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Should We Wear a Mask? Household Assessment of Mask Wearing for COVID-19 in Ya'an, China

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Should We Wear a Mask? Household Assessment of Mask Wearing for COVID-19 in Ya'an, China

by

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Abstract

In late 2019 and 2020, the novel SARS-CoV-2 virus spread worldwide and resulted in the COVID-19 pandemic, the second deadliest pandemic in modern history since the 1918 influenza pandemic. Since the virus was novel, no therapeutics and vaccines existed. Effective implementation of non-pharmaceutical interventions was essential to reducing the transmission of the disease until the discovery of effective therapeutics and vaccines. This study explores the influence of the facilitating protective action attribute on adopting mask-wearing as a protective action in Ya'an, Sichuan Province, China. The study found that perceptions of mask effectiveness to reduce the probability of contracting and spreading the disease, positive social influences, and the influence of an alert emotion shaped the facilitating protective action attribute and the adoption of mask-wearing during the COVID-19 pandemic. The research also revealed a significant positive correlation between the expected consequences from contracting COVID-19, the influence of both the alert and positive emotions, and information sources on the adoption of mask-wearing as a protective action. Lastly, expected consequences from exposure, indirectly affected by age, and information from authorities directly affected the adoption of the recommended protective action. The significance of both expected consequences and information from authorities affected the adoption of the recommended action. The finding suggested what actions public health, public policy, and emergency management leadership can take to enhance the effectiveness of non-pharmaceutical interventions to mitigate the spread of disease during future pandemics.

Keywords: risk perception, protective action assessment, decision-making, mask-wearing, COVID-19.

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Dedication

An important lesson learned during the doctoral process is the importance of grit, which is most certainly required. In Grit, Angela Duckworth (2016) defines *grit* as a mixture of *passion* and *perseverance*. With that in mind, I dedicate this dissertation to my parents, Colonel Leonard R. Peterson (Ret., USAF) and Jo Peterson.

My father passed along his *passion* for learning and, through our involvement in the Boy Scouts, to *be prepared.* He inspired my appetite for education, which resulted in my pursuit of a doctorate in emergency management. My mother passed along her sense of *perseverance* and she inspired me to exercise the persistence and stubbornness to complete the process. I would not have finished without their love, support, and the values and lessons they passed along to me.

Additionally, I dedicate this dissertation to those who lost their lives to the SARS-CoV-2 virus. These lives include many within the emergency management community and several friends and associates. May they rest in peace.

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Vita

Leonard Russell Peterson, Jr. was born on Moody Air Force Base, Georgia, and is the son of Colonel (Ret., USAF) Leonard and Jo Peterson. He is married to Laura, and they have one son, Jayden. Russell, like his father, is an Eagle Scout through the Boy Scouts of America. Russell received his Associate of Science in Liberal Arts and Sciences from Sinclair Community College in Dayton, Ohio, a Bachelor of Arts in Economics from The University of Tennessee at Knoxville, a Master of Science in Safety from Middle Tennessee State University in Murfreesboro, Tennessee, a graduate certificate in Community Preparedness and Disaster Management from The University of North Carolina at Chapel Hill School of Public Health, and a Master of Science in Emergency Management and a Master of Public Administration from Jacksonville State University in Jacksonville, Alabama. Russell retired as the Division Chief for Training, Risk, and Emergency Management from the Brentwood Fire & Rescue Department in 2018 with 36 years of public safety service. The Peterson’s live in Nashville, Tennessee.

Introduction

Effectively communicating risk and enabling individuals to take recommended protective actions is essential for effective emergency management. The purpose and focus of this study were to determine how individuals assess recommended protective actions and determine what factors affect these assessments. Individuals within a specific study area were surveyed for their opinions on perceived risks, expected consequences, and the effectiveness of a recommended protective action across various measures. This study sought to contribute to the knowledge and practice of emergency management by determining and explaining the assessment factors involved in adopting recommended protective actions that apply to outbreaks, epidemics, and pandemics, specifically, and in an all-hazards environment, generally.

Overview of the COVID-19 Pandemic

Late in 2019, residents of Wuhan, China, were reportedly infected with an unknown respiratory disease with symptoms that included fever, cough, fatigue, and difficulty breathing, and, uniquely, the loss of taste and smell (Mullol et al., 2020). All of these symptoms, except for the loss of taste and smell, are like influenza and other respiratory diseases, including Severe Acute Respiratory Syndrome (SARS) (WHO, 2003i) and Middle Eastern Respiratory Syndrome (MERS) (World Health Organization, 2019). This unknown disease was later named COVID-19, and its' rapid spread resulted in the first global pandemic since the H1N1 influenza pandemic of 2009, ten years earlier (CDC, 2018c). As of November 15, 2021, COVID-19 had infected more than 250 million people and had killed more than 5 million people worldwide (Johns Hopkins, 2021). By comparison, the influenza pandemic of 1918 resulted in the infection of around 500 million people resulting in the death of at least 50 million people (CDC, 2018c). In the United States alone, as of November 1, 2021, the number of COVID-19 deaths (more than 737,000)

exceeded the number of deaths (675,000) from the 1918 influenza pandemic (Kamp & Calfas, 2021).

Jean and Peter Medawar, as quoted by Corum & Zimmer (2020), state that a virus is "simply a piece of bad news wrapped up in protein" (p. 2). On February 11, 2020, the International Committee on Virus Taxonomy, as reported by the World Health Organization (WHO), named this latest "piece of bad news" Severe Acute Respiratory Syndrome - Corona Virus – 2 (WHO, 2020j). SARS-CoV-2 is the novel virus that is the cause of Corona Virus Disease - 2019 (COVID-19) and was responsible for the global pandemic (WHO, 2020m).

Coronaviruses are a group of ribonucleic acid (RNA) viruses that can cause diseases in mammals and birds. Dangerously, RNA viruses, as distinguished from DNA (deoxyribonucleic acid) viruses, are "prone to mutation (and) are highly and rapidly adaptive" (Quammen, 2012, p. 41). RNA viruses, also known as retroviruses, use ribonucleic acid as their genetic material (the "bad news") protected by a protein coating. This genetic material is inserted into a host cell, converted into deoxyribonucleic acid (DNA), and replicates through reverse transcription (Thompson, 2018).

Before 2003 and the SARS-CoV-1 outbreak, scientists believed coronaviruses only caused mild respiratory tract infections like the common cold (Ching et al., 2020). SARS-CoV-2 is one of seven coronaviruses that can cause disease in humans. This group includes the four coronaviruses that cause the common cold and two others that cause more deadly infections, such as SARS-CoV-1 (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome) (Ching et al., 2020). Both of these diseases (MERS and SARS) were involved in recent outbreaks. An earlier SARS epidemic spread throughout Asia and North America in late 2002 through mid-2003 resulted in 8,096 infections and 774 deaths with a case

fatality ratio of 9.5% (Chan-Yeung & Xu, 2003) and a reproduction ratio between 2 and 3 (Salzberger et al., 2021). More recently, a MERS outbreak in Saudi Arabia in 2012 resulted in 688 infections and 282 deaths with a case fatality ratio of 40.9% (McNeil, 2014) and a reproduction ratio of 0.45 (WHO, 2019k).

Impacts from the COVID-19 Pandemic

Internationally, the COVID-19 pandemic has resulted in enormous economic and social impacts. The United Nations News (2021) reported that the economic effects from COVID-19 "cost the world the equivalent of 255 million jobs in 2020 or was equivalent to $3.7 trillion or 4.4 percent of global gross domestic product" (p. 1). Social impacts by March 4, 2020, as reported by Sandford (2020), included "more than 3.9 billion people, or half of the world's population, asked or ordered to stay at home due to collated compulsory or recommended confinements, curfews, and quarantines in more than 90 countries or territories" (p. 1). Within the United States alone, Kamp & Calfas (2021) reported that the COVID-19 pandemic had increased the number of deaths per 100,000 people from 715 in 2019 to 829 in 2020 (Kamp & Calfas, 2021), an increase of 114 deaths per 100,000 people in one year. Additionally, the pandemic reduced the average life expectancy of U.S. citizens from 78.8 years in 2019 to 77.8 years in 2020 (Kamp & Calfas, 2021). This surge in decreased life expectancy was the highest since the 1918 flu pandemic (Kamp & Calfas, 2021).

Social Adaptation and the COVID-19 Pandemic

Terziev (2019, p. 495), in research on social adaptation, stated that "adaptation is used to denote the process by which the subject adapts to the new environment" and that "adaptation is associated with the certain goal towards which the subject strives: 'to stay alive (p. 495)'" Due to this pandemic, individuals, households, and communities have had to make significant

adaptations to respond to the pandemic, including adopting protective actions to reduce the disease's transmission to others and decrease the likelihood of illness, hospitalization, intensive care unit admission, hospitalization, or death. Adaptation by individuals, households, and communities was critical; those who did not adapt to the new threat and implemented protective actions were more likely to become ill and die than those who adopted protective actions. Based on Terziev's (2019) research on social adaptation, the COVID-19 pandemic presented a "new environment" to individuals, households, and communities. There was a necessity to adapt socially and provided a goal: "to stay alive." Adopting the wearing of masks as a protective action to reduce the transmission of the virus and reduce the possibility of acquiring the disease was an important example of how individuals and households used social adaptation to "adapt to the new environment."

Social Adaptation via NPIs during the COVID-19 Pandemic

The mitigation of disease transmission in pandemics and regionalized epidemics relies fundamentally upon two strategies: non-pharmaceutical interventions, which primarily include personal hygiene and social distancing measures, and pharmaceutical interventions, such as vaccines and therapeutics (Hatfill et al., 2020). Since SARS-CoV-2 was a novel virus, there were no known effective vaccines for the resulting disease and no existing therapeutics at the onset of the outbreak. The result was a reliance on non-pharmaceutical interventions, which included wearing masks as source control, to control the transmission of the disease until a vaccine was developed and produced.

Non-pharmaceutical interventions, also known as NPIs, have been used for centuries to control epidemics and, for the most part, have remained unchanged. Consider, for example, the word *quarantine*. Quarantine is a mid-17th century Italian word that means "forty days," which

was the amount of time that arriving ships were required to remain anchored offshore in isolation during the Plague (Merriam-Webster.com, 2021). Other non-pharmaceutical interventions, according to Hatfill et al. (2019), include "respiratory etiquette, hand hygiene, the routine cleaning of frequently touched surfaces, voluntary home isolation when ill, the voluntary home quarantine of potentially exposed household members, the self-use of face masks in community settings when ill, and the use of individual social distancing measures" (p. 175). This statement supported the use of face masks as a non-pharmaceutical intervention associated primarily with source control or control of a potential source of infection rather than as a protective action.

Phases of Social Adaptation and the COVID-19 Pandemic

Concerning its effect on wearing masks as a protective action, the COVID-19 pandemic went through several phases, resulting in varying degrees of reliance on and the importance of non-pharmaceutical interventions, including wearing face masks. This pandemic was loosely based upon the WHO pandemic phases (WHO, 2021n). This pandemic was split into three phases: emergence and discovery, outbreak and epidemic, and global pandemic for this study. Each phase describes the transmission of the virus from a localized outbreak to a regional epidemic and, eventually, to a global pandemic.

In the emergence phase, very little was known about the virus and the resulting disease by public officials with a corresponding lack of information. However, public health officials know little about the virus and its transmissibility. Non-pharmaceutical efforts to stop the virus from spreading were implemented, which included wearing face masks. In hindsight, this phase was evidenced during the COVID-19 pandemic when on December 30, 2019, ProMED, or the International Society for Infectious Diseases' Program for Monitoring Emerging Diseases, posted a report of several "pneumonia of unknown cause" cases in Wuhan (Center for Infectious

Disease Research And Policy, 2019; International Society for Infectious Diseases, 2019). The previous report was followed on January 5, 2020, when the World Health Organization (WHO, 2020j) reported information regarding several cases of ‘viral pneumonia in Wuhan, China.

On January 5, 2020, to control the spread of the virus, the WHO provided information on the cluster of unknown respiratory illnesses and advised all its’ member states to begin taking precautions, in the form of non-pharmaceutical interventions, to mitigate the risk of transmission of the novel disease (WHO, 2020j). Later, on January 9, 2020, the WHO (2020j) reported that China had determined that an unknown coronavirus caused the cluster of respiratory-related illnesses. On January 11, 2020, China reported its first fatality from the new disease, illustrating that this novel coronavirus was now clearly pathogenic and was a known threat to life (WHO, 2020j).

During the outbreak and epidemic phase, the spread of the virus increased and crossed geographic borders. The first case outside the People’s Republic of China involved a person who had traveled from Wuhan to Thailand (WHO, 2020j). On January 15, 2020, Japan reported its first case of the new respiratory disease involving a person who had traveled to Wuhan (WHO, 2020j). The United States reported its first case of the new disease on January 19, 2020 (WHO, 2020j). Throughout this phase, additional information was collected about the threat of the virus and the consequences of the disease. Still, control of the spread of the virus by the public health community was limited. This limitation is from a lack of information on the properties of the virus and understanding how to control the transmission of the virus. In the absence of a viable pharmaceutical intervention such as a therapeutic or a vaccine, reliance on non-pharmaceutical interventions, which included wearing face masks as source control, was increasingly the focus of efforts even in the face of the unknown efficacy of the intervention. Additionally, with the

potential for loss of life from the COVID-19 pandemic, reliance on wearing face masks as a protective action became more apparent, even though the transmission route was not entirely clear.

During the emergence phase, on January 14, 2020, the WHO (2020j, p. 5) reported that "it is certainly possible that there is limited human-to-human transmission" associated with the new respiratory disease. However, the WHO (2020j) indicated that the Chinese had not found clear-cut evidence of human-to-human transmission and that additional investigation would be needed to determine "the presence of human-to-human transmission, modes of transmission, a common source of exposure and the presence of asymptomatic or mildly symptomatic cases that are undetected" (p. 5). This information regarding the human-to-human transmission of the virus was evidence of the confusion within the public health community. It impacted the perception of future protective actions and the decision of individuals and households on whether to adopt the protective action of mask-wearing. They further emphasized the use of masks as a protective measure; on January 29, 2020, the WHO issued guidance on the community use of masks, primarily by caregivers during home care of sick patients and within the health care environment. This guidance from the WHO was the first official mention of using face masks as a protective action to protect against transmission (WHO, 2020c). By February 25, 2020, the virus was reported on four major continents: Africa, Asia, Europe, and North America (WHO, 2020j) and had reached the pandemic phase.

Within the pandemic phase, the spread of the virus was unlimited, uncontrolled, and resulted in disease worldwide. There was little, if any, control over the spread of the virus by the international public health community. On March 11, 2020, the WHO determined that COVID-19 was a global pandemic (WHO, 2020m). Since there was little control over the spread of the

virus, no known therapeutics, and no available vaccines, the public health community continued reliance on non-pharmaceutical interventions. The WHO Director-General issued official guidance on March 11, 2020, which formally included wearing face masks as a protective action to limit the loss of life until the development of a vaccine to end the pandemic (WHO, 2020n).

The WHO stressed the importance of wearing face masks as both a protective action and a means of source control while also releasing a significant new development on how the virus could be transmitted. On April 2, 2020, the WHO (2020j) reported on "evidence of transmission from symptomatic, pre-symptomatic and asymptomatic people infected with COVID-19, noting that transmission from a pre-symptomatic case can occur before symptom onset" (p. 20). Later that week, in a continued effort to mitigate the transmission of the virus using face masks as a form of non-pharmaceutical intervention, the WHO issued new information on the use of masks. Notably, this included information on the community use of masks by healthy people (a significant departure from all previous information principally citing the use of face masks as a source of infection control), reiterating the importance of wearing face masks as a protective action (WHO, 2020d). Several months later, on June 5, 2020, the WHO (2020e) updated their information on the use of masks by healthy people to control the transmission of the disease "which provided updated advice on who should wear a mask, when it should be worn, and what it should be made of" (p. 28).

Further continuing its' messaging on the importance of wearing a mask as a protective action, on August 4, 2020, the WHO implemented a "Wear a Mask" campaign on social media to encourage people to wear a mask as a means of protective action against COVID-19 (WHO, 2020o). Later, on August 21, 2020, in conjunction with the United Nations Children's Fund (UNICEF), the WHO issued guidelines on masks as a protective action against COVID-19 for

children in community settings (WHO, 2020b). Later in the year, on November 10, 2020, the WHO began a campaign named “In This Together” to promote the adoption of “five key measures to counter COVID-19: cleaning hands, wearing masks, coughing and sneezing safely, keeping distant and opening windows” (WHO, 2020j, p. 43).

These instances exemplified the international public health community's attention on implementing non-pharmaceutical interventions, specifically the wearing of face masks as a protective action, through all three phases of the virus spread and disease transmission. The World Health Organization advocated using face masks as a source of control for persons with COVID-19 and as a protective action for healthy people against acquiring COVID-19. Using face masks as a protective action was an essential component of implementing non-pharmaceutical interventions and controlling and ending the COVID-19 pandemic.

Challenges to Social Adaptation and the COVID-19 Pandemic

An essential lesson of the COVID-19 pandemic has been the controversy surrounding wearing face masks as a protective action against contracting the disease versus simply as a means of source control. Everchanging and sometimes conflicting information from public health officials and public policymakers possibly resulted in confusion within the public on whether to adopt wearing face masks as a protective action or as a means of source control. Determining how individuals and households assessed the information they received and how they ultimately decided to adopt or not wear face masks during the COVID-19 pandemic was essential to inform public policy and public information about future pandemics.

Mask Wearing as a Protective Action Against the Spread of Respiratory Diseases

During the 1918 influenza pandemic, Barry (2004) related a story about Joe Capps, a doctor treating people infected with the disease. The story told how Capps had “experimented

with the wearing of gauze masks by patients with respiratory disease" (p. 211). Barry (2004) quoted a co-worker of Capps who called the mask "a great thing…an important contribution in the prevention of spray infections" (p. 211). Barry related that Capps found using masks so successful that they began using them as "a routine measure" (p. 211). This story would appear to be the first documentation in the modern history of masks used as a means of source control or control of a potential source of infection. There has been the recommendation for masks as control of source for infected persons in more recent times. Masks were worn during the more recent pandemics, including the 2003 SARS pandemic (Bell, 2004) and the 2009 H1N1 influenza pandemics (Cowling, 2010). Most recently, during the COVID-19 pandemic, Brooks & Butler (2021) cite eleven separate internationally-based studies which support mask-wearing as an effective means to reduce the transmission of the SARS-COV-2 virus, which causes COVID-19. These mask effectiveness studies, as cited by Brooks & Butler, included studies in Beijing, China (Wang et al., 2020), Bangkok, Thailand (Doung-ngern, 2020), Jena, Germany (Mitze et al., n.d.), Canada (Karaianov et al., n.d.) and throughout the United States (2021).

The COVID-19 pandemic was different from earlier pandemics as there was the distinct possibility of pre-symptomatic or asymptomatic transmission of the virus. This possibility was supported by Li et al. (2020), who indicated that "studies also suggested that asymptomatic patients could spread the virus as their viral loads have no significant differences compared to those of symptomatic patients" (p. 4). Since there was the possibility of pre-symptomatic and asymptomatic spread of COVID-19, the WHO (2020h) recommended taking simple precautions, which included maintaining distance from others, staying away from crowds, and good hand, sneeze, and cough hygiene, and notably included the suggestion to wear a mask by all individuals. Similarly, the U.S. Centers for Disease Control and Prevention (CDC) (2020d)

recommended that people, including healthy individuals, wear masks whenever they are around other people, including being in public, at events with many people. The CDC (2020b) continued by stating that wearing a mask protected the person and others. The CDC (2020b) suggested that masks explicitly be used as a protective action (rather than solely for source control) by stating that people should wear a mask whenever they cared for someone sick with symptoms of or had tested positive COVID-19.

These recommendations are supported in a study by Matuschek et al. (2020), who gave the following as the arguments supporting the use of a face mask during the COVID-19 pandemic: “wearing a mask in areas where sufficient distance is not feasible, such as public transportation, most likely reduces the spread of virus-loaded droplets and therefore the risk of transferring SARS-CoV-2” (p. 29). Furthermore, in a study by Li et al. (2020), the researchers found that “wearing a face mask can be effectively combined with social distancing to flatten the epidemic curve and that wearing a mask presents a rational way to implement as an NPI to combat COVID-19” (p. 1). Li et al. (2020) concluded based upon comparing disease transmission as related to mask-wearing in several scenarios. Similarly, a study by Abboah-Offei et al. (2021) found that “all studies that compared the use of face mask, irrespective of the type, to non-use of face masks observed a significantly higher rate of infection among the participants who did not use a mask” (p. 5). Both studies provide evidence of the effectiveness of mask-wearing as a protective action by individuals, households, and communities during pandemics.

Lastly, there may be some cultural components to wearing face masks that vary globally and may affect the adoption of mask-wearing as a protective action. Specifically, in a study by

Nakayachi et al. (2020), the researchers found the regular use of masks as a protective action by people within East Asia, particularly Japan. According to Nakayachi et al. (2020),

> "wearing masks against COVID-19 is beneficial in suppressing pandemic spread, not through preventing the wearer from being infected but by preventing the wearer from infecting others, according to suggestions from the World Health Organization (WHO, 2020) and lessons from previous pandemics, such as the 2003 severe acute respiratory syndrome (SARS) pandemic and the 2009 influenza A virus subtype H1N1 pandemic" (p. 1).

Nakayachi et al. (2020) sought to determine why Japanese residents were so likely to wear a face mask when no evidence supported it protected the wearer. The study's conclusion found that there were several reasons that Japanese residents wore masks to include "altruistic risk reduction" (p. 2). However, this might have included some form of self-interest even with the lack of evidence supporting the benefit of both wearing the mask and the perception of the seriousness of the threat of the disease. The study's conclusion found that for most of the study's participants wearing a mask was simply a norm.

Dizikes (2021), quoting research by Lu et al. (2021), reports that "a public sense of 'collectivism' clearly predicts mask usage" (p. 2). Dizikes (2021) also explains that "collectivism broadly refers to the inclination to prioritize a group's needs over an individual's concerns, and social scientists have often worked on measuring its presence among different populations" (p. 2). Notably, Schwab, 2013 reported that Asian countries have lower individualism and are more collective than non-Asian cultures. Lastly, Nakayachi et al. state that wearing masks became the norm in Hong Kong during the 2009 H1N1 epidemic, indicating that wearing masks is not limited to Japan and is also present in other areas of the Asian region.

The literature supported the importance of mask-wearing as a protective action during pandemic events. Public policy should consider this within social messaging during outbreaks, epidemics, and pandemics. Additional study into the efficacy of wearing face masks as a protective action and associated emergency risk communications is paramount as we continue to plan for future pandemics.

Research Gaps

Two areas need additional research that will be explored as the focus of this study. The first gap in research was concerned with the differences between urban and rural environments related to public health policy, both internationally and domestically. Most public health policy research addresses urban and rural areas combined or explores predominantly urban (CDC, 2021a,e; Hoadley et al., 2018; Kochtitzky et al., 2006; Mueller et al., 2018). Based on this, there was a need to assess protective actions in rural areas. Relatedly, existing data was available for this study that explicitly addresses a rural environment in China.

While there was a need to research the protective action assessment differences between rural and urban areas, there was also a need to research why the assessment of protective actions was critical. There was a second research gap in understanding how individuals and households assess protective actions, especially given that the literature shows that protective action assessment was essential to decision-making and was a less studied topic (Lindell & Perry, 2012). As stated, wearing face masks, in conjunction with other non-pharmaceutical interventions that include social distancing, working from home, and avoiding indoor environments, is an essential component of public health practitioners' and policy makers' tools to manage pandemics (Hatfield et al., 2020). Motivating household members to wear face masks

during a pandemic ensures that the household residents receive and interpret a clear, concise, and consistent message that is available across all emergency risk communications mediums.

There is agreement within the literature that wearing masks by sick persons is effective as source control to mitigate disease transmission. What was less clear is the efficacy of mask-wearing as a protective action against transmittable infectious diseases. This disagreement and the resulting confusion by the public were compounded by the presence of disease with pre-symptomatic or asymptomatic transmission. If health experts disagree and are confused about whether face masks are effective as protective actions, indeed policymakers and the public are equally, if not more, confused and disagreeable. Much can be done to communicate better and explain the science and the limitations surrounding the use of face masks as both a source of transmission control for people who are both sick and well and as a protective action for those who are well to policymakers and the public.

Additionally, much can be done to research how households and communities assess the value of taking protective action during pandemic events, in general, and wearing a mask to limit the spread of the disease and to protect themselves from the disease. Presumably and using Lindell and Perry's (2012) Protective Action Decision Model (PADM) as a framework, the attention of households is gained by information stakeholders, typically authorities and officials communicating through the traditional media, social media, or other families and friends. The information that the households see, read, or hear must be understandable and acted upon (Lindell & Perry, 2012). Additionally, the households may also take in cues that they obtain socially (Lindell & Perry, 2012), such as seeing others participating in the recommended protective action such as wearing masks, maintaining physical distancing, or stocking up on supplies or can consider protective actions based on previous experiences.

For the information to be acted upon, there must be trust between the individual and the stakeholders – information by stakeholders that is not trusted by the decision-maker likely will not be considered in the protective action decision. At this point, the individuals and households may also perceive the hazard level from the threat communicated, for example, the consequences of COVID-19.

One challenge of communicating risk with COVID-19 may be the case fatality ratio. The case-fatality ratio is determined by dividing the number of fatalities from the disease by the number of people infected. As of November 1, 2021, the average case fatality ratio internationally for COVID-19 is approximately 2% (Johns Hopkins, 2021) as compared to Ebola Virus Disease, which has been and continues to be involved in periodic outbreaks primarily in Africa, with an average case fatality ratio of 50% (Aylward et al., 2014; WHO, 2021). In the case of COVID-19, despite a higher death count and its' presence globally, individuals and households may have a lower level of concern from COVID-19 than from the Ebola Virus Disease, a disease which resulted in fewer deaths and affects a much smaller geographical area but is more exotic. Lastly, there may be some perception by the individual or household on the efficacy of the protective action against the threat, in this case, the wearing of face masks to protect themselves from the SARS-CoV-2 virus. After conducting this assessment process, the individuals and households may determine if the household adopts and implements the recommended protective action. Furthermore, and according to Lindell and Perry's PADM (2012), the individuals and households may continue to re-evaluate their decision by searching for and assessing new information on the efficacy of the protective action.

Literature Review

This study addressed the assessment of face masks as a protective action by individuals and households in rural China during the COVID-19 pandemic. The literature reviewed for this proposal included various theoretical frameworks available to support the research, research into theories about protective action assessment, and assessment of previous studies applying the theoretical framework to protective action assessment. Additionally, significant attention was spent on determining the characteristics of rural environments and how these characteristics differed from urban areas.

The goal of the literature search was to find journal articles related to the assessment of protective actions within rural populations worldwide during COVID-19. The literature search was limited to COVID-19 because of the virus's novel characteristics (for example, asymptomatic spread) and the wide range of consequences from the disease (for example, from no symptoms to intensive care unit admission and death). A search for literature about protective action assessment within rural populations during COVID-19 was accomplished using online research resources through the Jacksonville State University Library, including EBSCO, JSTOR, ScienceDirect, ResearchGate, and the independent research of the Library, Google Scholar. Keywords that were searched for included COVID-19 protective action assessment; COVID-19 protective actions; protective action assessment; behavioral health theories; rural protective action assessment; protective action decision model; emergency risk communications; risk perception; emotion; expected consequences from COVID-19; exposure pathways for COVID-19; hazard adjustment attributes; protection motivation theory; planned behavior theory; theory of reasoned action; information sources and COVID-19; and COVID-19 and face masks.

Theories about Protective Action Decision Making

Ejeta et al. (2015) suggested that several social cognitive theories can be used to address health-related research. These theories, mentioned within the Ejeta et al. (2015) review, including the Health Belief Model (HBM), the Extended Parallel Process Model (EPPM), and the Theory of Planned Behavior (TPB), the Multidimensional Locus of Control (MLOC) theory, the Protective Motivation Theory (PMT), and the Protective Action Decision Model (PADM).

Ejeta et al. (2015) studied several relevant theories related to emergency health preparedness concerning the variables used and how these variables were related. Ejeta et al. (2015) found that the Extended Parallel Process Model (EPPM), the Health Behavior Model (HBM), the Theory of Planned Behavior (TPB), and social cognitive theories were the most commonly used theories for hazards preparedness. The choice of the Health Belief Model by Ejeta et al. (2015) was based upon the "HBM's history of empirically predicting preventive health behavior" (p. 9). The value of the Extended Parallel Process Model, as suggested by Ejeta et al. (2015), is that it helps the researcher to understand "how health care may positively or negatively influence their [health workers'] willingness to fulfill the response expectations" (Ejeta et al., 2015, p. 9) and the Theory of Planned Behavior for its' appropriateness to explain "situations where individuals do not perceive themselves as having complete control over their behavior" (Ejeta et al., 2015, p. 9).

This study needed a theoretical model to explain how individuals psychologically assess the costs and benefits of wearing a mask as a protective action against a threat. Through the Protection Motivation Theory, Rogers (1975) explained individuals' motivation to adopt attitudinal changes in the face of fear. As pertains to PMT, Rogers (1975) suggested that "the three crucial components of a fear appeal to be (a) the magnitude of noxiousness of a depicted

event; (b) the probability of that event's occurrence; and (c) the efficacy of a protective response" (p. 93).

Even though the Protective Motivation Theory (Rogers, 1975) provided a means to explain individuals' motivation to adopt a protective action, it did not address the perception of various informational components and the protective action. Lindell and Perry's Protective Action Decision Model (2012; 2017) more specifically addressed these perceptions and serves as a more appropriate framework for assessing the influence of these perceptions on the protective action adoption decision. Ejeta et al. (2015) stated that the advantages of the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) are that it "has a more detailed set of salient beliefs and its clarity in terms of response costs compared with PMT" (p. 13). Ejeta et al. (2015) also suggested that the reason to use the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) "was to assess the risk reduction process in an all-hazards context" (p. 13). Importantly, Ejeta et al. (2015) aligned the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) directly with the assessment aims of this study by stating that "hazard related attributes and risk perception were positively associated with … preparedness intention, while resource-related attributes were negatively associated with preparedness intentions" (p. 13).

Based on this review of the theories proposed by Ejeta et al., the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) was the best fit as a theoretical framework for this study. The reasons for this decision were that the model uses a psychological framework to explain human behavior; the model was derived from theories that were focused on individuals and households, rather than (presumably large) groups of people; and the model has previously been used to research disaster and emergency preparedness (Ejeta et al., 2015).

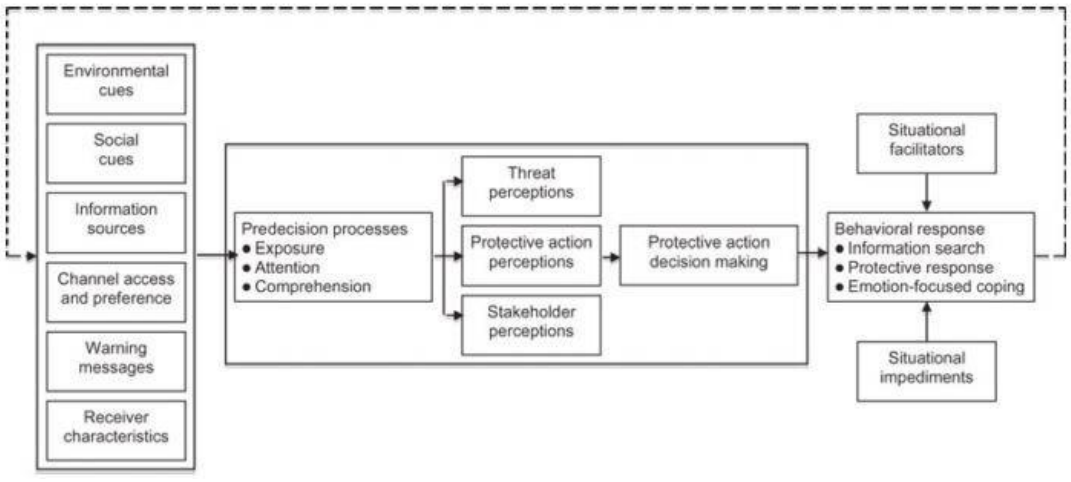
Given that the PADM is a psychological model that assesses the perceptions of individuals (i.e., psychological and within the scope of this study) rather than the behavior of large groups of people (or sociological and outside the scope of this study), the PADM was a good fit as a theoretical framework for this study.

Theory - Protective Action Decision Model

Understanding how rural individuals and households assess protective actions requires a framework that explains how individuals collect information, assess that information, and then act on the information they have received. The Protective Action Decision Model (Figure 1), as described by Lindell & Perry (2012) and expanded upon by Lindell (2017), is a multistage psychological model that is based on findings from research on individuals or households' responses to hazards that they receive information on and how they process that information to make decisions to protect themselves from the hazard ultimately.

Figure 1.

Information Flow in the Protective Action Decision Model (PADM).



Note. From "Communicating Imminent Risk" by M. K. Lindell, 2017, *Handbook of Disaster Research,* p. 475.

The model takes the various ways that individuals or households receive information then theorizes how the individuals or households process that information based upon various perceptions that the individuals or households have regarding the threat, the available protective actions, and the various stakeholders involved in information dissemination. The model also theorizes how the individual or households process this conceptualized information through a specific decision-making process that further vets the received information and, along with situational considerations, results in a change in behavior by the individual or household. Individuals and households decide to take a protective action within the model based on three pre-decisional phases (Lindell, 2017; Lindell & Perry, 2012). Using previously acquired information on the threat, protective action, and stakeholder perception, the individual identifies the risk they face, assesses that risk, searches from available protective actions, determines which protective action is most appropriate, and then implements it. At that stage, the individual or households will begin to determine what additional information is needed to refine the protective action, seek sources of that information, evaluate any sources found, and then implement the most appropriate information, potentially refining the protective action that was initially chosen. Within the context of the COVID-19 pandemic, these final stages can be represented by the additional information available to individuals as continuing research into protective actions for COVID-19. As this additional information is made available, individuals or households refine their protective actions to implement the best available action.

The Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) has been used to explain the risk identification, risk perception, and corresponding protective action behaviors across several hazards, including hurricanes (Huang et al., 2017; Lin et al., 2014; Lindell & Hwang, 2008), flooding (Lindell & Hwang, 2008; Terpstra & Lindell, 2013), wildland

fires (Kuligowski et al., 2020), hazardous materials releases (Lindell & Hwang, 2008; Savitt, 2015), nuclear power emergencies (Lindell, 2000) and water contamination events (Lindell et al., 2015). The model has been used against a variety of both natural and technological hazards to assess decision making on protective actions by both individuals and households through the lens of the various sources of information, threat perception, protective action perception, and the perception of the stakeholders disseminating the information, given the diverse and dynamic social, economic, and political environments which exist within the pandemic coupled with rapidly changing information on both the SARS-CoV-2 virus and the COVID-19 disease, the model can address the perception of exposure to the virus, the consequences of contracting the virus, and the protective actions available to the public which can influence decision making by rural individuals and households.

Attributes of Protective Action Assessments

Attributes related to protective action assessment are closely linked with the situational facilitators and impediments identified within the Protective Action Decision (Lindell, 2017; Lindell & Perry, 2012). These attributes have been applied to a variety of hazards, including hurricanes (Huang et al., 2017; Lin et al., 2014), flooding (Terpstra & Lindell, 2013), wildland fires (Kuligowski et al., 2020), hazardous materials releases (Savitt, 2015), nuclear power emergencies (Lindell, 2000) and water contamination events (Lindell et al., 2015). The importance of these attributes stems from the modification that can occur between the intentional decision of the decision-maker and the actual behavior of the decision-maker, most often based on attributes that can inhibit or facilitate the intended behavior (Lindell & Perry, 2012). Using the Protective Action Decision Model (Terpstra & Lindell, 2013) identified these attributes as hazard adjustments, identified as either hazard-related or resource-related. Hazard-related

attributes tie the threat to the protective action, whereas resource-related attributes tie the protective action to the financial, physical, or temporal resources of the individual or households involved in the decision-making process. Hazard-related attributes, in other words, are more related to the threat and its' potential consequences and the ability of the protective action to protect the individual or households from the threat as compared to the ability of the individual or households to pay for, have the time to, or have the physical ability to enact an available protective action (Lindell, 2017). Terpstra & Lindell (2013) also theorized that, according to the PADM, hazard-related attributes are correlated with the adoption of the intended behavior. In contrast, resource-related attributes are correlated with the non-adoption of the intended behavior. Based upon this and for this study, these two attributes were re-considered as either a facilitating attribute (which increases the likelihood of adopting the recommended behavior) or as an inhibiting attribute (which decreases the likelihood of adopting the recommended behavior).

Within the literature, facilitator-related attributes typically include personal and household safety, personal and household property protection, and the preservation of personal or household usefulness (Terpstra & Lindell, 2013). Most often, and especially considering a significant threat, individuals and households are immediately motivated by preserving the self and the family. Preservation of property and usefulness is typically addressed after the immediate life safety considerations. Additionally, and addressed later in this chapter, adopting social cues and emotions can facilitate the decision process. Other facilitator-related attributes can be applied in the longer term, such as the adoption, acceptability, and sustainability of the intended policy outcome (Melbourne School for Population and Global Health, 2021a,b). Policy-based implementation of facilitator-related attributes that have been successful in modifying behavior

can be reimplemented or redeployed to increase the adoption of positive behaviors further, ideally motivating individuals and households to adopt the recommended protective action through economic, social, or political avenues.

The available literature identifies impediment-related attributes as financial and temporal limitations, insufficient training, and the necessity for external resources (Terpstra & Lindell, 2013). Individuals and households may have insufficient money or time to adopt the intended protective action. Examples of these financial inhibitors can include "direct labor costs, indirect labor costs, and non-labor costs" (Melbourne School for Population and Global Health, 2021c, p. 1). These inhibiting financial costs can also include the need to work to support the individual and household and the cost of implementing the desired protective action, such as purchasing face masks. Frequently, individuals and households have insufficient training or information on the threat or risk, which inhibits adopting the intended protective action. Lastly, some individuals and households lack the external resources (for example, means of transportation, temporary lodging, and family support) necessary to adopt the desired protective action and can include the lack of adequate social cues to prompt the desired protective action.

Individuals' Interpretation of the Risk

Risk is defined as the "severity and probability of consequences" (Haimes, 2009, p. 1648). With this definition, there are two principal components of risk: first, the magnitude of the consequences and, second, the probability of the consequences. Haimes (2009) suggested that defining risk also addresses the probability of adverse consequences compared to the magnitude of adverse consequences. This definition of risk applies to the risk perception of both exposures to the risk and the expected consequences resulting from that exposure. Much of this risk perception is based on previous experience (or "schemas") and is, almost in its' entirety,

automatic (Lindell, 2017). Much of the perception of the threat is based upon what the receiver considers to be the probability and consequences of encountering the threat. However, fear, and fear of the unknown, play a role in the perception of the threat. Notably, the individuals' perception of the threat informs the individual or households' perception of the protective action that can be taken. Perception of the protective action is aligned with what Lindell et al. (2018) referred to as "hazard adjustments," which are actions that the receiver takes to minimize the threat.

This study applied the perception of the risk, in general, and the perceived exposure to the virus and expected consequences of the disease. For this study, risk perception was connected to how the decision-maker felt emotionally about the perceived exposure, through standard exposure pathways, to the SARS-CoV-2 virus and the expected consequences from the COVID-19 disease, specifically in China, related to admission to an intensive care unit. As for the risk perception, Li et al. (2020) found that anxiety related to the perceived exposure to the virus was highest with those individuals or households who knew someone else who had contracted the virus or was living in an area with more disease cases.

Wang et al. (2018) suggested that perceptions related to protective actions and the risk from the threat positively influence individuals or households' willingness to take any recommended protective actions. Additionally, threat characteristics, including perceived exposure and expected consequences, and the information source's quality, were considered to play an essential role in assessing the protective action (Thompson & Lazer, 2020).

The impact of formal education or training on adopting protective action was related to the individual or households' educational level and previous disaster experience. It may influence the assessment of protective actions. Scarinci et al. (2021) suggested that, within the United

States, higher perceived susceptibility to the SARS-CoV-2 virus was correlated to race, gender, and educational level. For example, whites and females had a higher perceived susceptibility to the virus than African Americans and males (Scarinci et al., 2021). Specifically, the literature indicates that gender (females, in particular) may positively affect adopting protective actions, irrespective of previous disaster experience (Silver & Andrey, 2014).

Additionally, individuals with a high school education or less had a lower perceived susceptibility than those with college or higher education who had a higher perceived susceptibility (Scarinci et al., 2021). Furthermore, Rohrbeck & Wirtz (2018) suggested that formal education on the threat is more effective with individuals with lower incomes and no previous disaster experience. In comparison, it is less effective with those individuals or households with higher incomes and those with previous disaster experience. Lastly, within the United States, individuals in lower socioeconomic classes had lower perceived susceptibility to the virus than those in higher socioeconomic classes (Schaner et al., 2020).

The age of the individual also influenced the perceived susceptibility to the virus. Individuals who were greater than 70-year-old with more comorbidities had a higher perceived susceptibility to the virus (Schoeni et al., 2021). Additionally, this group of individuals was more likely to wear a face mask (greater than 90% of surveyed individuals) and comply with non-pharmaceutical interventions (Schoeni et al., 2021).

The expected consequences, both individually and collectively, from COVID-19 are extensive. The pandemic has had worldwide impacts but was particularly harmful to more vulnerable groups, including those living in poverty, the elderly, and the young (United Nations Department of Economic and Social Affairs, 2021). The delineation of these consequences can fall within the following categories: “healthcare…, economic…, and social…” (Haleem et al.,

2020, p. 78). Explicitly related to healthcare impacts, in addition to the short-term consequences of contracting COVID-19, some people continue to experience symptoms of the disease after they have initially recovered from the disease (Mayo Clinic Health Information Library, 2021). These longer-term symptoms, referred to as *long haulers*, are defined as symptoms that persist for more than four weeks after initial diagnosis. These long-term consequences will likely result in continuing demands on the healthcare system and lasting economic impacts due to lost work.

Economically, there are short-term and mid-term impacts are on supply chains and logistics, information flow, and scientific research (Scott, 2020). The international supply chain and logistics have been impacted by either a reduced demand for goods resulting from lockdowns (for example, new vehicles) or increased demand (for example, personal protective equipment such as N95 masks and nitrile gloves). Information flow and scientific research resources have been impacted due to being diverted to focus on mitigating the impacts of the pandemic, including the development of vaccines and therapeutics. In addition to poor economic and health consequences, the social impacts of the disease are far-reaching. In addition to impacting people worldwide, the pandemic has disproportionately impacted the social interaction of the elderly (for example, locked down long term care facilities that prevented the family from visiting) (LaFave, 2020) and the poor (lock downs which closed homeless shelters, food banks, and mass feeding facilities) (United Nations Department of Economic and Social Affairs, 2021). Additionally, the young were substantially impacted due to a loss of social interaction, lack of outdoor activity, and in-person attendance at school (Ghosh et al., 2020).

Emotions

Risk perception is based firmly on emotion (Han et al., 2021). The literature supported that risk perception is directly related to two different responses. The first response is more

emotional and has an immediate response to the danger. The emotions that can present themselves in the face of danger can range from relaxed and optimistic to nervous, depressed, or fearful (Lindell et al., 2016). Individuals' reactive actions range from no response to the danger to outright panic (Guten & Allen, 1972). The second response is more methodical and related to a cognitive response (Shahrabani et al., 2019). When faced with a threat, individuals and households will react instinctively based on previous experience and training or collect information, deliberate on this information, and then act. The decision on whether to act immediately or to deliberate and then act is based upon the perception of the risk. Shahrabani et al. (2019) supported that risk perception is related to negative emotions, including fear. Individuals and households with higher levels of fear related to the threat are more likely to avoid the threat by immediately adopting the recommended protective action. Specifically related to COVID-19, risk perception was related to emotion (Han et al., 2021). A higher perception of risk related to COVID-19 was observed within females, with an associated higher adoption of recommended protective actions (Rana, 2021).

Information and Social Cue Sources on Risk Communication

During crises, governmental authorities attempt to increase the public understanding of the risk of the specific threat being addressed and reduce the possibility of or actual misinformation that may be present during the crisis. Typically, all public officials follow an established process when communicating risk to the public by deploying various information sources. Information sources can consist of dissemination, broadcast, and diffusion methods (Lindell, 2017 quoting Rogers & Sorenson, 1998). Dissemination of information typically is from official sources such as public policy and administrative authorities, and public health authorities in the case of the COVID-19 pandemic. Typically, the next step is broadcasting the

disseminated information is through mass media news organizations, such as television, print news media, and online news media. Lastly, the broadcasted information is diffused using social media, secondary online sources, and word of mouth. Outside of this dissemination method, individuals or households can obtain information from social cues, such as preparedness activities (e.g., purchasing household items) and adopting protective actions (e.g., mask-wearing).

Information sources include any information that the decision-maker receives and uses to decide to adopt the protective action of wearing a mask during the pandemic to include notifications from public health and governmental officials, newspaper articles, TV and radio broadcasts, social media postings, and information received from family, friends, and neighbors. Research from the New York University School of Global Public Health (Scire, 2020) found that, on average, individuals use an average of six information sources when making decisions related explicitly to COVID-19. Beusekom (2020), citing research published in JMIR Public Health and Surveillance, indicated that people seek information on the pandemic from different sources based on various personal characteristics, including age, gender, and educational level, and personal opinion.

Research by the New York University (Scire, 2020) supported that the choice of information sources is linked to age, gender, educational level, and political affiliation and also indicated that educational level and political affiliation play significant roles in choosing information sources during the COVID-19 pandemic. Lu et al. (2021) found that “political affiliation has a large impact on mask usage in the United States, where people in more Republican states tend to use masks less than people in more Democratic states” (p. 2). Individuals with higher levels of education and education in the sciences were more informed

about the pandemic (Olaimat et al., 2020) and, related to implementing a non-pharmaceutical intervention, those with PhDs have the highest rate of implementation (Schaner et al., 2020). Related to political affiliation, Berman (2020), citing research from the University of Pennsylvania and University of Illinois, stated that individuals who relied on conservative news and social media sources and news aggregators were less informed regarding COVID-19. Lastly, research from Bridgman et al. (2020) found that getting information from social media is related to misinformation about COVID-19, while the opposite exists for the traditional news media.

The social and environmental contexts are essential components of emergency risk communications. Environmental cues include any hazard that the receiver is exposed to, including the primary hazard types, including natural, technological, and manmade hazards. Social cues are information that the individual or household receives from the action of others around them. Information sources, warning channels, and warning messages are all related to sources of information, which may be available to an individual or household, including official warnings, traditional media, and social media. Through social cues, people are inclined to respond to the behavior of others that they see (Allen & Marco, 2020). Importantly within the context of this portion of the model, research by Hsing et al. (2021) supported that both the cultural and social context influences individual behavior.

Additionally, the influence of social cues, including the approval of prevailing social behaviors and the disapproval of negative social behaviors (Holzwarth, 2020), can influence the protective action decision of individuals. Lastly, critical social cues for this study include individuals and households specifically seeing others adopting the protective action of wearing a mask during the pandemic. Calbi et al. (2021) suggested that social cues and anxiety on the faces

of others (presumably influencing the perception of the threat) are detectable and still recognizable despite the wearing of face coverings.

Receivers' Characteristics

Receiver characteristics are related to the attributes of the individual or households that impact the adoption of a particular protective action. These characteristics can include the individual's cognitive ability and the receiver's experience with the threat, either through direct experience or training (Lindell, 2017). Receiver characteristics consist of cognitive processes used to make decisions (Lindell, 2016; Huang, 2015). The decision-makers demographics include their age, gender, marital status, ethnicity, property ownership, education level, and annual household income. In general, warnings from authorities, an expectation of a significant consequence, and the use of social cues is a better predictor of adoption of the recommended protective action than others (Huang, 2016). There is a minor effect on taking recommended protective actions based upon other identified demographics and previous experience with the threat (Baker, 1991, as quoted by Huang, 2016).

Within the context of this study and related to the physical characteristics of individuals contracting COVID-19, some scholars have suggested that older adults (specifically those greater than 70 years of age) are most vulnerable to severe consequences from the COVID-19 disease (Pettrone et al., 2021; Yang & Xin, 2020) and more likely to require intensive care (Puah, 2021). The most common pre-existing health impairment among those admitted with COVID-19 was high blood pressure (Myers et al., 2020). In addition to the physical characteristics explicitly related to wearing face coverings, Coolidge (2021) suggested that personality characteristics are strongly associated with both compliant and non-compliant people. For example, Coolidge (2021) found, in a Brazilian study, that "people who were resistant to comply with the

containment measures scored higher on measures of manipulativeness, deceitfulness, callousness, irresponsibility, impulsivity, hostility, and risk-taking" (p. 3). Additionally, Coolidge (2021) found that individuals who "took the virus seriously experienced higher levels of depression,…, nervousness, anxiety, (and) worry" (p. 6).

Rural Environments

Rural environments vary significantly from urban areas, and this difference is essential to their assessment of protective actions. Rural areas are far different from urban areas in a variety of ways. A way to focus specifically on these differences between the urban and rural environments is by applying macroenvironmental scanning (Aguilar, 1967, as quoted in Choo, 1999). Macroenvironmental scanning is defined by Choo (1999) as "the acquisition and use of information about events, trends, and relationships in an organization's external environment." (p. 21). Furthermore, macroenvironmental scanning provides a framework for information-seeking, which can assess the situational dynamics within any external environment (Choo, 1999). These situational dynamics are summarized into five dimensions: social, technological, economic, environmental, and political (Baruah, 2020).

Considering the first dimension, social, rural communities are different from urban areas in various ways. The density of individuals and households in rural communities is significantly less than in urban areas, in that individuals and households are typically located farther apart. Therefore, there is an increased sense of and need for self-reliance within rural communities. This self-reliance might result in household residents making protective action decisions based upon their intuition rather than relying on external sources of information (Slama, 2004).

There are technical differences between rural and urban areas. The primary difference might be in the availability of broadband internet access. This lack of access to broadband

internet might result in household residents not having access to or easy access to sources of information, which can influence their decision-making on protective actions (Nelson, 2020).

Economic differences between rural and urban areas might include lower income in the rural areas than in urban areas, less monetary savings, and reduced availability of banking institutions to handle financial transactions. These economic differences could result in a difference in the assessment of protective actions from the availability of money to purchase face masks or a delay in the ability to purchase masks (Rural Health Information Hub, 2021; Valdez, 2016).

The environmental differences between the rural and urban areas are partly related to the social dimension. First, the spacing of individuals and households in a rural area is further apart than in urban areas. Second, there is a reduced concentration of industries in the rural areas resulting in cleaner air. The concentration of particulate in the air in the urban areas may result in greater use of face masks to filter out the particulate, whereas that is less likely to be observed in the rural areas (Oliveri, N.D.; Strosnider et al., 2017).

The last dimension to consider was the political differences that exist between the rural and urban areas. The presence and demand for governmental services should be lower in rural areas, where there would be both a higher presence and demand for governmental services in urban areas. The disparity would impact the enforcement of mandates requiring wearing face masks in both rural and urban areas. Law enforcement or public health officials have too many square miles to cover in rural areas. In contrast, in the urban area, where there are fewer square miles, there are too many competing demands for the services of law enforcement officials to enforce face mask mandates. Additionally, in the rural areas, the population per elected official would be fewer per capita than in urban areas. Therefore, there may be more political pressure on

the elected official around policymaking in rural areas than in urban areas (Dillon & Henly, 2008).

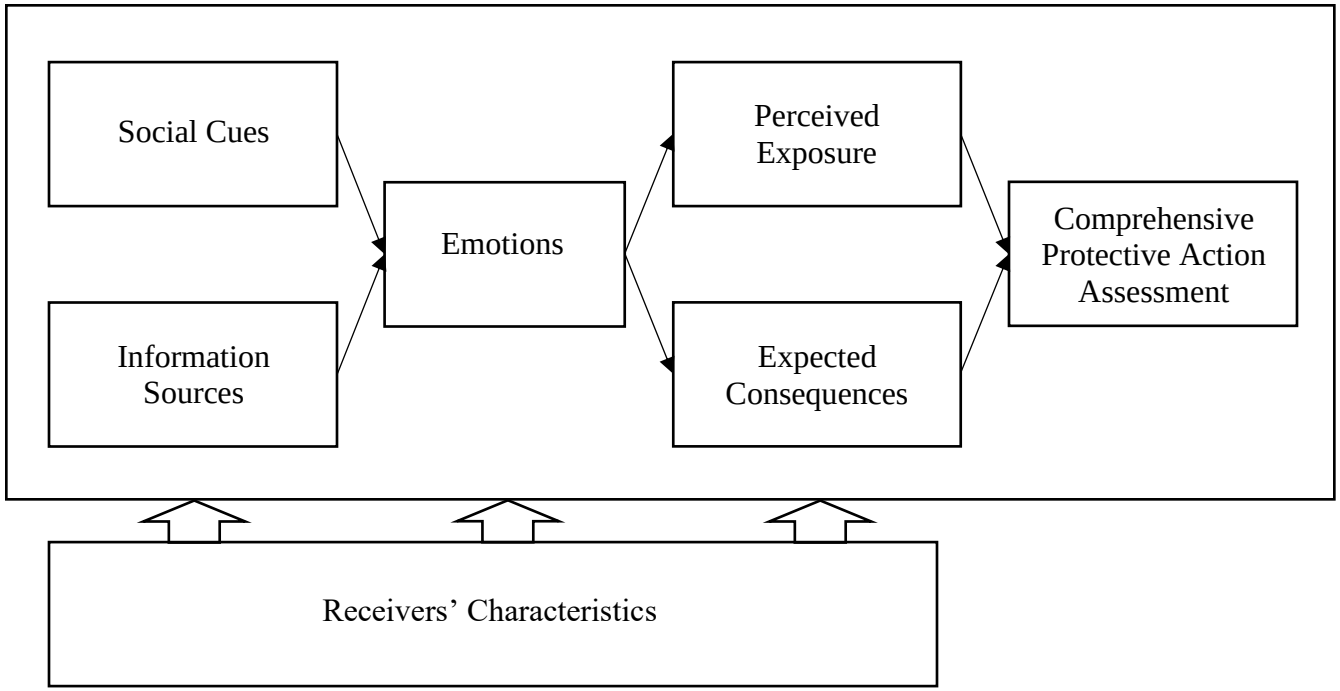
Conceptual Framework, Research Question, and Research Hypotheses

Based on the previous applications of the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) to a variety of scenarios involving both natural and technological hazards, the model was appropriate, at least in part, for the assessment of protective action decision making as related to mask-wearing by rural individuals and households during the COVID-19 pandemic. Focusing on the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012) most directly related to this study resulted in an abbreviated version of the PADM and a conceptual, theoretical development framework. This abbreviated conceptual framework was used to determine what variables influenced the decision by the rural individuals and households to ultimately adopt the protective action of wearing a mask during the COVID-19 pandemic as related to the perceptions of the threat and the perception of the protective action of wearing a mask.

This abbreviated version included (a) portions of the environmental and social context and (b) psychological processes, specifically the various perceptions within the model, to include threat, protective action, and stakeholder perceptions. The intermediary steps between the environmental and social context and the perception portion of the psychological context, namely the pre-decision processes, were assumed to have been fulfilled and not assessed within this study's parameters. This adapted conceptual, theoretical framework is illustrated in Figure 2.

Figure 2.

Conceptual Framework Using an Abbreviated Version of the PADM.



In summarizing the literature review, this study aspires to answer the following questions:

(1) How do rural residents in Ya'an, China, assess the protective action of mask-wearing during the COVID-19 pandemic?

(2) What factors affect their assessments?

To better understand these questions, there was one research question and two research hypotheses associated with this study as proposed below:

Research Question: How do rural residents in China assess the protective action of mask-wearing during the COVID-19 pandemic in terms of concerns related to effectiveness, social impression, expense, and life convenience?

Research Hypothesis 1: As predicted through the Protective Action Decision Model, risk perception variables (for example, perceived exposure and expected consequences), emotional variables, and information sources, and social cues (including traditional and social media) will significantly correlate with each of the protective action assessments.

Research Hypothesis 2: Only the risk perception variables will receive the significant regression coefficients when all the variables are controlled for regression of the protective action assessments.

Summary

It is clear from the literature search and reviews that there is essential information on protective action decision-making theories, risk perception, the effect of emotion on risk perception, and the influence of sources of information and social cues on behavior and receiver characteristics. These protective action decision-making theories have been applied against various threats, including hurricanes, tornadoes, flooding, hazardous materials incidents, nuclear

power plant emergencies, and water contamination events. Applying the literature against less researched concepts is essential, explicitly assessing protective actions in general and within a pandemic environment. Furthermore, it is essential to apply these findings to the rural environment that is different from urban areas, as supported by the literature.

Methodology

Survey Area

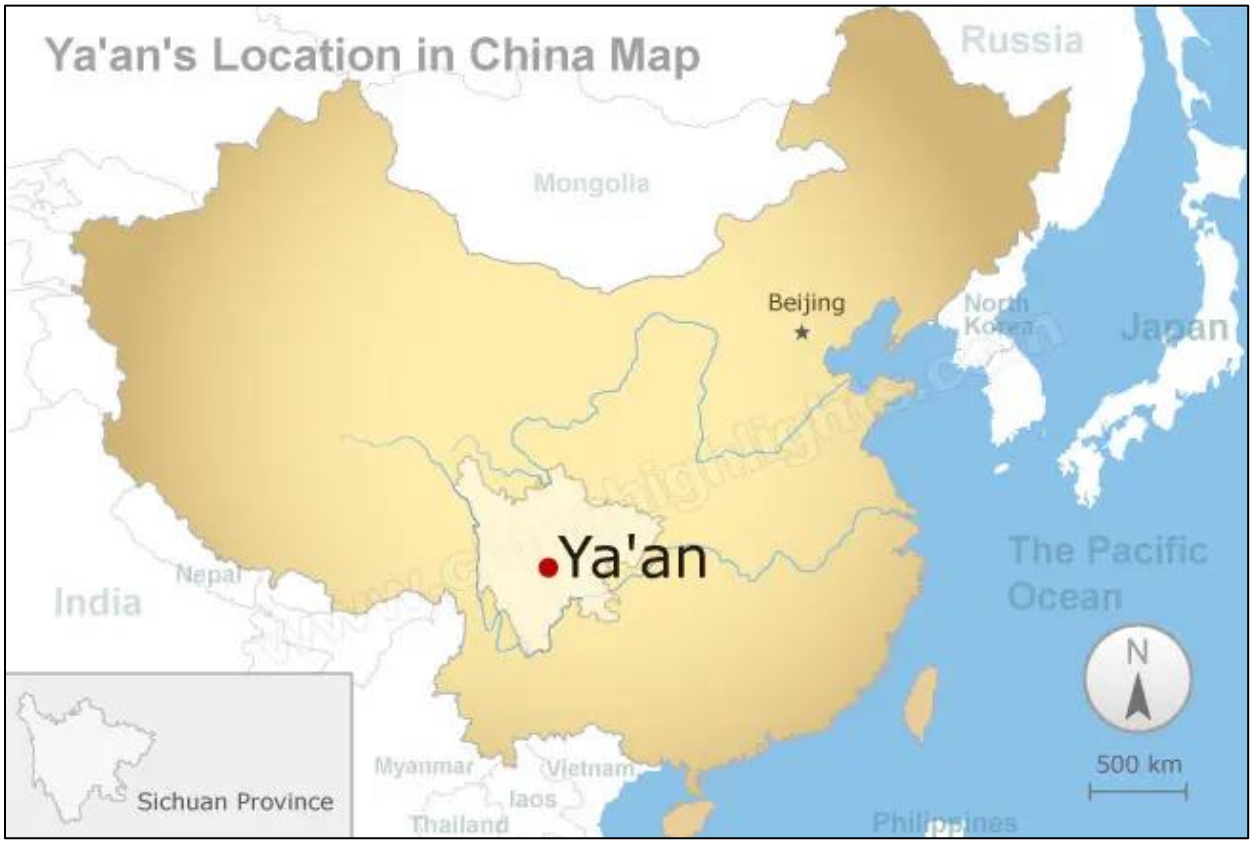
The data for this study was existing data collected in late November of 2020 through surveying residents of the city of Ya'an, Sichuan Province of China (Figure 3). Ya'an is located 74 miles from the city of Chengdu, the administrative center of Sichuan Province (Ya'an Municipal People's Government, 2021). The city is known as the "City of Rain," is a famous center for history and culture, and is emerging as a tourism destination (Ya'an Municipal People's Government, 2021). Ya'an has two districts (Yucheng and Mingshan) and six counties (named Lushan, Baoxing, Tianquan, Yingjing, Hanyuan, and Shimian) (Ya'an Municipal People's Government, 2021). According to the Ya'an Municipal People's Government website, the permanent resident population of Ya'an is 1.54 million, with 55.62% of residents living in rural areas (Ya'an Municipal People's Government, 2021). The population of Ya'an accounts for 1.84% of the total population of Sichuan Province (Sichuan Provincial Bureau of Statistics, 2021). 51.1% of the population of Ya'an is male, and 48.9% is female (Sichuan Provincial Bureau of Statistics, 2021). Ya'an is the home to Sichuan Agricultural University and Ya'an Polytechnic College (Ya'an Municipal People's Government, 2021).

Before the COVID-19 pandemic, Ya'an had experienced several significant disasters, which likely increased their preparedness for future events. According to Goff (2013), a 6.6 magnitude earthquake struck Lushan County near Ya'an in April of 2013. The China Earthquake Administration estimated that at least 156 people were killed, with more than 5,500 people injured (Goff, 2013) by the earthquake. The earthquake damaged critical infrastructure, including energy and telecommunications services, and damaged close to 10,000 residential structures (Goff, 2013).

This earthquake followed another earthquake that occurred in the same vicinity five years previously. In May of 2008, that earthquake resulted in the deaths of at least 70,000 people and left 18,000 people missing (Goff, 2013). In response to these earthquakes, it is reported that Ya'an had increased its' investments in earthquake-resistant structural engineering, early warning systems, and public education programs since the last earthquake (Huang, 2018, quoting Li, 2015).

Figure 3.

Map of Ya'an's Location in China.



Note. From China Highlights, 2021. (https://www.chinahighlights.com/yaan/map.htm) . In the public domain.

During the COVID-19 pandemic (as of March 31, 2021), the Chinese Centers for Disease Control and Prevention reported only eight confirmed COVID-19 cases in Ya'an (Chinese

Centers for Disease Control and Prevention, 2021). This information indicated that Ya'an, like many other rural areas in China, has been less directly impacted by the pandemic as compared to urban areas, including Wuhan, which accounts for 48.8% of the total COVID-19 cases, and Hong Kong with 11.2% of the total cases (Chinese Centers for Disease Control and Prevention, 2021).

Survey Methods

This study used existing data collected by a collaborative project between Sichuan University (SCU) in Chengdu, Sichuan Province, China, and Jacksonville State University (JSU) in Jacksonville, Alabama. A survey instrument was designed by the principal investigators of the collaborative project from both sides and was approved by the Institutional Review Board (IRB) at JSU. Then, SCU administered the instrument by conducting field surveys in Ya'an, China using volunteer student interviewers. The survey was conducted from November 24 through November 27, 2020. Rural individuals and households were the targets for the survey samples. Half of the samples were selected from within the Yucheng District, which is the city center of Ya'an and has a more developed economy. The remaining samples were collected in both Lushan and Baoxing counties, which have less developed economies. The survey method used was a face-to-face distribution of a multi-item questionnaire.

During the survey process, the informed consent of the survey participants was obtained before the survey was conducted. If the participants were able to read and write, the survey participants completed the questionnaire independently. If the participant could not read or write, the survey respondent was assisted by an investigator. No questionnaires were given to residents who did not want to participate in the survey. Surveyors collected a total of 492 valid questionnaires.

Ethical Considerations

Although the data used for this study were existing data, approval by the JSU IRB was required. Since this study used existing data (and using Dr. Shih-Kai Huang's IRB approval as a basis for approval), an exempt review category request was made. The IRB approval was submitted on July 2, 2020, based upon the previous approval of a related proposal, and the IRB approved the exempt IRB application on July 6, 2021.

Instrumentation

The data used in this study were collected by the SCU-JSU collaborative project mentioned above. The questionnaire used in the survey was comprised of thirty-six questions. For this study, fourteen questions were chosen from the survey for data analyses. The results from responses to these fourteen questions were used to address the following variables.

Comprehensive Protective Action Assessment

Survey participants were asked to assess the protective action of wearing a mask related explicitly to four different criteria: the effectiveness of wearing the mask, the expense of wearing the mask, the convenience of wearing the mask, and any social influences related to wearing masks. All attributes assessed by the survey were measured for internal consistency by determining their Cronbach's α. Tavakol and Dennick (2011) explained that Cronbach's α is "a measure of the internal consistency of a test or scale" (p. 53). Furthermore, Tavakol and Dennick (2011) define internal consistency as "the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test" (p. 53). This is important because Cronbach's α shows that the data within the survey is internally consistent with the study that it is being applied.

Within the survey, attributes related to effectiveness were measured by asking participants to express their agreement on two questions—whether the action reduces the respondent's risk of getting infected with the virus by other people with a 5-point Likert scale from 1 = completely disagree to 5 = completely agree. This yielded a measure with high internal consistency reliability (*Cronbach's* α = .95). An expense-related attribute was directly measured by asking participants' agreement on whether the costs were affordable using the same 5-point Likert response scale. Convenience-related attributes were measured by asking whether the participants agreed that wearing a face mask would cause a feeling of discomfort or cause issues with breathing using the same 5-point Likert scale. This yielded a measure with high internal consistency reliability (*Cronbach's* α = .88). Finally, social-influence-related attributes were measured by examining participants' concerns of stress from a mask mandate, concerns of being discriminated against, and their peers' perception of their actions using the same response scale. The measure also reached a high internal reliability (*Cronbach's* α = .89). The results of a follow-up factor analysis suggested the classification of the four attributes into two categories by grouping effectiveness and social-influence-related attributes as facilitators and grouping expense-related and convenience-related attributes as inhibiting.

Perceived Exposure

Survey participants' perceived exposure was calculated by averaging the differences between the likelihood of being infected if wearing and not wearing a face mask. This was calculated in terms of eight behaviors: walking with social distancing larger than one meter, chatting with a suspected patient for more than five minutes with at least one-meter social distancing, having a meal at the same table for longer than five minutes, hugging a suspected patient, ordering a take-away from the restaurant where a suspected patient works, watching the

same movie with a suspected patient in the cinema, waiting in the same section of the hospital with a suspected patient; and taking the same flight with a suspected patient). Participants were asked to rate the infection likelihoods of those eight behaviors without wearing a face mask and then with mask-wearing. The likelihood was measured by a 5-point Likert scale from 1 = extremely unlikely to 5 = extremely likely. The differences were counted by the infection likelihoods of each behavior in wearing a mask minus the likelihoods in the condition without mask-wearing. The internal reliability of the measure of perceived exposure yielded a high-level result (*Cronbach's* α = .92).

Expected Consequences

The survey participants' expected consequences from contracting COVID-19 were measured by asking participants to report their expectations regarding the probability that a patient would be admitted to an intensive care unit using five different age ranges: 20 years old or younger, 21 to 40 years old, 41 to 60 years old, 61 to 80 years old, and older than 80 years old. Survey participants were asked to rate the expected consequences based on a 5-point Likert scale from 1 = extremely unlikely to 5 = extremely likely, matching the probability with participants' self-reported age.

Emotions

Related to the influence of emotions on the protective action assessment, the survey respondent's emotions which influence their protective action assessment was determined by assessing the respondent's feelings about the lockdown in Wuhan, China using nine different emotions: optimistic, frustrated, angry, energetic, nervous, annoyed, alert, fearful, and anxious. Survey participants were asked to rate their emotions based on a 5-point Likert scale from 1 = extremely unlikely to 5 = extremely likely. After the survey, those nine items were entered into a

factor analysis that recommends a three-factor solution: *positive emotions* formed by grouping Optimistic and Energetic (*Cronbach's* α = .73); *negative emotions* formed by grouping Frustrated, Angry, Nervous, Annoyed, Fearful, and Anxious (*Cronbach's* α = .94); and the *alert emotion*, which remained as an independent factor.

Social Cues

The survey respondent's observation of social cues which influence their protective action assessment was determined by assessing the respondent's response to what approximate percentage of people they saw wearing masks on the street in the week preceding the survey with a 100% scale divided into ten evenly divided percentage (by tenths) ranges from 0% to 100%.

Information Sources

Participants were asked to assess information sources based upon three criteria: the knowledge of COVID-19 prevention and control information, the level of difficulty in obtaining the knowledge of COVID-19 prevention and control information, and the speed of information release and update. Survey participants were asked to apply these assessment criteria to the following nine sources/channels:

- Authorities (including public health experts, district, county, and town government officials, provincial officials, and country officials);
- Traditional mass media (including television, radio, and newspaper);
- Online news media (including online newspapers, headlines, and internet searches);
- Social media (including Weibo, official accounts, and TikTok);
- Community organizations (to include village committees, neighborhood committee, and community property management offices); and

- Relatives
- Friends
- Neighbors, and
- Peers.

Survey participants were asked to rate the three criteria based on a 5-point Likert scale from 1 = extremely unlikely to 5 = extremely likely. A follow-up factor analysis recommended a three-factor solution assigning nine items into three categories - *Authorities, Public Intermediates, and Peers*. *Authorities* was formed by combining all authorities (including public health experts; district, county, and town governments; province and city governments; and national governments) with a moderate-high level of reliability (Cronbach's α = .87). *Public Intermediates* was formed by combining Traditional mass media, Online news media, and Social media, yielding an acceptable level of internal reliability (Cronbach's α = .79). Lastly, *Peers*, was constructed from Community organizations, Relatives, Friends, Neighbors, and Peers, had an acceptable level of internal reliability (Cronbach's α = .71).

Receiver Characteristics

Related to the receiver characteristics which influence the protective action assessment, the survey respondent's characteristics were determined by assessing age, gender, marital status, household size, and the highest level of education. Survey participants were asked to self-report their age using a ratio measure. The survey participants were also asked their gender (0 = male, 1 = female). Participants were asked their marital status (0 = married, 1 = not married [single, divorced, or widowed]. Home ownership was determined by asking survey participants if they owned, rented, or built their homes themselves (0 = own, 1 = rent, 2 = self-built). Household size was determined through self-reporting with a ratio measure within the following age ranges:

under 18, 18-60, or over 60 years old. Participants were also asked to provide their highest level of education status with 6 = Junior High School or less, 12 = High School/Technical secondary school, 14 = College/vocational school, 16 = Undergraduate, or 18 = Graduate school. Participants were asked to self-report if their household income was within one of the following ranges: less than $30,000, $30,000 to $80,000, $80,000 to $150,000, $150,000 to $300,000, and more than $300,000.

Analysis

All the data from the selected questions were imported into an IBM SPSS (Statistical Product and Service Solutions) database for statistical analysis. The primary dependent variable was the protective action assessment related to wearing a mask during the COVID-19 pandemic. The independent variables were perceived exposure, expected consequences, emotions, social cues, information sources, and receiver characteristics (includes all the variables included in the abbreviated protective action decision-making model).

Descriptive Statistics

The study's research question was analyzed using descriptive statistics and analysis of variance (ANOVA). This analysis intends to determine what influence demographic variables have on the decision-making process of wearing a mask during the COVID-19 pandemic and to determine how rural residents in China assess the protective action of mask-wearing during the COVID-19 pandemic in terms of concerns related to effectiveness, social impression, expense, and life convenience.

Correlation Analysis

The study's first research hypothesis was analyzed using correlation analysis. The purpose of applying correlation analysis was to determine if, as predicted through the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012), risk perception variables (for example, perceived exposure and expected consequences), emotional variables, and information sources and social cues (including traditional and social media) results in significant correlation with each of the protective action assessments.

Regression Analysis

The study's second research hypothesis was analyzed using regression analysis. The purpose of applying regression analysis was to determine if, when all the variables are controlled for regression of the protective action assessments, only the risk perception variables receive the significant regression coefficients.

Results

Significance Level

In the data analysis for this study, 307 statistical tests were conducted, resulting in an additional concern of the experiment-wide error rate. Specifically, the number of false-positive tests, defined as FP = α x *n*, where FP represents the number of false-positive test results, α is the Type I error rate, and *n* is the number of statistical tests. For this study, with α = .05 and n = 307, then FP = 15. Related to setting the significance level, Benjamini and Hochberg (1995) recommend that researchers 1) specify a false discovery rate (or *d*) for the entire study, 2) sort the p_i significance values for the individual tests in ascending order where $1 \leq i \leq n$, and 3) classify each $p_i \leq d$ x i/n as statistically significant. For this study, the exact critical value of p_i = .022 was rounded down to $p = .01$, and only p values less than $p<.01$ will be classified as statistically significant.

Description Statistics of the Variables

Independent Variables

There were 55 items included in the existing Ya'an survey data set used in the analysis for this study. Of these 55 items, 47 were used to create 16 independent variables divided into four general categories. These four categories included *risk perceptions*, *emotion-related variables*, *information source*, and *receiver characteristics* (demographics).

The first category of independent variables was the risk perception variables. This included the expected consequence from contracting the disease (identified as *Exp_Consequence*). The second variable within this category included the aggregated risk exposure variables, which were identified as AdjRiskExpo. Within the conceptual framework, *adjusted risk exposure* is identified as Perceived Exposure. The average score for *expected*

consequences was 3.59 (*M* = 3.59, *SD* = .97), while the average score for the aggregated *adjusted risk exposure* was .73 ($\overline{M}$ = .73, $\overline{SD}$ = .83) with a range between -2.5 to 4.

The second category of independent variables included emotion-related variables. These variables included, with their corresponding data identifiers, the aggregated independent variable *positive emotions* (*Emo_Pos*) included the following independent variables: *optimistic* and *energetic*. The aggregated independent variable *negative emotions* (*Emo_Neg*) included the following emotions: *fearful, frustrated, nervous, annoyed, angry*, and *anxious*. The remaining emotion-related item - *alert emotion* (*Emo_Alert*), remained independent as related to the recommendation of the factor analysis results.

As shown in Table 1 and Figure 4 below, the ratings (between a low rating of 1 and a high rating of 5) of each emotion-related item are displayed. The *alert emotion* had the highest rating, with an average score of 3.17 ($\overline{M}$ *= 3.17,* $\overline{SD}$ *= 1.21*) which was followed by the two *positive emotion*s items with an average mean of 2.98 ($\overline{M}$ = 2.98, $\overline{SD}$ = 1.18). The *negative emotions* received a much lower average mean of 2.56 ($\overline{M} = 2.56, \overline{SD} = 1.25$).

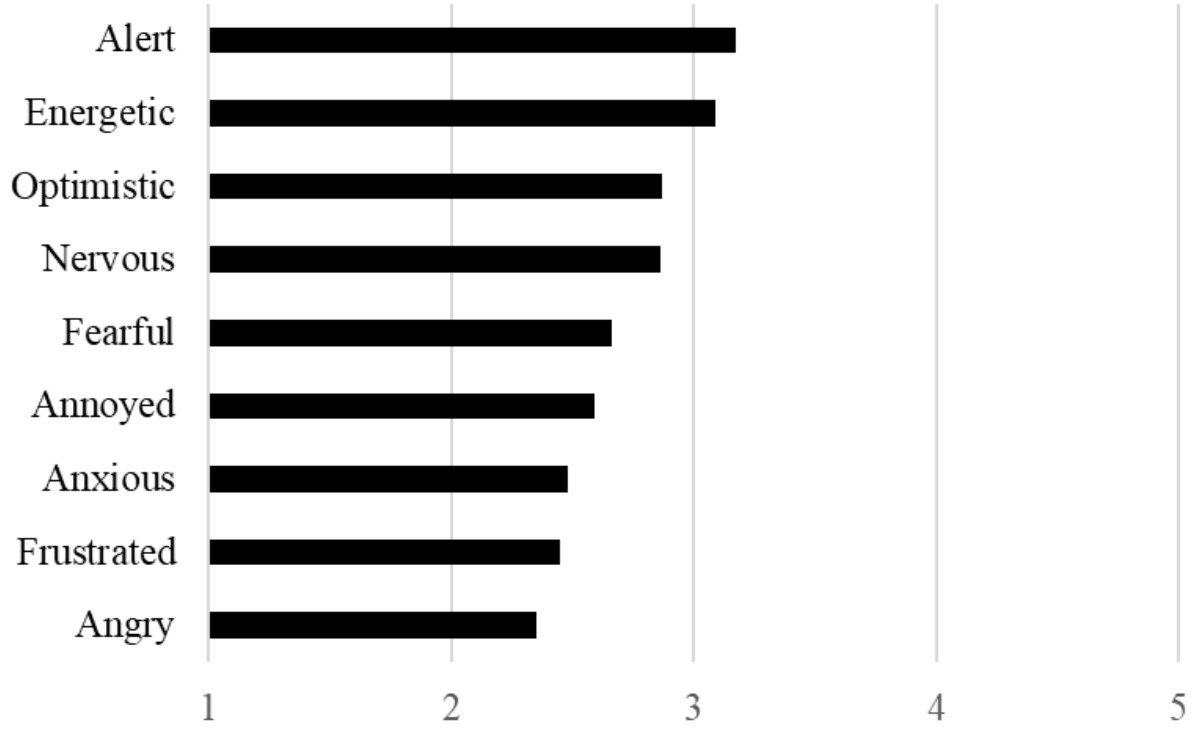
Table 1.

Emotions Experienced by Survey Participants during the Wuhan Lockdown.

Emotions	Mean	Standard Deviation
Alert	3.17	1.21
Energetic	3.09	1.12
Optimistic	2.87	1.24
Nervous	2.86	1.23
Fearful	2.66	1.28
Annoyed	2.59	1.22
Anxious	2.48	1.25
Frustrated	2.45	1.22
Angry	2.35	1.27

Figure 4.

Emotions Experienced by Survey Participants during the Wuhan Lockdown.



The third category of independent variables included the information source independent variables that were aggregated through factor analysis. This category includes *information from authorities* (*Info_Authorities*), *information from public intermediaries* (*Info_Pubmedia*), and *information from peers* (*Info_Peer*). Information sources used by the participants during the pandemic were measured based on three criteria: the knowledge of COVID-19 and prevention and control information, the level of difficulty in obtaining the knowledge of COVID-19, and prevention and control information, and the speed of information release and update. After applying factor analysis to the results, three categories were created: *information from authorities* combined public health experts; district, county, and town governments; province and city governments; and national governments as information sources; i*nformation from public intermediates* was created by combining traditional mass media, online news media, and social

media as sources of information. Lastly, *information from peers* was created by including community organizations, relatives and friends, neighbors, and peers as sources of information. As shown in Table 2 and Figure 5, the highest average reported (on a scale of 1 to 5) was *information from public intermediaries* at 3.86 ($\overline{M}$ *= 3.86,* $\overline{SD}$ *= 1.00*), while *information from authorities* was reported at 3.83 ($\overline{M}$ *= 3.83,* $\overline{SD}$ *= .90*). The lowest average reported for *information from peers* was 3.79 ($\overline{M}$ *= 3.79,* $\overline{SD}$ *= .93*).

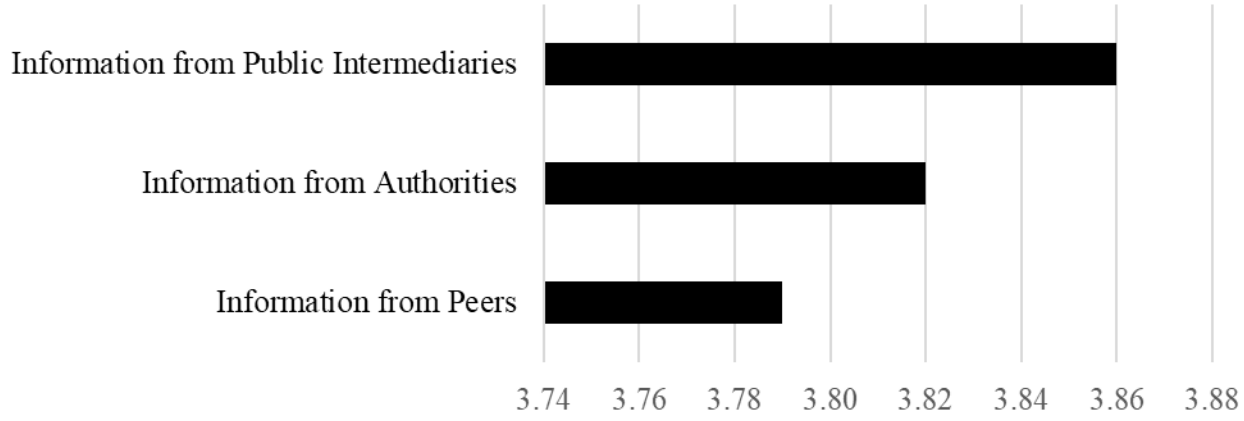
Table 2.

Information Sources Used by Survey Participants.

Information Sources	Mean	Standard Deviation
Information from Peers	3.79	.93
Information from Authorities	3.82	.90
Information from Public Intermediaries	3.86	1.00

Figure 5.

Information Sources Used by Survey Participants.



Lastly, social cues observed by participants were measured on the survey by determining what approximate percentage of people the participants saw wearing masks on the street in the week preceding the survey with a 100% scale divided into ten evenly divided percentage ranges

from 0% to 100% (see Table 3). The highest percentage reported was 35.2%, who reported seeing 10% of other people wearing masks. Observations by the survey participants of seeing less than 40% of other people wearing masks accounted for 71.2% of the observations. Significantly, almost half (48.8%) of the survey participants reported seeing less than 10% of others wearing a mask.

Table 3.

Percentage of People Seen Wearing Masks in the Week Preceding Survey Collection.

% (by range) of People Seen Wearing a Mask	Percent Observed
0	13.6
10	35.2
20	12.2
30	10.2
40	3.7
50	7.3
60	3.9
70	4.3
80	3.5
90	4.1
100	2.2

The fifth and last category included the receiver characteristic independent variables. The last grouping of questions on the survey pertained to the demographics of the participants and their households. Table 4 summarizes the demographic characteristics of the 492 survey participants. The demographic variables included both participant and household characteristics. Participant characteristics included age (identified as *Age*), gender (*Gender*), marital status (identified in the dataset as *Marital Status* and including whether the survey participant was

married or not married [including single, divorced, and widowed]), and educational level (*Edu_Yrs*, which included junior high school or less through graduate school). Household characteristics included household size (*HH_Status*, which included the number of household occupants within the following age ranges: under 18, 18-60, and over 60 years old) and home ownership (*Home_Ownership*), which was determined by asking survey participants if they owned their home, rented their home, or if they built their home themselves (0 = own, 1 = rent, 2 = self-built), and household income (*Income*) ranging from less than $30,000 through over $300,000.

Table 4.

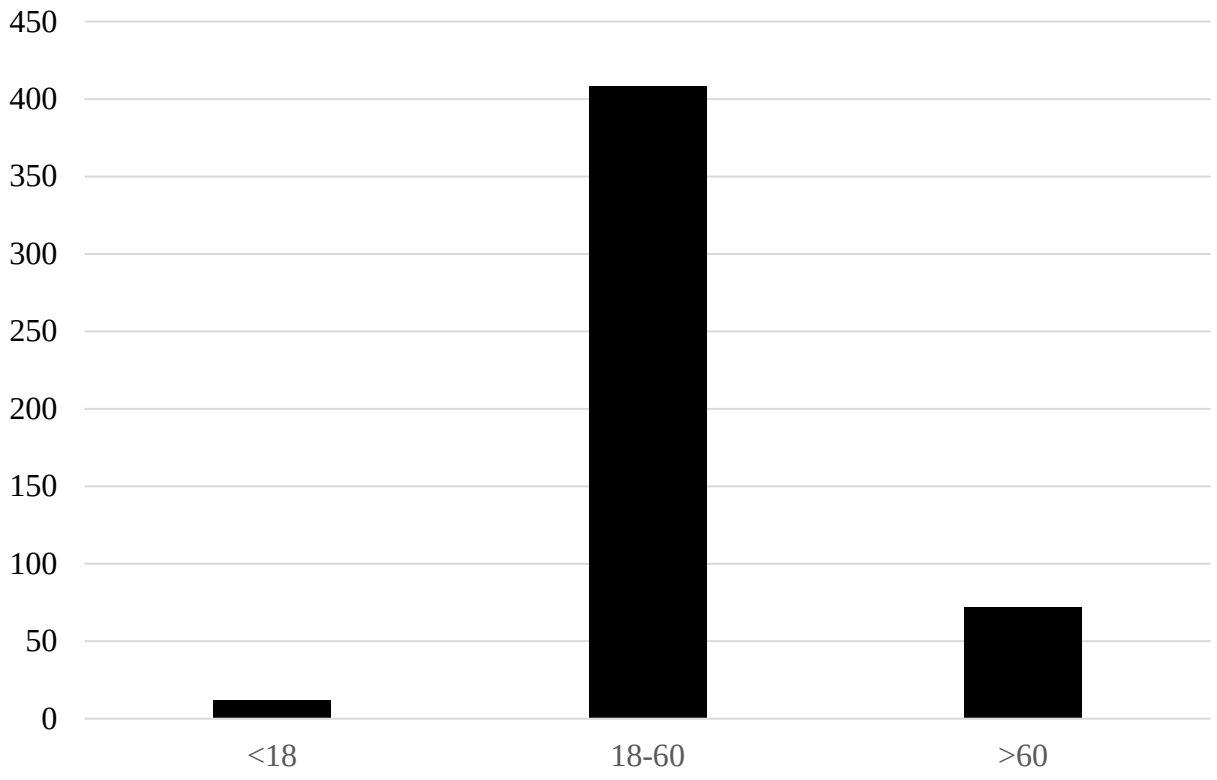
Survey Participants' Demographics Descriptive Statistics.

		N	*%*	*M*	*SD*
Age				44.18	15.76
	<18 y/o	12	2.4		
	18-60	408	82.9		
	>60 y/o	72	14.6		
Gender					
	Male	217	44.1		
	Female	275	55.9		
Marital Status					
	Married	396	80.5		
	Not Married	96	19.5		
Education				11.6	2.67
	Junior HS	221	44.9		
	High School	115	23.4		
	Vocational	81	16.5		
	Undergraduate	72	14.6		
	Graduate	3	0.6		
Home Ownership					
	Self-built	339	68.9		
	Own	131	26.6		
	Rent	22	4.5		
Household Size				5.55	2.31
Household Income				$67,113	56,142
	<$30,000	0	0		
	$30,000-$80,000	372	77.6		
	$80,000-$150,000	74	15		
	$150,000-$300,000	36	39.1		
	>$300,000	0	0		

All the participants answered all survey questions, and there was no missing data. Participants were asked to self-report their age using a ratio measure. As calculated using the SPSS statistical software, the average age of the participants was 44.18 years old (*M = 44.18, SD = 15.76*). Within age groupings included in the survey, Figure 6 shows that 12 participants were younger than 18 years old, 408 participants were between 18 and 60 years old, and 72 were older than 60 years old.

Figure 6.

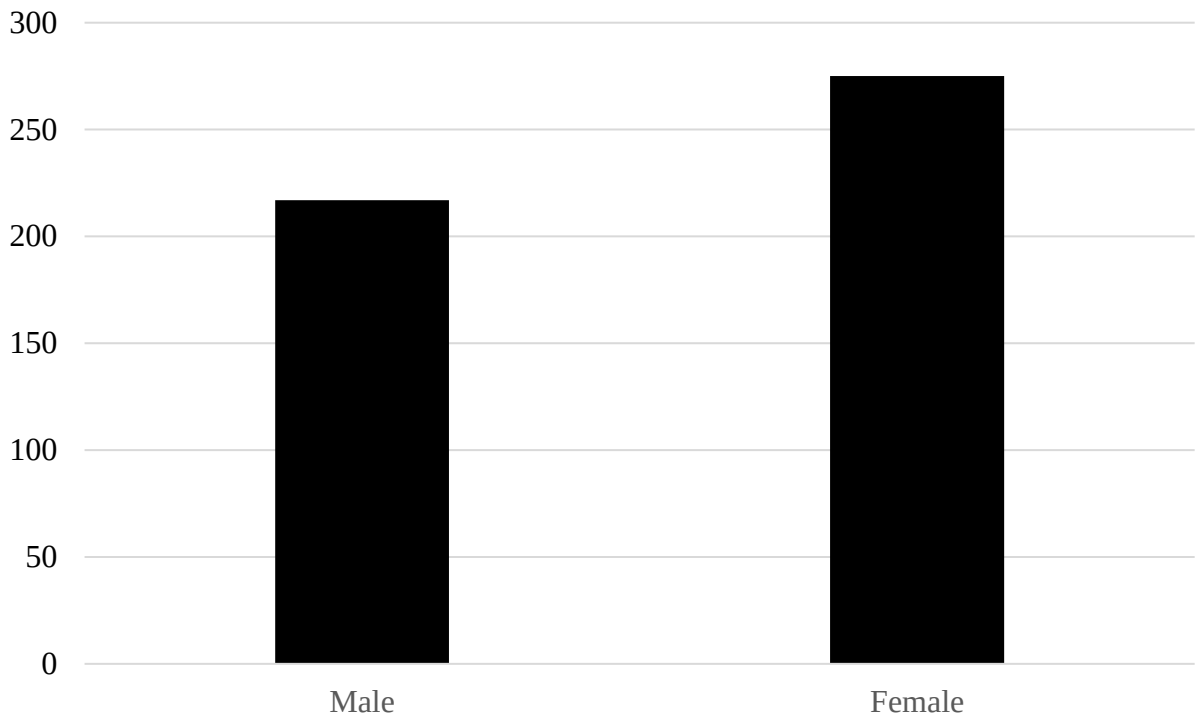
Distribution by the Age of Survey Participants.



As shown in Figure 7, 217 (or 44.1%) reported as male, and 275 (or 55.9%) reported as female.

Figure 7.

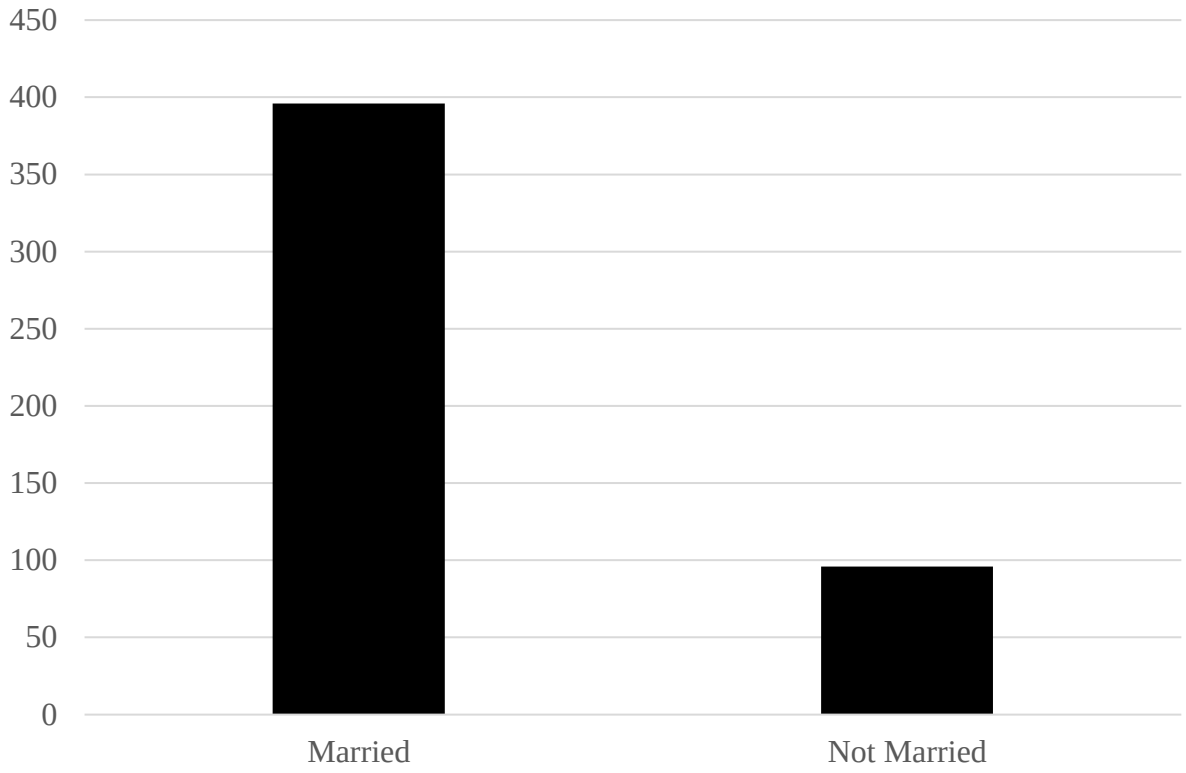
Distribution by Gender of Survey Participants.



Related to marital status, Figure 8 displays that 396 (or 80.5%) of the participants reported that they were married, and 96 (or 19.5%) reported that they were unmarried (either single, divorced, or widowed).

Figure 8.

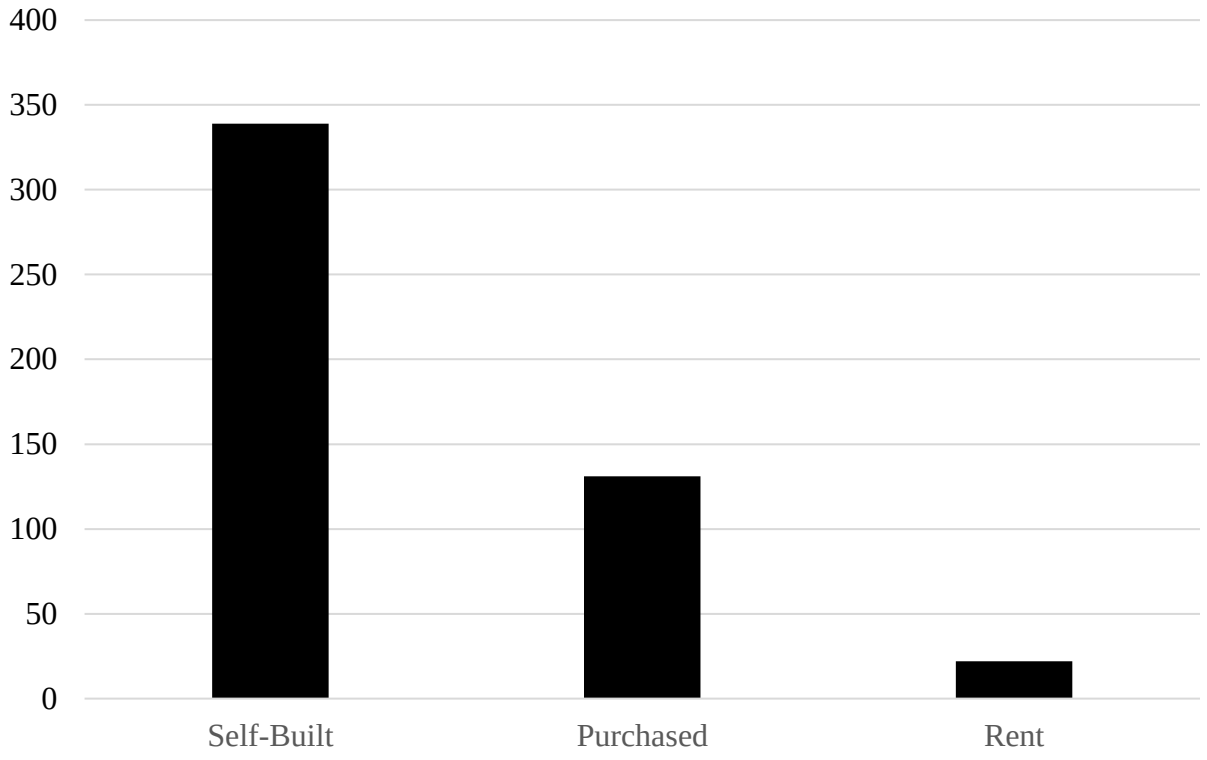
Distribution of Marital Status of Survey Participants.



Related to home ownership, 339 (or 68.9%) of the participants reported that their homes were self-built, 131 participants (or 26.6%) reported that they owned their own home, and 22 participants (or 4.5%) reported that they rented their home (Figure 9). The mean *household size* was 5.55 (*M = 5.55, SD = 2.31*). The range of the household sizes was 1 to 19 people.

Figure 9.

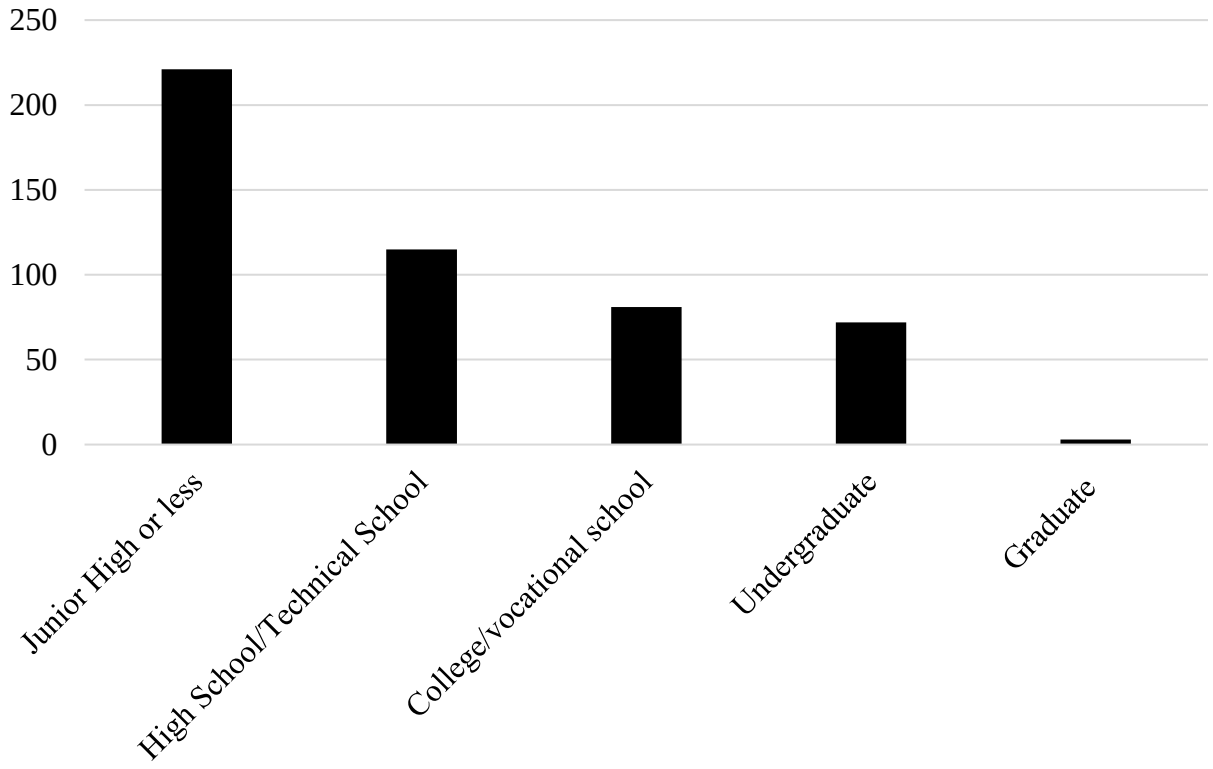
Distribution of Home Ownership by Survey Participants.



Related to the respondent's highest level of education, the average level of education of the survey participants, as calculated using the SPSS statistical software, was 11.60 years of education (*M = 11.60, SD = 2.67*). 221 (or 44.9%) of the participants had a junior high school or less as their highest level of education. In comparison, 115 (or 23.4%) of the participants had a high school or technical secondary school as their highest level of education, for a total of 68.3% of the participants. 81 (or 16.5%) of the participants reported their highest level of education as being a college or vocational school. An undergraduate level of education was reported by 72 (or 14.6%) of the participants, while 3 (or .6%) of the participants reported graduate school as their highest level of education (see Figure 10).

Figure 10.

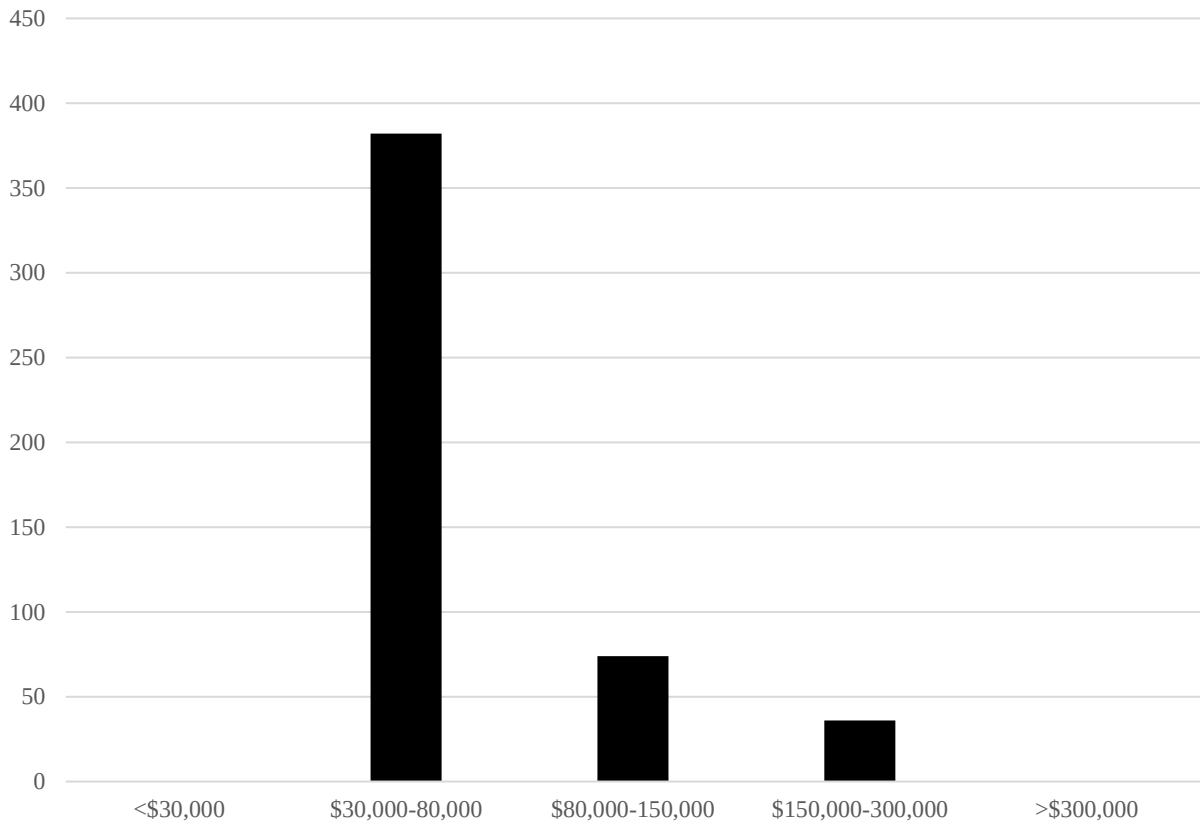
Distribution of Educational Level of Survey Participants.



Related specifically to household income, the average household income of the survey participants, as calculated by the SPSS statistical software, was $67,113 (*M = 67,113, SD = 56,142*). No participants reported an income of less than $30,000 or more than $300,000. 382 (or 77.6%) participants reported an income of $30,000 to $80,000, 74 (or 15%) participants reported an income of $80,000 to $150,000, and 36 (or 39.1%) participants reported an income of $150,000 to $300,000 (see Figure 11).

Figure 11.

Distribution of Household Income by Survey Participants.



Dependent Variable

The dependent variable(s) related to this study were measured within the survey participants by evaluating the assessment about the participants' perceptions of mask-wearing as a protective action against both the SARS-CoV-2 virus and the COVID-19 pandemic in terms of eight considerations. The eight protective action assessment items were classified into four categories: effectiveness-related attributes (including *reducing contracting the disease* and *spreading the virus*), social-influence-related attributes (*whether the wearer was mandated to wear a mask, the positive social influence of wearing a mask,* and *support from peers for wearing a mask*), expense-related attribute (*the cost of wearing a mask*), and convenience-related attributes (*the discomfort of wearing a mask* and *difficulty breathing while wearing a mask*).

The mean and standard deviation of the eight questions related to wearing a mask was calculated, and the results are included in Table 11 and Figure 12. Questions related to effectiveness-related attributes and two-thirds of the social-influence-related attributes had the highest means; the effectiveness of reducing the probability of contracting the disease was 4.50 (*M = 4.50, SD = .69*), the effectiveness of reducing the probability of spreading the disease was 4.49 (*M = 4.49, SD = .69*), the attribute of the positive support from peers with a mean of 4.24 (*M = 4.24, SD = .96*), and the positive social influence of wearing a mask with a mean of 3.65 (*M = 3.65, SD = 1.40*). The other third of the social-influence-related attributes, namely the mandate to wear the mask, the expense-related attribute, and the convenience-related attributes, all had lower means; the mandate to wear a mask had a mean of 3.17 (*M = 3.17, SD = 1.39*), the cost of wearing a mask had a mean of 2.95 (*M = 2.95, SD = 1.33*). In contrast, the convenience-related attributes, the discomfort of wearing the mask, and difficulty breathing while wearing the mask had means of 3.10 and 2.67, respectively (*M = 3.10, SD = 1.25*), (*M = 2.67, SD = 1.32*).

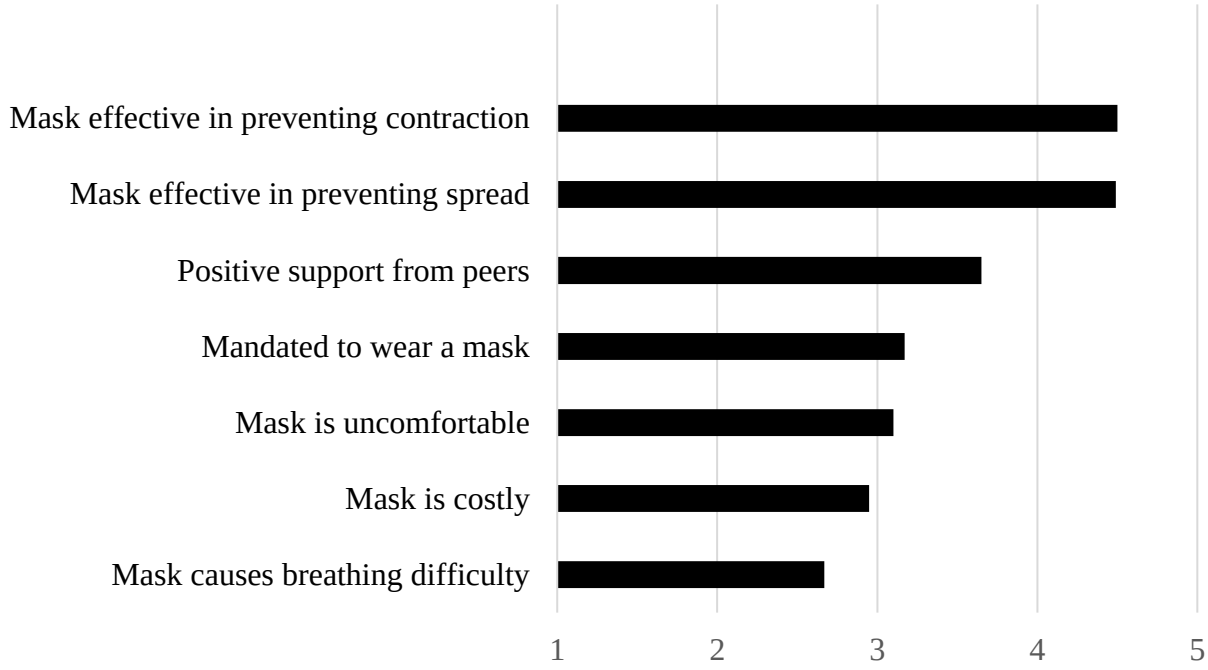
Table 5.

Ratings of Protective Action Assessment Attribute by Survey Participants.

Mask Perceptions	Mean	Standard Deviation
Mask causes breathing difficulty	2.67	1.32
Mask is costly	2.95	1.33
Mask is uncomfortable	3.10	1.25
Mandated to wear a mask	3.17	1.39
Positive support from peers	3.65	0.96
Mask effective in preventing spread	4.49	0.69
Mask effective in preventing contraction	4.50	0.69

Figure 12.

Ratings of Protective Action Assessment Attribute by Survey Participants.



Though not explicitly included in the hypothesis, ANOVAs and follow-up t-tests were conducted within this study to determine whether differences existed between either of the protective action assessment items and amongst the four attribute categories. The results of the analysis of variance concluded that the eight items are statistically different from each other ($F_{8,484}$ = 6034.36, p < .001), as well as the results among the four categories ($F_{4,488}$ = 9143.46, p < .001). The results of the t-tests revealed in Table 12 showed that survey participants differed in their concerns not only between attribute categories but also within attribute categories. The only two exceptions were the ratings between *mask effective in preventing contraction* and *mask effective in preventing spread* (t = 0.48, *ns.*) and between *mandated to wear the mask* and *discomfort of wearing a mask* (t = 1.30, *ns.*). A follow-up factor analysis suggested combining effectiveness-related and social-influence-related attributes into a new variable, namely

facilitating attributes (average loading coefficients = .78 after rotation) and combining expense-related and convenience-related attributes into another new variable, namely *inhibiting attributes* (average loading coefficients = .92 after rotated) was appropriate.

Table 6.

Paired t-Test Between Protective Action Assessment Items.

		95% Confidence Interval of the Difference		t	Sig. (2-tailed)
		Lower	*Upper*		
Pair 1	Q7a_infect - Q7b_spread	-.020	.032	.457	.648
Pair 2	Q7a_infect - Q7c_expense	1.416	1.673	23.656	.000
Pair 3	Q7a_infect - Q7d_uncomfortable	1.274	1.523	22.114	.000
Pair 4	Q7a_infect - Q7e_breathing	1.695	1.951	27.981	.000
Pair 5	Q7a_infect - Q7f_mandate	1.188	1.454	19.532	.000
Pair 6	Q7a_infect - Q7g_social_influence	2.014	2.282	31.493	.000
Pair 7	Q7a_infect - Q7h_support	.168	.336	5.874	.000
Pair 8	Q7b_spread - Q7c_expense	1.409	1.668	23.357	.000
Pair 9	Q7b_spread - Q7d_uncomfortable	1.268	1.517	21.980	.000
Pair 10	Q7b_spread - Q7e_breathing	1.689	1.945	27.943	.000
Pair 11	Q7b_spread - Q7f_mandate	1.184	1.447	19.648	.000
Pair 12	Q7b_spread - Q7g_social_influence	2.008	2.276	31.434	.000
Pair 13	Q7b_spread - Q7h_support	.163	.329	5.794	.000
Pair 14	Q7c_expense - Q7d_uncomfortable	-.241	-.051	-3.030	.003
Pair 15	Q7c_expense - Q7e_breathing	.183	.374	5.748	.000
Pair 16	Q7c_expense - Q7f_mandate	-.349	-.099	-3.515	.000
Pair 17	Q7c_expense - Q7g_social_influence	.501	.706	11.569	.000
Pair 18	Q7c_expense - Q7h_support	-1.428	-1.158	-18.819	.000
Pair 19	Q7d_uncomfortable - Q7e_breathing	.351	.499	11.319	.000
Pair 20	Q7d_uncomfortable - Q7f_mandate	-.194	.039	-1.304	.193
Pair 21	Q7d_uncomfortable - Q7g_social_influence	.647	.853	14.324	.000
Pair 22	Q7d_uncomfortable - Q7h_support	-1.271	-1.022	-18.058	.000
Pair 23	Q7e_breathing - Q7f_mandate	-.610	-.394	-9.114	.000
Pair 24	Q7e_breathing - Q7g_social_influence	.234	.416	7.023	.000
Pair 25	Q7e_breathing - Q7h_support	-1.703	-1.439	-23.363	.000
Pair 26	Q7f_mandate - Q7g_social_influence	.705	.949	13.330	.000
Pair 27	Q7f_mandate - Q7h_support	-1.205	-.934	-15.497	.000
Pair 28	Q7g_social_influence - Q7h_support	-2.039	-1.754	-26.116	.000

Correlation Analysis

Applying the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012), the first hypothesis predicted that risk perception variables, emotional variables, information sources, and social cues (including traditional and social media) would significantly correlate with each of the protective action assessments. Correlation analysis was conducted to test this

hypothesis by dividing variables into five categories: the dependent variable (protective action assessment), risk perceptions, emotional perceptions, sources of information, and receiver characteristics. The resulting correlation matrix is shown in Table 13.

Based upon the analysis, the first hypothesis is partially supported. The *facilitating protective action assessment* has significant correlation at a significance level of $p = <.01$ with only one of the risk perception variables (*expected consequences*; r = .17, $p = <.001$), one of the three emotional-related variables (*alert emotion*; $r = .13$, $p < .01$), and all three of the sources of information (*information from authority, public intermediate,* and *peers*; $r = .29$, .22, and .20, $p <$ .001, respectively). Conversely, *inhibiting protective action assessment* had significant correlations with both of the risk perception variables (*expected consequence*; $r = .12$, $p < .01$ and *perceived exposure*, $r = -.25$, $p < .001$), all of the three emotional-related variables (*positive, negative,* and *alert emotions*; $r = .14$, .36, .17, $p < .001$, respectively), two of the sources of information (*information from public intermediaries* and *peers*; $r = .12$ and .13, $p < .01$, respectively. No correlations were found between any of the receiver characteristics, social cues, and the protective action assessments.

Although not included in the hypothesis, Table 7 also reveals the inter-items correlations among independent variables. Surprisingly, the two risk perception variables are not significantly correlated ($r = -.04$, *ns.*). *Expected consequences* is significantly correlated with *alert emotions* ($r = .11$, $p <.01$), *information from authority* ($r = .13$, $p <.01$), *information from peers* ($r = .11$, $p <.01$), and *age* ($r = .16$, $p <.001$). *Perceived exposure* is significantly correlated with *negative emotion* ($r = -.28$, $p <.001$), *alert emotions* ($r = .16$, $p <.001$), *social cues* ($r = -.12$, $p <.01$), and *age* ($r = .18$, $p <.001$). As expected, three emotional related variables are highly correlated ($\bar{r} =$

.43, p <.001). Seven of twelve (58.3%) correlations between emotional related and information variables are significant, yielding an average correlation of $\bar{r}$ = .14 (p <.001).

On the other hand, only *positive emotions* were significantly correlated with some demographic variables, including *age* (r = -.17, p <.001), *gender* (r = -.13, p <.01), *education* (r = .24, p <.001), *income* (r = .12, p <.01), and *marital status* (r = -.14, p <.001). The other two emotional variables generally receive nonsignificant correlations with demographic variables. Similarly, seven of the 24 (29%) correlations between sources of information and the receiver characteristic variables are significant yielding an average correlation of $\bar{r}$ = -.015 (p <.001). Only *information from public intermediaries* were significantly correlated with some receiver characteristic variables, including *age* (r = -.40, p <.001), *education* (r = .24, p <.001), *income* (r = .15, p <.001), while *social cues* were significantly correlated with some demographic variables, including *age* (r = -.29, p <.001), *education* (r = .24, p < .001), *income* (r = .121, p <.007), and *marital status* (r = -.167, p < .001).

Table 7.

Intercorrelation Between Independent and Dependent Variables.

		Facilitating Protective Action Assessment	Inhibiting Protective Action Assessment	Expected Consequences	Perceived Exposure	Emotions - Positive	Emotions - Negative	Emotion - Alert	Information from Authorities	Information from Public Intermediaries	Information from Peers	Social Cues	Age	Gender	Home Ownership	Education in Years	Income	Marital Status
Facilitating Protective Action Assessment	Pearson Correlation	1.000	.022	.170**	.048	.097*	.017	.126*	.291**	.215**	.204**	.043	-.028	.019	-.021	.082	.047	.001
	Sig. (2-tailed)		.622	.000	.292	.032	.711	.005	.000	.000	.000	.338	.539	.671	.646	.069	.295	.983
Inhibiting Protective Action Assessment	Pearson Correlation	.022	1.000	.118*	-.247**	.140*	.364**	.171**	.047	.119*	.132*	.111	-.034	-.050	.024	-.023	-.026	.000
	Sig. (2-tailed)	.622		.009	.000	.002	.000	.000	.297	.008	.003	.014	.446	.271	.600	.618	.558	.993
Expected Consequences	Pearson Correlation	.170**	.118*	1.000	-.036	.042	.075	.106	.131*	.045	.105	.044	.160**	-.077	.061	-.063	-.012	.080
	Sig. (2-tailed)	.000	.009		.420	.352	.096	.019	.004	.315	0.019	0.325	0	0.087	0.176	.166	.795	.078
Perceived Exposure	Pearson Correlation	.048	-.247**	-.036	1.000	-.092*	-.283**	-.160**	.041	-.037	0.004	-0.118*	.178**	.105*	-0.032	-.093*	-.092*	.067
	Sig. (2-tailed)	.292	.000	.420		.042	.000	.000	.367	.415	0.925	0.009	0	0.02	0.476	.040	.042	.135
Emotions - Positive	Pearson Correlation	.097	.140*	.042	-.092	1.000	.309**	.347**	.230**	.228**	.148**	.182**	-.166**	-.129*	0.023	.236**	.122*	-.142*
	Sig. (2-tailed)	.032	.002	.352	.042		.000	.000	.000	.000	0.001	0	0	0.004	0.618	.000	.007	.002
Emotions - Negative	Pearson Correlation	.017	.364**	.075	-.283**	.309**	1.000	.640**	.059	.059	.091*	.102*	-.108	0.012	0.078	.068	.010	-.040
	Sig. (2-tailed)	.711	.000	.096	.000	.000		.000	.191	.189	.045	.023	.017	.783	.084	.130	.833	.382
Emotion - Alert	Pearson Correlation	.126*	.171**	.106	-.160**	.347**	.640**	1.000	.195**	.143**	.175**	.102*	-.102	-.098	.118**	.066	.061	-.060
	Sig. (2-tailed)	.005	.000	.019	.000	.000	.000		.000	.001	.000	.024	.024	.029	.009	.142	.178	.182
Information from Authorities	Pearson Correlation	.291**	.047	.131*	.041	.230**	.059	.195**	1.000	.555**	.681**	.109*	-.085	-.036	.015	.091*	.113*	.033
	Sig. (2-tailed)	.000	.297	.004	.367	.000	.191	.000		.000	.000	.016	.061	.419	.734	.043	.012	.461
Information from Public Intermediaries	Pearson Correlation	.215**	.119*	.045	-.037	.228**	.059	.143**	.555**	1.000	.531**	.213**	-.403**	-.010	.003	.237**	.153**	-.069
	Sig. (2-tailed)	.000	.008	.315	.415	.000	.189	.001	.000		.000	.000	.000	.831	.941	.000	.001	.127
Information from Peers	Pearson Correlation	.204**	.132*	.105	.004	.148**	.091*	.175**	.681**	.531**	1.000	.144**	-.036	.040	.071	.007	.041	.049
	Sig. (2-tailed)	.000	.003	.019	.925	.001	.045	.000	.000	.000		.001	.431	.377	.117	.875	.361	.277
Social Cues	Pearson Correlation	.043	.111	.044	.118	.182**	.102*	.102	.109*	.213**	.144**	1.000	-.292**	-.047	-.070	.243**	.121*	-.167**
	Sig. (2-tailed)	.338	.014	.325	.009	.000	.023	.024	.016	.000	.001		.000	.298	.120	.000	.007	.000
Age	Pearson Correlation	-.028	-.034	.160**	.178**	-.166**	-.108*	-.102	-.085	-.403**	-.036	-.292**	1.000	-.093	.045	-.498**	-.239**	.484**
	Sig. (2-tailed)	.539	.446	.000	.000	.000	.017	.024	.061	.000	.431	.000		.040	.321	.000	.000	.000
Gender	Pearson Correlation	.019	-.050	-.077	.105*	.129*	.012	-.098	-.036	-.010	.040	-.047	-.093	1.000	-.099*	-.025	-.018	.007
	Sig. (2-tailed)	.671	.271	.087	.020	.004	.783	.029	.419	.831	.377	.298	.040		.028	.586	.685	.880
Home Ownership	Pearson Correlation	-.021	.024	.061	-.032	.023	.078	.118*	.015	.003	.071	-.070	.045	-.099*	1.000	-.275**	-.301**	-.002
	Sig. (2-tailed)	.646	.600	.176	.476	.618	.084	.009	.734	.941	.117	.120	.321	.028		.000	.000	.957
Education in Years	Pearson Correlation	.082	-.023	-.063	-.093	.236**	.068	.066	.091	.237**	.007	.243**	-.498**	-.025	-.275**	1.000	.395**	-.243**
	Sig. (2-tailed)	.069	.618	.166	.040	.000	.130	.142	.043	.000	.875	.000	.000	.586	.000		.000	.000
Income	Pearson Correlation	.047	-.026	-.012	-.092	.122**	.010	.061	.113	.153**	.041	.121*	-.239**	-.018	-.301**	.395**	1.000	-.119*
	Sig. (2-tailed)	.295	.558	.795	.042	.007	.833	.178	.012	.001	.361	.007	.000	.685	.000	.000		.008
Marital Status	Pearson Correlation	.001	.000	.080	.067	-.142**	-.040	-.060	.033	-.069	.049	-.167**	.484**	.007	-.002	-.243**	-.119*	1.000
	Sig. (2-tailed)	.983	.993	.078	.135	.002	.382	.182	.461	.127	.277	.000	.000	.880	.957	.000	.008	

** Correlation is significant at the 0.001 level (2-tailed).
* Correlation is significant at the 0.01 level (2-tailed).

Note. *p <.01. **p <.001

Regression Analysis

Facilitating Protective Action Assessment

The data collected from the survey was analyzed for regression of the independent variables against the dependent variable, facilitating protective action assessment. The regression analysis demonstrated that the following independent variables were a significant predictor of the dependent variable, *facilitating protective action assessment*, at the .01 significance level (see Table 14). *Expected consequences* were a significant predictor of *facilitating protective action assessment* with a beta value of, $\beta = .13$ ($p < .01$). At the same time, *information from authorities* was a significant predictor of *facilitating protective action assessment* with a beta value of, $\beta = .27$ ($p < .001$). The *adjusted R Square* value for Model 1 was .10, and the *adjusted R square* value for Model 2 was .10.

Table 8.

Regression Analysis of the Facilitating Protective Action Assessment.

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	2.910	.228		12.784	.000	3.207	.112		28.595	.000
Age	.001	.002	.037	.648	.517					
Gender	.051	.044	.052	1.151	.250					
Home Ownership	-.012	.026	-.021	-.448	.655					
Education in Years	.013	.010	.071	1.298	.195					
Income	.000	.000	-.016	-.336	.737					
Information from Authorities	.115	.034	.215	3.388	.001	.147	.023	.274	6.335	.000
Information from Public Intermediaries	.042	.029	.088	1.459	.145					
Information from Peers	-.009	.033	-.017	-.264	.792					
Social Cues	.000	.001	-.008	-.169	.866					
Emotions - Positive	.005	.023	.010	.204	.839					
Emotions - Negative	-.035	.026	-.079	-1.339	.181					
Emotion - Alert	.048	.024	.121	2.058	.040					
Expected Consequences	.069	.022	.137	3.085	.002	.067	.022	.134	3.094	.002
Perceived Exposure	.021	.027	.037	.794	.428					
	F (14,477) = 4.781, p <.001					F (2,489) = 27.91, p <.001				
	$adjR^2$ = .097					$adjR^2$ = .099				

Note. *$p < .01$. **$p < .001$

[a] $F(14,447)=4.781$*** (adjusted $R^2 = .097$)

[b] $F(2,489)=27.91^{***}$ (adjusted $R^2 = .099$)

Inhibiting Protective Action Assessment

Education in years, information from public intermediaries, negative emotions, alert emotions, perceived exposure, and *expected consequences* had been selected as predictors of *inhibiting protective action assessment* (see Table 15). Of the predictors, the effects of education in years with a beta value of β = -.08 (ns.), information from public intermediaries with a beta value of β = .12 (ns.), the alert emotion with a beta value of β = -.13 (ns.) and expected consequences with a beta value of β = .09 (ns.) were not significant. Additionally, *negative emotions* were a predictor of *inhibiting protective action assessment* with a beta value of, β = .40 ($p < .001$), Perceived exposure was a significant predictor of *inhibiting protective action assessment* with a beta value of, β = -.16 ($p < .001$). The *adjusted R Square* value for Model 1 was .18, and the *adjusted R square* value for Model 2 was .18.

Table 9.

Regression Analysis of the Inhibiting Protective Action Assessment.

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	1.912	.522		3.665	.000	1.868	.338		5.529	.000
Age	.001	.004	.019	.342	.732					
Gender	-.117	.101	-.050	-1.163	.246					
Home Ownership	-.056	.059	-.042	-.941	.347					
Education in Years	-.034	.023	-.079	-1.506	.133	-.035	.019	-.079	-1.863	.063
Income	.000	.000	-.035	-.750	.453					
Information from Authorities	-.123	.078	-.096	-1.583	.114					
Information from Public Intermediaries	.126	.067	.109	1.900	.058	.142	.049	.122	2.871	.004
Information from Peers	.143	.075	.114	1.911	.057					
Social Cues	.002	.002	.050	1.143	.254					
Emotions - Positive	.047	.052	.042	.910	.363					
Emotions - Negative	.406	.060	.383	6.815	.000	.415	.058	.391	7.117	.000
Emotion - Alert	-.129	.054	-.134	-2.386	.017	-.121	.052	-.125	-2.324	.021
Perceived Exposure	-.211	.062	-.150	-3.410	.001	-.219	.060	-.156	-3.643	.000
Expected Consequences	.096	.051	.080	1.876	.061	.103	.050	.085	2.066	.039
	F (14,477) = 8.59, p <.001					F (6,485) = 18.44, p <.001				
	$adjR^2$ = .178					$adjR^2$ = .176				

Note. *$p < .01$. **$p < .001$

[a] $F(14,447)=8.59^{***}$ (adjusted $R^2 = .178$)

[b] $F(6,485)=18.44^{***}$ (adjusted $R^2 = .176$)

Expected Consequences

Social cues, *age*, *information from authorities*, and the *alert emotion* had been selected as predictors of *expected consequences* (see Table 16). Of the predictors, the effects of s*ocial cues* with a beta value of, $\beta = .08$ (ns.) and the *alert emotion* with a beta value of , $\beta = .10$ (ns.) were not significant. Additionally, *information from authorities* was a predictor of *expected consequences* with a beta value of, $\beta = .12$ ($p < .01$), and the survey participant's *age* was a significant predictor of *expected consequences* with a beta value of, $\beta = .20$ ($p < .001$). The *adjusted R Square* value for Model 1 was .05, and the *adjusted R square* value for Model 2 was .06.

Table 10.

Regression Analysis of Expected Consequences.

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	1.980	.457		4.328	.000	2.223	.253		8.802	.000
Age	.014	.004	.234	4.041	.000	.013	.003	.204	4.431	.000
Gender	-.063	.090	-.033	-.704	.482					
Home Ownership	.054	.053	.049	1.018	.309					
Education in Years	.004	.020	.011	.189	.850					
Income	.000	.000	.018	.364	.716					
Information from Authorities	.115	.069	.108	1.660	.098	.130	.048	.121	2.696	.007
Information from Public Intermediaries	.054	.059	.057	.916	.360					
Information from Peers	-.016	.067	-.015	-.235	.814					
Social Cues	.003	.002	.076	1.598	.111	.003	.002	.081	1.759	.079
Emotions - Positive	-.013	.046	-.014	-.279	.780					
Emotions - Negative	.027	.053	.031	.515	.607					
Emotions - Alert	.050	.048	.062	1.035	.301	.076	.036	.095	2.111	.035
Perceived Exposure	-.054	.055	-.046	-.977	.329					
	F (13,478) = 2.8, p <.001					F (4,487) = 8.1, p <.001				
	$adjR^2$ = .045					$adjR^2$ = .055				

Note. *$p < .01$. **$p < .001$

[a] $F(13,448)=2.8^{***}$ (adjusted $R^2 = .045$)

[b] $F(4,487)=8.1^{***}$ (adjusted $R^2 = .055$)

Perceived Exposure

Age and *gender* were significant predictors, and *negative emotions* were a significant negative predictor of *perceived exposure* (see Table 17). The survey participant's *age* was a significant predictor of *perceived exposure* with a beta value of, $\beta = .17$ ($p < .001$), while *gender* was a significant predictor of *perceived exposure* with a beta value of, $\beta = .13$ ($p < .01$). *Negative emotions* were a significant negative predictor of *perceived exposure* with a beta value of, $\beta = -.27$ ($p < .001$). The *adjusted R Square* value for Model 1 was .11, and the *adjusted R square* value for Model 2 was .12.

Table 11.

Regression Analysis of Perceived Exposure

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	.489	.378		1.293	.197	.482	.215		2.236	.026
Age	.009	.003	.163	2.949	.003	.009	.002	.167	3.879	.000
Gender	.219	.074	.131	2.964	.003	.211	.071	.127	2.966	.003
Home Ownership	-.027	.044	-.028	-.604	.546					
Education in Years	.008	.017	.026	.473	.637					
Income	.000	.000	-.078	-1.632	.103					
Information from Authorities	.081	.057	.089	1.416	.157	.069	.039	.075	1.768	.078
Information from Public Intermediaries	.021	.049	.025	.427	.670					
Information from Peers	-.037	.055	-.042	-.675	.500					
Social Cues	-.002	.001	-.050	-1.086	.278					
Emotions - Positive	.016	.038	.020	.419	.676					
Emotions - Negative	-.231	.043	-.306	-5.391	.000	-.205	.032	-.271	-6.342	.000
Emotions - Alert	.038	.040	.056	.961	.337					
	F (12, 479) = 6.11, p <.001					F (4,487) = 17.05, p <.001				
	$adjR^2$ = .111					$adjR^2$ = .116				

Note. *$p < .01$. **$p < .001$

[a] $F(12,449)=6.11$*** (adjusted $R^2 = .111$)

[b] $F(4,487)=17.05$*** (adjusted $R^2 = .116$)

Alert Emotion

Information from authorities, *negative emotions*, and *positive emotions* were significant predictors, and *home ownership* was a predictor, and *gender* was a negative predictor of the *alert*

emotion (see Table 18). *Home ownership* had been selected as a predictor of the *alert emotion*, without significant effect with a beta value of, β = .06 (ns.), neither did the effect of gender with a beta value of, β = -.08, (ns.). Conversely, *positive emotions* were a significant predictor of the *alert emotion* with a beta value of, β = .12 (p < .01). Also, *information from authorities* was a significant predictor of the *alert emotion* with a beta value of, β = .13 (p < .001), and *negative emotions* were a significant predictor of the *alert emotion* with a beta value of, β = .59 (p < .001). The *adjusted R Square* value for Model 1 was .451, and the *adjusted R square* value for Model 2 was .46.

Table 12.

Regression Analysis of the Alert Emotion.

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	.456	.433		1.053	.293	.335	.237		1.417	.157
Age	-.002	.003	-.022	-.503	.615					
Gender	-.201	.084	-.083	-2.394	.017	-.193	.082	-.079	-2.348	.019
Home Ownership	.091	.050	.066	1.812	.071	.081	.046	.059	1.756	.080
Education in Years	-.012	.019	-.026	-.607	.544					
Income	.000	.000	.052	1.373	.170					
Information from Authorities	.141	.065	.105	2.152	.032	.172	.046	.128	3.747	.000
Information from Public Intermediaries	-.007	.056	-.006	-.132	.895					
Information from Peers	.041	.063	.031	.645	.519					
Social Cues	.000	.002	-.001	-.028	.978					
Emotions - Negative	.649	.039	.589	16.558	.000	.651	.039	.591	16.785	.000
Emotions - Positive	.141	.043	.122	3.254	.001	.143	.042	.124	3.412	.001
	F (11,480) = 37.734, p <.001					F (5,486) = 83.06, p <.001				
	$adjR^2$ = .451					$adjR^2$ = .455				

Note. *p < .01. **p < .001

[a] $F(11,480)=37.734$*** (adjusted R^2 = .451)

[b] $F(5,486)=83.06$*** (adjusted R^2 = .455)

Positive Emotions

Education, *information from authorities*, and *negative emotions* were significant predictors of *positive emotions*, and *social cues* were predictors for *positive emotions* (see Table 19). *Social cues* had been selected as a predictor of *positive emotions* without a significant effect

with a beta value of, (β = .09, ns.). Conversely, *education* was a significant predictor of *positive emotion* with a beta value of, β = .18 (p < .001). *Information from authorities* was a significant predictor of *positive emotions* with a beta value of, β = .18 (p < .001), while *negative emotions* were a significant predictor of *positive emotions* with a beta value of, β = .28 (p < .001). *Gender* was a significant negative predictor of *positive emotions* with a beta value of, β = -.12 (p < .01). The *adjusted R Square* value for Model 1 was .19, and the *adjusted R square* value for Model 2 was .19.

Table 13.

Regression Analysis of Positive Emotions.

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.	Unstandardized Coefficients		Standardized Coefficients	*t*	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	.460	.455		1.011	.312	.724	.270		2.682	.008
Age	.001	.004	.015	.283	.777					
Gender	-.228	.088	-.108	-2.591	.010	-.247	.086	-.117	-2.879	.004
Home Ownership	.061	.053	.051	1.155	.249					
Education in Years	.066	.020	.168	3.275	.001	.069	.016	.177	4.208	.000
Income	.000	.000	.030	.653	.514					
Information from Authorities	.195	.068	.168	2.847	.005	.213	.048	.184	4.480	.000
Information from Public Intermediaries	.093	.059	.089	1.565	.118					
Information from Peers	-.058	.067	-.051	-.866	.387					
Social Cues	.003	.002	.082	1.887	.060	.003	.002	.085	2.013	.045
Emotions - Negative	.265	.039	.277	6.707	.000	.266	.039	.278	6.813	.000
	F (10,481) = 12.58, p <.001					F (5,486) = 24.33, p <.001				
	$adjR^2$ = .191					$adjR^2$ = .192				

Note. *p < .01. **p < .001

[a] F(10,481)=12.58*** (adjusted R^2 = .191)

[b] F(5,486)=24.33*** (adjusted R^2 = .192)

Negative Emotions

Household ownership had been selected as a predictor of *negative emotions* without a significant effect with a beta value of (β = .08, ns.), neither was *information from peers* with a beta value of (β = .081, ns.) nor was *age* with a beta value of (β = -.11, ns.) (see Table 20). The

adjusted R Square value for Model 1 was .02, and the *adjusted R square* value for Model 2 was .02.

Table 14.

Regression Analysis of Negative Emotions.

	Model 1					Model 2				
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	*Std. Error*	*Beta*			*B*	*Std. Error*	*Beta*		
(Constant)	2.006	.518		3.875	.000	2.301	.276		8.335	.000
Age	-.006	.004	-.086	-1.474	.141	-.008	.003	-.109	-2.425	.016
Gender	.031	.102	.014	.301	.763					
Home Ownership	.116	.061	.093	1.903	.058	.096	.056	.077	1.718	.086
Education in Years	.020	.023	.049	.865	.388					
Income	.000	.000	-.007	-.133	.894					
Information from Authorities	.005	.079	.004	.064	.949					
Information from Public Intermediaries	-.060	.068	-.055	-.873	.383					
Information from Peers	.114	.077	.096	1.480	.139	.096	.053	.081	1.813	.070
Social Cues	.003	.002	.071	1.473	.141					
	F (9,482) = 1.82, p <.001					F (3,488) = 4.19, p <.001				
	$adjR^2$ = .015					$adjR^2$ = .019				

Note. *p < .01. **p < .001

[a] $F(9,482)=1.82$*** (adjusted R^2 = .015)

[b] $F(3,488)=4.19$*** (adjusted R^2 = .019)

For this study, Hypothesis 2 is partially supported.

The original conceptual framework proposed that there was a singular comprehensive protective action assessment. Additionally, the originally proposed conceptual framework was horizontally linear. Social cues and information sources influenced emotions, either expected consequences or perceived exposure, which influenced the comprehensive protective action assessment. The results of the data analysis demonstrated that comprehensive protective action assessment is two independent assessments: facilitating protective action assessment and inhibiting protective action assessment. Furthermore, the variables that influence either or both of the protective action assessments are independent and are not necessarily dependent in a horizontally linear construct on each other. Information sources and social cues can have direct,

indirect, or no effect on either protective action assessments, independent of emotion, perceived exposure, or expected consequences. In light of this observation, revised conceptual frameworks were created to understand better how the numerous variables ultimately affected either of the two resulting protective action assessments.

Revised Conceptual Frameworks

This statistical analysis resulted in a revised abbreviation of the conceptual model, which now includes both facilitating and inhibiting attributes, rather than solely a comprehensive protective action assessment, which more accurately reflects the findings from the data (Figures 13 and 14). Within the framework, the red lines indicate direct effects (direct effect on the attribute), and the orange lines indicate secondary effects (affects the direct effects) at the $p<.001$ significance level. Dashed lines indicate non-contributory effects at the $p<.01$ significance level.

Figure 13.

Revised Conceptual Framework for the Facilitating Attribute.

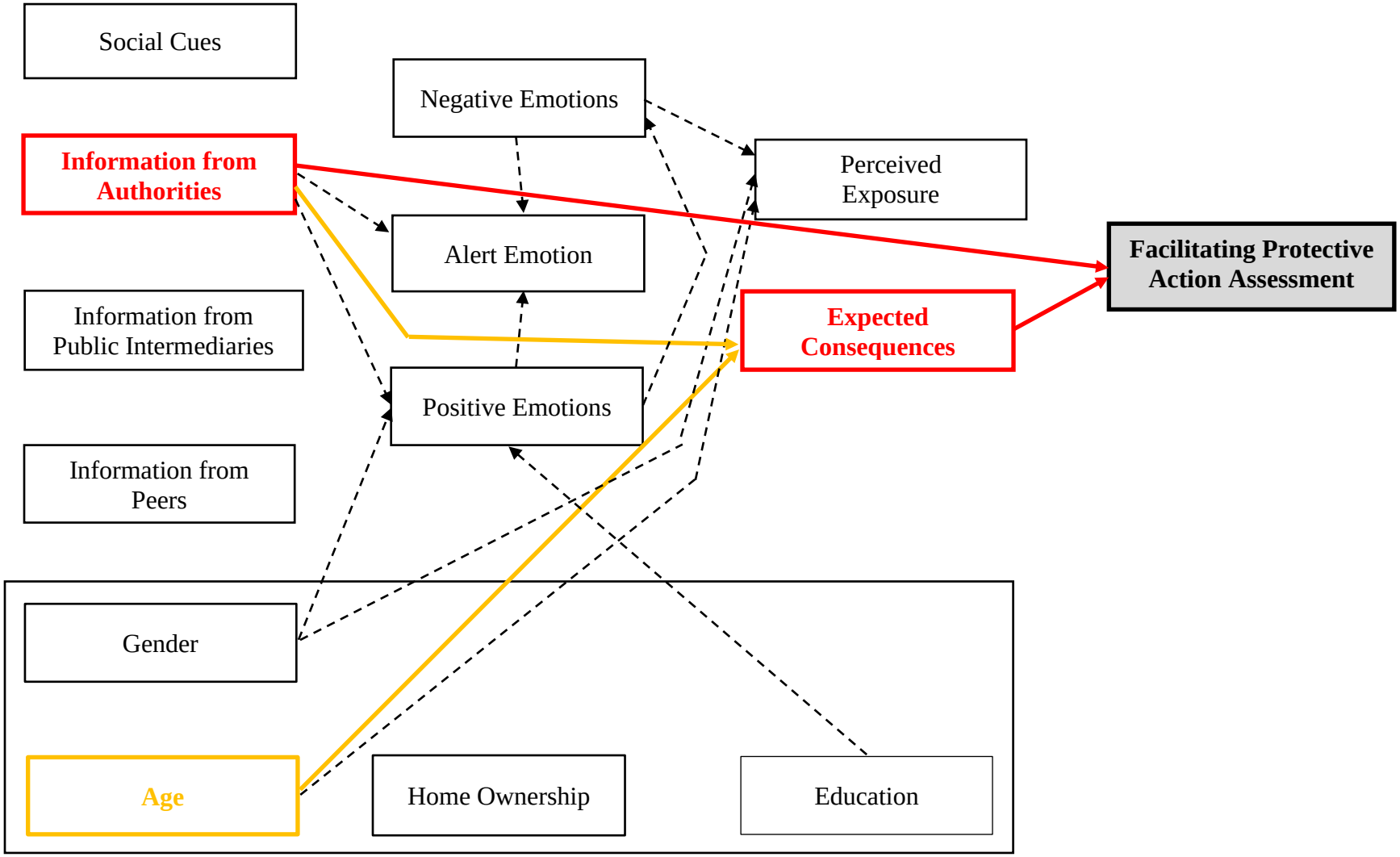
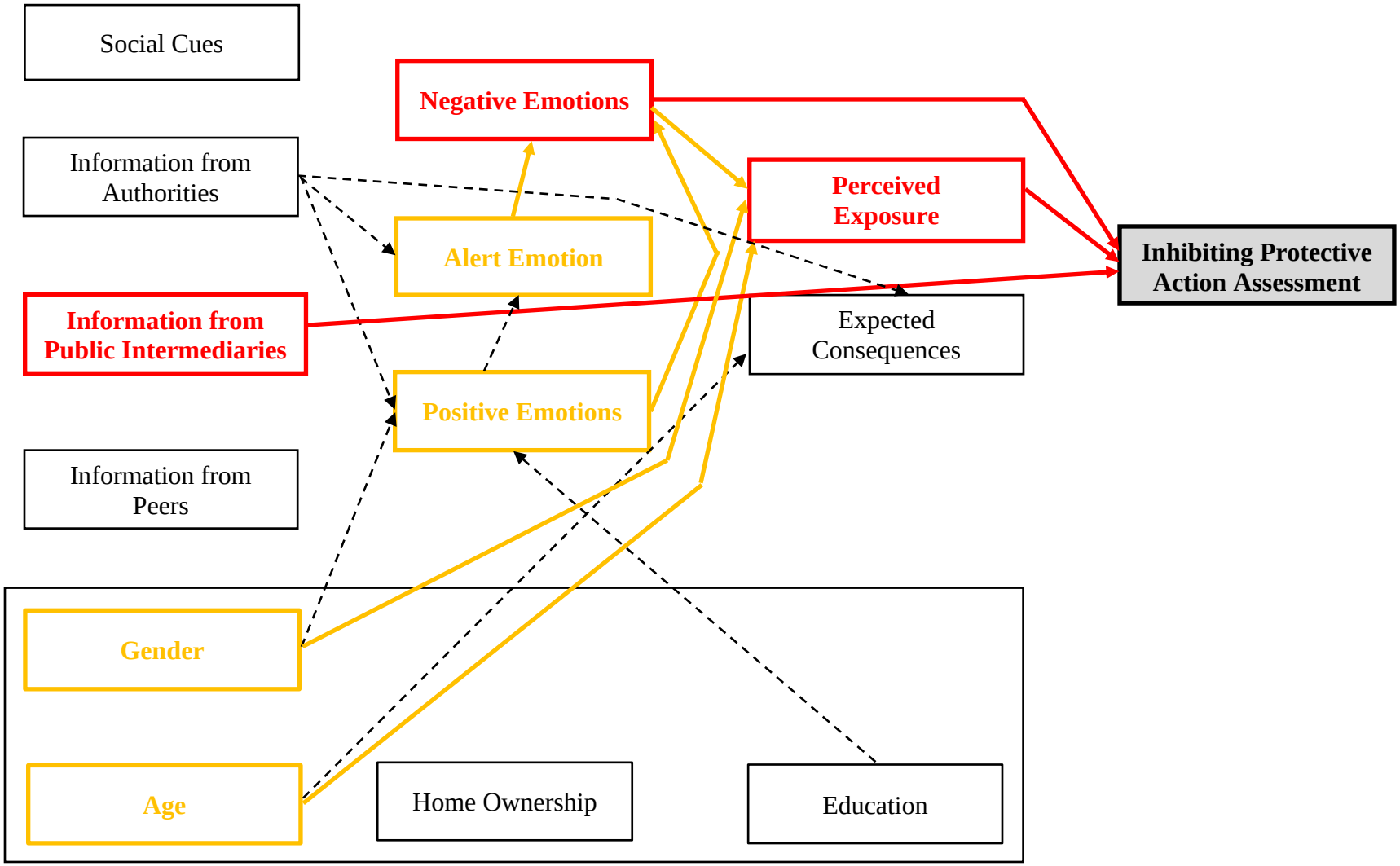


Figure 14.

Revised Conceptual Framework for the Inhibiting Attribute.



Summary

This study intended to apply descriptive statistics, correlation analysis, and regression analysis to determine how the rural residents in Ya'an, China (a) assessed the protective action of mask-wearing during the COVID-19 pandemic; (b) what factors affected these assessments; (c) if there were correlations between two risk perception variables (specifically perceived exposure and expected consequences), emotional variables, information sources, social cues (including traditional and social media) and the protective action assessments; and (d) if there were variables that would predict the adopt the protective action of mask-wearing.

Correlation analysis indicated a strong correlation between six independent and dependent variables, *facilitating protective action assessment*. These variables included *expected consequences*, *alert emotion*, *information from authorities*, *information from public intermediaries*, information from *peers*, and a lesser correlation with *positive emotions*. Conversely, variables that indicated a strong correlation with *inhibiting protective action assessment* were *positive emotions*, *negative emotions*, *alert emotion*, *information from authorities*, *public intermediaries*, *peers*, and *social cues*. *Adjusted risk exposure* was negatively correlated with the *inhibiting protective action assessment attribute*.

Regression analysis indicated two independent predictors of the dependent variable, *facilitating protective action assessment*. These predictors of the dependent variable were *expected consequences* and *information from authorities*. Further regression analysis revealed that *Age* and *Information from Authorities* were secondary predictors of one of the primary predictors, expected consequences. Conversely, *inhibiting protective action assessment* was predicted by three predictors to include *perceived exposure*, *negative emotions*, and *information from public intermediaries*. *Age*, *gender*, *household ownership*, *alert emotion*, and *positive*

emotions were secondary predictors of the primary predictors with negative emotions. Age and gender were predictors for perceived exposure and emotion – alert and emotions – positive secondary predictors for negative emotions.

Discussion

It is essential for public health, public policy, and emergency management leadership to understand how individuals and households are influenced by various emotions, social cues, and numerous information sources and make decisions during emergencies. The COVID-19 pandemic has presented individuals and households with various emotions, social cues, and information sources in a very dynamic environment. Protective actions, initially in the form of non-pharmaceutical interventions (specifically the wearing of masks, social distancing, telework, and cough and sneeze hygiene) and more recently in the form of pharmaceutical interventions (specifical vaccines), have been recommended to individuals and households. Some individuals and households have decided to adopt these recommended protective actions, while some have not. Furthermore, unfortunately, these decisions have had life and death consequences.

This study intended to determine how rural residents assessed the protective action of mask-wearing during the COVID-19 pandemic, in general, and what specific factors affected their assessments, in particular. The analyses started with understanding respondents' protective action assessment through the lens of the effectiveness of mask-wearing, social influences related to mask-wearing, the expense of mask-wearing, and the convenience (or lack thereof) of mask-wearing. Then, follow-up analyses were used to determine the correlation between the various independent and dependent variables, the facilitating attribute (derived by combining mask effectiveness and social influence through factor analysis). Lastly, the study determines the effect routes of the independent variables regarding their impact types on protective action assessments.

Sample Characteristics

An analysis of the samples collected from the survey shows a demographic match between the survey group and a typical rural environment, including those characteristics mentioned earlier in the Literature Review. As a reminder, these characteristics included an older population (14.6% of this study's survey participants were older than 60), the presence of disparities within social, economic, and health care systems between the urban and rural environments, and sub-standard housing (for example, a prevalence of self-built homes which was reported by 68.9% of this study's survey respondents) (Health and Places Initiative, 2015). Additional characteristics in this study that reflected a rural environment were a higher rate of marriage (80.5% of this study's survey respondents reported that they were married), lower levels of education (44.9% of this study's survey respondents reported less than a high school education) and lower-income levels reported by survey respondents (77.6% of this study's survey participants reported an income of between $30,000 and $80,000) (UN, 2021).

Research Question

This study's research question pertained to how rural residents in China assessed the protective action of mask-wearing during the COVID-19 pandemic in terms of concerns related to effectiveness, social impression, expense, and life convenience. The facilitating protective action assessment consisted of mask effectiveness and a positive social impression. The answer to this question about mask effectiveness and social impression combined to form the facilitating protective action attribute is fully supported by the data and is confirmed.

An exciting result of the study is the similarity of the means between the survey participants' perception of the probability of contracting the virus while wearing a mask compared to the probability of spreading the virus while wearing a mask. Additionally, the

insignificance between the two variables when a paired t-test is applied supported that these two variables were insignificant and unrelated. Given the similarity of the means and the insignificance in their relationship, it can be inferred that survey participants gave equal weight to both aspects of mask effectiveness. It can also be inferred, based upon this analysis, that survey participants equally weighed the effectiveness of a mask both as a source of transmission control and as a protective measure. This observation further supported previous literature related to collectivism prominent in Asian countries and the likelihood that an individual would wear a mask in the collective interest of those around them. Furthermore, this study suggested that the surveyed individual may wear the mask partly out of personal interest in addition to the collective interest. Additionally, the high means observed with the positive social influence item indicate those survey participants perceived positive social rewards from wearing masks.

Two policy implications result from these observations. Given that the study infers that participants weigh the probability of contracting and spreading the virus equally, public health, public policy, and emergency management leadership should consider this when communicating recommended protective actions. Since the effectiveness of masks as a means of source control and as a protective action is seen equally, communication about the effectiveness of wearing masks as either a means of source control or as a protective action should be equally effective and if, as determined within this study, combined with information coming from authorities with a focus on expected consequences (or lack thereof) of wearing masks, was more effective. Additionally, emergency risk communications from public health, public policy, and emergency management leadership should create positive social influence in support of non-pharmaceutical interventions. Lastly, it can be inferred by the results of the study that focuses on mandates, and negative social influence will inhibit the adoption of the recommended protective action.

Similarly, public health, public policy, and emergency management leadership should consider purchasing comfortable and high-quality masks to facilitate adopting the recommended protective action due to cost and potential discomfort.

Research Hypotheses

Research Hypothesis 1

The first hypothesis, related to the correlation of the independent variables with the dependent variable of the facilitating protective action assessment, was only partially supported by the data, and was not confirmed. There is a significant positive relationship between independent variables, specifically expected consequences, alert emotion, and all sources of information with the dependent variable, the facilitating protective action assessment, at the $p<.01$ significance level. About the participants of the survey used for this study, the expected consequences of being admitted to an intensive care unit after contracting the disease, being influenced by the alert emotion, being influenced by all sources of information, and being influenced by the alert emotion, resulting in the participants adopting the facilitating protective action assessment.

Conversely, there was a significant positive relationship between independent variables, specifically perceived exposure, all three emotions (positive, negative, and alert), and all information sources with the inhibiting protective action assessment, at the $p<.01$ significance level. On the participants of the survey used for this study, being influenced by perceived exposure, positive, negative, and alert emotions, all sources of information and, to a lesser extent, the expected consequences of contracting the virus, resulted in the participants not adopting the recommended protective action.

Expected consequences are significantly correlated with the facilitating protective action assessment and to a lesser extent with the inhibiting protective action assessment. There are several reasons why expected consequences might be correlated with the adoption of the protective action. Within the study, expected consequences were defined as being admitted into an intensive care unit. There are several factors, as discussed in the literature, that result in admission to an ICU. These variables include age and having coexisting conditions such as high blood pressure, diabetes, chronic respiratory diseases, et cetera.

Additionally, admission to an ICU was incumbent on being exposed to and infected with the SARS-CoV-2 virus. Exposure to and infection with the virus depends upon several factors, including compliance with recommended non-pharmaceutical interventions to include social distancing, hand hygiene, remote work, amount of time spent indoors and in large groups of people, and mask-wearing. However, compliance with non-pharmaceutical interventions do not preclude exposure to or infection with the virus but substantially reduces the risk.

Conversely, the perceived exposure to the SARS-CoV-2 virus was a subjective measurement of the risk of being exposed to and infected with the virus. This risk was moderated by compliance with non-pharmaceutical interventions. Risk tolerance was related to the virus (for example, being younger and healthy without coexisting chronic conditions). Therefore, when coupled with age, expected consequences are biased towards adopting the recommended protective action compared to perceived exposure, possibly explaining its' significant correlation with the facilitating protective action assessment.

Also associated with the facilitation of the recommended protective action are the alert emotion and all sources of information. The alert emotion was most readily identified with a state of readiness. Given that the survey respondent felt ready to respond to the risk, it was easier

to explain their choice to adopt the recommended protective action through facilitation. Additionally, as reported in the literature review, people used at least six sources of information to make decisions during the COVID-19 pandemic. This explains why all three sources of information used in the survey (from authorities, intermediaries, and peers) significantly correlate with the facilitating protective action assessment.

Conversely, as related to the significant correlations with inhibiting protective action assessment, perceived exposure was more subjective and harder to quantify. Therefore, it was understandable that it would correlate with the inhibition of the adoption of the protective action. When you add the significant correlation of all three emotions (alert, negative, and positive) and all three sources of information (from authorities, intermediaries, and peers), we can better understand why some people do not choose or are inhibited adopt the recommended protective action.

Presumably, all three emotions are involved in some portion to the inhibition of the protective action assessment. Given that the alert emotion was significantly related to the facilitating protective action assessment, it can be interpolated that it plays a lesser role in assessment inhibition and that positive and negative emotions played more of a role in inhibition. As mentioned previously in the literature review, risk perception was related to emotion. However, the findings of this study contradict the research mentioned within the literature review, which suggested that higher levels of fear related to greater adoption of the recommended protective action. Within this study, negative (fear and anxiety) and positive (optimism and energetic) emotions were significantly correlated with the non-adoption of the recommended protective action. Lastly, the significant correlation between all sources of

information (from authorities, intermediaries, and peers) was explained the same way that it was within the facilitating protective action assessment.

What was harder to explain was the lack of significant correlation between social cues and facilitating and inhibiting protective action assessment. Research related to social cues to facilitate the adoption of the recommended protective action was mentioned in the literature review. The absence of the influence of social cues in both of the protective action assessments was hard to explain. Possible explanations include that survey respondents observed very few persons wearing masks or that adopting the recommended protective action was more internally motivated than social cues.

What was clear from the data analysis was that various variables influenced the decision to adopt the recommended protective action by survey participants. Some variables are influential in the survey participants not adopting the recommended protective action. Notably, the differences between the facilitating and inhibiting protective action assessment can be focused upon from a policy perspective. From a perspective of correlation, both assessments share the alert emotion and all sources of information. The variable of expected consequences was more significant in the facilitating protective action assessment, and only the negative emotions and social cues variables apply to the inhibiting protective action assessment, whereas the positive emotions variable was also more significant.

Based on this observation, several policy implications are related to the correlations between facilitating and inhibiting protective action assessments. Other things equal, specifically related to information sources, public health, public policy, and emergency management leadership, can increase the adoption of the recommended protective action by emphasizing the expected consequences in emergency risk communications with the public. Additionally, public

health, public policy, and emergency management leadership can reverse the effects of the inhibiting protective action assessment by de-emphasizing negative emotions and emphasizing the alert emotion in emergency risk communications with the public.

There mainly was agreement between the literature used for this study and the data analyzed. Silver and Andrey (2013) suggested that gender might be positively correlated to adopting the protective action. This study found a positive correlation between gender and positive emotions, which was correlated with perceived exposure. Still, this study did not find a correlation between perceived exposure and facilitating protective action assessment, resulting in the adoption of the protective action. Similarly, Scarinci et al. (2021) stated that individuals with a high school education or less had a lower perceived susceptibility compared to those with college or higher education who had a higher perceived susceptibility. This study found a positive correlation between education level and positive emotions, with positive emotions being positively correlated with perceived exposure. Schoeni et al. (2021) suggested that age was related to the adoption of the protective action. This study found that age was positively correlated with both perceived exposure and expected consequences, the latter which was positively correlated with the facilitating protective action assessment.

Given that a vast majority (71.2%) of the survey respondents observed less than 40% of others wearing a mask during the week preceding the survey, the influence of social cues as proposed by Holzwarth (2020) and Huang (2016), and the influence it plays on the protective action decision of individuals, was not supported by this study with the finding that social cues influence positive emotions but do not positively correlate with either the facilitating protective action assessment or inhibiting protective action assessment. Additionally, the study was unable to confirm research by Shahrabani et al. (2019) that individuals and households with higher

levels of fear related to the threat are more likely to avoid the threat by immediately adopting the recommended protective action as this study found that negative emotions were positively correlated with perceived exposure which was positively correlated with inhibiting protective action assessment.

Research Hypothesis 2

The second hypothesis, referring to the risk perception variables receiving significant regression coefficients when controlling for regression, was partially supported by the data, and was not confirmed. Expected consequences and information from authorities directly affected the dependent variable, the facilitating protective action assessment, at the $p<.01$ significance level. This was partially supported in previous research by Huang (2016), except for social cues, who stated that warnings from authorities, an expectation of a significant consequence, and the use of social cues affected the adoption of the recommended protective action. Information from authorities and expected consequences directly affected the facilitating protective action assessment and, ultimately, the adoption of the recommended protective action. Notably, age had an indirect effect on expected consequences, while information from authorities had an indirect effect on expected consequences.

Equally important to consider are the variables that affected inhibiting protective action assessment, including perceived exposure, information from public intermediaries, and negative emotions. Interestingly, this finding contradicts previous research by Wang et al. (2018) related to an individual or households' willingness to take any recommended protective actions based upon risk perception. Additionally, research by Thompson et al. (2011), related to threat characteristics, suggested that perceived exposure and expected consequences are essential in assessing the protective action.

These findings from the data analysis provided valuable insight into how individuals and households make protective action decisions. This insight can be translated into recommendations for policymaking, in general, and emergency risk communications, in particular. As supported by the data analysis, these policy implications can improve the efficiency and effectiveness of public health, public policy, and emergency management leadership during pandemic response. Explicitly related to the facilitating protective action attribute model, the data supported that expected consequences and information from authorities are the two direct effectors of adopting the recommended protective action. Additionally, the data support that age has an indirect effect on expected consequences. Many of the remaining variables have a predictive effect on the other variables. Still, those mentioned earlier have the most direct effect on adopting the recommended protective action, with the apparent exclusion of both social cues and information from peers in both models.

Within the emotion variables, only negative emotions had a direct effect on inhibiting protective action assessment. No emotions affected the facilitating protection action assessment. This finding does not support earlier research by Shahrabani et al. (2019), which suggested that individuals and households with higher levels of fear related to the threat were more likely to avoid the threat by immediately adopting the recommended protective action. In the facilitating protective action assessment model, negative and positive emotions had a tertiary effect on the alert emotion, not affecting expected consequences. This finding was most closely related to research by Shahrabani et al. (2019). A response that was not negatively based (based on fear, anxiety, anger, et cetera) was more methodical and cognitive. Within the inhibiting protective action assessment, the alert and positive emotions indirectly affected the negative, directly

affecting perceived exposure. Han et al. (2021) support this finding which stated that risk perception was related to emotion.

Within the sources of information, only information from authorities directly affected facilitating protective action assessment. This also presents an interesting dilemma for public health, public policy, and emergency management leadership when considering risk communications related to improving the adoption of the recommended protective action. These findings leverage the information from public intermediaries (including the traditional and social media) and information from peers (family and friends) against the information from authorities (public officials). This finding correlates with Hsing et al. (2021) research, which supported that cultural and social contexts influence individual behavior.

Significantly, information from authorities affected the facilitating protective action assessment through two avenues: directly and through expected consequences. It can be inferred that information conveyed by authorities regarding expected consequences was most effective in facilitating the adoption of the recommended protective action. Also, this finding suggested that, for the recommendation of the adoption of protective action to be successful, the risk communications coming from public officials must have greater weight than the messaging that comes from both traditional and social media. This finding calls for accurate, clear, and consistent risk communications from public officials in addition to clarifying mixed or erroneous messages that may be communicated via both traditional and social media. This finding supported research by Berman (2020), who cited research from the University of Pennsylvania and University of Illinois that found that individuals who relied on conservative news and social media sources and news aggregators were less informed regarding COVID-19.

Public health, public policy, and emergency management leadership should not underestimate the influence of information from authorities on the adoption of the recommended protective action. Additionally, consideration of the receiver characteristics and demographics of the targeted group was also essential based upon research by Scire (2020), which found that the choice of information sources was linked to age, gender, educational level, and political affiliation. Information from authorities was more effective than both information from public intermediaries (including traditional and social media), which inhibited adopting the recommended protective action.

Conversely, information from public intermediaries had a direct effect on inhibiting protective action assessment. This correlates with Bridgman et al. (2020) research, who found that getting information from social media was related to misinformation about COVID-19 while the opposite exists for traditional news media. Interestingly, social cues do not affect the facilitating or inhibiting protective action assessment as predicted in the original conceptual framework within these models. This finding conflicts with research by Holzwarth (2020), who suggested that the influence of social cues, including the approval of prevailing social behaviors and the disapproval of negative social behaviors, can influence the protective action decision of individuals and research by Allen et al. (2020) who found that, through social cues, people are inclined to respond to the behavior of others that they see.

Interestingly, some of the variables that had significant correlations with either of the protective action assessments were non-significant in their effects on the same protective action assessment. For example, the alert emotion, information from intermediaries, and information from peers had a significant correlation with the facilitating protective action assessment. Still, they were insignificant in their effect on the facilitating assessment. A possible explanation for

the absence of the alert emotion on the facilitating protective action assessment was the reliance of the assessment on both expected consequences and information from authorities. Both of these variables are objective and, as such, would seem to decrease any influence of emotion when choosing to adopt the recommended action. Likewise, information from peers, which was more subjective, would be less likely to be used in the assessment than the more objective-natured information from authorities.

Conversely, within the inhibiting protective action assessment, both information from authorities and information from peers had a significant correlation with the assessment. Still, both are insignificant in their effect on the assessment. Similar to the facilitating protective action assessment, information from authorities was objective. As such, it was less likely to affect a subjective assessment (as mentioned previously).

The lack of effect of information from peers was less understood. A lack of effect from information from peers within the more objective natured facilitating protective action assessment was predictable, but not within the more subjective and more emotional inhibiting protective action assessment. One possible explanation would be due to the collective nature of the region and, presumably, that peers are receiving the same official information from authorities which diminishes the effect of information from peers on the inhibiting protective action assessment as it was seen as the same. As mentioned previously, the absolute lack of correlation and effect of social cues was exciting and may be explained by the high collective behavior seen within the region.

The data analysis resulted in the revision of the conceptual model into two separately revised conceptual models. The conceptual model originally proposed to explain best the assessment of protective actions suggested that two direct effectors, expected consequences and

perceived exposure, were involved in predicting the comprehensive protective action assessment. The original conceptual model suggested that the emotional variables, the different sources of information including social cues, and the various receiver characteristics were all involved in explaining the assessment of the protective action. The data analysis determined that the two separate assessment attributes (facilitating and inhibiting), previously suggested through the literature, indeed existed. However, the data disputed the risk perception variables that were predicted to influence both assessment attributes.

The only risk perception variable that affects facilitating protective action assessment within the two revised models was expected consequence. In contrast, perceived exposure was the only risk perception variable that affects inhibiting protective action assessment. Furthermore, the emotional variables and the different sources of information have effects in different ways on the risk perception variables, none had equal influence, and only information from authorities had a direct predictive effect on the facilitating protective action assessment attribute.

Related to the inhibiting protective action assessment model, the model was significantly different. The data supported that perceived exposure, negative emotions, and information from public intermediaries directly affect the non-adoption of the recommended protective action through inhibition. The alert emotion, positive emotions, gender, and age have indirect effects through perceived exposure. The alert emotion and positive emotions have indirect effects acting upon negative emotions.

The two models are similar within only a few variables. Both models exclude social cues and information from peers from any effect on either protective action assessments. Lastly, age

has an indirect effect in both models (expected consequences in facilitating protective action assessment and perceived exposure in inhibiting protective action assessment).

The two models are dissimilar in many more ways than they are similar. First and foremost, the two risk assessment variables are singular in their influence on the assessment attribute. The expected consequence was the only risk assessment variable that affects the facilitating protective action assessment, and perceived exposure was the only variable that inhibits protective action assessment. This conclusion was a significant departure from what was predicted with the original conceptual framework. Importantly, this indicates that the protective action assessment was not shared between the two risk assessments but that one risk assessment, expected consequences, was solely predictive of the adoption of the recommended protective action. It was easier, knowing this, for public health, public policy, and emergency management leadership to isolate and focus their risk communications to increase the adoption of the recommended protective action.

Receiver characteristics are also dissimilar between the models. Gender only has an indirect effect, through perceived exposure, on the inhibiting protective action assessment. Previous research found that females with an associated higher adoption of recommended protective actions (Rana, 2021), there was a higher perceived susceptibility to the SARS-CoV-2 virus to race, gender, and educational level (Scarinci et al., 2021), and gender (females, in particular) may be positively correlated to the adoption of protective actions, irrespective of previous disaster experience (Silver, 2013). Within the facilitating model, gender affects the alert emotion and affects perceived exposure within the inhibiting model.

Lastly, both models' age indirectly affected the direct risk perception variable associated with the model. For the inhibiting model, this finding was supported by previous research that

found that individuals who are more significant than 70-year-old with more comorbidities have a higher perceived susceptibility to the virus (Schoeni et al., 2021) and, for the facilitating model, that the elderly (specifically those greater than 70 years of age) are most vulnerable (Yang et al., 2020; Pettrone et al., 2021). These findings, as mentioned earlier, are also partially supported by previous research (age and gender, in particular) by Scarinci et al. (2021) and Silver and Andrey (2013). Within the context of the COVID-19 pandemic, the influence of age on expected consequences was supported by previous research related to the higher probability of older persons being admitted to intensive care units. This finding was supported in research by Puah (2021), who found that older individuals were more likely to require intensive care. Importantly, these findings provide insight into particular demographics that public health, public policy, and emergency management leadership can focus on with risk communications. Given this, public health, public policy, and emergency management leadership should emphasize emergency risk communications on the expected consequences of exposure to the threat. Risk communications are especially effective regarding age and gender, age directly and gender indirectly through the alert emotion. For example, effectively communicating the risk of the expected consequences of exposure to the SARS-CoV-2 virus with older populations will likely be successful in that groups' adoption of the recommended protective action, as suggested in research by Schoeni et al. (2021). Additionally, providing risk communications that focus on the alert emotion within the gender and household ownership demographic groups may result in greater adoption of the recommended protective action.

Several other essential policy implications are related to the similarities and differences between facilitating and inhibiting protective action assessments. When considering the facilitating protective action assessment, which relates to the adoption of recommended

protective actions, the influence of the risk perception variable on the recommended action was essential. As previously mentioned, information from authorities and expected consequence are significant variables on adopting the recommended protective action. Equal emphasis should be given by public health, public policy, and emergency management leaders to diminish the influence of the inhibiting protective action assessment.

Perceived exposure, negative emotions, and information from public intermediaries directly affected protective action assessment. Public health, public policy, and emergency management leadership can de-emphasize perceived exposure in emergency risk communications and deconflict misinformation in the traditional media and disinformation in the social media by emphasizing the importance of obtaining information from official sources, not the traditional media and social media. Lastly, emphasizing communication and messaging to specific age groups as appropriate. The age variable was a predictor in both the facilitating and inhibiting protective action assessment. It was an essential variable for public health, public policy, and emergency management leadership to manage emergency risk communications to promote the recommended protective action.

Summary

The purpose of this study was to determine how individuals and households assessed recommended protective actions and to determine what factors affected these assessments, specifically related to the decision to adopt the protective action of mask-wearing during the COVID-19 pandemic. During outbreaks, epidemics, and pandemics, it was essential to communicate the risks of transmitting and contracting disease vectors effectively. Enabling individuals and households to take recommended protective actions were essential for effective public health emergency management. Effective emergency risk communications depend upon

understanding the perception of emotions and sources of information in conjunction with receiver characteristics of the individuals and households. It is the hope that this study will contribute to the knowledge and practice of emergency management by determining and explaining the assessment factors involved in the adoption of recommended protective actions, specifically during pandemic events, and applicable in an all-hazards environment.

Conclusion

Contributions to Research

There were chiefly three different contributions that this study has made to the body of research within the field of emergency management. These three contributions, broadly, are the confirmation of some of the previous research related to pandemics, in general, and the COVID-19 pandemic, in particular, the proposal of a revised conceptual framework to better understand decision making during pandemics, and lastly, the exposure of additional areas of research.

Related to confirming some of the previous research, much of the research discussed in this study's literature review was confirmed. The study was able to confirm that both age and gender influenced perceived exposure and that older adults were influenced by expected consequences. Some, however, were not. This includes that negative emotions were not related to the adoption of the recommended protective action assessment and that, at least in this study, that social cues do not inform human behavior as related to the adoption of the recommended protective action.

The second contribution of this study was the proposal of a refined conceptual framework that separated comprehensive protective action assessment into two independent assessments: facilitating and inhibiting. Additionally, this study supported that only expected consequences and information from authorities influenced the facilitating protective action assessment. In contrast, perceived exposure, information from public intermediaries, information from peers, and negative emotions only influenced the inhibiting protective action assessment. Lastly, the study found that social cues did not influence protective action assessment and had little influence on inhibiting protective action assessment. This may be the most valuable contribution of this study. The value of being able to visualize the interplay of the variables and how the

variables influence the protective action assessment is practical, not only in this study but in others.

Lastly, the study exposed areas for additional research that can be addressed in the future. These areas of future research might further support the revised conceptual framework. Likewise, additional research may dispute some of the findings of this research. The recommended areas for future research are addressed in the latter part of this section.

Limitations

There are several limitations to this study. As with most studies, there are threats to external validity that exist. This limitation results in the limited applicability of the study to different scenarios or environments. The second limitation was related to the limits of the revised conceptual model and the immediate relevancy of the revised conceptual model to the present pandemic.

The first and foremost limitation was related to external validity. Specifically, two conditions exist within the survey area that may impact the study's external validity in other parts of the world. The first limit to external validity was the socio-cultural environment within China, particularly in the Asian region, in general. As mentioned previously, research by Lu et al. (2021), as quoted by Dizikes (2021), indicates that Asian countries display more collectivist behaviors than non-Asian countries and that this collectivism might explain the prevalence of mask-wearing within Asian countries. Additionally, as mentioned previously and related to research by Nakayachi et al. (2020), this “altruistic risk reduction” resulted in mask wearing becoming a norm within Asian countries. This same degree of adoption of mask-wearing as a protective action was likely not the same in non-Asian countries.

An additional limitation to the study which may impact external validity was the sample size. The small sample size of 492 participants against an estimated population of 1.5 million (0.003% of the population) within the City of Ya'an and an estimated population of 1.39 billion (CIA, 2021) places limits on the external validity of the study. Larger sample sizes could address this limitation within the current study area. The inclusion of more rural areas geographically remote from each other within China would address the limitation related to the size of the population of China.

China is a large country by landmass and is the largest country in the world by population (Central Intelligence Agency, 2021). Another limitation of this study was related to the lack of familiarization by the researcher with the country's social, economic, and political environment. There are likely nuanced social, economic, and political considerations that may have influenced the data and the discussion regarding the study results.

The second limitation was the applicability of the revised conceptual framework used for the study to scenarios outside of the present pandemic. This study's readers should not overinterpret the results based on the small sample size and other external validity threats. Additionally, this study assessed a specific scenario at a specific moment in time. In fact, the data used for this study was collected almost a year before this study was completed. Additional future research might verify the findings of this study and enhance the study's external validity.

Opportunities for Additional Research

There are several opportunities for additional research presented by this study. Additional research opportunities involve either changing the survey area or focusing on specific variables included within the study. Lastly, further work to verify the accuracy of the findings of the study's model was needed.

The first opportunity for additional research is to assess protective actions in non-Asian countries where less collectivism and more individualism exist. Less collective behavior is exhibited in the Scandinavian countries (e.g., Denmark, Norway, and Sweden), the Middle Eastern countries (e.g., Saudi Arabi, Qatar, and UAE), and the United States, United Kingdom, and Oceania (specifically, Australia and New Zealand) than the Asian countries as supported by Schwab (2013). The model derived from this study could be applied to one of these areas to determine if the external validity of the original study exists.

The second opportunity for additional research is whether the independent variables that were significant for facilitating and inhibiting protective action assessments change based upon changes within the socio-cultural, economic, or political climate. One example is whether information from public intermediaries, in general, and social media, in particular, would be more significant for facilitating or inhibiting protective action assessment based upon the survey participants. An additional example would be the significance of a particular information source including, and taken from this study, information from peers and social cues on the facilitating and inhibiting protective action assessment.

Additionally, research that further narrows the focus on the variables was an area of future opportunity. These variables can include information sources and receiver characteristics. Focusing on the influence of social media, specifically on inhibiting protective action assessment, was an example. Lastly, focusing on the influence of specific age ranges on expected consequences was another example.

The third area for additional research would include studies that verify the findings of this particular study or verify the findings of the conceptual model against other hazards. Minor

revisions to the revised conceptual framework might help future researchers better understand how individuals and households make decisions during future pandemics.

Another area for additional research includes applying the same study to assess the protective action assessments related to pharmaceutical interventions, for example, vaccines. Lastly, verifying the findings of this study will enhance the external validity of the study.

In closing, given a pandemic of historical significance, the purpose of this study was to determine how individuals and households assessed the recommended protective actions of mask-wearing and determine what factors affect these assessments. Using an abbreviated version of the Protective Action Decision Model (Lindell, 2017; Lindell & Perry, 2012), the study focused on the influence of the facilitating protective action attribute on the adoption of mask-wearing as a protective action in Ya'an, Sichuan Province, China. The study found that perceptions of the effectiveness of wearing a mask to reduce the probability of contracting and spreading the disease, positive social influences, and the influence of an alert emotion shape the facilitating protective action attribute and the adoption of mask-wearing during the COVID-19 pandemic. The research also revealed a significant positive relationship between the expected consequences from contracting COVID-19, the influence of both alert and positive emotions, and all information sources on the adoption of mask-wearing as a protective action. Lastly, expected consequences from exposure and information from authorities were significant predictors of the facilitating protective action attribute and the adoption of the recommended protective action. These findings, which included the significance of expected consequences and information from authorities as predictors of the adoption of the recommended action, suggested what actions can be taken by public health, public policy, and emergency management leadership to enhance the effectiveness of non-pharmaceutical interventions to mitigate the spread of disease during future

pandemics. It was with the hope that this finding would contribute to the field of emergency management.

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Appendix A Survey Questionnaire for the Prevention & Control of the COVID-19 Pandemic

1. How often did you use the knowledge of COVID-19 and prevention and control information provided by the following organizations?	Very low	Below average	Average	Above average	Very high
(1) Public health experts	□	□	□	□	□
(2) District, county, town governments	□	□	□	□	□
(3) Province, city	□	□	□	□	□
(4) Country	□	□	□	□	□
(5) Traditional mass media (TV, radio, newspaper)	□	□	□	□	□
(6) Online news media (online newspapers, headlines, hot searches)	□	□	□	□	□
(7) Social media (Weibo, official account, TikTok)	□	□	□	□	□
(8) Village committee, neighborhood committee, community property management office	□	□	□	□	□
(9) Relatives and friends, neighbors, peers	□	□	□	□	□
2. What do you think of the comprehensiveness and richness of the knowledge of COVID-19 and prevention and control information provided by the following organizations?	Very poor	Below average	Average	Above average	Very good
(1) Public health experts	□	□	□	□	□
(2) District, county, town governments	□	□	□	□	□
(3) Province, city	□	□	□	□	□
(4) Country	□	□	□	□	□
(5) Traditional mass media (TV, radio, newspaper)	□	□	□	□	□
(6) Online news media (online newspapers, headlines, hot searches)	□	□	□	□	□
(7) Social media (Weibo, official account, TikTok)	□	□	□	□	□
(8) Village committee, neighborhood committee, community property management office	□	□	□	□	□
(9) Relatives and friends, neighbors, peers	□	□	□	□	□
3. What do you think the level of difficulty in obtaining the knowledge of COVID-19 and prevention and control information from the following organizations?	Very difficult	Below average	Average	Above average	Very easy
(1) Public health experts	□	□	□	□	□
(2) District, county, town governments	□	□	□	□	□
(3) Province, city	□	□	□	□	□
(4) Country	□	□	□	□	□
(5) Traditional mass media (TV, radio, newspaper)	□	□	□	□	□
(6) Online news media (online newspapers, headlines, hot searches)	□	□	□	□	□
(7) Social media (Weibo, official account, TikTok)	□	□	□	□	□
(8) Village committee, neighborhood committee, community property management office	□	□	□	□	□
(9) Relatives and friends, neighbors, peers	□	□	□	□	□
4. About the knowledge of COVID-19 and prevention and control information provided by the following organizations, what do you think of the speed of information release and update?	Very slow	Above average	Average	Above average	Very fast
(1) Public health experts	□	□	□	□	□
(2) District, county, town governments	□	□	□	□	□
(3) Province, city	□	□	□	□	□
(4) Country	□	□	□	□	□
(5) Traditional mass media (TV, radio, newspaper)	□	□	□	□	□
(6) Online news media (online newspapers, headlines, hot searches)	□	□	□	□	□
(7) Social media (Weibo, official account, TikTok)	□	□	□	□	□

(8) Village committee, neighborhood committee, community property management office	□	□	□	□	□
(9) Relatives and friends, neighbors, peers	□	□	□	□	□
5. How much responsibility do you think the following organizations should bear in protecting you from infecting COVID-19?	Very low	Below average	Average	Above average	Very high
(1) Public health experts	□	□	□	□	□
(2) District, county, town governments	□	□	□	□	□
(3) Province, city	□	□	□	□	□
(4) Country	□	□	□	□	□
(5) Traditional mass media (TV, radio, newspaper)	□	□	□	□	□
(6) Online news media (online newspapers, headlines, hot searches)	□	□	□	□	□
(7) Social media (Weibo, official account, TikTok)	□	□	□	□	□
(8) Village committee, neighborhood committee, community property management office	□	□	□	□	□
(9) Relatives and friends, neighbors, peers	□	□	□	□	□
(10) Yourself	□	□	□	□	□
6. How do you think the level of necessity for taking the following prevention and control measures?	Not necessary at all	Not necessary	Moderately necessary	Necessary	Very Necessary
(1) Nucleic acid tests for people with symptoms of COVID-19	□	□	□	□	□
(2) Nucleic acid tests for people without symptoms of COVID-19	□	□	□	□	□
(3) Isolate people who contact with an infected person	□	□	□	□	□
(4) Isolate confirmed COVID-19 patients	□	□	□	□	□
(5) Implement 14-day quarantine for people from affected areas	□	□	□	□	□
(6) Close school	□	□	□	□	□
(7) Close non-emergency industries (except utilities)	□	□	□	□	□
(8) Closed-off management (lockdown, closed-off community)	□	□	□	□	□
(9) Measuring body temperature in public places	□	□	□	□	□
(10) Disinfection in public places	□	□	□	□	□
7. What do you think about wearing a mask?	Strongly disagree	Disagree	Average	Agree	Strongly agree
(1) Reduce the probability of others transmitting the virus to you	□	□	□	□	□
(2) Reduce the probability of you transmitting the virus to others	□	□	□	□	□
(3) Costly	□	□	□	□	□
(4) Uncomfortable	□	□	□	□	□
(5) Can cause breathing difficulties, harmful to health	□	□	□	□	□
(6) A mandate	□	□	□	□	□
(7) Might get strange look from others	□	□	□	□	□
(8) Supported by relatives and friends	□	□	□	□	□
8. When both you and the suspected patient wear masks, what do you think the probability that you will be infected with the COVID-19 under the following circumstances?	Very low	Below average	Average	Above average	Very high
(1) When walking, keep a distance of 1 meter from the suspected patient	□	□	□	□	□
(2) Chat with the suspected patient for 5 minutes, but keep a distance of 1 meter from each other	□	□	□	□	□
(3) Sit at the table with the suspected patient for more than 5 minutes	□	□	□	□	□
(4) Hug the suspected patient	□	□	□	□	□
(5) Order a takeaway from the restaurant where the suspected patient works	□	□	□	□	□
(6) Watch the same movie as the suspected patient in the cinema	□	□	□	□	□
(7) Wait in the same section of the hospital as the suspected patient	□	□	□	□	□
(8) Take the same flight as the suspected patient	□	□	□	□	□

9. When neither you nor the suspected patient wears a mask, what do you think the probability that you will be infected with COVID-19 under the following circumstances?	Very low	Below average	Average	Above average	Very high
(1) When walking, keep a distance of 1 meter from the suspected patient	□	□	□	□	□
(2) Chat with the suspected patient for 5 minutes, but keep a distance of 1 meter from each other	□	□	□	□	□
(3) Sitting at the table with the suspected patient for more than 5 minutes	□	□	□	□	□
(4) Hug the suspected patient	□	□	□	□	□
(5) Order a takeaway from the restaurant where the suspected patient works	□	□	□	□	□
(6) Watch the same movie as the suspected patient in the cinema	□	□	□	□	□
(7) Wait in the same section of the hospital as the suspected patient	□	□	□	□	□
(8) Take the same flight as the suspected patient	□	□	□	□	□
10. How do you feel about the effectiveness of the following prevention and control measures to protect you from COVID-19?	Very low	Below average	Average	Above average	Very high
(1) Reduce the number of going outside	□	□	□	□	□
(2) Keep a distance of more than 1 meter	□	□	□	□	□
(3) Frequently clean household items (door handles, elevator buttons)	□	□	□	□	□
(4) Wash your hands frequently	□	□	□	□	□
(5) Use hand sanitizer or alcohol	□	□	□	□	□
(6) Measure body temperature daily	□	□	□	□	□
(7) Reduce the use of public transportation	□	□	□	□	□
(8) Wear goggles and disposable gloves	□	□	□	□	□
11. During Wuhan's lockdown, how often did you take the following prevention and control measures?	Rarely	Some-times	Average	Often	Always
(1) Reduce the number of going outside	□	□	□	□	□
(2) Keep a distance of more than 1 meter	□	□	□	□	□
(3) Frequently clean household items (door handles, elevator buttons)	□	□	□	□	□
(4) Wash your hands frequently	□	□	□	□	□
(5) Use hand sanitizer or alcohol	□	□	□	□	□
(6) Measure body temperature daily	□	□	□	□	□
(7) Reduce the use of public transportation	□	□	□	□	□
(8) Wear goggles and disposable gloves	□	□	□	□	□
12. What do you think the probability that the following people will be admitted to the ICU (intensive care unit) after being infected with COVID-19?	Very low	Below average	Average	Above average	Very high
(1) 20 years old or younger	□	□	□	□	□
(2) 21-40 years old	□	□	□	□	□
(3) 41-60 years old	□	□	□	□	□
(4) 61-80 years old	□	□	□	□	□
(5) older than 80 years old	□	□	□	□	□
13. If you are unfortunately infected with COVID-19, what do you think the effect of taking the following drugs to prevent the disease from getting worse?	Very low	Below average	Average	Above average	Very high
(1) Antiviral drugs (Remdesivir "Hope of the People," Arbidol)	□	□	□	□	□
(2) Antimalarial drugs (chloroquine)	□	□	□	□	□
(3) Vitamin (Vitamin C)	□	□	□	□	□
(4) Cold medicine, antipyretic (Lianhua Qingwen, Ibuprofen)	□	□	□	□	□
(5) Banlangen and Shuanghuanglian oral liquid	□	□	□	□	□

14. During Wuhan's lockdown, when you were shopping, to what extent did you encounter the problem that the following items were in short supply?	Very low	Below average	Average	Above average	Very high
(1) Fresh vegetables and fruits	□	□	□	□	□
(2) Fresh meat (pork, beef, lamb, poultry)	□	□	□	□	□
(3) Non-perishable food (dry goods, canned food)	□	□	□	□	□
(4) Sterilized items (84 disinfectant, alcohol)	□	□	□	□	□
(5) Hygiene products (toilet paper)	□	□	□	□	□
(6) Cold medicine, cough medicine, antipyretic	□	□	□	□	□
15. During Wuhan's lockdown, to what extent did you change your purchase frequency and usage habits of the following items?	Very low	Below average	Average	Above average	Very high
(1) Fresh vegetables and fruits	□	□	□	□	□
(2) Fresh meat (pork, beef, lamb, poultry)	□	□	□	□	□
(3) Non-perishable food (dry goods, canned food)	□	□	□	□	□
(4) Sterilized items (84 disinfectant, alcohol)	□	□	□	□	□
(5) Hygiene products (toilet paper)	□	□	□	□	□
(6) Cold medicine, cough medicine, antipyretic	□	□	□	□	□
16. During Wuhan's lockdown, compared with the daily life before, to what extent did you increase the hoarding of the following items?	Very low	Below average	Average	Above average	Very high
(1) Fresh vegetables and fruits	□	□	□	□	□
(2) Fresh meat (pork, beef, lamb, poultry)	□	□	□	□	□
(3) Non-perishable food (dry goods, canned food)	□	□	□	□	□
(4) Sterilized items (84 disinfectant, alcohol)	□	□	□	□	□
(5) Hygiene products (toilet paper)	□	□	□	□	□
(6) Cold medicine, cough medicine, antipyretic	□	□	□	□	□
17. During Wuhan's lockdown, compared with the daily life before, to what extent did you think an average household increased the hoarding of the following items?	Very low	Below average	Average	Above average	Very high
(1) Fresh vegetables and fruits	□	□	□	□	□
(2) Fresh meat (pork, beef, lamb, poultry)	□	□	□	□	□
(3) Non-perishable food (dry goods, canned food)	□	□	□	□	□
(4) Sterilized items (84 disinfectant, alcohol)	□	□	□	□	□
(5) Hygiene products (toilet paper)	□	□	□	□	□
(6) Cold medicine, cough medicine, antipyretic	□	□	□	□	□
18. During Wuhan's lockdown, what did you think the probability of the following actions taken by the public across the country?	Very low	Below average	Average	Above average	Very high
(1) Actively respond to the threat of the epidemic and protect yourself and your family	□	□	□	□	□
(2) Actively contribute time and money to help relatives and friends	□	□	□	□	□
(3) Actively contribute time and money to help strangers	□	□	□	□	□
(4) Be excessively shocked and confused. and suspect that they cannot adapt to the changes brought about by the epidemic	□	□	□	□	□
(5) Be excessively dread and worried. Do something that causes the opposite effect and hurts yourself (drinking disinfectant)	□	□	□	□	□
(6) Be excessively dread and worried. Escape from reality (drinking)	□	□	□	□	□
(7) Do things that might harm the health and safety of others (go out without wearing a mask)	□	□	□	□	□
(8) Take the opportunity to make a fortune	□	□	□	□	□
19. Before Wuhan's lockdown, did you store the following supplies in your home?				No	Yes
(1) Battery operated radio				□	□
(2) 10 liters of bottled water per person (2 large barrels of mineral water)				□	□
(3) Food for 14 days (instant noodles, biscuits)				□	□
(4) Medicines for one week (cold medicine, diabetes medicine)				□	□
(5) Flashlight				□	□
(6) Power bank for cell phone				□	□

(7) Masks				☐	☐
20. During Wuhan's lockdown, to what extent did you feel about the following emotions?	Not at all	Slightly	Moderate	Very	Extremely
(1) Optimistic	☐	☐	☐	☐	☐
(2) Frustrated	☐	☐	☐	☐	☐
(3) Angry	☐	☐	☐	☐	☐
(4) Energetic	☐	☐	☐	☐	☐
(5) Nervous	☐	☐	☐	☐	☐
(6) Annoyed	☐	☐	☐	☐	☐
(7) Alert	☐	☐	☐	☐	☐
(8) Fearful	☐	☐	☐	☐	☐
(9) Anxious	☐	☐	☐	☐	☐
21. What do you think of the following description of the flu vaccine?	Disagree strongly	Disagree	Undecided	Agree	Agree strongly
(1) Can prevent infection with influenza	☐	☐	☐	☐	☐
(2) Can strengthen the immune system	☐	☐	☐	☐	☐
(3) Safe	☐	☐	☐	☐	☐
(4) Need more detailed information	☐	☐	☐	☐	☐
(5) Costly	☐	☐	☐	☐	☐
(6) I am willing to receive a vaccination.	☐	☐	☐	☐	☐
22. What do you think of the following description of the COVID-19 vaccine?	Disagree strongly	Disagree	Undecided	Agree	Agree strongly
(1) It can prevent infection with COVID-19	☐	☐	☐	☐	☐
(2) Can strengthen the immune system	☐	☐	☐	☐	☐
(3) Safe	☐	☐	☐	☐	☐
(4) Need more detailed information to	☐	☐	☐	☐	☐
(5) It might be costly	☐	☐	☐	☐	☐
(6) Taking into account the allocation of vaccine resources, I can receive the vaccination in the next year	☐	☐	☐	☐	☐
(7)) I am willing to receive a CODIV-19 vaccination	☐	☐	☐	☐	☐
23. During Wuhan's lockdown, if other disasters (fires, earthquakes, floods) occur, to what extent would you be worried about the following circumstances?	Very low	Below average	Average	Above average	Very high
(1) Will cause serious damage to your house.	☐	☐	☐	☐	☐
(2) Will cause injury or death to you or your family.	☐	☐	☐	☐	☐
(3) Will affect the medical needs of you or your family.	☐	☐	☐	☐	☐
(4) Will affect your work, and you cannot go to work or class normally.	☐	☐	☐	☐	☐
(5) Will interrupt local businesses.	☐	☐	☐	☐	☐
(6) Will cause traffic interruption.	☐	☐	☐	☐	☐
(7) Will cause water and power outages and damage infrastructure.	☐	☐	☐	☐	☐

24. During Wuhan's lockdown, what percentage of people you saw were wearing masks on the street? (Please check one)

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

25. In the past week, what percentage of people you saw were wearing masks on the street? (Please check one)

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

26. What do you think about the likelihood of you being infected with COVID-19? (Please check one)

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

27. Starting today, how long do you think COVID-19 will continue to affect your life? (Please check one)

0-2 months	3-5 months	6-8 months	9-11 months	12-14 months	15-17 months	18-20 months	21-23 months	24 months and more
☐	☐	☐	☐	☐	☐	☐	☐	☐

28. How old are you?								_____ years old		
29. What is your sex?								☐ Male	☐Female	
30. What is your marital status?										
☐ Married		☐ Single			☐ Divorced				☐ Widowed	
31. What ethnic group do you belong?										
☐ Han			☐ Minority				☐ Alien			
32. Regarding age, how many members of your family (including yourself) are:										
Under 18 years _____			18-60 years _____				Over 60 years_____			
33. The house where you live is?										
☐ Purchased home			☐ Rented				☐ Self-built house			
34. What is your highest level of education?										
☐ Junior high school or less		☐ High school/Technical secondary school (secondary vocational school)			☐ College/ vocational school			☐ Undergraduate	☐ Graduate school	
35. What is your annual household income?										
☐ less than $30,000		☐ $30,000-80,000			☐ $80,000-150,000			☐ $150,000-300,000	☐ more than 300,000	
36. What percentage of last year's average monthly income was your total household income last month? (Please check one)										
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100% and more
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Additional comments:

Thank you for participating in this study

Appendix B Jacksonville State University IRB Approval

JSU | INSTITUTIONAL REVIEW BOARD
JACKSONVILLE STATE UNIVERSITY

Institutional Review Board for the Protection of Human Subjects in Research
203 Angle Hall
700 Pelham Road North
Jacksonville, AL 36265-1602

July 6, 2021

Leonard Peterson
Jacksonville State University
Jacksonville, AL 36265

Dear Leonard:

Your protocol for the project titled "Assessment of Protective Actions by Rural Chinese Households During the COVID-19 Pandemic" protocol number 07062021-1 has been approved by the JSU Institutional Review Board for the Protection of Human Subjects in Research (IRB).

If your research deviates from that listed in the protocol, please notify me immediately. One year from the date of this approval letter, please send me a progress report of your research project.

Best wishes for a successful research project.

Sincerely,

Lynn Garner
Associate Human Protections Administrator, Institutional Review Board