

Master of Public Health
Integrative Learning Experience Report

***USE OF THE HEALTH BELIEF MODEL
TO ASSESS PREDICTORS FOR COVID-19 VACCINATION
IN RILEY COUNTY, KANSAS***

by

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submitted in partial fulfillment of the requirements for the degree

MASTER OF PUBLIC HEALTH

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Abstract

In the United States, there have been approximately 45 million total COVID-19 cases, and the number is still increasing as of October 2021, despite vaccine availability. During this same period, Riley County, Kansas, has had a total of 7,994 positive cases of COVID-19 (October 14, 2021). Using the Health Belief Model (HBM), this study aimed to assess predictors of Riley County residents' intent to get vaccinated against COVID-19 with one of the three major vaccines. The study employed a cross-sectional online survey (n=572) that was administered to Riley County residents. Results indicate that all aspects of the HBM are significantly correlated with intention to vaccinate, except cues to action. Interestingly, this study finds that participants who are between 38-47 years old perceive higher levels of COVID-19 severity than participants who are over 57. Participants who are between 18-27 also perceive lower levels of susceptibility than all other age groups. Furthermore, there is a significant positive correlative relationship between influenza vaccination and COVID-19 vaccine intention. Additionally, this study demonstrates the need for public health professionals and healthcare practitioners to foster interpersonal relationships with younger people to enhance vaccine adoption. Focus on increasing perceptions of susceptibility to and severity of vaccine-preventable diseases, on increasing perceptions of self-efficacy, and on decreasing perceptions of barriers to vaccination are important.

Subject Keywords: Health Belief Model, COVID-19, Intention to vaccinate

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Chapter 1 - Introduction

In the United States, there have been 45 million COVID-19 reported cases, and the number is still increasing as of October 2021 (Centers for Disease Control and Prevention, 2021). During this same period, Riley County, Kansas, has had a total of 7,994 positive cases of COVID-19, with a current two-week cumulative percent positive of about 3.64% as of October 14, 2021 (Riley County Health Department, 2021). COVID-19 has caused many other damages to society; approximately one-third of American adults lost their jobs due to the pandemic, and half of the low-income families (annual income less than \$40,100) have had difficulties paying their bills since the pandemic started (Parker, et al., 2020). Additional incidents include social upsets; for example, the discrimination against Chinese people became more intense. Xenophobia has increased, impairing the harmony among different ethnicities and leading to societal instability. For example, between March and July 2020, there were approximately 2600 anti-Asian discrimination cases in America (Mohapatra, 2020). Among the problems of making the vaccine available around the world, the largest problem, arguably, is vaccine-hesitancy in a segment of the population where the vaccine is available, resulting in a declining global vaccination rate which, in turn, creates more critical problems facing the world's population (Omer et al., 2009).

In the U.S., the current fully vaccinated rate is only 57%. Additionally, there were 80,248 new cases and 1,619 deaths as of October 25 (CDC, 2021). During the same period, Riley County experienced 38 new cases and 59 deaths (RCHD, 2021). As of October 25, 2021, Riley County's full vaccination rate was only 38% (Kansas Department of Health and Environment, 2021). Many locations provide free COVID-19 vaccines, such as Walmart, Hy-Vee Pharmacy,

and CVS Pharmacy in Riley County (RCHD, 2021), still the vaccination rate is relatively low compared to the national average rate.

This study was conducted in collaboration with the Riley County Health Department (RCHD). The RCHD started in 1952 as a city health department and became a county health department in 2011 (RCHD, 2021). The mission of the RCHD is to maximize people's health regardless of their location, occupation, and religion (RCHD, 2021). The preceptor of this project is Dr. Aryn Price, who is the clinical supervisor. Price earned her Ph.D. at Emory University in microbiology and molecular genetics and her B.S. nursing degree at Duke University.

The purpose of this study was to try to understand the reasons behind people's vaccine hesitancy, using Riley County, Kansas, residents as the study group. Some people might think that COVID-19 is not infectious enough to require them to get the vaccine. Others might think the COVID-19 vaccine does not work well to protect them (Du et al., 2021). There could also be some other barriers, such as religious beliefs or infringement on personal civil rights, to getting vaccinated. Based on the HBM, this study sought to understand those perceptions and any barriers that lead to hesitancy.

As we know, the pandemic affected our entire society, including Riley County institutions and service providers. For example, Kansas State's biggest library—Hale Library--limited the student numbers in the study room, the Manhattan Public Library no longer provided public chairs for people, and many restaurants were not accepting dine-in customers.

Due to the COVID-19, the U.S. unemployment rate increased from approximately 3.5% in February 2020, before the pandemic, to approximately 15% in April 2020. Even in August

2021, the unemployment rate was still approximately 5% (Bureau of Labor Statistics, 2021). The U.S. was not the only country impacted by lost jobs, the whole world's unemployment increased. For example, from 2019 to 2020, the Canadian unemployment rate increased from 5.7% to 9.7%, and the United Kingdom's unemployment rate increased from 3.8% to 5.4% (Jones et al., 2021). At the same time, the Kansas unemployment rate increased from 3% to 12% (Kansas Legislative Division of Post Audit, 2021). Also, there was a 97% drop in footfall (people shopping in an area within a certain time) in Germany and a 78% drop in footfall in the United Kingdom (Jones et al., 2021). However, these changes did not appear during the Severe Acute Respiratory Syndrome (SARS) pandemic from 2002 to 2004. According to Lau et al (2005), the most significant behavior change during the SARS pandemic involved people seeking a healthy lifestyle. People exercised more, washed their hands more, and spent more money on health products.

Study Significance

This study identifies factors that influence people's vaccination decisions and can therefore help boost the vaccination rate. It can also help the RCHD adjust the current policy to target low vaccination populations and increase the COVID-19 vaccination rate in Riley County. Focusing on increasing vaccination rates within vaccine hesitant populations could save time and boost vaccination rate efficiently. After the vaccination rate increases, people will feel more comfortable and be more willing to meet each other again. The K-State University campus could then adjust its activity policies, businesses and companies could reopen, and the unemployment rate might decrease.

The high mortality and morbidity crowd the country's healthcare system. For example, the COVID-19 pandemic increased the shortage of nurses. In Dallas, doctors have had to perform nursing duties due to the shortage of nurses (Boyle, 2021).

Results from this study were used to inform a health campaign designed to promote COVID-19 vaccination in Riley County. The health campaign involves increasing people's perceived benefits of the COVID-19 vaccine, perceived susceptibility to COVID-19, perceived severity of COVID-19, and self-efficacy. The health campaign also involves decreasing people's perceived barriers to getting the COVID-19 vaccine.

Where does the vaccine come from?

The earliest vaccinations against infectious disease were first recorded in China or India before 200 BC ("History of Vaccines," n.d.). At that time, people used it to prevent smallpox, a viral disease caused by the variola virus (CDC, 2016). Traditionally, attenuated viruses/bacteria were used to inject into the human body to stimulate the immune system. The immune system would recognize these foreign particles and produce antibodies specifically against these antigens. Later, when the same virulent pathogens again invaded the vaccinated human body, they would be recognized by the existing antibodies and eliminated (WHO, 2020). For the COVID-19 mRNA vaccines, usually modified mRNA is injected into the human body. Then the mRNA begins to produce the SARS-CoV-2's spike proteins which are harmless. Because of the SARS-CoV-2's spike proteins, the immune system will produce the antibodies to react with the mRNA proteins, and these antibodies will also work on SARS-CoV-2 (WHO, 2021).

Examples of vaccine effectiveness

In the U.S., polio used to be a very contagious disease. Over 35,000 people were infected each year because it spread through food or water. Polio virus can also cause paralysis and death.

At the same time, today there is still not a cure for this disease, and the polio vaccine is the only option to prevent getting it (CDC, 2019). Luckily, the polio vaccine became available in 1955, and polio was eradicated in the U.S. by 1979 (CDC, 2021). However, there were still over 350,000 polio paralytic cases globally in the 1980s (Ochmann & Roser, 2017). Another contagious disease is chickenpox, which is caused by varicella-zoster virus (VZV) infection. Before the chickenpox vaccine was available, 4 million people got infected and 10,000 people were hospitalized each year in the U.S. The chickenpox vaccine became available in 1995 and has prevented more than 3.5 million infections and 9,000 hospitalizations each year (CDC, 2019).

The CDC also recommends people get the MMR vaccine, which protects against three diseases: measles, mumps, and rubella. Measles was found by a Persian doctor in the 9th century, and it spread to American in 1912. Before the vaccine was available, approximately 4 million people got infected every year (CDC, 2020). The measles virus causes watery/red eyes, high fever, cough, and a runny nose and can also lead to severe conditions like pneumonia, encephalitis, and death (CDC, 2020). The mumps virus can lead to fever, headache, muscle aches, tiredness, and loss of appetite. Most of the time, people who have mumps will have swollen cheeks. Mumps can also cause deafness and meningitis (CDC, 2021). In 1968, there were about 152,000 mumps cases. After the vaccine was invented, the cases dropped to 231 in 2003 (CDC, 2021). Rubella was first found in monkeys by Alfred F. Hess in 1914. In 1940 rubella became a pandemic disease, which spread across countries (CDC, 2021). Most people with rubella will show symptoms of sore throats, rash, and fevers. However, when a pregnant woman gets infected, it can cause miscarriage, and in severe cases congenital disabilities (CDC, 2020).

The MMR vaccine can prevent all three diseases. According to the CDC (2021), people who get a single dose of the MMR vaccine reduce their likelihood of contracting the measles virus by 93%, the mumps virus by 78%, and the rubella virus by 97%. People who get two doses of the MMR vaccine will reduce their likelihood of contracting the measles virus by 97% and the mumps virus by 88%.

What is COVID-19?

COVID-19 is caused by one kind of coronavirus—SARS-CoV-2 (World Health Organization, 2020). There are three mechanisms of transmission for this virus to spread: 1) People breathe in tiny droplets containing COVID-19 virus; 2) People's faces collect small droplets containing COVID-19 virus; and/or 3) People touch their faces with COVID-19-contaminated hands (CDC, 2021). Among these three transmission routes, the first and second are the most common (WHO, 2021). That is why it is vital to wear a mask and wash hands frequently. The two common ways to detect COVID-19 virus are the rapid antigen test (RDT) and polymerase chain reaction (PCR) test. The RDT result is available faster but is less accurate. The RDT's turnover time is 15 minutes to detect SARS-CoV-2, but the PCR test takes 2 to 3 days (Memorial Healthcare, 2020). According to Dinnes et al (2020), the RDT's average sensitivity for SARS-CoV-2 is 56.2%, and the RDT's average specificity is 99.5%. The PCR test's average sensitivity and specificity for SARS-CoV-2 are 95.2% and 98.9%, respectively. After people contract the COVID-19 virus, the most common symptoms include fever, dry cough, and fatigue. However, the symptoms may vary between individuals. For example, COVID-19 virus could cause trouble breathing, confusion, skin color changes, chest pressure or pain, and inability to wake or stay awake (CDC, 2021). If the COVID-19 test comes back as

positive, besides seeking medical assistance, people without symptoms need to isolate for 10 days, and people with symptoms need to isolate for 13 days (WHO, 2020).

Why should we get the COVID-19 vaccine?

To date, the COVID-19 vaccines is the most efficient way to save people's lives. There is a huge difference in hospitalization rates between vaccinated and unvaccinated people. In August 2021, for vaccinated adults who contracted COVID-19, the hospitalization rate was 4.5%. However, unvaccinated adults with COVID-19 had an 83.6% COVID-19 hospitalization rate (CDC, 2021).

Currently, there are three kinds of COVID-19 vaccines available in the U.S.: Pfizer-BioNTech, Moderna, and Johnson & Johnson's Janssen. The Pfizer-BioNTech vaccine has a 95% effectiveness, the Moderna vaccine has a 94.1% effectiveness, and the Johnson & Johnson's Janssen vaccine has a 66.3% effectiveness (CDC, 2020). Although these three vaccines can have some mild side effects, vaccination is the most effective way to prevent COVID-19 transmission.

Vaccines are classified as artificial immunization, which involves antibody production with minor side effects. Natural infection also stimulates antibody production, but there is a difference between the vaccination's antibodies and the infection's antibodies. According to Francis Collins of the National Institutes of Health (2021), the antibodies induced by the COVID-19 vaccine can bind with more receptor binding domains (RBD) of the COVID-19 virus compared to the natural infection's induced antibodies. The RBD represent a vital area of spike proteins on the virus surface, and antibodies bind these domains to deactivate the virus.

The current dominant COVID-19 virus variant is Delta. Regarding the new COVID-19 cases, the 83% new infections were caused by Delta variant in July 2021 (Stolberg, 2021). Compared to the previous variant, the Delta variant can spread twice as fast and cause more severe symptoms. However, the current vaccines are still the most potent weapon against it (CDC, 2021). The CDC is now administering a booster dose to people who are already fully vaccinated. This is because after building up the immune defense to the COVID-19, the protection strength decreases gradually over time (CDC, 2021). A booster dose increases the protection strength and helps to resist the Delta variant. For example, the Pfizer vaccine's third dose can against the Delta variant with 95.6% effectiveness (The Times of Israel, 2021).

What challenges does the COVID-19 vaccine have?

Even though the COVID-19 vaccine is effective, there are still anti-vaccine movements, which have a long history. In the 19th century, there were some arguments about the smallpox vaccine in the United Kingdom. Some people believed the smallpox vaccine was incompatible with their religion because the vaccine came from the cowpox blister. In the 20th century, an organization named Association of Parents of Vaccine Damaged Children (APVDC) opposed the DTP (diphtheria, tetanus, and pertussis) vaccine. Later in 1998, a physician from England named Andrew Wakefield mentioned that there might be a relationship between the MMR vaccine and autism, also saying that the vaccine was not safe to use. These stories got distorted and spread by media, creating a panic among different publics about the MMR vaccine. However, it was determined that he had been paid by a law board to try to find the evidence that supporting the idea that vaccines caused autism, and he lost his medical license. His work was initially published in *Lancet*; however, the paper was retracted in 2010 after the British General Council

made claims against him. Journalist Brian Deer found that Andrew Wakefield had manipulated his research data and tried to profit illegally, and this evidence was published by BMJ, a medical journal website in the UK (The College of Physicians of Philadelphia, 2018).

Regarding the COVID-19 vaccine, there are primarily three claims from the anti-vaccine supporters: 1) The government is lying to the public about the COVID-19 and vaccine and is using the vaccine to decrease the global population and inject tracking devices in humans. 2) Mandatory vaccination infringes on people's rights. A common position is that parents should have the right to decide if their children should get vaccinated or not because they are the most familiar with their children's medical condition. 3) Artificial immunization is not as good as natural infection (Smith & Reiss, 2020).

According to Ozawa and Stack (2013), vaccine intention is positively associated with faith in government. Since the anti-vaccine supporters do not trust government authority, they tend to have a very low vaccine intention. For example, people in the Democratic Republic of the Congo resisted polio vaccination because of a lack of trust in government.

Although the average one-dose vaccination rate is approximately 77% in the U.S., there are still vaccination disparities among different ethnicity groups. According to the data reported from 43 states, the one-dose vaccination rate is 45% for Black people and 49% for Hispanic people (Ndugga et al., 2021). According to Momplaisir et al. (2021), Black, Latino, and Hispanic health workers have a high vaccine hesitancy for the COVID-19 vaccine. People worry about the side effects of the vaccine and think it is too new (Momplaisir et al., 2021).

What have COVID-19 health campaigns done?

Different health campaigns in different countries and communities try to spread information to target populations. Social media plays a significant role in people's lives now, and

the information carried by social media reaches people fast. Approximately 72% of Americans use social media, and people post their photos, videos, and opinions on different platforms (ProCon.org, 2020). Because social media can deliver information to people easily, it has been a leading source of health information that influences people in both positive and negative ways.

Regarding COVID-19 health information, social media can positively influence people's lives by: 1) distributing the government's announcements immediately, 2) enabling people to understand health information easily with pictures and graphs, and 3) enabling people to get updated health information from other reliable medical sources. However, social media can also influence people negatively: 1) Some information on social media is not accurate. 2) Social influencers knowingly can share false information on social media. 3) Social media exposes people to overwhelming information that leads to confusion (Venegas-Vera et al., 2020).

The positive influence of social media can boost the vaccination rate. Glanz et al. (2017) found that people who used interactive media were more likely to vaccinate their children than people who did not. Interactive media is one kind of social media that enables people to share graphic and textual information, for example, Facebook (Dhir, 2021).

However, the negative influence of social media can increase vaccine hesitancy. Research by Wilson & Wiysonge (2020) found a negative relationship between false information on social media and the COVID-19 vaccination rate, as the former increased public doubt on COVID-19 vaccine safety. Wilson & Wiysonge (2020) suggested that the government should make social media companies responsible for this anti-vaccine content and retract this information.

France only had approximately 500 people who received the COVID-19 vaccine in January 2021 (Briançon, 2021). This failed health campaign was due to the people's distrust of

the French government (Briançon, 2021). People were skeptical about COVID-19 vaccine's safety because of the vaccine's short invention period (Walt, 2021). At the same time, another campaign in Novato, California, successfully increased the vaccination rate by 25% within two months. This health campaign included posters, newspapers, and social media. Health providers in Novato even went directly to residents' apartments to give them the COVID-19 vaccine (Rodriguez, 2021).

Chapter 2 - Theoretical Framework

Health Belief Model

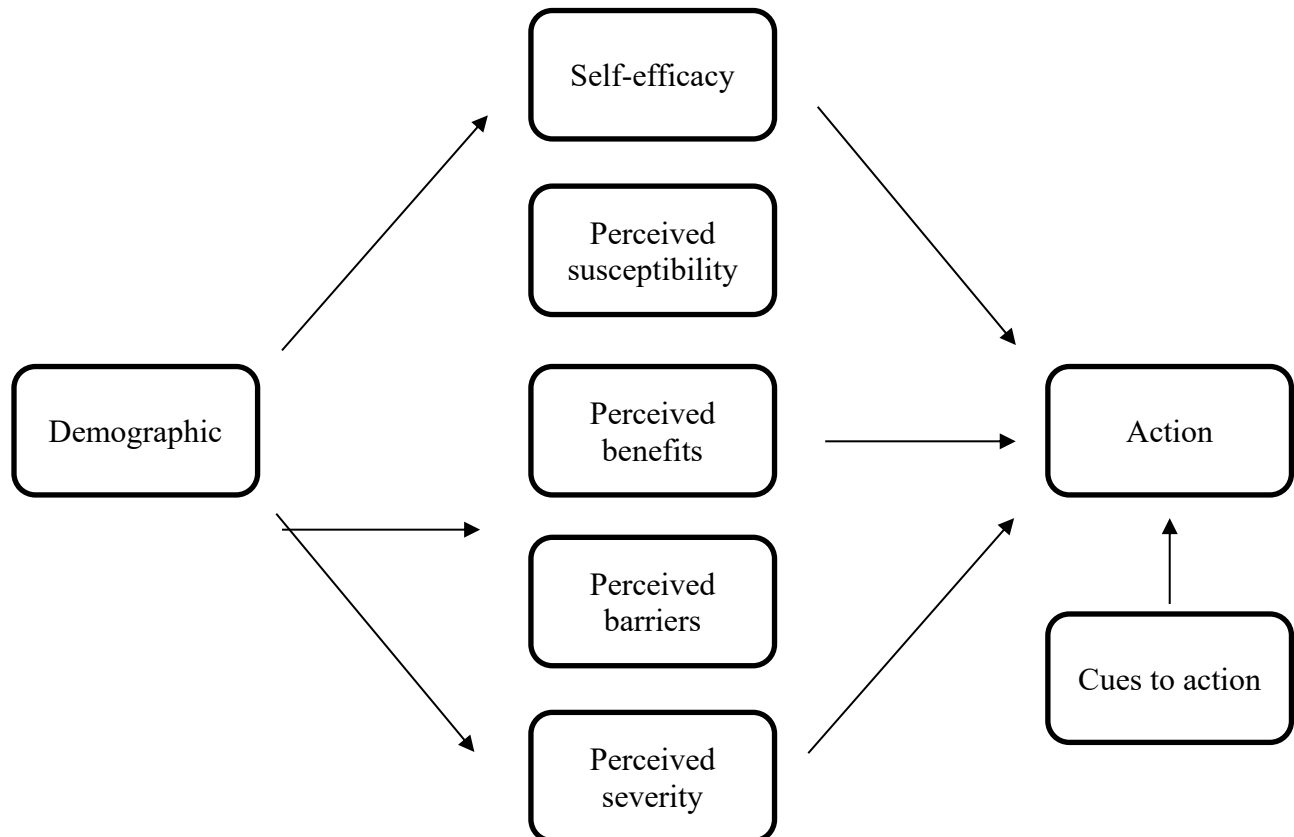
This study used the Health Belief Model (HBM) theory (Hochbaum & Rosenstock, 1952), developed by scientists who worked at the U.S. Public Health Service to assess target populations' perceptions (LaMorte, 2019; Mckellar & Sillence, 2020). HBM was initially used to prevent undesirable behavior, and then applied to the health service relationship analysis.

HBM has two significant parts: threat perception and behavioral evaluation. Threat perception includes perceived susceptibility and perceived severity (Conner & Norman, 2015). Perceived susceptibility assesses how susceptible the target population thinks they are to this risk, and perceived severity assesses how severe the target population thinks this risk is. Both susceptibility and severity represent the threat faced by the population (Scherr et al., 2016).

The behavioral evaluation includes perceived benefits and perceived barriers (Conner & Norman, 2015). Perceived benefits are factors that the target population thinks they can be beneficial from desirable behaviors. Perceived barriers are factors that hinder the target population from performing desirable behaviors. Both link actions by the population to reduce the threat (Scherr et al., 2016). Besides these two major parts, cues to action and self-efficacy also play a role. Cues to action include factors that could trigger the target population to perform desirable behaviors (Conner & Norman, 2015). Self-efficacy indicates of whether the target population is confident in performing desirable behaviors (Thalacker, 2011). See Figure 2.1 below. According to the HBM, people will be more likely to get an influenza vaccine if they believe: 1) they are at high risk to get influenza; 2) influenza is a severe disease; 3) the vaccine will protect them from getting influenza; 4) it is easy to get the influenza vaccine; and 5) they

can get the influenza vaccine; and 6) they receive an influenza vaccine reminder (Ratnapradipa et al., 2017). This is illustrated below in one study of the Hmong community and vaccine hesitancy.

Figure 2.1 Health Belief Model



Based on the model in Hypertension and the Hmong Community: Using the Health Belief Model for Health Promotion

Hypotheses

This study has three hypotheses (H) and four research questions (RQ) based on the Health Belief Model:

H1: COVID-19 vaccine intention will be positively related to the perceived threat of COVID-19.

H2: COVID-19 vaccine intention will be negatively related to perceived barriers.

H3: COVID-19 vaccine intention will be positively related to the perceived benefits of the COVID-19 vaccine.

RQ1: Is there a relationship between the influenza vaccination and COVID-19 vaccine intention?

RQ2: Is there a difference among different age groups in their perceptions about COVID-19 severity and susceptibility?

RQ3: Are there differences in vaccination hesitancy based on ethnicity?

RQ4: What are the most used interpersonal and media sources for COVID-19 health information?

Data Collection and Analysis

The study population is from Riley County, Kansas. Riley County has a distinctive character to make it ideal as our target population: high fluidity. There were approximately 73,000 people in Riley County in 2021 (Riley County Health Department, 2021), comprising two significant population influencers, Kansas State University (KSU) and the Fort Riley military base. There were approximately 20,000 students at KSU in 2020 (Kansas State University, 2021). Among these students, there was a geographic diversity of people from different states and countries. On the Fort Riley military base, there were approximately 55,000 people in 2020, including approximately 23,000 family members (MilitaryINSTALLATIONS, 2021). Both populations have a high fluidity property, which increases the chance to spread COVID-19.

The KSU Committee on Research Involving Human Subjects reviewed and authorized this project. The project data were collected by a cross-sectional survey, which was entirely voluntary and anonymous. Participants needed to agree to the consent form before answering the survey. The survey was web-based, and it had two parts: HBM and demographic information. The HBM of the survey included perceived susceptibility to the COVID-19 virus, perceived severity of the COVID-19 virus, perceived self-efficacy, perceived COVID-19 vaccine benefits, perceived access/clinical barriers to COVID-19 vaccination, and cues to action for the target population. The demographic information included age, gender, education level, COVID-19 infection/COVID-19 test, influenza vaccine, number of children, ethnicity, occupation, annual income, and zip code. The survey was generated through Qualtrics and shared through a link of the survey to different social media platforms, including Twitter and Facebook. The survey was also shared through extended agencies, including the Riley County Health Department (RCHD) and KSU's International Student and Scholar Services. During the data collection, uncompleted responses were deleted. Finally, 572 reliable responses were collected.

The data were analyzed through Statistical Package for the Social Sciences (SPSS). The scale measured the HBM's elements from 1 (strongly disagree) to 5 (strongly agree). The scale also measured the frequency from 1 (never) to 5 (always) for behavioral items including media usage. Cronbach's α is used to measure the consistency and reliability of the data. According to Daud et al. (2018), a Cronbach's α value above .60 is considered reliable and acceptable for data. Statistical analysis included descriptives (frequencies, means, and standard deviations), reliability analysis, t-test, and one-way ANOVA.

Chapter 3 - Results

Demographics

Data were collected from March 2nd to May 6th of 2021. This period was selected because the COVID-19 vaccine had just come out, and most people had not been vaccinated. Data gathered at this time reflected people's perceptions of the COVID-19 vaccine more accurately. There were some highlights among the sample population. The primary ethnicity was Caucasian (78%). Most people were female (73%). For the number of children, 47% of the participants reported no children. For the education level, 43% had a graduate/professional degree. According to the health information portion of the survey, most people received the COVID-19 test to see if they had contracted the virus (65.5%). The survey also revealed that most people used Facebook (92.6%) and Google (91.4%) to find COVID-19 virus and vaccine information. Additionally, 16.3% of the participants reported a positive COVID-19 diagnosis. See Table 3.1 below.

Table 3.1 Study Population Demographics

Variable	Number (N)	Percentage (%)
Age		
18-27	171	29.9
28-37	132	23.1
38-47	87	15.8
48-57	85	15.4
58+	76	13.3
Gender		

Male	133	23.3
Female	415	72.6
Other	5	0.9
Ethnicity		
Caucasian	446	78
Black or African American	19	3.3
Latino/Hispanic	36	6.3
Asian	51	8.9
Native American or Pacific Islander	14	2.4
Other	12	2.1
Number of Children		
0	266	46.5
1	77	13.5
2	133	19.8
3	49	8.6
3+	26	4.5
Estimated Annual Income		
Less than \$10,000	95	16.6
\$10,001-\$25,000	87	15.2
\$25,001-\$40,000	89	15.6
\$40,001-\$55,000	82	14.3
More than \$55,000	190	33.2
COVID-19 Positive	90	15.7

The percentage may not add up to 100% due to missing data

As mentioned before, the variables in this study were drawn based on HBM elements of which were measured on a Likert Scale from 1 (strongly disagree) to 5 (strongly agree). Data were processed using mean (M) and standard deviation (SD). The mean is the average of the element score, and the SD measures the data's distribution. For example, If the mean is 4 out of 5, this represents that the agreement of the sample is high.

For the intention to get the COVID-19 vaccine (M=4.44, SD=.98, Cronbach's α =.92), most people in the sample showed high intention. However, the mean of the perceived benefits of COVID-19 vaccination (M=3.72, SD=.94, Cronbach's α =.77) and perceived self-efficacy (M=3.6, SD=.85, Cronbach's α =.68) were relatively low. This shows that the people in the sample do not think the COVID-19 vaccine is highly beneficial and are not confident in their ability to get it.

The perceived severity (M= 2.99, SD=.96, Cronbach's α =.79) was moderately low, which could be a concern. This shows the most people in the sample do not think the COVID-19 is severe enough to warrant getting the vaccine.

Perceived clinical barriers to COVID-19 vaccination (M=1.94, SD=.74, Cronbach's α =.63), and perceived access barriers to COVID-19 vaccination (M=2.22, SD=.73, Cronbach's α =.59) were not high. If the mean is 1 out of 5, this indicates the perceived barrier is low. The data show that most of the people in the sample do not think they have a high barrier to get the COVID-19 vaccine. For the perceived susceptibility, a mean of 4 out of 5 represents high susceptibility. In the sample, the M=4.03 value shows that most people agree they are highly susceptible to COVID-19 infection (SD=.71). The Cronbach's α =.67 parameter indicates that the data have an acceptable internal consistency. See Table 3.2 below.

Table 3.2 Health Belief Model Element Descriptives

	Mean	SD	Cronbach's α
Intention	4.44	.98	.92
Perceived Benefits	3.72	.94	.77
Perceived Severity	2.99	.96	.79
Perceived Susceptibility	4.03	.71	.67
Perceived Clinical Barriers	1.94	.74	.63
Perceived Access Barriers	2.22	.73	.59
Self-Efficacy	3.60	.85	.68

Hypotheses Testing

Pearson Correlation (r) was used to test whether there is a relationship between two factors. The correlation coefficient varies from -1 to 1, where -1 represents two factors that are strongly negatively related, and 1 represents two factors that are strongly positively related. At the same time, to decide whether a relationship is statistically significant, the p-value was used to determine statistical significance. P-values of $< .05$, indicate the result is statistically significant, which means the result is less than 5 percent wrong. P-values of $< .01$, indicate the result is highly statistically significant, meaning it is less than 1 percent wrong.

H1 predicted that COVID-19 vaccine intention would be positively related to the perceived threat of COVID-19. This hypothesis was supported. There was a statistically significant positive relationship between COVID-19 vaccine intention and perceived virus severity ($r=.205$, $p<.001$). The positive relationship shows that vaccine intention increases as the threat increases. This means that if people believe the COVID-19 virus is severe, they may be more likely to get the vaccine.

H2 predicted that COVID-19 vaccine intention would be negatively related to perceived barriers. This hypothesis was supported. Results show a statistically significant negative relationship between COVID-19 vaccine intention and the perceived access barriers ($r=-.436$, $p<.001$). There was also a statistically significant negative relationship between the COVID-19 vaccine intention and the perceived clinical barriers ($r=-.552$, $p<.001$). The negative relationship indicates that the vaccination intention decreases as the barriers increase. This means that if people believe there are more barriers to getting the COVID-19 vaccine, they will be less likely to get it.

H3 predicted that COVID-19 vaccine intention would be positively related to the perceived benefits of the COVID-19 vaccine. This hypothesis was supported. Results show a statistically significant positive relationship between COVID-19 vaccine intention and the perceived benefits of the COVID-19 vaccine ($r=.52$, $p<.001$). This means that if people believe the COVID-19 vaccine is beneficial, they will be more likely to get the vaccine. See Table 3.3 below.

Table 3.3 Bivariate Intercorrelations of Key Study Variables

	Intention	Perceived Benefits	Perceived Severity	Perceived Susceptibility	Perceived Clinical Barriers	Perceived Access Barriers	Self-Efficacy	Influenza Vaccination	Media Channel	Interpersonal Channel
Intention	1									
Perceived Benefits	.520**	1								
Perceived Severity	.205**	.253**	1							
Perceived Susceptibility	.288**	.200**	.134**	1						
Perceived Clinical Barriers	-.552**	-.391**	-.085*	-.215**	1					
Perceived Access Barriers	-.436**	-.300**	-.001	-.111**	.355**	1				
Self-Efficacy	.251**	.137**	-.600	.142**	-.197**	-.238**	1			
Influenza Vaccination	.375**	.220**	.035	.214**	-.304**	-.226**	.128**	1		
Media Channel	.214**	.175**	.090*	.109**	-.074	-.103*	.065	.099*	1	
Interpersonal Channel	.047	.121**	.041	.102*	.079	.024	.012	.045	.398**	1

*Correlation is significant at the 0.05 level (two-tailed).

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

Pearson's correlation (r) was used to test the research questions. The first research question (RQ1) examined the relationship between the influenza vaccination and COVID-19 vaccine intention. Pearson's correlation showed a statistically significant positive relationship between the intention to get a COVID-19 and an influenza vaccination ($r=.375$, $p<.001$). This means that people who got the influenza vaccine have a high likelihood to get the COVID-19 vaccine, too.

The second research question (RQ2) examined the differences among different age groups' consideration of COVID-19 severity and susceptibility. For severity, results from the One-way Analysis of Variance (ANOVA) showed a statistically significant difference between different age groups [$F(4, 545) = 2.482$, $p=.043$]. Tukey's post-hoc analysis demonstrated that the 38-47 age group differed significantly in their perceived severity from the over-57 age group ($p<.05$). The average score for the age group over 57 is 2.78, but the average score for the age group between 38-47 is 3.20, which means the age group between 38-47 thinks the COVID-19 is more severe than the age group over 57.

There was also a significant difference in participants' perceived susceptibility based on age groups [$F(4, 546) = 7.071$, $p<.001$]. Tukey's post-hoc analysis showed that the 18-27 age group differed significantly from all other age groups ($p<.05$). The average score of the perceived susceptibility score for the 18-27-year-olds was 3.82, which is lower than all other age groups.

The third research question (RQ3) examined whether there is a difference among different ethnic groups regarding vaccination hesitancy. Results from the One-way ANOVA showed a statistically significant difference among different ethnicity groups.

Regarding COVID-19 vaccine intention, One-way ANOVA [$F(5, 522) = 4.027, p = .001$] and Tukey's post-hoc analysis showed that the Native American or other Pacific Islander group differed significantly from Caucasian ($p = .006$), Black or African American ($p = .031$), Latino/Hispanic ($p = .005$), and Asian ($p = .022$) groups. The average score for COVID-19 vaccine intention for the Native American or other Pacific Islander group was 2.87, which is lower than Caucasian ($M = 4.50$), Black or African American ($M = 4.46$), Latino/Hispanic ($M = 4.64$), and Asian ($M = 4.38$) groups.

Regarding the perception of COVID-19 vaccine benefits, One-way ANOVA [$F(5, 524) = 2.700, p = .02$] and Tukey's post-hoc analysis showed that the Native American or other Pacific Islander group differed significantly from Caucasian ($p = .026$), Black or African American ($p = .026$) and Latino/Hispanic ($p = .046$) groups. The average score for the perceived COVID-19 vaccine benefits for the Native American or other Pacific Islander group was 2.38, which is lower than Caucasian ($M = 3.77$), Black or African American ($M = 3.96$), and Latino/Hispanic ($M = 3.77$) groups.

For the perception of COVID-19 virus susceptibility, One-way ANOVA [$F(5, 524) = 7.251, p < .001$] and Tukey's post-hoc analysis showed that Asians differed significantly from Caucasians ($p < .001$). The average score for perceived virus susceptibility for Asians was 3.55, which is lower than for Caucasians ($M = 4.11$).

For the perceived COVID-19 vaccine clinical barriers, One-way ANOVA [$F(5, 523) = 4.780, p < .001$] and Tukey's post-hoc analysis showed that the Asians differed significantly from Caucasians ($p = .003$). The average score for the perceived clinical barriers for Asians was 2.31, which is higher than for Caucasians ($M = 1.89$).

The fourth research question (RQ4) examined the most used interpersonal and media sources of health information. The results showed that the most used interpersonal source is friends (92.85%), and the most used media source is the internet (98.65%). Media sources of health information are significant and positively related to COVID-19 vaccine intention ($r=.214$, $p<.001$) and perceived vaccine benefits ($r=.175$, $p<.001$). This result means that people who listen to the media health information more frequently tend to have higher vaccination intention and consider the COVID-19 vaccine to be more beneficial. See Table 3.4 below.

Table 3.4 One-way ANOVA between Groups based on Demographic Factors

Age Group	
Perceived Severity	F (4, 545) = 2.482, $p=.043$
Perceived Susceptibility	F (4, 546) = 7.071, $p<.001$
Ethnicity Group	
Intention	F (5, 522) = 4.027, $p=.001$
Perceived Benefits	F (5, 524) = 2.700, $p=.02$
Perceived Susceptibility	F (5, 524) = 7.251, $p<.001$

Chapter 4 - Discussion

The purpose of this study was to explore people's positive and negative perceptions of COVID-19 vaccination. There were 572 respondents, a relatively large sample size, which lends itself to high reliability and generalizability. The study results are applicable across a broad area.

This study's data collection was completed before the COVID-19 vaccine was available, and at that time there was a high vaccine intention ($M=4.44$). However, some factors may reflect the reasons why the current vaccination rate is not as high as the vaccine intention indicated. First, the results suggest that people do not think the vaccine is useful enough for COVID-19 prevention ($M=3.72$). The low benefit perception may be due to a lack of information since the vaccine was newly launched at survey time, and not much information was available prior to this study. This suggested the importance of early health education and dissemination of accurate information in preventing future pandemics or spreading of infectious diseases that require vaccinations.

Second, most people did not consider COVID-19 as a severe illness ($M=2.99$), even though they agreed they were likely to contract the virus with a higher level of perceived susceptibility ($M=4.03$). This might be because a large portion of the study group was young people (18-37-year-olds, 53%). Young people have a much lower death rate than older people when infected with COVID-19. For example, for people more than 85 years old, the death rate was 570 times higher than in those between 18-29 years old (CDC, 2021). The information distributed through media and other channels during the study period alluded to the idea that young people were less likely to die from COVID-19 than the elderly, which may have influenced their perceptions of severity.

Third, most of the study participants did not think they were ready to get the COVID-19 vaccine ($M=3.60$). However, they reported high intentions of getting vaccinated at some point in the future. As the results for specific questions indicate, participants did not believe the vaccine was safe, which led to the low self-efficacy score and low confidence in getting vaccinated.

With regarding to different ethnic groups of people, the Native Americans/other Pacific Islander group did not think the vaccine was as beneficial as Caucasians, Black/African American, and Latino/Hispanic groups. Furthermore, the Native Americans/other Pacific Islanders had very low vaccine intentions compared to all other groups. For the perceived COVID-19 virus susceptibility, Caucasians thought they were more likely to get the COVID-19 than Asians. However, regarding COVID-19 vaccine clinical barriers, Asians perceived higher barriers than Caucasians. With these results, it is important to consider health disparities while addressing the barriers to vaccine acceptance.

In conclusion, the people in this study perceived a low severity of COVID-19 virus, showed a low confidence in COVID-19 vaccination, and perceived low COVID-19 vaccine benefits. This suggests that vaccine hesitancy plays a role in Riley County and hinders the vaccination rate. The local health department needs to enhance COVID-19 vaccine education to decrease vaccine hesitancy. The health campaign could use flyers and presentations to distribute health information about COVID-19 and its vaccines (see the Appendix 3: Health Campaign Plan). An effective health campaign will boost the vaccination rate effectively.

Study limitations

Although the study results provided many important insights, they also had some limitations. First, the majority ethnicity was Caucasian (78%), and this could diminish the generalizability. The Native American/other Pacific Islander groups only constituted 2.4% of all

study participants, so the generalizability of this study result decreases. Second, the gender disproportion could also influence the generalizability since most participants were female (72.6%). Third, most participants had either an undergraduate or graduate degree (71.9%), which might influence the research results due to the high educational level. Additionally, there was a high number of positive COVID-19 histories among the participants (15.7%). According to CDC (2021), a positivity rate over 10% for COVID-19 is considered a high transmission.

Chapter 5 - Competencies

This chapter shows what I applied from what I learned in my class to the project.

Table 5.1 Summary of MPH Foundational Competencies

Number and Competency		Description
#1	Apply epidemiological methods to the breadth of settings and situations in public health practice	This study used the cross-sectional method to compare different groups at the same time.
#2	Select quantitative and qualitative data collection methods appropriate for a given public health context.	The questionnaire used in this study includes both quantitative and qualitative data collection methods.
#3	Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	This project involved the analysis of data using the software Statistical Package for the Social Sciences (SPSS).
#4	Interpret results of data analysis for public health research policy or practice	Riley County Health Department can use the study results as references for policymaking.
#22	Apply systems thinking tools to a public health issue	Used the Health Belief Model (HBM) flow chart to illustrate the sequences between different theory elements to solve the problem.

Competency #1 requires that this study to include epidemiological methods. The epidemiological methods include descriptive, analytical, and experimental techniques. The descriptive technique is the health problem's description. The analytical technique is the health problem's causation. The experimental technique is to test hypotheses. This study achieved competency #1 during the data collection by using the cross-sectional method, which belongs to

the description technique category. This study used Qualtrics to collect data from different groups at the same time. This study also tested three hypotheses.

Competency # 2 included selecting quantitative and qualitative data collection methods. Quantitative data are measurable; for example, questions may relate to frequency. Qualitative data are descriptive; for example, the hair color can be described as black. This study achieved competency # 2 by using a survey. This survey included both quantitative and qualitative data collection. For example, quantitative data collection in the survey included collecting age information, and the qualitative data collection in the survey included asking questions about COVID-19 vaccine intention.

Competency # 3 included using computer software to analyze quantitative and qualitative data. This competency was achieved by using SPSS (Statistical Package for the Social Sciences). SPSS is computer software to analyze data and involves both inferential and descriptive analysis. This study involved descriptives (frequencies, means, and standard deviations), reliability analysis of scales, n recode and creation of variables, comparison of means using t-tests, one-way ANOVAs, and correlation tests.

Competency # 4 involves use of the study results by a public health agency to help improve policymaking for public health. This competency was achieved by the study results and products. The study products included a poster and a health campaign. The study results showed that the target population had low perceived COVID-19 severity and susceptibility. Based on the study results, the health campaign can be designed to increase the COVID-19 vaccination rate. Riley County Health Department can use the study results as a reference for future policymaking.

Competency # 22 includes using a systemic tool for a public health issue. The systemic tool involves exploring the relationship between different factors within the whole system. This competency was achieved by using the HBM flow chart to demonstrate the sequences of several different elements, such as perceived severity, perceived susceptibility, self-efficacy, perceived barriers, and perceived benefits. The flow chart illustrated the problem-solving steps and provided the basic framework for the study questionnaire construct.

Below is a list of the 22 Public Health Foundational Competencies, the competency number, and the courses in which they are taught to facilitate completing the table above.

Table 5.2 MPH Foundational Competencies and Course Taken

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming, and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy, or practice	x		x		
Public Health and Health Care Systems					
5. Compare the organization, structure, and function of health care, public health, and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities, and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					X

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Planning and Management to Promote Health					
7. Assess population needs, assets, and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs					X
9. Design a population-based policy, program, project, or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		x		x	
14. Advocate for political, social, or economic policies and programs that will improve health in diverse populations		x			X
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					
16. Apply principles of leadership, governance, and management, which include creating a vision, empowering others, fostering collaboration, and guiding decision making		x			X
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815, FNDH 880 or KIN 796				
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	DMP 815, FNDH 880 or KIN 796				
20. Describe the importance of cultural competence in communicating public health content		x			X

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Interprofessional Practice					
21. Perform effectively on interprofessional teams		x			X
Systems Thinking					
22. Apply systems thinking tools to a public health issue			x	x	

Table 5.3 Summary of MPH Emphasis Area Competencies

MPH Emphasis Area: Infectious Diseases and Zoonoses		
Number and Competency		Description
1	Pathogens/pathogenic mechanisms	Evaluate modes of disease causation of infectious agents.
2	Host response to pathogens/immunology	Investigate the host immune response to infection.
3	Environmental/ecological influences	Examine the influence of environmental and ecological forces on infectious diseases.
4	Disease surveillance	Analyze disease risk factors and select appropriate surveillance.
5	Disease vectors	Investigate the role of vectors, toxic plants, and other toxins in infectious diseases.

Competency # 1: Pathogens/pathogenic mechanisms

In the class Pathogenic Microbiology (BIOL530), I learned about different bacterial mechanisms that make people sick. For example, *Vibrio cholera* is a comma-shaped bacterium that can secrete toxins. The cholera toxin causes people to have severe diarrhea, which leads to water and electrolyte loss. For my project, I learned the mechanism of the COVID-19 virus. After the virus enters the human body, the viral RNA will be released into the host cell's

cytoplasm. After transcription and translation, the viral protein will burst from the host cell. Eventually, this rupture of the host cell will lead to the host cell's death (Kumar et al., 2020).

Competency # 2: Host response to pathogens/immunology

In the class Principles of Veterinary Immunology (DMP 817), I learned the general principles of immunology for infection. For example, neutrophils have an oxidative mechanism to kill pathogens. After NADPH oxidase is activated, hydrogen peroxide will be produced in neutrophils, and the hydrogen peroxide is powerful to kill pathogens. During the project, I learned that the COVID-19 antibodies usually develop between 1-3 weeks after symptoms appear (WHO, 2020). For example, the IgG will be produced after 3 to 14 days after infection (Mainieri, 2021). IgG is the most common antibody in our body with its main function to fight against viral and bacterial infection (Hirsch, 2020).

Competency # 3: Environmental/ecological influences

In the class Environmental Health (MPH 802), I learned how water and air quality affect human health. For example, contaminated water can carry infectious agents to humans, which can cause diseases such as cryptosporidiosis and giardiasis. In the project, I learned how COVID-19 virus is transmitted. As mentioned earlier, the COVID-19 virus can enter the human body by breathing in the tiny droplets containing the virus, touching the face with contaminated hands, or by having tiny droplets land on the face (CDC, 2021).

Competency # 4: Disease surveillance

In the class Environmental Health (MPH 802), I learned many different risk factors from the occupational environment, such as dust, noise, and chronic stress. Dust can lead to Chronic

Obstructive Pulmonary Disease (COPD). Noise can lead to hearing loss, and chronic stress can lead to neurotic disorders. These risk factors need Personal Protective Equipment (PPE), engineering control, and administrative controls to mitigate. In the project, I learned that a mask is a powerful tool to reduce the spread of COVID-19. For example, a cloth mask can block 80% of droplets (CDC, 2021). For monitoring, the measure of one's body temperature is a common way to self-check for COVID-19.

Competency # 5: Disease vectors

In the class Introduction to One Health (DMP 710), I learned about different disease vectors, such as mosquitoes. Mosquitoes can cause malaria transmission by passing the protozoan parasite. In this project, COVID-19 virus mainly spread from person to person and through close contact. For example, when people sneeze or cough, the virus spreads in liquid particles. Other people can get infected if they inhale the liquid particles (WHO, 2020).

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Appendix 1: Poster

The Use of Health Belief Model to Assess Predictors for COVID-19 Vaccination in Riley County, Kansas

KANSAS STATE
UNIVERSITY

Yibo Liu and Nancy Muturi

Kansas State University, Manhattan, KS 66506

INTRODUCTION

In the United States, there were around 37 million COVID-19 total cases by August 2021 with a steady increase since March 2020 when it was declared an epidemic (CDC, 2021). Riley County has had about 7000 COVID-19 positive cases and a two-week cumulative percent positive of about 5.15 percent (Riley County Health Department, 2021). The pandemic has serious socioeconomic impacts at organizational and personal levels causing job losses, financial difficulties among other social and psychological damages (Parker, Minkin & Bennett, 2020). COVID-19 vaccine is an efficient way to prevent it. However, the vaccine-hesitance and the resultant declining global vaccination rates are critical problems facing the world's population (Omer et al., 2009). To understand Riley County people's perception of the COVID-19 vaccine, and barriers to vaccine acceptance, we conducted a study based on the Health Belief Model (HBM).

HYPOTHESES AND METHODS

Three hypotheses and four research questions based on Health Belief Model :

H1: COVID-19 vaccine intention will be positively related to the perceived threat of COVID-19. (Supported)

H2: COVID-19 vaccine intention will be negatively related to perceived barriers. (Supported)

H3: COVID-19 vaccine intention will be positively related to the perceived benefits of the COVID-19 vaccine. (Supported)

RQ1: Is there a relationship between the influenza vaccination and COVID-19 vaccine intention?

RQ2: Is there a difference among different age groups in their perceptions about COVID-19 severity and susceptibility?

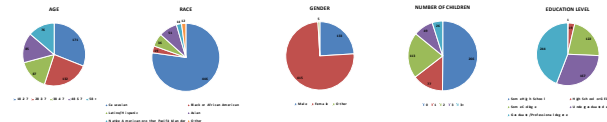
RQ3: Are there differences in vaccination hesitancy based on ethnicity?

RQ4: What are the most used interpersonal and media sources for COVID-19 health information?

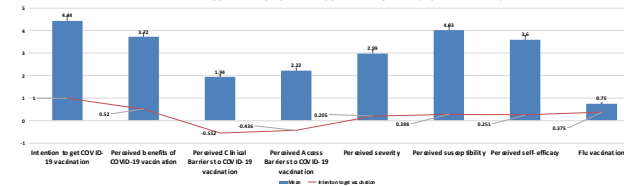
This study employed a cross-sectional online survey (n=572) that was administered to Riley County's residents.

RESULTS

Results indicated that all aspects of the HBM are significantly correlated with intention to vaccinate except cues to action. Interestingly, this study found that participants between 38-47 reported perceived higher levels of virus severity than participants who are over 57. For different ethnicity groups, Native Americans or other Pacific Islanders did not think the vaccine was beneficial enough compared to Caucasians, Black or African Americans and Latino/Hispanics. The results also showed that the most used interpersonal source is friends (92.85% people used), and the most used media source is the internet (98.65% people used). Furthermore, there was a significant relationship between flu vaccination and COVID-19 vaccine intention. These findings illustrated the flu vaccination can be used as an indication of COVID-19 vaccination. Additionally, it showed the need for public health professionals and healthcare practitioners to foster interpersonal relationships with young people to enhance vaccine adoption by changing their perceptions of susceptibility to and severity of vaccine-preventable diseases.



BIVARIATE CORRELATIONS AND DESCRIPTIVE FOR KEY STUDY VARIABLES



FUTURE PLAN

We plan to design and initiate a health campaign for the K-State students to boost the COVID-19 vaccination rate. This campaign aims to decrease people's vaccine hesitancy and increase the COVID-19 vaccination rate in Riley County, Kansas. There are several parts included in this campaign: 1) Education material distribution about mRNA vaccination, and 2) social media promotion of credible information. In addition to other communication strategies, fliers with COVID-19 education and health information to encourage people to wear masks, promote personal hygiene, and a healthy lifestyle will be distributed. The campaign goal is to increase K-State students' perceived susceptibility of the COVID-19 virus and the perceived benefits of COVID-19 vaccine.

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Appendix 2: Questionnaire

10/12/21, 12:33 AM

Edit Survey | Qualtrics Experience Management

Tools

Saved Sep 10, 2021 at 6:40 PM

Draft



Preview

Publish

The use of Health Belief Model to assess Predictors for COVID-19 Vaccination in Riley County, Kansas

IQ Score: Fair

▼ Informed Consent & Participant Discriminators

Q1

▼ Skip to

End of Survey if I Decline Is Selected

Thank you very much for supporting our research. We realize that your time is valuable and we appreciate your participation. The purpose of this study is to explore perceptions of the COVID-19 vaccine in the Riley County community. This study is being conducted as part of an academic project at Kansas State University and will use the information you provide to design a health campaign.

This survey will take about 8-10 minutes of your time. Please answer all questions truthfully and to the best of your ability. This study is completely anonymous and your name or other personal information that could identify you will not be asked or recorded.

This project has been approved by Kansas State University's Institutional Review Board (IRB # 10519). **You must be at least 18 years or older to participate.**

Please note that this survey is completely voluntary and you may withdraw at any point with no repercussions. All the data collected from the survey will be kept confidential and only used for the purpose of this project.

By clicking the "I Accept" button below, you are stating that you understand that this is a research project that you have voluntarily agreed to participate in. We appreciate your time and participation.

☐ I Accept

☐ I Decline

Q2

▼ Skip to

End of Survey if No Is Selected

Are you over 18 and below 65?

☐ Yes

☐ No

Q3

▼ **Skip to**

End of Survey if No is Selected

Do you live or work in Riley County, Kansas?

☐ Yes

☐ No

▲

[Import from library](#) [Add new question](#)

Add Block

▼ **Cues To Action**

Q4 iQ

Please respond to the following:

	Yes	No
Are you aware that the Riley County Health Department is currently offering COVID-19 vaccination?	☐	☐
Have you seen public service announcements about COVID-19 vaccines? (e.g., radio or TV)	☐	☐
Have you seen information on social media about the COVID-19 vaccination? (e.g., Facebook, Twitter)	☐	☐
Have you seen business advertisements regarding COVID-19 vaccination? (pharmacy or grocery store ads)	☐	☐
Has your primary care doctor or off-campus health providers spoken to you about the COVID-19 vaccination?	☐	☐
Has a physician or healthcare provider that you have seen at Lafene discussed COVID-19 vaccination?	☐	☐
Have you seen announcements about the COVID-19 vaccination? (e.g., newsletters, posters, signs)	☐	☐

▲

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Add Block

▼ **Virus/Vaccine Information Sources**

Q5

iQ

Please indicate how often you use the following sources to obtain information about the COVID-19 virus.

	Never	Sometimes	About half the time	Most of the time	Always
Telephone	☐	☐	☐	☐	☐
Internet	☐	☐	☐	☐	☐
Radio	☐	☐	☐	☐	☐
Newspaper	☐	☐	☐	☐	☐
Television	☐	☐	☐	☐	☐
Family Member	☐	☐	☐	☐	☐
Friend	☐	☐	☐	☐	☐
Physician/Primary Care Provider	☐	☐	☐	☐	☐
Pharmacist	☐	☐	☐	☐	☐
Nurse	☐	☐	☐	☐	☐
Other Healthcare Provider	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

Q6

iQ

Please indicate how often you use the following sources to obtain information about the COVID-19 vaccine.

	Never	Sometimes	About half the time	Most of the time	Always
Telephone	☐	☐	☐	☐	☐
Internet	☐	☐	☐	☐	☐
Radio	☐	☐	☐	☐	☐
Newspaper	☐	☐	☐	☐	☐
Television	☐	☐	☐	☐	☐
Family Member	☐	☐	☐	☐	☐
Friend	☐	☐	☐	☐	☐
Physician/Primary Care Provider	☐	☐	☐	☐	☐
Pharmacist	☐	☐	☐	☐	☐
Nurse	☐	☐	☐	☐	☐
Other Healthcare Provider	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

Q7

iQ

Rate the following in terms of their usefulness as sources of health information using the following scale.

	Extremely useful	Very useful	Moderately useful	Slightly useful	Not at all useful
Television	☐	☐	☐	☐	☐
Radio	☐	☐	☐	☐	☐
Print media – newspapers, magazines, other print	☐	☐	☐	☐	☐
Social media (Facebook, Tweeter, Instagram, WhatsApp)	☐	☐	☐	☐	☐
Medical professionals (doctor, nurse, other health practitioner etc.)	☐	☐	☐	☐	☐
Community leader that people respect	☐	☐	☐	☐	☐
Celebrities – people we admire and know through the media	☐	☐	☐	☐	☐
Internet or other web-based channels	☐	☐	☐	☐	☐
Other (Specify)	☐	☐	☐	☐	☐

Q8

[Skip to](#)

End of Block if No is Selected

Do you use social media? (e.g., Facebook, Twitter, Instagram)

- ☐ Yes
- ☐ No

Q9 iQ

Which social media platform do you use most frequently? Please rate your most frequently using media platforms.

	Never	Rarely (few times a month)	Sometimes (few times a week)	Often (several times a day)	Always (several times an hour)
Facebook	☐	☐	☐	☐	☐
Facebook Messenger	☐	☐	☐	☐	☐
Instagram	☐	☐	☐	☐	☐
LinkedIn	☐	☐	☐	☐	☐
Twitter	☐	☐	☐	☐	☐
WhatsApp	☐	☐	☐	☐	☐
Snapchat	☐	☐	☐	☐	☐
WeChat	☐	☐	☐	☐	☐
YouTube	☐	☐	☐	☐	☐
TikTok	☐	☐	☐	☐	☐
Reddit	☐	☐	☐	☐	☐
Google	☐	☐	☐	☐	☐
QQ	☐	☐	☐	☐	☐
Other - Specify	☐	☐	☐	☐	☐

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[Add new question](#)

Add Block

▼ Perceived Vaccine Benefits

Q10 iQ

Please respond to the following:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
COVID-19 vaccine prevents COVID-19.	☐	☐	☐	☐	☐
If I get the COVID-19 vaccine, I will not get COVID-19.	☐	☐	☐	☐	☐
If I get the COVID-19 vaccine, it may prevent others from getting COVID-19.	☐	☐	☐	☐	☐
If I get the vaccinated against COVID-19, the disease may, someday, be eradicated.	☐	☐	☐	☐	☐

[Import from library](#)
[Add new question](#)

Add Block

▼ Perceived Severity of the Virus

Q11 iQ

Please respond to the following:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
If I get COVID-19, I will get sick.	☐	☐	☐	☐	☐
If I get COVID-19, I will lose income later in life.	☐	☐	☐	☐	☐
If I get COVID-19, other members in my home will get sick.	☐	☐	☐	☐	☐
If I get COVID-19, I will die.	☐	☐	☐	☐	☐

[Import from library](#)
[Add new question](#)

Add Block

Perceived Susceptibility to the Virus

Q12 iQ

Please respond to the following:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I am at risk for getting COVID-19.	☐	☐	☐	☐	☐
My other family members are at risk of getting COVID-19.	☐	☐	☐	☐	☐
I feel knowledgeable about my risk of getting COVID-19.	☐	☐	☐	☐	☐
I feel knowledgeable about my other family member's risk for getting COVID-19.	☐	☐	☐	☐	☐

[Import from library](#)
[Add new question](#)

Add Block

Perceived Clinical Barriers to Vaccination

Q13 iQ

Please respond to the following:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I will have side effects from the COVID-19 vaccine.	☐	☐	☐	☐	☐
I will get sick from the COVID-19 vaccine.	☐	☐	☐	☐	☐
I will get COVID-19 from the COVID-19 vaccine.	☐	☐	☐	☐	☐
COVID-19 vaccine won't work.	☐	☐	☐	☐	☐
The COVID-19 vaccine will be painful.	☐	☐	☐	☐	☐

Add Block

▼ Perceived self-efficacy

Q14 iQ

Please respond to the following:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I would get vaccinated if the COVID-19 vaccine was made available to me.	☐	☐	☐	☐	☐
The COVID-19 vaccine is easy to get in my hometown when it's available.	☐	☐	☐	☐	☐
The COVID-19 vaccine is easy to get in Manhattan, KS.	☐	☐	☐	☐	☐
The COVID-19 vaccine is easy to get at the Riley County Health Department.	☐	☐	☐	☐	☐
I would vaccinate myself if the COVID-19 vaccine was free.	☐	☐	☐	☐	☐

Add Block

▼ Perceived Access Barriers to Vaccination

Q15 iQ

Please respond to the following:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
It will be expensive to get the COVID-19 vaccine.	☐	☐	☐	☐	☐
It is inconvenient to get the COVID-19 vaccine.	☐	☐	☐	☐	☐
It's likely I will miss the vaccination appointment without reminder.	☐	☐	☐	☐	☐
Some of my family members do not believe in COVID-19 vaccination	☐	☐	☐	☐	☐
Some of my friends do not believe in COVID-19 vaccination	☐	☐	☐	☐	☐
My faith group or organization (e.g. church, mosque) does not believe in immunization	☐	☐	☐	☐	☐

Add Block

Intention To Vaccinate

Q16

Please respond to the following:

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
If you believe the COVID-19 vaccine is safe, how likely are you to receive a COVID-19 vaccine?	☐	☐	☐	☐	☐
If your family members haven't got the COVID-19 vaccine, how likely will you suggest them to get the vaccination?	☐	☐	☐	☐	☐
If you recovered from the COVID-19, how likely are you to receive a COVID-19 vaccine?	☐	☐	☐	☐	☐
If your employer recommends you have the COVID-19 vaccine, and it's safe and effective, how likely will you get a COVID-19 vaccine?	☐	☐	☐	☐	☐

Import from library Add new question

Add Block

Demographic Questions

Q17

Have you got the COVID-19 test?

☐ Yes
☐ No

Q18

Have you got COVID-19?

☐ Yes
☐ No

Q19

Did you get the flu vaccine last year?

☐ Yes
☐ No

Q20

Age (Please indicate your age in years numerically)

Q21

Please indicate your gender.

- ☐ Male
- ☐ Female
- ☐ Other

Q22



Number of children

Q23

Please indicate your race/ethnicity. (Choose all that apply)

- ☐ Caucasian
- ☐ Black or African American
- ☐ Latino/Hispanic
- ☐ Asian
- ☐ Native American or Other Pacific Islander
- ☐ Other

Q24

Occupation

- ☐ Doctors
- ☐ Nurses
- ☐ Other medical related work field
- ☐ Not related to medical field
- ☐ Unemployed

Q25

What is your estimated annual income?

- ☐ < \$10,000
- ☐ \$10,001 to \$25,000
- ☐ \$25,001 to \$40,000
- ☐ \$40,001 to \$55,000
- ☐ More than \$55,000

Q26

Please indicate the highest level of education you have achieved:

- ☐ Some High School
- ☐ High School or GED
- ☐ Some College
- ☐ Undergraduate degree
- ☐ Graduate/Professional degree

Q27

Living or Working Zip Code in Riley County, Kansas

[Import from library](#)[Add new question](#)[Add Block](#)

End of Survey

Thank you for participating in our survey! We appreciate your time and your comments.

If you have any questions about this research protocol, please contact Yibo Liu (yibo8023@ksu.edu) or Dr. Nancy Muturi (nmuturi@ksu.edu). Questions or concerns about your rights as a research participant may be directed to Rick Scheldt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224. IRB # 10519

Appendix 3: Health Campaign Plan

Vaccine: The Last Chance to Save the World

by

Yibo Liu

MPH Candidate

KANSAS STATE
UNIVERSITY

Master of Public Health
Interdisciplinary Program



Executive Summary

In the United States, there are approximately 45 million COVID-19 total cases, and the number is still increasing as of October 2021 (Centers for Disease Control and Prevention, 2021). At the same time, Riley County had a total of 7,994 positive cases of COVID-19 and a two-week cumulative percent positive of about 3.64% as of October 14, 2021 (Riley County Health Department, 2021). Approximately one-third of American adults lost their jobs due to the pandemic, and half of the low-income people have had difficulties paying their bills since the pandemic started (Parker, Minkin & Bennett, 2020). This campaign aims to decrease people's vaccine hesitancy and increase the COVID-19 vaccination rate in Riley County, Kansas. There are several parts included in this campaign: 1) Education material distribution about mRNA vaccination, and 2) social media promotion of credible information.

Background

In the U.S., the current fully vaccinated rate for COVID-19 is only 57%. Also, there were 80,248 new cases and 1,619 deaths as of October 25 (CDC, 2021). Due to the COVID-19, the U.S. unemployment rate rose to approximately 15% in April 2020. Even until August 2021, the unemployment rate was still approximately 5% (Bureau of Labor Statistics, 2021). Not only the U.S., but the whole world's unemployment rate was high. From 2019 to 2020, the Canadian unemployment rate increased from 5.7% to 9.7%, and the United Kingdom's unemployment rate increased from 3.8% to 5.4% (Jones et al., 2021). At the same time, the Kansas unemployment

rate increased from 3% to 12% (Kansas Legislative Division of Post Audit, 2021). Also, there was a 97% drop in footfall (people shopping in an area within a certain time) in Germany, and there was a 78% drop in footfall in United Kingdom (Jones et al., 2021). Although the economic impact is a critical condition, the low vaccination rate will not impede the COVID-19 spread, and more people will get infected. Hence the need for a campaign to promote the vaccination.

At the same time, Riley County had 38 new cases and 59 deaths (RCHD, 2021). As of October 25, 2021, Riley County's full vaccination rate was 38% only (Kansas Department of Health and Environment, 2021).

Regarding COVID-19 health information, social media could positively influence people's lives in the following ways: 1) social media could help people to get government's announcements immediately; 2) social media could enable people to understand health information easily with graphs and illustrations; and 3) social media could enable people to get updated health information from other reliable medical sources. (Venegas-Vera et al., 2020).

The positive influence of social media could boost the vaccination rate. Glanz et al. (2017) found that people who use interactive media were more likely to vaccinate their children compared to people did not use it. Interactive media is one kind of social media that can enable people to share graphic and textual information; for example, Facebook belongs to the interactive media (Dhir, 2021). At the same time, another campaign in Novato, California successfully increased the vaccination rate by 25% within two months. This health campaign included posters, newspapers, and social media. Health providers in Novato even went directly to residents' apartments to give them the COVID-19 vaccine (Rodriguez, 2021).

From the background information above, this campaign will use different methods to promote the COVID-19 vaccination rate, such as distributing flyers, posting to social media, and making presentations.

Target Population

This campaign will focus on the population of Kansas State students. K-State students have the distinctive characteristic of high fluidity to make them this campaign's target population. There were approximately 73,000 people in Riley County in 2021 (Riley County Health Department, 2021). Also, there were approximately 20,000 students at KSU in 2020 (Kansas State University, 2021).

Among these students, there are people from different states and different countries. Most of students are between the ages of 18-27, and in this study, there was a significant difference on participants' susceptibility to get a COVID vaccine based on age groups. More specifically, the age group between 18-27 had a significant low susceptibility than all other age groups. This represents the people between the ages of 18-27 who thought they were unlikely to get COVID-19. However, the population has a high fluidity rate which increases the chance to spread COVID-19.

Agency

This campaign will be conducted in collaboration with Riley County Health Department (RCHD). The RCHD will use the campaign to increase people's perceived severity of COVID-

19 virus, perceived susceptibility of COVID-19 virus, perceived benefits of COVID-19 vaccine, and perceived self-efficacy of COVID-19 vaccine. At the same time, the campaign may decrease the perceived access barriers to COVID-19 vaccination.

Campaign Goal

The campaign goal is to increase K-State students' perceived susceptibility of the COVID-19 virus and the perceived benefits of COVID-19 vaccine.

Objectives

1. Educate 500 people on susceptibility of COVID-19 virus by the end of May 2022.
2. Educate 500 people on benefits of COVID-19 vaccine by the end of May 2022.

Strategies

Strategies for Objective 1 and 2:

Strategy 1: Enhance the basic health education on COVID-19 virus and vaccine for K-State students.

K-State students will have more chances to learn information about COVID-19 on how the virus influences human health. At the same time, K-State students also will have another source about different COVID-19 vaccines, including how they are made and how they can protect people.

Tactics:

1. Distribute educational material to K-State students. Flyers about COVID-19 disease and vaccine will be made. These flyers should be posted in the places are high traffic, such as Hale Library.
2. Use influencers to spread COVID-19 information. These influencers could be Bill Snyder, Ken Jeong, or people who are respected at K-State.
3. Use social media like Facebook to share information about COVID-19 virus and vaccine information.
4. Require mandatory COVID-19 training for all K-State Students before the semester begin. The training will include two parts: information about the COVID-19 virus and vaccines. The COVID-19 virus part will talk about the disease's transmission methods, symptoms, preventions, and common false information. The vaccine training part will talk about the differences between the traditional vaccines and the mRNA vaccine, vaccine safety, and vaccine effectiveness.

Strategy 2: Increase familiarity between people and COVID-19. (Testimonials)

The RCHD will organize activities to let young people experience what real COVID-19 looks like. Young people will share their sick experiences, and this will enhance people's emotional feelings about potential COVID-19 consequences.

Tactics

1. Invite young people who suffered from COVID-19 to talk about their experiences or people whose family or friends have suffered the COVID-19.
2. Make PowerPoints to show people pictures or videos about COVID-19 symptoms and what the younger people had to endure during the infection and recovery period.

Key Messages

The major finding for the target population is people lacking the perceived susceptibility of COVID-19 and perceived benefits of COVID-19 vaccine. So, the key messages will pay attention to promoting the people's awareness on COVID-19 susceptibility and COVID-19 vaccine effectiveness.

1. Vaccine saves life!
2. Half a million people's lives went away with COVID.
3. It's never too late to get the vaccine.
4. COVID is everywhere.
5. The last chance to save the world: COVID vaccine.
6. Watch what you read on social media!

Evaluation

The evaluation of the campaign will include three parts:

1. For distribution part, the flyers will be distributed to K-State campus. The PowerPoints will be sent through K-State emails and websites. Influencers and people who have been through COVID-19 will be invited to give presentations. The

mandatory COVID-19 training will be initiated before the spring semester 2022.

RCHD social media platforms will post information about COVID-19 disease and vaccines. Then a short survey will be sent to K-State students to check how many people have seen the COVID-19 information from flyers, presentations, and social media platforms.

2. For the perception part, a survey will be distributed to K-State students similar to what was done with the baseline survey. This survey will focus on the objectives that were set after the baseline but also on the expected outcomes – mainly perceptions that are based on the HBM. After data collection and analysis, the new score from HBM will be compared to the old value.
3. For the action part, the COVID-19 vaccination rate will be compared to the rate at the baseline and with the national COVID-19 vaccination rate.

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