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Journal of Public Health Research 2021; volume 10:2273

Article

The use of the health belief model to assess U.S. college students' perceptions of COVID-19 and adherence to preventive measures

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Abstract

Background: This study utilized the Health Belief Model to examine college students' perceptions of the COVID-19 pandemic. It examined the extent to which the Health Belief Model and perceived threat are associated with the adoption of COVID-19 preventive measures among college students.

Design and Methods: An online questionnaire was utilized and sent to a simple random sample of college students at a large Midwestern university in the United States between May and July of 2020. The number of undergraduate and graduate students who participated in this study was 1,723.

Results: The study found that the Health Belief Model and perceived threat are significantly associated with COVID-19 preventive measures. College students with higher Health Belief Model scores were more likely to adhere to COVID-19 preventive measures than those with lower scores. College students also reported high cues to action and low perceived barriers to most of the COVID-19 preventive measures.

Conclusion: Applying the Health Belief Model is crucial for health professionals and university administrators for developing effective communication messages for COVID-19 prevention and future health outbreaks.

Introduction

The COVID-19 global pandemic has caused significant upheavals to life as we knew it, spurring communities, world leaders, public health authorities, businesses, school and university administrators to take unprecedented measures to mitigate the deadly disease from spreading.[1] The virus has infected more than 119 million people with more than 2.6 million deaths worldwide, and the United States has the highest numbers of all nations with more than 29 million COVID-19 cases and more than 430,100 related deaths as of March 2021, according to the World Health Organization (WHO).[2] A crisis can occur quickly and unexpectedly, and disease outbreaks are unavoidable.[3] A crisis can cause serious threats, including public safety threats, financial, and reputation loss,[4] which continues to be the case with COVID-19 and its new variants from the United Kingdom and South Africa.

Public health authorities, such as Centers for Disease Control and Prevention (CDC), have been using risk communication strategies to mitigate the threats of health outbreaks, including COVID-19, by promoting scientific-based health messages designed for targeted groups through various communication channels.[5] The CDC has been at the forefront in fighting COVID-19 by launching public campaigns that aim to educate the public and raise awareness of the importance of adopting COVID-19's preventive measures through basic yet effective health messages to protect the public.[6,7] The health messages further aim for individuals to make behavioral changes[8] by encouraging them to adopt preventive health behaviors such as washing hands frequently, wearing masks, and staying 6-feet apart. Such preventive health measures must be integrated in all public settings, including colleges and universities, to ensure the safety of students, faculty, and staff.[9] As of December 11, 2020, more than 397,000 cases and 90 deaths have been reported across more than 1,800 college campuses in the United States.[10.]

The purpose of this study was to assess college students' adoption of COVID-19 preventive measures through the lens of the Health Belief Model (HBM). Notably, it examined the relationships between the HBM, perceived threat, and COVID-19 recommended preventive measures. The study also examined the perceived barriers and cues to action that impede or trigger college students to adopt preventive behaviors during a health outbreak. Understanding the perceived barriers, cues to action, and the relationships of the HBM and perceived threats to adopting preventive health behaviors would help university administrators determine whether health messages promoted during the COVID-19 crisis had effectively spurred college students to adopt healthy behaviors. This understanding also would help researchers and public health authorities craft more tailored and persuasive messages that address perceived barriers and cues to action during future health crises.

Literature review

COVID-19 pandemic

According to CDC, individuals of all ages are susceptible to

Significance for public health

This study aims to examine college students' adherence to COVID-19 preventive measures through the lens of the Health Belief Model (HBM). Mainly, it looks at how cues to action and perceived barriers may spur or hinder college students from adopting healthy behaviors. It's imperative for school administrators and health professionals to comprehend students' perceptions of a particular disease to craft effective and persuasive health messages that trigger adoption of healthy behaviors.

COVID-19 infection, which carries mild to severe symptoms, including loss of taste or smell, fever, cough, sneezing, shortness of breath, headache, fatigue, among other symptoms.[6] Those symptoms could appear within 2-14 days after being exposed to the virus, and elderly and individuals with underlying medical conditions, like heart or lung diseases, are at higher risks of having serious complications from the virus.[11] Tailored health messages for such groups recommend monitoring any serious signs, such as trouble breathing, that may occur, and advise seeking immediate emergency medical care.[6]

The WHO and CDC have launched massive public health campaigns to mitigate the risk of COVID-19 using all possible communication channels to reach the public.[6,12] The WHO recommends the public stay alert for emerging information regarding COVID-19 and its preventive measures,[12] while the CDC recommends that people closely follow guidance and COVID-19 information from state and local authorities.[7]

A health campaign with either negative or positive incentive strategies aims to change behaviors.[8] The utilization of traditional and social media during the COVID-19 pandemic include videos, social media, and brochures aimed to induce behavioral changes among the public.[6,12] These include messages about adherence to basic yet effective measures to fight COVID-19. For instance, in efforts to reduce widespread COVID-19 cases, the WHO launched a comprehensive online campaign called #HealthyAtHome that encourages individuals to adopt healthy behaviors, such as eating healthy during the COVID-19 lockdown.[13]

COVID-19 preventive measures

Since early 2020, the WHO and CDC have been extensively promoting comprehensive educational health messages in various forms and in different communication channels to increase public awareness of the risk of the COVID-19 pandemic.[6,12-14] Precautionary preventive measures of COVID-19 include wearing a mask in public settings, washing hands with soap and water frequently, and using a tissue or covering a mouth and nose when coughing or sneezing.[6,12] Other preventive measures included keeping at least 6-feet distance, avoiding close contact with sick people, and cleaning and disinfecting frequently touched surfaces daily.[6,12] The WHO and CDC also encourage individuals to exercise regularly, eat a healthy and balanced diet, sleep for 7 hours or more per night to boost the immune system, and limit interaction with animals.[6,12-16] These preventive measures are believed to protect individuals from carrying or spreading COVID-19 to others .[6,12] Prevention standards also have been issued for specific work establishments, including restaurants, entertainment venues, schools, businesses, and higher education institutions, as well as specific publics, including healthcare workers, international travelers, and critical infrastructure workers.[7,17] How individuals perceive those health messages and whether or not they adopt these recommendations could be explained through the HBM. For this study, college students will be the unit of analysis through which the HBM will be explored.

Theoretical framework

Health belief model

The HBM was developed in the 1950s and widely used in health behavior research.[18] The HBM aims to understand why individuals tend to engage or disengage in certain health behaviors[19] and further explains and predicts individual acceptance and decline of preventive health behaviors.[20] The HBM has six constructs that help predict why individuals decide to adopt healthy behavior to prevent a disease.[18] They are: i) perceived susceptibility: refers to how individuals perceive the risk of the disease; ii) perceived severity: how individuals feel about the seriousness of contracting the disease; iii) perceived barriers: how individuals perceive the obstacles that may prevent them from adopting a healthy behavior; iv) perceived benefits: how individuals perceive the benefits and effectiveness of taking a healthy behavior; v) cues to action: internal and external factors that trigger decision making and motivate individuals to take action; and vi) self-efficacy: the confidence of ability to perform preventive and healthy behaviors.[18,20] While the HBM constructs play essential roles in predicting the adoption of preventive health behaviors, previous studies found that perceived barriers were the strongest predictor[18] and that motivation is considered an essential factor to adopting a preventive and healthy behavior.[21] The combination of both the perceived susceptibility and perceived severity is called the perceived threat of a particular disease.[18] Thus, assessing the perceived threat of the COVID-19 pandemic among college students is crucial to understanding the risk they might perceive.

As the HBM's six constructs help predict why individuals adopt healthy behaviors, other factors such as sociodemographic factors, including gender, age, ethnicity, race, and education level, were found to influence individuals' health perceptions and adoption of healthy preventive behaviors.[18-19] Habitual behaviors, like smoking cigarettes, are other factors that could impact decision-making processes and prevent them from adopting healthy behaviors.[20] Past experiences could also play critical roles in how individuals perceive certain behaviors. For example, a study found that factors such as past experiences, socioeconomic, social influence, and medical recommendations had both direct and indirect effects on inoculation behaviors during the swine flu of 1976.[22]

The HBM has been widely used in studies that predict adopting preventive and healthy behaviors among college students, including intentions of getting the H1N1 vaccines;[23] intentions and predictions of getting the seasonal flu vaccines;[24] involvement in vigorous physical activity to improve health;[25] perceived barriers and benefits of weight management;[26] self-management behaviors among food-allergic college students;[27] perceived threat and perceptions of using e-cigarettes;[28] and, the effectiveness of a health campaign encouraging students to take naps on campus.[29] In one study, college students with higher scores of perceived susceptibility, perceived severity, perceived benefits, cues to action, and self-efficacy were more likely to follow preventive health measures to lower the risk of getting the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) than those with lower scores.[30] Meanwhile, those with higher perceived barriers were found to be less likely to adopt healthy behaviors.[30]Another study found that the HBM was an excellent predictor for following a recommended behavior.[31] Specifically, undergraduate students with higher perceived susceptibility, perceived benefits, perceived severity, and lower perceived barriers were more likely to wear a helmet when riding a bicycle.[31] Self-efficacy and perceived barriers were also found to predict female college students' breast self-exam performance (BSE) to check for signs of breast cancer. Females with higher self-efficacy scores were more likely to perform BSE than those with lower scores.[32] In a study on condom use among college students, perceived barriers were reduced pleasure and little intimacy, while perceived benefits to condom use were preventing sexual diseases, pregnancy, and a feeling of safety having sex.[33]

To our knowledge, little or no research has been conducted on the HBM, perceived threat, cues to action, and perceived barriers to COVID-19 preventive behaviors among college students in the

U.S. Few studies, however, did use the HBM to investigate intentions to get the COVID-19 vaccine. For instance, a study utilized the HBM to assess intents and willingness to get COVID-19 vaccines.[34] The study found that 48% of the sample reported a definite intent to get the vaccine, followed by 29% who said they will probably get it, and 16% who said they will possibly get the vaccine. The study suggested that perceived benefits of the vaccine played significant roles in the definitive intention to receive the vaccines and willingness to pay. Another study utilized the HBM to examine whether demographic and psychosocial factors influenced individuals' decisions to take COVID-19 vaccines.[35] The study concluded that factors like age and ethnicity, higher perceived benefits, higher perceived susceptibility, higher self-efficacy, and lower perceived barriers were found to be significant predictors for taking the vaccination.[35]

This study posed two research questions and four hypotheses to assess college students perceived threats, cues to action, and perceived barriers to adopting COVID-19 preventive measures:

RQ1: What are the perceived barriers to adopting healthy preventive measures among college students during the COVID-19 crisis?

RQ2: What are the cues to action to adopting healthy preventive measures among college students during the COVID-19 crisis?

Research hypotheses:

H1: College students with higher perceived barriers are less likely to adopt COVID-19 preventive measures.

H2: College students with higher cues to action are more likely to adopt COVID-19 preventive measures.

H3: There is a positive association between HBM and COVID-19 preventive measures.

H4: There is a positive association between the perceived threat of COVID-19 and adopting preventive measures.

Methods

This cross-sectional study utilized a simple random sample of college students from a large Midwestern university of approximately 20,000 students. The online survey was reviewed and approved by the Office of Academic Assessment and the IRB. Informed consent was obtained by all participants.

Instrument

The study adapted Champion's Health Belief Model with a 5-point Likert- scale (strongly disagree = 1 to strongly agree = 5) used in many studies.[36,37] This study advanced Alsulaiman and Rentner's work that used the HBM scale with 43 items to study the Middle East Respiratory Syndrome Coronavirus (MERS-CoV).[30] An additional 16 items based on the WHO and CDC COVID-19 recommendations were included, bringing the total to 59 items. An exploratory factor analysis using the principal component analysis with Direct Oblimin rotation was conducted. Based on rigorous criteria followed by scholars regarding factor analysis (e.g., Kaiser-Meyer-Olkin of sampling adequacy were above 0.80 for all HBM constructs, eigenvalue greater than 1, variables loading above 0.5, a weak commonality of <0.45 or cross-loading were discarded), 14 items were removed, bringing the total to 45 items. Those items were as following: perceived susceptibility with five items explaining 62% of the variance; perceived severity with six items explaining 66.5% of the variance; perceived barriers with 13 items explaining 60% of the variance; perceived benefits with eight items explaining 68% of the variance; cues to action with seven items explaining 67.5% of the variance; and, self-efficacy with six items explaining 64% of the variance. The composite of the 45 items represented the HBM, and the composite of perceived susceptibility (5 items) and the perceived severity (6 items) represented the perceived threat with 11 items. The perceived barriers scores were reversed (strongly disagree = 5 to strongly agree = 1) only for conducting the HBM analysis.

The reliability of the scale using Cronbach's Alpha was 0.83. Eight preventive measures questions (*e.g., yes/no/sometimes questions, multiple-choice questions*) recommended by the WHO and CDC to curb COVID-19 comprised this section of the survey. Questions included the number of times washing hands a day for at least 20 seconds *(I don't wash my hands = 1 to 9 or more times = 6*), wearing a mask in public settings *(no = 1 to yes = 3),* wearing a mask when visiting sick people (*no = 1 to yes = 4*), following a healthy and balanced diet to strengthen the immune system (*no = 1 to yes = 3*), and staying away from animals *(no = 1 to yes = 3*). Multiple choice questions asked about the average number of hours of sleep per night (*less than 4 hours = 1 to 5 = 7 hours or more*), covering their mouth or using a tissue when coughing or sneezing (*never = 1 to always = 5*), and minutes of weekly exercise *(I don't exercise = 1 to 4 = 150 minutes or more).*

Procedures

A random sample of students' emails were provided to the researchers by the institution via Qualtrics. The study was sent via emails using Qualtrics between May and July of 2020. The number of students who clicked on the study's link was 2,114, and the number of those who participated was 1,773, with a completion rate of 84%. The invitation email was sent three times to encourage participation in this study.

Data analysis

Statistical analyses were conducted using SPSS. Missing data were removed from analyses. Only significant results ($p<0.05$) were reported.

Results

Characteristics of students who participated in this study showed that 65% were females (n=1,111), 33% males (n=572), and 2% identified as other (n=40). The majority of participants (82%) were undergraduates (n=1,419) and 18% were graduates students (n=305).

RQ1: What are the perceived barriers to adopting healthy preventive measures among college students during the COVID-19 crisis?

In general, college students reported low-to-moderate perceived barriers to adopting COVID-19 preventive measures with an overall mean score of 2.12 (SD=0.60). Staying away from animals was the most challenging behavior to follow (M=3.14, SD=1.37), followed by the variable doing exercise regularly is time consuming (M=2.74, SD=1.23). Other perceived barriers to adopting COVID-19 healthy behaviors can be found in Table 1.

RQ2: What are the cues to action to adopting healthy preventive measures among college students during the COVID-19 crisis?

In general, college students reported high cues to action for adopting COVID-19 preventive measures with an overall mean score of 4.18 (SD=0.58). Maintaining proper hygiene was the highest cues to action (M=4.42, SD=0.62), followed by distancing from people if COVID-19 is spreading in their community (M=4.28, SD=0.89). Other cues to action to adopt COVID-19 healthy behaviors can be found in Table 2.

H1: College students with higher perceived barriers are less likely to adopt COVID-19 preventive measures.

Two statistical tests were conducted, and only significant results were reported. First, the Spearman's rank correlation coefficient found a negative correlation between the perceived barriers and times of weekly exercise and the frequency of washing hands, meaning those with higher perceived barriers were less likely to wash hands and exercise regularly (Table 3). Second, the Kruskal Wallis test found significant differences in following COVID-19 preventive measures (Table 4). Generally, those with higher perceived barriers were less likely to adopt healthy behaviors. H1 was supported on these measures.

H2: College students with higher cues to action are more likely to adopt COVID-19 preventive measures.

Two statistical tests were conducted, and only significant results were reported. First, the Spearman's rank correlation coefficient found a positive correlation between cues to action and times of weekly exercise and frequency of washing hands, meaning those with higher cues to action were more likely to wash hands and exercise regularly (Table 3). H2 was supported for these preventive measures. Second, the Kruskal Wallis test found significant differences in following COVID-19 preventive measures (Table 5). Generally, those with higher cues to action were more likely to adopt healthy behaviors. H2 was supported for these preventive behaviors.

H3: There is a positive association between the HBM and COVID-19 preventive measures.

First, the nonparametric Kruskal Wallis test indicated a significant relationship between the HBM and the preventive measure of wearing a mask/face cloth mask in public settings ($p<.001$), x^2 (2) = 266.979. Respondents with higher HBM scores (Mdn=3.85) were more likely to wear a face mask than those who said they sometimes wear a mask (Mdn=3.4) or those who do not wear a mask in public settings (Mdn=3). Second, the nonparametric Kruskal Wallis test indicated a significant relationship between the HBM and wearing a mask when visiting sick people ($p<0.001$), x^2 (3) = 37.727. Respondents with higher HBM scores (Mdn=3.75) were more likely to wear a mask when visiting sick people than those who said they do not wear a mask (Mdn=2.78) or sometimes wear a mask (Mdn=3.04). Respondents who do not visit sick people scored similarly to those wearing a mask (Mdn=3.75). Third, the nonparametric Kruskal Wallis test indicated a significant relationship between the HBM and the preventive measure of following a healthy diet to strengthen the immune system ($p<0.001$), x^2 (2) = 20.116. Respondents with higher HBM scores (Mdn=3.75) were more likely to follow a healthy diet than those who do not follow a healthy diet (Mdn=3.56). Those who said sometimes (Mdn=3.75) scored similarly to those who said yes. Fourth, the Spearman's rank correlation coefficient found significant correlations between the HBM and frequency of washing hands and frequency of covering a mouth or using a tissue when coughing or sneezing (Table 4). H3 was supported on all measures.

H4: There is a positive association between the perceived threat of COVID-19 and adopting preventive measures.

The perceived threat is the combination of perceived susceptibility and perceived severity items. First, the nonparametric

Table 1. Perceived barriers to COVID-19 preventive behaviors.

Variables	M	SD
1. Handwashing stations and/or hand sanitizers are not available at the places where I spend most of my day.	2.05	1.09
2. Face masks/cloth face masks are not available to me.	1.61	0.77
3. Staying away from animals is not easy.	3.14	1.37
4. Washing my hands frequently for at least 20 seconds with soap and water is not convenient.	1.87	0.99
5. Washing my hands with soap and water frequently is time consuming.	2.02	1.07
6. It is difficult to avoid close contact with sick people.	2.29	1.13
7. Preventive measures regarding coronavirus are difficult to apply in everyday situations.	2.58	1.22
8. I am not comfortable wearing a mask in public settings to prevent getting or spreading coronavirus.	1.96	1.21
9. Covering a mouth with a tissue when coughing or sneezing is not convenient.	1.73	1.01
10. Wearing a mask when visiting sick people is not convenient.	1.51	0.84
11. Doing exercise regularly is time consuming.	2.74	1.23
12. I cannot put distance (6 ft.) between me and other people if COVID-19 is spreading in my community.	2.13	1.08
13. I cannot clean and disinfect frequently touched surfaces daily in my home or workplace.	1.95	0.99

n=1435; M, mean; SD, standard deviation; Cronbach's alpha=0.811.

Table 2. Cues to action to COVID-19 preventive measures.

Variables	M	SD
1. I always follow medical advice to stay healthy.	3.95	0.88
2. I wear a mask/cloth face mask to reduce the chance of getting or spreading coronavirus.	4.09	1.10
3. Getting enough sleep will help me to be in good health.	4.06	0.78
4. Maintaining proper hygiene is important to good health.	4.42	0.62
5. Eating well-balanced meals will help to maintain good health.	4.27	0.65
6. It's important to exercise to maintain good health.	4.18	0.68
7. It's important to distance myself from people if COVID-19 is spreading within my community to stay healthy.	4.28	0.89

n=1,214; M, mean; SD, standard deviation; Cronbach's alpha=0.816.

Kruskal Wallis test indicated a significant relationship between the perceived threat and the preventive measure of wearing a mask/face cloth mask in public settings ($p<0.001$), x^2 (2) = 146.519. Respondents with higher perceived threat scores (Mdn=3) were more likely to wear a face mask in public settings than those who said they sometimes wear a mask (Mdn=2.36) or those who do not wear a mask in public settings (Mdn=1.90). H4 was supported for this preventive measure. Second, the nonparametric Kruskal Wallis test indicated a significant relationship between perceived threat and the preventive measure of following a healthy diet to strengthen the immune system ($p<0.01$), x^2 (2) = 13.579. Both respondents who followed a healthy diet and those who did not scored similarly on the perceived threat (Mdn=2.72) compared to those who sometimes followed a healthy diet (Mdn=3). H4 was not supported on this preventive measure. Third, the Spearman's rank correlation coefficient found a positive correlation between perceived threats and the frequency of washing hands, and a negative correlation between perceived threat and times of weekly exercise (Table 3). H4 is partially supported on these measures.

Discussion

The purpose of this study was to assess college students' adoption of COVID-19 preventive measures. The study explored this relationship through the lens of the HBM, specifically examining the perceived threats, perceived barriers, and cues to action that impede or trigger college students to adopt recommended COVID-19 preventive measures. A key finding was that college students reported low perceived barriers and high cues to action to the COVID-19 preventive measures. Only staying away from animals was the most challenging barrier that students reported. With 57% of American households owning pets, this can be difficult.[38]

When describing practices of following recommended healthy guidelines, those with higher perceived barriers were less likely to adhere to washing hands, exercising, wearing a mask in public settings, wearing a mask when visiting sick people, or following a healthy and balanced diet to strengthen the immune system. The findings support a study that indicated perceived barriers were the strongest predictor for not adopting healthy behaviors.[18] The findings also support other studies, like the one that found students with higher perceived barriers were less likely to adhere to safe behaviors, such as wearing a helmet when riding a bike[31] and the study that found students with higher perceived barriers were less likely to adhere to MERS-CoV preventive measures.[30] Such findings foster the idea that reducing the perceived barriers is crucial in persuading individuals to adopt healthy behaviors. This could be achieved by reinforcing other factors, such as perceived benefits,

Table 3. Spearman rho correlations between HBM subscales, perceived threat and COVID-19 preventive measures.

Variables	Spearman's rho
Cues to action and:	
Frequency of washing hands	0.161***
Hours of sleep	0.117***
Time of weekly exercise	0.084*
Frequency of covering a mouth or using a tissue when coughing or sneezing	-0.225***
Perceived Barriers and:	
Frequency of washing hands	
Time of weekly exercise	-0.183***
Frequency of covering a mouth or using a tissue when coughing or sneezing	-0.143***
HBM and:	0.213***
Frequency of washing hands	
Covering a mouth and using a tissue when coughing or sneezing	0.161***
Perceived threat and:	-0.143***
Frequency of washing hands	0.108***
Time of weekly exercise	-0.136***

***p<0.001, **p<0.01, *p<0.05, n=910. Only significant findings were reported.

Table 4. Summary of Kruskal-Wallis tests of differences between individuals with high and low perceived barriers scores in following healthy behaviors.

Variables	(Mdn)	X^2 (SD)	p
Do you wear a mask/ cloth face mask in public settings?	Yes = (2) No = (2.4) Sometimes = (2.2)	X^2 (2) = 74.008	< .001
Do you follow a healthy and balanced diet to strengthen your immune system?	Yes = (2) No = (2.3) Sometimes = (2.07)	X^2 (2) = 58.802	< .001
Do you wear a mask when you visit sick people?	Yes = (2) No = (2.85) I don't visit sick people = (2.07) Sometimes = (2.80)	X^2 (3) = 26.244	< .001

Higher (Mdn) scores indicate higher perceived barriers.

of a particular behavior while at the same time giving attention to potential barriers that may hinder students from adopting healthy behaviors. Therefore, to overcome perceived barriers to the COVID-19 pandemic among college students, it is imperative to make sure that students have access to information, like regular university updates, and resources, including face masks, handwashing stations, and hand sanitizers. Accessibility to healthy foods and a healthy lifestyle, and social and mental counseling are also imperative for achieving positive behavioral changes. The availability of resources is essential to limit the barriers.

The study found significant differences between students with high cues to action and low cues to action to COVID-19 preventive measures. Those with higher cues to action were more likely to wash hands frequently, exercise more, and get more sleep per night. Students with more cues to action were more likely to wear a mask in public settings, wear a mask when visiting sick people, and eat a healthy and balanced diet. This is consistent with other studies that found college students with higher cues to action were more engaged in vigorous physical activities than students with lower cues to action.[25] Another study also found that cues to action, like physician advice, was a successful indicator for getting the flu vaccine.[22] Only one preventive measure that negatively correlated with cues to action and positively correlated with perceived barriers was the frequency of covering a mouth or using a tissue when coughing or sneezing.

Furthermore, the findings suggest a positive association between the HBM and adopting most of the COVID-19's preventive measures. Those who wear a mask in public settings, wear a mask when visiting sick people, and follow a healthy and balanced diet to strengthen the immune system had higher HBM scores than others. The findings also suggest a positive correlation between the HBM and the frequency of washing hands, meaning as the HBM scores increase, the frequency of washing hands increases, too. This also supports other studies, such as the one utilized the HBM to examine stress management among college students and found that students with higher perceived benefits and cues to action and lower perceived barriers were more likely to engage and use stress management techniques.[39] This is also consistent with a study that found college students with higher HBM scores were more likely to engage in MERS-CoV preventive measures, such as washing hands frequently.[30] Only covering a mouth or using a tissue when coughing or sneezing was negatively correlated with the HBM. One reason could be a misunderstanding that if people are practicing social distancing that germs from a cough or sneeze will not carry that far. Perhaps tissues are not handy, it is not convenient to cough/sneeze into an elbow, or that coughing and sneezing are not necessarily indicative of an illness. For some, it may simply be a matter that they were not trained to cover their mouth or believe that a cough or sneeze spread germs. As other studies suggested, certain habitual behaviors, like brushing teeth and smoking, may impede individuals from thinking to adopt a healthy behavior.[20] In this case, not covering a mouth when coughing or sneezing could be a habitual behavior among some students. Hence, extra health messages focusing on this measure are needed.

Other preventive measures, like sleeping well and doing exercising have no relationship with the HBM. Hence, it could be an area where students could be educated about the importance and benefits of these preventive measures to fight COVID-19.

The study also shows that perceived threat has a positive association with COVID-19 preventive measures, such as frequency of washing hands, wearing a mask in public settings, and wearing a mask when visiting sick people. As the perceived threat increases, students tended to adopt these healthy behaviors. However, students with higher perceived threat scores were less likely to exercise regularly and follow a healthy diet to strengthen the immune system than those with lower scores. One potential explanation for this is that students are focusing on the three major COVID-19 preventive messages of wearing a mask, washing hands frequently, and social distancing, therefore overlooking other necessary messages important to preventing COVID-19. Also, it is possible that students are not connecting a direct correlation of healthy diet and exercise to COVID-19 prevention much like they would social distancing, mask wearing, and hand washing. Additionally, barriers may outweigh the perceived threat. For example, some common barriers that prevent healthy eating include time constraints, snacking on unhealthy or fast foods, easy access to junk food, stress, and the high cost of purchasing healthy foods.[40] Or, students simply are not exposed to these health messages as often the other messages. Hence, public health organizations may want to increase their efforts in educating the public about the values of adhering to all preventive measures in decreasing the likelihood of getting infected.

Establishing best practices

Findings from this study may help university administrations and public health authorities craft more tailored and persuasive messages for college students that address perceived barriers and encourage students with low cues to action to follow preventive measures. The American College Health Association (ACHA) developed the ACHA 2021 guidelines suggesting a social norming approach in which administration and students are involved in developing communication plans to promote a safe and healthy

Table 5. Summary of Kruskal-Wallis tests of differences between individuals with high and low cues to action in following healthy behaviors.

Variables	(Mdn)	X^2 (SD)	p
Do you wear a mask/ cloth face mask in public settings?	Yes = (4.42) No = (3.57) Sometimes = (4)	X^2 (2) = 211.164	< .001
Do you follow a healthy and balanced diet to strengthen your immune system?	Yes = (4.42) No = (3.85) Sometimes = (4.14)	X^2 (2) = 68.739	< .001
Do you wear a mask when you visit sick people?	Yes = (4.28) No = (3.28) I don't visit sick people = (4.14) Sometimes = (3.5)	X^2(3) = 43.050	< .001

Higher (Mdn) scores indicate higher cues to action.

environment.[41] This would involve social media, texts, and emails that focus on the barriers for practicing preventive behavior. For example, students could be given information that connects exercise and healthy eating as ways to help prevent getting COVID-19.

The use of monologue and dialogue scenarios would provide campus health educators and empower students with another venue for disseminating COVID-19 messaging. For example, in a study on HIV prevention among African-American women at historically Black colleges and universities, one researcher found that brief dialogues and monologues along with socially and culturally relevant HIV messages were important to this group.[42] Moreover, the study found that these audio-visual messages should be conveyed in familiar settings, such a dorm room, and recommended including appealing graphics and emojis.[43] Similarly, testimonials or peer modeling could provide students with the cues to action needed to make behavioral changes. For example, feature students showing creative ways in which they exercise and eat healthy. Interestingly, storytelling[43] and education-entertainment strategies[44] have been used in COVID-19 educational campaigns as ways to lead to behavioral changes.

Limitations

This study utilized an online survey to assess college students' HBM and perceived threat to COVID-19 preventive measures during the early stages of the pandemic, a time in which universities closed and less knowledge about the virus and prevention was known. While the goal of this study was to provide a snapshot of college students in general, analyses that include demographic, cultural, socioeconomic, and psychographic variables may provide relevant differences on the perceived threats and adherence to preventive practices.

Future directions

More studies need to be conducted at different points of time during the pandemic. For example, how has the reopening of universities, in various learning modes, impacted perceived threats, cues to action, and following recommended preventive guidelines? In addition, conducting interviews or focus groups might provide additional and in-depth insights about the topic under study. These methods may help in understanding why students chose not to engage in particular health behaviors despite the absence of barriers and may unveil other significant factors. Also suggested here are studies that assess the HBM and COVID-19 in relation to college student demographics, social and cultural differences, and psychographics. Finally, the emergence of COVID-19 vaccines and students' intentions to get the vaccines should be considered in future studies.

Conclusion

Never has emphasis on crafting effective health communication messages been more urgent than during the COVID-19 pandemic. For university administrators this means understanding what recommended preventive health guidelines college students are practicing, the barriers that are preventing such practices, and the cues to action for adopting healthy behaviors. Armed with this knowledge, university health promotion experts can launch effective, targeted campaigns to mitigate the risk of contracting COVID-19 or future health crises.

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Keywords: Health belief model (HBM); COVID-19; college students; preventive measures.

Funding: No funding was provided for this project.

Contributions: Saud Alsulaiman conceptualized the study, collected and analyzed the data, and wrote the manuscript. Terry Rentner gave input to the study design, wrote parts of the introduction, discussion, and conclusion sections, and provided substantial revisions to the manuscript. All authors critically reviewed subsequent versions of the manuscript and approved the final version for submission.

Acknowledgment: The first researcher would like to thank the Deanship of Scientific Research at King Saud University, Riyadh, the Kingdom of Saudi Arabia for supporting this research.

Ethical approval: The study was approved by the Institutional Review Board (IRB) at Bowling Green State University, OH, USA (no.1590862-2.). In accordance with the Declaration of Helsinki, informed consent was obtained from all participants.

Availability of data and materials: Data will be available upon the request from the corresponding author.

Competing interests: The authors have no potential conflict of interest to declare.

Received for publication: 19 March 2021.
Accepted for publication: 23 April 2021.

Journal of Public Health Research 2021;10:2273
doi:10.4081/jphr.2021.2273

References

1. United Nations. United Nations comprehensive response to COVID-19: Saving lives, protecting societies, recovering better. 2020. Accessed: 17 January 2021. Available from: https://www.un.org/pga/75/wp-content/uploads/sites/100/2020/10/un_comprehensive_response_to_covid.pdf
2. WHO. WHO coronavirus disease (COVID-19) Dashboard. 2021. Accessed: 15 March 2021. Available from: https://covid19.who.int/
3. Ulmer RR, Sellnow TL, Seeger MW. Effective crisis communication: Moving from crisis to opportunity. Sage Publications; 2017.
4. Institute for Public Relations [Internet]. Crisis management and communications (Updated September 2014). 2014. Accessed: 13 December 2020. Available from: https://instituteforpr.org/crisis-management-and-communications/
5. Seeger MW, Reynolds B, Sellnow TL. Crisis and emergency risk communication in health contexts: Applying the CDC model to pandemic influenza. In Heath RL, O'Hair DH editors. Handbook of risk and crisis and crisis communication. New York: Routledge; 2009. p. 493-506.
6. CDC. COVID-19: How to protect yourself & others. 2021. Accessed: 12 March 2021. Available from:

https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html
7. CDC. Public health guidance for community-related exposure. 2021. Accessed: 03 March 2021. Available from: https://www.cdc.gov/coronavirus/2019-ncov/php/public-health-recommendations.html
8. Salmon CT, Atkin C. Using media campaigns for health promotion. In: Thompson TL, Dorsey A, Miller KI, Parrott R, editors. Handbook of health communication. New York: Taylor & Francis, Inc; 2003. p. 449-472.
9. Wrighton MS, Lawrence SJ. Reopening colleges and universities during the covid-19 pandemic. Ann Intern Med 2020;173:664-5.
10. The New York Times [Internet]. Tracking the coronavirus at U.S. colleges and universities. 2020. Accessed: 2 March 2021. Available from: https://www.nytimes.com/interactive /2020/ us/covid-college-cases-tracker.html
11. CDC. Older adults: At greater risk requiring hospitalization or dying if diagnosed with COVID-19. 2021. Accessed: 28 February 2021. Available from: https://www.cdc.gov /coronavirus/2019-ncov/need-extra-precautions/older-adults.html
12. WHO. Advice for the public.2021. Accessed: 13 January 2021. Available from: https://www.who.int/ emergencies/diseases/novel-coronavirus-2019/advice-for public#:~:text=Protect%20yourself%20and%20others% 20from,a%20bent%20elbow%20or%20tissue.
13. WHO. #HealthAtHome. 2021. Accessed: 11 January 2021. Available from: https://www.who.int/campaigns/connecting-the-world-to-combat-coronavirus/healthyathome
14. CDC. If you have pets. 2021. Accessed: 23 January 2021. Available from: https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/pets.html
15. WHO. Origins of the SARS-CoV-2 virus. 2021. Accessed: 02 January 2021. Available from: https://www.who.int/health-topics/coronavirus/origins-of-the-virus
16. CDC. How much sleep do I need?. 2017. Accessed: 14 November 2020. Available from: https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html
17. WHO. Technical guidance publications. 2021. Accessed: 13 February 2021. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance-publications
18. Champion VL, Skinner CS. The health belief model. In Glanz, KB, Rimer K, Viswanath K editors. Health behavior and health education: Theory, research, and practice. San Francisco: Jossey-Bass; 2008. p.45-65.
19. Rosenstock IM. The health belief model and preventive health behavior. Health Educ Monogr 1974;2:354-86.
20. Janz NK, Becker MH. The health belief model: A decade later. Health Educ Q 1984;11:1-47.
21. Maiman LA, Becker MH. The health belief model: Origins and correlates in psychological theory. Health Educ Monogr 1974;2:336-53.
22. Cummings KM, Jette AM, Brock BM, Haefner DP. Psychosocial determinants of immunization behavior in a swine influenza campaign. Med Care 1979;17:639-49.
23. Yang ZJ. Predicting young adults' intentions to get the H1N1 vaccine: An integrated model. J Health Commun 2015;20:69-79.
24. Fall E, Izaute M, Chakroun-Baggioni N. How can the health belief model and self-determination theory predict both influenza vaccination and vaccination intention? A longitudinal study among university students. Psychol Health 2018;33:746-64.
25. King KA, Vidourek RA, English L, Merianos AL. Vigorous physical activity among college students: using the health belief model to assess involvement and social support. Arch Exerc Health Dis 2013;4:267-79.
26. Das BM, Evans EM. Understanding weight management perceptions in first-year college students using the health belief model. J Am Coll Health 2014;62:488-97.
27. Duncan SE, Annunziato RA. Barriers to self-management behaviors in college students with food allergies. J Am Coll Health 2018;66:331-9.
28. Case K, Crook B, Lazard A, Mackert M. Formative research to identify perceptions of e-cigarettes in college students: Implications for future health communication campaigns. J Am Coll Health 2016;64:380-9.
29. Mackert M, Lazard A, Guadagno M, Hughes Wagner J. The role of implied motion in engaging audiences for health promotion: Encouraging naps on a college campus. J Am Coll Health 2014;62:542-51.
30. Alsulaiman SA, Rentner TL. The health belief model and preventive measures: A study of the ministry of health campaign on coronavirus in Saudi Arabia. J Inter Crisis Risk Commun Res 2018;1:3.
31. Ross TP, Ross LT, Rahman A, Cataldo S. The bicycle helmet attitudes scale: using the health belief model to predict helmet use among undergraduates. J Am Coll Health 2010;59:29-36.
32. Guilford K, McKinley E, Turner L. Breast cancer knowledge, beliefs, and screening behaviors of college women: application of the health belief model. Am J Health Educ 2017;48:256-63.
33. Fehr SK, Vidourek RA, King KA, Nabors LA. Perceived barriers and benefits of condom use among college students. Am J Health Stud 2017;32:80.
34. Wong LP, Alias H, Wong PF, et al. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. Hum Vaccin Immunotherap 2020;16:2204-14.
35. Guidry JP, Laestadius LI, Vraga EK, et al. Willingness to get the COVID-19 vaccine with and without emergency use authorization. Am J Infect Control 2021;49:137-42.
36. Champion VL. Instrument refinement for breast cancer screening behaviors. Nurs Res 1993;42:139–43.
37. Champion VL. Instrument development for health belief model constructs. Adv Nurs Sci 1984;6:73-85.
38. American Veterinary Medical Association. Where the (not-so) wild things are: AVMA releases data on top, bottom states for dog, cat and overall pet ownership. 2018. Accessed: 03 February 2021. Available from: https://www.avma.org/ news/press-releases/where-not-so-wild-things-are-avma-releases-data-top-bottom-states-dog-cat-and
39. King KA, Singh M, Bernard A, et al. Employing the health belief model to examine stress management among college students. Am J Health Stud 2012;27:192-203.
40. Sogari G, Velez-Argumedo C, Gómez MI, Mora C. College students and eating habits: A study using an ecological model for healthy behavior. Nutrients 2018;10:1823.
41. American College Health Association (ACHA). ACHA guidelines: Considerations for reopening institutions of higher education for the spring semester 2021. 2020. Accessed: 12 January 2021. Available from: https://www.acha.org/documents/resources/guidelines /ACHA_Considerations_for_Reopening_IHEs_for_Spring_2021.pdf
42. Chandler-Coley R, Ross H, Ozoya O, et al. Exploring black college females' perceptions regarding HIV prevention message content. J Health Commun 2017;22:102-10.
43. Bai GH. Fighting COVID-19 with Mongolian fiddle stories. Multilingua 2020;39:577-86.
44. Riley AH, Sangalang A, Critchlow E, et al. Entertainment-education campaigns and COVID-19: How three global organizations adapted the health communication strategy for pandemic response and takeaways for the future. Health Commun 2021;36:42-9.