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Research Article

An assessment of the health belief model, vaccine hesitancy, and credible sources of health messages during flu season

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ABSTRACT

This study incorporated the World Health Organization's adult vaccine hesitancy scale and the health belief model to determine the relationships between vaccine hesitancy, individual perceptions, and vaccine uptake during the flu season between September 2023 and March 2024 at a large university in Saudi Arabia. The study also investigated information-seeking behaviors, the credibility of flu messages disseminated by health authorities, and adherence to flu preventive measures among individuals. This quantitative study used a purposive online survey sent via research email service to students, faculty, and staff (N = 1,130) at a large university in Riyadh, Saudi Arabia. Multiple statistical tests were conducted, including multiple linear regression, Kruskal-Wallis, and Mann-Whitney tests. Findings indicated that 45% of individuals first turned to Internet search engines for health information about the flu and believed that public health authorities were credible sources compared to other sources, such as traditional and social media. Findings also showed that the HBM and age significantly predicted vaccine hesitancy. Age and sex did not predict vaccine uptake among participants. Respondents reported strong health beliefs, low vaccine hesitancy, and perceived flu messages as credible. Although individuals reported high health beliefs and low vaccine hesitancy, the flu vaccine uptake in Saudi Arabia remains a concern. The study highlighted the discrepancy between positive health beliefs and actual vaccination behavior, shedding light on effective strategies for tackling the issue of suboptimal vaccine uptake in the country.

Keywords: health belief model, vaccine hesitancy, information-seeking, credibility of flu messages, preventive measures

INTRODUCTION

Seasonal influenza (the flu) is profoundly impacting various countries worldwide, with around 5 million people becoming seriously ill every year. It is estimated that between 290,000 and 650,000 deaths occur annually (World Health Organization [WHO], 2024a). In the global fight against the flu, health authorities, such as the WHO, play a crucial role in providing comprehensive support to countries worldwide. In Saudi Arabia, the Ministry of Health (MOH) launched a national health campaign to educate the public about the flu and encourage people to follow healthy behaviors, including vaccination (MOH, 2023). Following healthy behaviors, such as washing hands regularly, can help prevent the flu; however, vaccination is the most effective way to avoid it (WHO, 2024a). The Centers for Disease Control and Prevention (CDC) estimated that between 2019 and 2020, flu vaccines prevented 7 million illnesses, 3 million hospital visits, 100,000 hospitalizations, and 7,000 deaths in the United States (CDC, 2024b). Although perceptions of vaccines and vaccination uptake differ from country to country (Welch et al., 2023), previous studies have indicated that

Saudi Arabia had suboptimal flu vaccine uptake (see Alsuwailem et al., 2023; Alwazzeh et al., 2021; Alzahrani et al., 2023; Barry et al., 2020; Khan et al., 2021; Sales et al., 2021; Tharkar et al., 2023). Furthermore, a recent comprehensive review of 80 studies found that negative attitudes toward healthcare providers and low trust were the main impediments to flu vaccination (Welch et al., 2023).

Extensive research has shown that the health belief model (HBM), the WHO's vaccine hesitancy scale (VHS), and the credibility of health messages have been considered significant determinants of vaccination uptake. Therefore, this study is unique in that it incorporates all these concepts at once. In particular, it aimed to measure participants' perceptions of flu vaccines and vaccine hesitancy and their relation to vaccine uptake during the 2023/2024 flu season by integrating the HBM as a theoretical framework and using the WHO's VHS. It also examined the sources participants trust and how this influences their decisions to get the flu vaccine. Adherence to flu preventive measures, such as wearing masks and washing hands, was also investigated.

The study's findings deepen the understanding of the psychological factors affecting vaccine uptake by combining the HBM and the WHO's VHS. It also provides practical approaches on persuading the public through credible health messages that increase public trust and compliance with healthy measures—chiefly, helping to increase flu vaccination rates in future health campaigns in Saudi Arabia.

LITERATURE REVIEW

Seasonal Influenza

The CDC (2024a) defines seasonal flu as a "contagious respiratory illness caused by influenza viruses that infect the nose, throat, and lungs" (para. 1). The flu can spread rapidly among individuals of all ages through coughing, sneezing, or talking. Although most people recover from the flu within a week without treatment, some are at higher risk than others, such as pregnant women, the elderly, children, healthcare workers, and individuals with chronic diseases, such as heart disease (CDC, 2024a; WHO, 2024a). Most adults experience mild to severe symptoms, such as cough, fever, runny nose, fatigue, sore throat, and aches, while symptoms like vomiting and diarrhea are common among children. People can suddenly become infected with the flu virus, and some may die. Individuals are encouraged to take several preventive measures in their daily lives, such as washing hands regularly with soap and water, staying away from sick people, staying home when they feel ill, covering their mouth and nose with a tissue when coughing or sneezing, wearing a mask, avoiding touching the eyes and nose, cleaning and disinfecting surfaces, getting enough sleep, following a healthy balanced diet, and exercising (CDC, 2024a; WHO, 2024a).

Getting an annual vaccination is another crucial healthy behavior that public health authorities recommend (CDC, 2024a; WHO, 2024a). Nonetheless, vaccine hesitancy has been reported in Saudi Arabia (see, for example, Alenazi, 2022; Alolayan et al., 2019). Sociodemographic factors, like age, sex, and marital status, were associated with higher vaccine hesitancy in Saudi Arabia. Other factors that hindered individuals from getting vaccinated included working in a healthcare setting, concerns about the vaccine's efficacy and safety, chronic diseases, previous COVID-19 exposure, and sources of information (Alsuwailem et al., 2023; Fadhel, 2023; Sayed, 2022). For instance, a study investigating individuals' perceptions of the severity of and susceptibility to COVID-19 found that those who relied on social media as a primary source of COVID-19 information did not believe that COVID-19 was serious or that they were at risk of contracting the virus (Alrajeh et al., 2021).

As part of its efforts to fight seasonal flu in Saudi Arabia, the MOH launched essential initiatives highlighting the threat of severe illness and life-threatening complications in an attempt to encourage at-risk people, such as pregnant women and older people, to get vaccinated (Alhatim et al., 2022; WHO, 2015, 2022). The MOH campaign "Let's make it a healthy season" aimed to educate the public about preventive measures, such as practicing good hygiene, and addressed the safety and efficacy of the flu vaccine (MOH, 2015, 2020).

Although the MOH in Saudi Arabia is active on social media, its posts could benefit from more effective health communication strategies. A study by Alkazemi et al. (2022) examined public health information of 1,000 Instagram posts by the Ministries of Health in Gulf Cooperation Council (GCC) countries found that there was a significant focus on perceived benefits and cues to action in most Instagram posts, while other HBM constructs, such as perceived severity and susceptibility, received less attention. The study called for a

balanced incorporation of HBM constructs into health messages and a shift from public relations to health education to enhance the effectiveness of public health communications on Instagram (Alkazemi et al., 2022).

Theoretical Framework

The health belief model

The HBM has been widely used in health research since its development in 1950. It explains and predicts why individuals adopt, reject, or maintain certain health behaviors during health campaigns (Champion & Skinner, 2008; Hochbaum, 1958; Janz & Backer, 1984; Rosenstock, 1974). The HBM comprises six constructs designed to measure respondents' perceptions of their susceptibility to the disease, severity of the disease, the benefits of taking specific actions against it, and obstacles preventing such actions. Questions on cues to action seek the internal and external triggers that motivate people to adopt healthy behaviors, while self-efficacy concerns their ability to do so. Other factors, such as ethnicity, race, gender, age, level of education, habitual behaviors, and past experiences, may affect perceptions and decision-making processes (Champion & Skinner, 2008; Cummings et al., 1979; Janz & Backer, 1984; Rosenstock, 1974).

The HBM has been widely and successfully used in many studies concerning health behaviors, such as willingness to receive H1N1 vaccines (Yang, 2015), encouraging college students to take a nap on campus (Mackert et al., 2014), willingness to get COVID-19 vaccines (Cai et al., 2022; Wong et al., 2020), adherence to COVID-19 preventive measures (Alsulaiman & Rentner, 2021; Karimy et al., 2021; Niu et al., 2022), information-seeking during the COVID-19 pandemic (Alsulaiman & Rentner, 2022; Niu et al., 2022; Yang et al., 2022), predicting the use of helmets when biking (Ross et al., 2010), analysis of health messages in GCC countries (Alkazemi et al., 2022), and promoting breast cancer screenings (Calnan, 1984; Champion, 1993; Champion & Scott, 1997; Guilford et al., 2017; Norman & Brain, 2005). Numerous studies have used the HBM to assess individuals' perceptions of the flu vaccine. For instance, Xie et al. (2019) conducted a simple random sampling in the US population and found that Americans had higher perceptions of susceptibility, severity, and benefits and fewer barriers to getting vaccinated. The study reported that vaccinated individuals had received more recommendations from their healthcare providers than unvaccinated groups, who were less likely to seek medical information from healthcare providers or the media. The study suggested that unvaccinated people had a direct or indirect bad experience and a less positive attitude toward the flu vaccine. The study concluded that HBM constructs, individuals' trust in health information, and vaccination behavior strongly predict vaccine hesitancy (Xie et al., 2019). The HBM was also successfully applied to assess the perceptions of a random sample of people aged 65 years and older in Portugal, a high-risk group, and found that their perceptions of less susceptibility and higher barriers, such as vaccine side effects, significantly reduced vaccination uptake (Santos et al., 2017).

Another extensive study in the literature that applied the HBM to study individual perceptions of the flu over six years in 22 Middle Eastern countries found that most countries had low vaccination rates and high perceived barriers, including vaccine side effects, vaccination efficacy, and cost, and these were significant predictors of low vaccination uptake. The study found that factors like advanced age, pre-existing medical conditions, and working in a high-risk environment were motivators among Saudis to get vaccinated (Alalag et al., 2022). Although the study found that Saudi Arabia topped the list regarding vaccination uptake in the Middle East, it still has a low vaccination rate compared to other developed countries (see Alsuwailem et al., 2023; Alwazzeh et al., 2021; Alzahrani et al., 2023; Barry et al., 2020; Khan et al., 2021; Sales et al., 2021; Tharkar et al., 2023). Thus, we operationalized HBM as a single composite construct, consistent with prior research.

Information-seeking, message credibility, and trust

Although HBM helps to understand and predict individuals' health behaviors, message credibility may play a significant role in shaping individuals' health beliefs. Message credibility refers to the accuracy of information provided as well as the perceived trustworthiness of particular information (McCroskey & Teven, 1999; Hornikx & O'Keefe, 2009). Thus, individuals are more prone to process and accept credible information. Research found that individuals' trust in health messages is a crucial element in both vaccine attitudes and hesitancy (Larson et al., 2015; MacDonald, 2015). For example, previous studies suggested that lower trust and credibility in health messages were associated with lower vaccine uptake (Dubé et al., 2015; Freeman et

al., 2022). Therefore, tailored and credible health messages are vitally important in influencing individuals' health beliefs and vaccination choices, as individuals increasingly seek health information from various sources.

A Pew Research Center study reported that over 50% of the US population with premedical conditions had searched online for health information, such as for a particular illness, prescriptions, or medical procedures (Fox & Purcell, 2010). The study indicated that 66% of Americans who reported not having medical conditions had also searched online for health information, compared to 44% with two or more medical conditions. The study reported that factors like education, health status, and types of Internet access were considered strong predictors for obtaining health information (Fox & Purcell, 2010). Another Pew Research Center study suggested that 80% of Internet users of both genders have searched online for health information. The study found that 86% of women looked for health information, compared to 73% of men. A higher level of education was associated with searching for health information, such as medical procedures, hospitals, and health providers (Fox, 2011). Bundorf et al. (2006) found that chronic disease and barriers to accessing healthcare were prominent factors that triggered individuals to look online for health information. Many studies have emphasized trust as a major element when seeking online health information (see Donohue et al., 2009; Dutta-Bergman, 2003; Miller & Bell, 2012; Rains, 2007; Zulman et al., 2011).

Kim (2016) conducted a systematic literature review of online health information and found that most studies indicated that the quality of information, appearance and interface features of the website, age, personality, level of education, health status, prior experience, health literacy, types of sources, familiarity, and perceived risk impacted individuals' trust when consuming online health information. A Pew Research Center study found that the COVID-19 pandemic led many Americans to trust health information conveyed by medical scientists, believe that scientists acted in the public's best interest, and view them positively. For instance, the study found that 6 out of 10 believed social distancing during the COVID-19 pandemic was a proper measure to curb the disease (Funk et al., 2020). However, a year later, Americans' trust in medical scientists had declined sharply, with only 29% of Americans expressing high confidence, a decrease from the 40% reported in the previous year (Kennedy et al., 2022). The data also revealed a worrying belief among many Americans that medical professionals and scientists are not acting in the public's best interest (Kennedy et al., 2022). Another study, however, suggested that US college students trusted the health information conveyed by public health authorities, such as the CDC and the WHO, more than other sources, such as social and traditional media, during the COVID-19 pandemic (Alsulaiman & Rentner, 2022).

Similar findings were reported among Saudis, suggesting that public health authorities, such as the MOH, the WHO, and doctors and healthcare workers, had greater credibility than other communication sources when conveying health information during the COVID-19 pandemic (Alsulaiman, 2023). To measure message credibility, scholars have suggested that believability, trustworthiness, bias, accuracy, and completeness are the most significant dimensions of measuring message credibility (see Austin & Dong, 1994; Gaziano, 1988; Metzger et al., 2003; Meyer, 1988; Rimmer & Weaver, 1987; West, 1994). Therefore, we conceptualize message credibility in this study as a general evaluative judgment formed through information-seeking, rather than passive exposure, regarding the believability, trustworthiness, bias, accuracy, and completeness of health information among individuals who actively sought health content and information related to the flu vaccine during the study period.

Thus, based on the literature, the following research questions and hypotheses were posed:

RQ1: What is the first source of information that students, staff, and faculty at a large university in Saudi Arabia turn to when concerned about the flu virus?

RQ2: What are the most common communication channels students, staff, and faculty at a large university in Saudi Arabia use to obtain health information about the flu?

RQ3: What are the most credible sources for flu information among students, staff, and faculty at a large university in Saudi Arabia?

RQ4: To what extent do students, staff, and faculty adopt healthy behaviors to prevent the flu?

RQ5: What perceptions do students, staff, and faculty have of seasonal flu and the flu vaccine?

H1: Individuals with higher mean HBM scores are more likely to get a flu vaccine for the current season and take it annually.

H2: Individuals with less vaccine hesitancy are more likely to receive a flu vaccine for the current season and annually than those with high vaccine hesitancy.

H3: The credibility of health messages and the HBM are strong predictors of vaccine hesitancy.

H4: Increased credibility of flu messages predicts flu vaccine uptake among students, staff, and faculty.

H5: Age and sex are significant predictors of vaccine uptake.

H6: Age and sex are significant predictors of vaccine hesitancy.

H7: Age and sex are significant predictors of the credibility of health messages.

METHODS

The study employed a purposive online survey among students, employees, and faculty members at a large university in the central region of Saudi Arabia. The university is the first nation-founded university, with more than 24 colleges with over 35,000 enrolled students and 3,800 faculty members (QS Ranking, 2024). The university was chosen because it has diverse students and faculty backgrounds.

Instruments

The study utilized previously developed scales. First, the researchers used a previously validated 5-point Likert scale (5 = *strongly disagree* to 1 = *strongly agree*) of 10 items of the WHO's adult VHS (see Larson et al., 2015; Nour et al., 2022) and applied a 5-point Likert scale (5 = *strongly disagree* to 1 = *strongly agree*). Seven items were reverse coded as recommended by Nour et al. (2022) for consistency (e.*g., vaccines are important for my health*). We tested the internal consistency of the scale using Cronbach's alpha, and it showed .65. However, after examination of item-total statistics, one item dropped, which resulted in improved internal consistency to .75. A factor analysis with a principal component analysis with direct oblimin rotation was conducted. The data were suitable for analysis (KMO = .914, Bartlett's test of sphericity, x^2 [36] = 5,073.741), eigenvalues was greater than 1, with two factors explaining 68.14% of the variance. All items were loading above .59, the reliability was 0.75, bringing the total to 9 items. High mean scores on the flu VHS indicate lower vaccine hesitancy. Second, to measure HBM, Cheney and John (2013) validated constructs of perceived severity with 3 items, perceived barriers with 23 items, perceived benefits with 9 items, and cues to action with 4 items were used (*e.g., Influenza is a serious illness for someone at my age*). We also incorporated the 6 validated items of perceived susceptibility (e.g.*, I do not think I am likely to get the flu etc.*) and 10 items on self-efficacy (*e.g., I can cover my mouth and nose or use a tissue when coughing or sneezing etc.*) from Alsulaiman and Rentner (2018, 2021, 2022), which were developed based on HBM by Champion (1984, 1993) and Champion and Scott (1997). The overall 5-point Likert HBM scale (*5 = Strongly agree to 1 = Strongly disagree*) consisted of 54 items after conducting Cronbach's alpha test and dropping one item from perceived susceptibility. The Cronbach's alpha of the HBM scale showed high reliability at 0.90. The perceived barriers scores were reversed for proper analysis (5 = *strongly disagree* to 1 = *strongly agree*). A higher HBM mean score indicates higher adherence and a prediction of healthy behavior.

Third, the recommended media credibility scale consisting of 5 dimensions—believability, trustworthiness, accuracy, completeness, and biases—was also adapted to measure the credibility of 19 communication channels (Austin & Dong, 1994; Gaziano, 1988; Metzger et al., 2003; Meyer, 1988; Rimmer & Weaver, 1987; West, 1994). The 5-point Likert scale (e.g., 5 = *very accurate* to 1 = *not accurate at all*) aimed to measure the credibility of health information about the flu in various communication channels (mean [M] = 3.19, standard deviation [SD] = 0.53, Cronbach's alpha = 0.85). Fourth, the researchers used a 5-point Likert scale (5 = *extremely likely* to 1 = *extremely unlikely*) to measure the likelihood of using 19 communication channels to obtain health information about the flu (e.g., CDC, WHO, Snapchat, Twitter (X), etc.). We used skip logic for those who had never sought health information about the flu so they did not respond to credibility and likelihood of using communication channel scales. Thus, variations in sample size across analyses were due to the study's skip logic, as certain items were conditionally displayed based on participants' responses, such as on the message credibility scale. Hence, not all participants completed all variables in the study; no cases

were removed listwise, and the analyses were performed using available data for each variable (pairwise deletion), which is consistent with common approaches in handling survey variables (Dillman et al., 2014; Little & Roman, 2019).

We also included the WHO and CDC recommendations to prevent getting the flu (CDC, 2024a, 2024b; WHO, 2024a). Participants answered (*Yes, sometimes, no*) questions about how often a particular health behavior was followed (*always, often, sometimes, rarely, never*). These included: *Do you wear a mask when you visit sick people? Do you wash your hands with soap and water daily? Do you cover your mouth or use a tissue when coughing or sneezing?* and so on. Vaccine uptake was measured by asking participants whether they received flu vaccinations for the current season (e.g., Have you received the flu vaccination for this season: yes, no) and whether they receive the flu vaccine every year (Do you take the flu vaccine every year: Yes, no, sometimes). Normality tests were performed using the Shapiro-Wilk and Kolmogorov-Smirnov tests. The tests showed that the data were not normally distributed, $p < 0.05$. Hence, nonparametric tests, such as the Mann-Whitney and Kruskal-Wallis tests, were performed. Dummy variables were only used when conducting regression analyses. Demographic questions, such as sex, age, and level of education, were also included. Participants took 10 minutes to complete the study.

Procedures

An online survey was circulated via email to all students, employees, and faculty members at a large university located in the central region of Saudi Arabia. The study took place during the flu season between September 2023 and March 2024. The university research center uses the research email service to disseminate research studies to its students, employees, and faculty members, meaning all university affiliates receive research emails regularly. The research email service sent the study's title, IRB approval, researchers' names, link, and QR code to all students, employees, and faculty members. Participants must be 18 years and older and affiliated with the university. The number of participants who clicked on the study link was 1,130, and the completion rate was 59%. Research participants were offered incentives to encourage participation in the study. Five gift cards totaling $134 from different stores, such as Apple and Google stores, were randomly offered to participants who chose to enter the drawing by providing their email addresses. The Research Ethics Committee at the university approved the study, and informed consent was obtained from all participants before the study.

Data Analysis

The study used SPSS version 21 to run descriptive and inferential statistics. Cronbach's alpha tests, normality tests, factor analysis, Mann-Whitney tests, Kruskal-Wallis tests, and multiple linear regression tests were performed in this study.

RESULTS

Participant Characteristics

The number of respondents who participated in the study was 1130, with a 59% completion rate. The respondents' ages ranged from 18 to 70 years, with a mean of 27.79 years. Around 62% were women (n = 700), and 38% were men (n = 430). More than 35% of respondents had completed a bachelor's degree (n = 397), 30.45% had finished high school (n = 345), 16.55% had a master's degree (n = 187), 8.94% had an associate degree (n = 101), 7.70% had a doctorate (n = 87), and 1.15% had completed a medical degree (n = 13).

Research Questions

RQ1: What is the first source of information that students, staff, and faculty at a large university in Saudi Arabia turn to when concerned about the flu virus?

Around 45% of respondents (n = 336) reported going first to Internet search engines, such as Google and Yahoo, to obtain information about the flu, and more than 20% of respondents (n = 152) went first to MOH's communication channels, like the website and social media, to acquire flu information. Around 9% went first to social media platforms, such as Snapchat and TikTok (n = 67), and less than 1% of respondents reported

going first to traditional media (*n* = 3) and social media influencers (*n* = 1). Less than 6% of respondents went to the WHO (*n* = 31) and CDC (*n* = 9) to obtain health information about the flu. Around 6% of respondents (*n* = 42) said they had never sought health information about the flu.

RQ2: What are the most common communication channels students, staff, and faculty at a large university in Saudi Arabia use to obtain health information about the flu?

Respondents were likelier to use the MOH's communication channels to get information about the flu (M = 4.44, SD = 0.98), followed by Internet search engines (M = 4.29, SD = 1.02), doctors, and healthcare providers (M = 4.25, SD = 0.94), WHO's communication channels (M = 3.83, SD = 1.32), family and friends (M = 3.56, SD = 1.20), and Twitter (X) (M = 3.56, SD = 1.27). However, respondents were less likely to use Facebook (M = 1.66, SD = 1.04), newspapers (M = 1.94, SD = 1.30), and radio (M = 2.02, SD = 1.24).

RQ3: What are the most credible sources for flu information among students, staff, and faculty at a large university in Saudi Arabia?

The most credible sources for flu information among respondents were as follows: the MOH (M = 4.23, SD = 0.76), followed by doctors and healthcare providers (M = 4.02, SD = 0.73), the WHO (M = 4.00, SD = 0.90), and the CDC (M = 3.96, SD = 0.92). Other sources, such as Internet search engines (M = 3.14, SD = 0.73) and television (M = 3.10, SD = 0.83), were considered moderately credible, while social media platforms like Twitter (X) (M = 2.77, SD = 0.74), YouTube (M = 2.69, SD = 0.80), and Instagram (M = 2.28, SD = 0.82) were viewed as less credible (**Table 1**).

Table 1. Most credible sources for flu information (n = 270)

Source	M	SD
MOH	4.23	0.76
Doctors and healthcare providers	4.02	0.73
WHO	4.00	0.90
CDC	3.96	0.92
The Internet search engines	3.14	0.73
Television	3.10	0.83
Family and friends	3.00	0.75
Newspaper	2.98	0.83
Radio	2.94	0.85
Blogs	2.85	0.73
Twitter (X)	2.77	0.74
YouTube	2.69	0.80
Social media influencers	2.40	0.85
Facebook	2.35	0.72
Snapchat	2.34	0.79
Instagram	2.28	0.82
TikTok	2.26	0.79
WhatsApp	2.21	0.80

RQ4: To what extent do students, staff, and faculty adopt healthy behaviors to prevent the flu?

The data indicated that respondents were generally proactive in adopting some flu-preventive behaviors. More than 33% reported washing their hands daily with soap and water for at least 20 seconds 7 times or more (*n* = 224), 26% stated that they wash 5-6 times (*n* = 171), and 25% between 3-4 times (*n* = 164). Also, around 55% said they always stay away from sick people (*n* = 366), compared to 40% who said only sometimes (*n* = 270). Most individuals (85%) reported using tissues to cover their mouth and nose when coughing or sneezing (*n* = 566), and 78% said they stay home when they feel sick (*n* = 519). However, almost 79% of individuals did not receive the flu vaccine for the current season (*n* = 528), and more than 57% stated that they do not take the annual flu shot every year (*n* = 386). Other notable variations in preventive behaviors are shown in **Table 2**.

Table 2. Adherence to healthy behaviors

Behavior		Percentage (%) (n)
How often do you wash your hands daily with soap and water for at least 20 seconds?	1-2 times	16.32 (109)
	3-4 times	24.55 (164)
	5-6 times	25.60 (171)
	9 times or more	17.96 (120)

Table 2 (Continued).

Behavior		Percentage (%) (n)
	9 times or more	17.96 (120)
Do you stay away from sick people?	Yes	54.79 (366)
	Sometimes	40.42 (270)
	No	4.79 (32)
Do you use a tissue and cover your mouth and nose when coughing or sneezing?	Yes	84.73 (566)
	Sometimes	12.43 (83)
	No	2.84 (19)
Do you stay home when you are sick?	Yes	77.69 (519)
	Sometimes	18.71 (125)
	No	3.59 (24)
How often do you touch your eyes, nose, or mouth?	Always	10.03 (67)
	Most of the time	25.00 (125)
	Sometimes	47.16 (315)
	Rarely	16.32 (109)
	Never	1.50 (10)
How often do you clean and disinfect frequently touched surfaces at home, work, or school?	Always	13.77 (92)
	Most of the time	25.75 (172)
	Sometimes	37.87 (253)
	Rarely	18.26 (122)
	Never	4.34 (29)
Do you follow a healthy and balanced diet to strengthen your immune system?	Yes	25.60 (171)
	Sometimes	44.76 (299)
	No	29.64 (198)
Have you received the flu vaccination for this season?	Yes	21.19 (142)
	No	78.81 (528)
Do you take the flu vaccine every year?	Yes	15.07 (101)
	Sometimes	27.31 (183)
	No	57.61 (386)

RQ5: What perceptions do students, staff, and faculty have of seasonal flu and the flu vaccine?

The overall VHS showed that participants had low vaccine hesitancy (M = 3.88, SD = 0.58) and an overall high HBM score (M = 3.85, SD = 0.44). Participants reported moderate susceptibility (M = 3.07, SD = 0.59) with the highest mean score for the item *It is extremely likely I will get the flu in the future* (M = 3.63, SD = 1.02); perceived severity (M = 3.30, SD = 0.86) with the highest mean score for the item *Influenza is a serious illness for the elderly* (M = 3.89, SD = 0.89) and lowest for *Influenza is a serious illness for someone my age* (M = 2.42, SD = 1.03); perceived benefits (M = 3.37, SD = 0.84) with the highest mean score for the item *I am willing to get a flu shot if I were sure it prevented the flu;* and high self-efficacy (M = 3.92, SD = 0.63) with the highest item *I cover my mouth and nose or use a tissue when coughing or sneezing* (M = 4.28, SD = 0.78). Respondents reported overall low perceived barriers (M = 3.38, SD = 0.65), with two moderate perceived barriers items: A *person with a cold should not get a flu shot* (M = 2.66, SD = 1.10) and *I worry about side effects from the flu shot* (M = 2.79, SD = 1.25). Also, individuals reported overall low cues to action (M = 2.13, SD = .23), with *News of a bad flu season would influence me to get the flu shot* (M = 2.06, SD = 0.30). Further, participants who did not receive the current flu vaccine were asked about the main reason that prevented them from taking it. Around 44% of participants reported that the flu vaccine is not risky (n = 228), 10% were concerned about vaccine safety (n = 50), 5% reported health issues (n = 24), and 42% said other reasons prevented them from taking the current flu vaccine (n = 224).

Hypotheses

H1: Individuals with higher mean HBM scores are more likely to get a flu vaccine for the current season and take it annually.

First, the nonparametric Mann-Whitney analysis was conducted to test the relationship between HBM and taking the flu for the current season. The analysis found significant differences between participants with high and low HBM, U = 15654.0, $p < .001$. Those with higher HBM mean scores were more likely to get vaccinated against the flu for the current season (Mdn = 4.16) compared to those who were not (Mdn = 3.72).

Second, to test the relationship between the HBM and taking the flu vaccine annually, the nonparametric Kruskal-Wallis analysis was conducted. The analysis indicated significant differences between participants

with high and low HBM, x^2 (2) = 138.072, p < .001. Those who said they got vaccinated every year had higher HBM (Mdn = 4.19) than those who said sometimes (Mdn = 4.00) and those who said they did not (Mdn = 3.64). **H1** was supported.

H2: Individuals with less vaccine hesitancy are more likely to receive a flu vaccine for the current season and annually than those with high vaccine hesitancy.

First, the nonparametric Mann-Whitney test was conducted to test the relationship between vaccine hesitancy and getting the flu vaccine for the current season. The analysis indicated a slight significant difference between participants with lower and higher vaccine hesitancy when taking the flu vaccine for the current season. Participants who had received the flu vaccine for the current season had slightly greater vaccine hesitancy scores (Mdn = 3.90) than those who had not (Mdn = 4.11), U = 27711.0, p < .001.

Second, the Kruskal-Wallis test was performed to test the relationship between vaccine hesitancy and receiving the flu vaccine annually. The analysis indicated a significant difference between participants with low and high vaccine hesitancy when taking the flu vaccine every year. Participants who stated that they did not take the annual flu shots had slightly lower vaccine hesitancy (Mdn = 4.22) compared to those who said they take it every year (Mdn = 4.00) and those who sometimes take it (Mdn = 3.80), x^2 (2) = 62.088, p < .001. **H2** was not supported.

H3: The credibility of health messages and the HBM are strong predictors of vaccine hesitancy.

A multiple linear regression model was performed to examine the relationship between the credibility of health messages, HBM, and vaccine hesitancy. Vaccine hesitancy was specified as the dependent variable and both HBM and credibility of health messages were treated as independent variables. The regression model was significant F (2, 277) = 75.33, p < .001, and the model explained 35.2% of the variance, R^2 = 0.352. The results indicated that HBM significantly predicted vaccine hesitancy, *B* = 0.566, B = 0.112, *t* (277) = 11.39, p < .001, and credibility of health messages had a positive relationship with vaccine hesitancy but was not a significant predictor, *B* = 0,046 *t* (277) = 1.877, p > .05. The results suggested that for every one unit increase in HBM, vaccine hesitancy increases by .0112, and the relatively large standardized coefficient indicates that HBM is the strongest predictor in the model. **H3** was partially supported. **Table 3** shows the regression coefficients with confidence intervals (CIs).

Table 3. Multiple linear regression analysis of the effects of HBM and credibility on vaccine hesitancy

Variable	B	Standard error	β	t	95% CI		p
					Lower level	Upper level	
Constant	8.821	2.280	-	3.869	4.333	13.308	< 0.001
HBM	0.112	0.010	0.566	11.393	0.093	0.132	< 0.001
Credibility	0.046	0.024	0.093	1.877	-0.002	0.099	0.062

Note. n = 277 & Durbin Watson = 1.980

H4: Increased credibility of flu messages predicts flu vaccine uptake among students, staff, and faculty.

Mann-Whitney and Kruskal-Wallis tests found no association between increased credibility of health messages and taking the current season flu vaccine or the flu shot annually. Hence, **H4** was not supported.

H5: Age and sex are significant predictors of vaccine uptake.

The binary logistic regression analysis model to examine the effects of sex and age on vaccine uptake was not significant, p > .05. **H5** was not supported.

H6: Age and sex are significant predictors of vaccine hesitancy.

The multiple linear regression analysis was conducted to examine whether age and sex predicted vaccine hesitancy. The overall model was significant, F = (2, N = 1.025) = 8.19, p < .001 (**Table 4**), which explained a small proportion of the variance in vaccine hesitancy (R^2 = .016), explaining only 1.6% of the model.

The analysis revealed that age was a significant predictor of vaccine hesitancy (B = -.126, p < .001), which means younger individuals reported lower vaccine hesitancy than older people. Sex, nonetheless, was not a significant predictor (B = 0.008, p =.786). Hence, the hypothesis was partially supported.

Table 4. Multiple linear regression analysis of the effects of sex and age on vaccine hesitancy

Variable	B	Standard error	β	t	95% CI		p
					Lower level	Upper level	
Constant	39.45	0.607	-	65.171	38.354	40.736	< 0.001
Sex	0.089	0.327	0.008	0.272	-0.553	0.731	0.786
Age	-0.063	0.015	-0.126	-4.042	-0.093	-0.032	< 0.001

Note. n = 1,028

H7: Age and sex are significant predictors of the credibility of health messages.

The multiple regression analysis did not find a significant relationship between sex, age, and the credibility of health messages. Thus, **H7** was not supported.

DISCUSSION

The results verify the role of HBM in determining participants' perceptions of health issues. The study examined vaccine hesitancy, information-seeking behaviors, preferred communication channels, the credibility of health messages, and preventive behaviors related to flu among the university community in Saudi Arabia.

The study showed that respondents who received the vaccine for the current flu season and who take it every year had higher mean HBM scores. The findings also suggest that HBM predicted vaccine hesitancy. This is imperative as the HBM has historically been incorporated into many healthy behaviors (Champion & Skinner, 2008; Janz & Baker, 1984), including getting the H1N1 vaccine (Yang, 2015), adopting safer sex behaviors (Petosa & Jackson, 1991), and receiving COVID-19 vaccines (Huang & Gerend, 2024; Limbu et al., 2022), providing researchers with an improved comprehension of individuals' health behavior.

The study also suggests that 45% of respondents went first to Internet search engines such as Google and Yahoo for flu information. This aligns with the global trend of the Internet becoming a chief source of health information (Fox, 2011; Fox & Purcell, 2010). This study revealed that most respondents rely primarily on MOH channels for flu information, followed by Internet search engines, doctors and healthcare providers, and the WHO. Respondents perceived the MOH, doctors, healthcare providers, the WHO, and the CDC as credible compared to other sources, such as social media platforms like TikTok, Facebook, WhatsApp, and Instagram. Such findings are comparable to previous research validating the significance of official health organizations in public health strategies (Alkazemi et al., 2022; Alsulaiman & Rentner, 2022; Mitchell et al., 2021). For instance, a Pew Research study conducted during the COVID-19 pandemic suggested that the majority of Americans trusted the CDC and other health organizations for information about COVID-19, surpassing other sources, including local and national news, and the President and his administration (Mitchell et al., 2020). Likewise, during the pandemic, people in Saudi Arabia trusted health organizations, such as the MOH, WHO, and CDC, more than other sources, such as traditional and social media (Alsulaiman, 2023).

Furthermore, the data on preventive behaviors indicate that participants typically take proactive measures to prevent the flu. These measures include staying home when feeling sick, washing hands frequently, and using tissues to cover the mouth and nose when coughing or sneezing. These findings are consistent with previous research that found adherence to preventive measures such as flu vaccination and handwashing has been significantly promoted through the MOH's public health campaigns, which resulted in effectively increased awareness and adherence to preventive behaviors, particularly during flu seasons in Saudi Arabia (Al-Ghamdi et al., 2021; Al-Mohaimeed et al., 2019; Alsubaie et al., 2020; Khedher et al., 2020). However, our study found some variations in the adoption of healthy behaviors, such as cleaning surfaces, avoiding touching the eyes and nose, and getting vaccinated. These are healthy behaviors that help curb the spread of the flu (WHO, 2024a). Thus, such findings press the need for continued public health education to promote comprehensive adherence to preventive measures, particularly vaccination, emphasizing the importance of individuals' collective work in this area. To tackle this, studies have emphasized the importance of community engagement in raising awareness and adherence to healthy behaviors (Alharbi et al., 2021; Alqurashi et al., 2022). Moreover, respondents have reported low perceived barriers, low vaccine hesitancy, high HBM scores regarding flu, and have perceived the information from health authorities to be credible.

Our findings also suggest that respondents with high HBM are more likely to get vaccinated. The analysis suggests that age predicts vaccine hesitancy, as an increase in age has been associated with greater vaccine hesitancy. However, most participants did not receive the seasonal flu vaccine, nor were they willing to take it every year. This conforms with earlier studies indicating that low vaccination rates remain a significant issue in Saudi Arabia (Alsubaie et al., 2019; Alsuwailem et al., 2023; Alzahrani et al., 2023; Tharkar et al., 2023). The issue of low vaccine hesitancy and low vaccine uptake may reflect the well-documented intention-behavior gap, in which holding positive attitudes or intentions does not lead to actual behavior (Ajzen, 1991; Sheeran, 2002; Sheeran & Webb, 2016). Optimistic bias could provide further explanation for not taking the vaccine. Optimistic bias means the tendency for a person to believe that he or she is less likely than others to go through negative experiences and more likely to experience positive events (Shepperd et al., 2013; Weinstein, 1980). For instance, individuals underestimate their risk of developing a serious illness, like cancer, compared to their peers (Weinstein, 1980). Scholars have found that optimistic bias plays a significant role in many health issues (see Chapin, 2001; Park & Ju, 2016; Rentner & Alsulaiman, 2024; Stanley-Clarke et al., 2024; Weinstein & Lyon, 1999), including taking or rejecting a vaccine (Raj et al., 2023; Rostad & Anderson, 2021; Wolff, 2021, 2024), yet other factors could contribute to the discrepancy between low hesitancy and low flu vaccine uptake. Another possible explanation is that the average age of participants in this study was 27 years, which conforms with previous studies that suggest young Saudis had higher vaccine hesitancy (Fadhel, 2023). In fact, our study showed that most young people do not consider the flu to be risky, and only the elderly are at risk. Such a finding may explain this discrepancy between these two variables. Previous research has suggested that other factors, such as prior experiences and cultural and social norms, may also contribute to the rejection of the flu vaccine (Streefland et al., 1999; Xie et al., 2019).

In fact, the WHO (2024b) has recently called experts, academics, and international organizations to join forces to address a crucial issue that might have hampered many Saudi individuals from taking the vaccine. The WHO's call is to address the spread of false and misleading information or an infodemic. This major issue hampers health efforts and causes confusion and risky behaviors among individuals, especially during a health emergency (WHO, 2024b). The MOH, therefore, should thoroughly investigate, through research and fieldwork, any potential predicaments that contribute to vaccine hesitancy. Learning from previous health campaigns conducted in other countries and amplifying effective communication strategies could also help the MOH increase flu vaccine uptake and achieve positive outcomes. Effective health and educational campaigns utilizing proper strategies could easily address any misconceptions about the flu vaccine and emphasize its safety and effectiveness.

Our study found no significant association between message credibility and the likelihood of receiving the seasonal flu vaccine. Previous research may provide further explanation of these findings by highlighting the MOH's use of ineffective health communication strategies in its messages. Alkazemi et al. (2022) demonstrated, through the application of the HBM, that in 1,000 Instagram posts from GCC Ministries of Health, 59% were related to public relations, such as announcements of occasions and events, while 41% were health-focused posts, including HBM variables, aimed at educating the public about health issues and specific diseases. The disparity in post topics and the belief that young and healthy individuals do not need to get vaccinated against the flu underlines the need for the MOH to review its health communication strategies. For instance, a practical approach that could help boost vaccination rates in Saudi Arabia and address the issue of low flu vaccine uptake is for the MOH to conduct awareness workshops in schools and universities.

Limitations and Recommendations

This study has two limitations. First, it used one method—a purposive online survey—and collected data from the students, employees, and faculty of a large university in the central region of Saudi Arabia. The sample represents a highly educated population, and the findings may not reflect the opinions or behaviors of the general population from other socioeconomic or educational backgrounds in Saudi Arabia. Further studies might use simple random sampling to collect broader and more representative data that can be generalized over the entire population. Second, reliance on self-reported data may result in recall bias when participants are asked to remember and accurately report their vaccination history and perceptions. Addressing these biases in future research by employing a mixed-methods approach to gather more in-depth data about the topic under study may also be helpful.

CONCLUSION

This study integrated the HBM and VHS to examine vaccine hesitancy and perceptions toward the seasonal 2023/2024 flu vaccine in Saudi Arabia. The study assessed information-seeking behaviors, vaccine hesitancy, the credibility of health messages, and adherence to healthy behaviors to understand what factors hindered individuals from getting vaccinated. The study concluded that individuals in Saudi Arabia have high HBM, low vaccine hesitancy, and perception of health messages to be credible, yet they do not get vaccinated. This requires immediate attention and a holistic approach to understand how to persuade individuals to get vaccinated. Launching a focused educational campaign targeting young and healthy individuals to increase confidence and vaccine access and overcome social and economic barriers could enhance vaccine uptake. Partnering with the community groups, influential leaders, and celebrities to promote accurate and concise call to action messages that focus on the benefits of vaccination may help in persuading young people to get vaccinated.

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