virginia)
- ☐ East North Central (Illinois, Indiana, Michigan, Ohio, and Wisconsin) ☐ East South Central (Alabama, Kentucky, Mississippi, and Tennessee)
- ☐ West South Central (Arkansas, Louisiana, Oklahoma, and Texas)
- ☐ Mountain (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming)
- ☐ Pacific (Alaska, California, Hawaii, Oregon, and Washington)

* 5. You consider your living area is?

- ☐ Urban
- ☐ Suburban
- ☐ Rural

* 6. Have you had the flu in the past five years?

- ☐ Yes
- ☐ No

* 7. Have you ever worn a face mask in public to prevent you from getting flu or exposing others when you had the flu?

- ☐ Yes
- ☐ No

The next set of questions are about possible reasons for wearing or not wearing face masks. Please respond to each one by checking strongly agree, agree, disagree, or strongly disagree.

* 8. Wearing a face mask reduces my risk of getting the flu.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 9. I know when to wear a face mask.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 10. I know how to wear a face mask.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 11. I have a high risk of getting the flu during flu season.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 12. I do not have to worry about the flu.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 13. Wearing a face mask covers my face and will make it difficult for others to see how I am feeling.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 14. Wearing a face mask might make it more likely that people will misinterpret how I am feeling.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 15. Wearing a face mask would make me feel embarrassed.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 16. Wearing a face mask might cause people to criticize me about being in public while ill.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 17. Wearing a face mask makes me look unattractive.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 18. Wearing a face mask might makes people think I am going to do something wrong or illegal.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 19. The appearance of face masks is unpleasant.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 20. Wearing a face mask is uncomfortable.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 21. It is important to wear a face mask because health experts recommend it.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 22. It is important to wear a face mask because mask-wearing protects other people from getting my flu.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 23. I don't need to wear a face mask if I have flu; other people should take care of themselves and avoid getting sick.

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly disagree

* 24. Are there other factors that prevent me from wearing a mask for flu prevention? What are they?

- ☐ No
- ☐ Yes (please specify)