Original Article

The Health Belief Model as an explanatory framework for COVID-19 prevention practices

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A B S T R A C T

Background: The COVID-19 government public health measures are necessary to prevent the spread of COVID-19, however, their efficacy is largely dependent on adherence. This study utilized the Health Belief Model (HBM) to explain the public's adopted prevention practices during the COVID-19 outbreak in Saudi Arabia.

Methods: This study used "COVID-19 Snapshot MOnitoring (COSMO): monitoring knowledge, risk perceptions, preventive behaviours, and public trust in the current coronavirus outbreak" research protocol which is developed by the WHO Regional Office for Europe and the COSMO group. The COSMO questionnaire was translated into Arabic and distributed as an online survey via WhatsApp instant messaging application from May 2nd to May 26th, 2020. The dependent variable was the mean of adopting ten COVID-19 preventive practices. These practices were hand washing, avoiding touching eyes, nose and mouth, use of hand sanitizer, covering mouth and nose when coughing/sneezing, staying home when sick, avoiding close contact with infected persons, social distancing, wearing masks, home isolation, and lockdown. The independent variables included the HBM constructs (susceptibility to and severity of COVID-19, benefits of and barriers to adopting preventive behaviors, cues to action, health motivation, and self-efficacy), sociodemographic factors, presence of chronic illness, and perceived and actual knowledge. We conducted bivariate and multivariate analyses and reported significant findings (P $\leq$ 0.05).

Results: We analyzed 1027 surveys. About 38% adhered to all COVID-19 preventive behaviors and the mean for adherence was 9. The HBM perceived benefits ($p = 0.001$), perceived barriers ($p = 0.004$), and cues to action ($p = 0.046$) were associated with adherence to COVID-19 preventive behaviors after adjusting for all other factors. Respondents with the highest levels of education and income were less likely to adopt COVID-19 preventive behaviors compared to those in the lower ranks of education and income.

Conclusion: Our findings suggest that the HBM can be applied to understand adherence to COVID-19 prevention practices. The recognition of perceived health beliefs and practices is important for developing effective COVID-19 health intervention strategies.

Introduction

SARS-CoV-2 or COVID-19 was declared a public health emergency of international concern by the World Health Organization (WHO) on January 31st, 2020 [1]. As of May 17th, 2021, there have been 163,174,951 cases and 3,381,517 deaths worldwide [2]. Typically, COVID-19 infection results in a flu-like illness and patients commonly report fever, dry cough, myalgia, dyspnea, nausea, and a loss of smell and taste [3]. For most people, the symptoms are self-limiting, however the elderly and individuals with co-morbidities are thought to be at risk of experiencing complications with COVID-19 [3].

In response to the pandemic, many countries implemented regulations such as social distancing, self-isolation, and national lockdowns to curb the spread of the virus. Although the first case of COVID-19 in Saudi Arabia was reported on March 2nd, 2020, the government banned international flights from countries with confirmed COVID-19 cases earlier in February [4]. Further restrictions were imposed with the transition to online learning by schools and universities, mandatory quarantine for travelers, suspension of all public gatherings, including prayers, and implementation of a national lockdown with a curfew [4].

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Several factors can affect individuals' willingness to follow COVID-19 guidelines and engage in protective behaviors. Age, gender, education, knowledge of COVID-19, and the mode they receive COVID-19 news are among the factors that motivate an individual to engage in protective behaviors [5–9]. A review of 21 studies from 14 countries found female gender and higher education to be highly correlated with adherence to guidance [5]. Multiple studies assessing the public's practice of social distancing, practicing hand hygiene, and avoiding cultural practices like handshaking in Saudi Arabia found that being older, female, and well educated were correlated with better COVID-19 protective practices [6,6,7,8,9].

The Health Belief Model (HBM) evaluates and predicts health related behaviors and helps explain, or mediate, the effects of demographic factors on health behavior patterns, which are amenable to change through health education [10]. The HBM focuses on risk perception, which is assessed by an individual's perceived susceptibility to disease and disease severity, and on behavioral evaluation, which is determined by the individual's perceived benefits of and barriers to adopting a health behavior [10]. The model also includes cues to action, individuals' health motivations to adopt a health behavior, and self-efficacy to perform the required behavior [10]. By targeting various aspects of the model's key constructs, governments can improve their communication and develop effective measures to encourage members of the public to adopt COVID-19 preventive behaviors [10,11]. This paper uses the HBM framework to understand the public's health beliefs that mediate their adherence to COVID-19 preventive practice guidelines.

Methods

This study uses the research protocol *"COVID-19 Snapshot Monitoring (COSMO): Monitoring knowledge, risk perceptions, preventive behaviors, and public trust in the current coronavirus outbreak"* which is developed by the WHO Regional Office for Europe in collaboration with the University of Erfurt, Germany, and the COSMO group. The overall aim of the COSMO protocol was to enable countries to inform their COVID-19 outbreak response measures, including policies, interventions, and communications. The protocol is available at: https://doi.org/10.23668/psycharchives.2782.

Study questionnaire

The COSMO questionnaire is evidence-based, simple and flexible to adjust. We modified the seven-point Likert scale which was used in the COSMO questionnaire to a five-point Likert scale to improve the response quality, response rate, and the overall satisfaction among respondents [12]. Next, we translated the questionnaire to Arabic and added/modified some questions, as recommended by the *COSMO Group* to represent the local context in Saudi Arabia. The questionnaire was back translated into English to make sure that the intended meaning was retained. The translation process was guided by a professional linguist who evaluated each question and made recommendations for proper translation. Once the translation was complete, the questions were reviewed again by the professional linguist. The questionnaire was then designed as an online survey using SurveyMonkey (http://www.surveymonkey.com) and pretested among 20 individuals. Minor modifications were made to improve wording and question format.

Study design and participants

We used a cross sectional research design to assess the public's perceptions and practices toward COVID-19. A link to the online survey along with an invitation message was widely distributed in Saudi Arabia via WhatsApp instant messaging application from May 2nd to May 26th, 2020. This time frame corresponds to the partial and complete lockdown time in Saudi Arabia. The study was approved by the Institutional Review Boards at King Abdulaziz City for Science and Technology (KACST) (IRB Log no. 20-288E) and King Abdulaziz University Faculty of Dentistry (KAUFD) (IRB Log no. 039-04-20).

Study variables

Dependent variable

The extent of COVID-19 preventive practices adopted during the initial phase of the pandemic was determined by asking respondents whether or not they followed 10 preventive behaviors. These behaviors were hand washing for 20 s, avoiding touching eyes, nose, and mouth with unwashed hands, use of disinfectants when soap and water are not available, covering mouth and nose when coughing or sneezing, staying home when sick, avoiding close contact with infected persons, social distancing, wearing masks, home isolation, and lockdown. Responses were coded as yes (1) and no (0) and an average score out of 10 was calculated. We measured the correlation between these behaviors and the Cronbach's alpha was 0.54.

Main independent variables

The HBM constructs included susceptibility to COVID-19, severity/seriousness of COVID-19, benefits of adopting preventive behavior, and barriers to adopting preventive behavior. Cues to action, health motivation, self-efficacy and perceived and actual knowledge about COVID-19 were also assessed.

We measured susceptibility to COVID-19 by a single question: "How susceptible do you consider yourself to an infection with the novel coronavirus?", scored from 0 "Not at all susceptible" to 4 "Extremely susceptible". Higher scores indicate a perception of higher susceptibility. For Severity/seriousness of COVID-19 we measured it by asking five questions: (1) "How severe would contracting the novel coronavirus be for you?", scored from 0 "Not severe" to 4 "Very severe"; (2) "How often do you think about coronavirus?", scored from 0 "Never" to 4 "all the time"; (3) "To me coronavirus is: (0) "Extremely not fear inducing" to (4) "Extremely fear inducing"; (4) "To me coronavirus is: (0) "Not at all worrying" to (4) "Extremely worrying"; (5) "To me coronavirus is: (0) "Not stressful at all" to (4) "Extremely stressful". Higher scores indicate an elevated perception of severity. Cronbach's alpha for severity was 0.77.

We also measured the Benefits of adopting preventive behaviors by answering yes (1) or no (0) to 12 statements. The first 10 statements assessed if each of the COVID-19 preventive behaviors is effective in protecting oneself against COVID-19. The last two statements were: "Washing my hands frequently protects others from getting the infection", and "Following lockdown rules and staying at home protects others from getting the infection". Higher scores denote a higher perception of benefits. Cronbach's alpha for benefits was 0.56. Barriers to adopting preventive behavior were measured by asking "How difficult or easy is it for you to [(wash your hands with water and soap for 20 s); (follow lockdown rules); (avoid handshaking)]?", scored from 0 "Very easy" to 4 "Very inconvenient". Higher scores suggest perceived barriers to preventive behavior. Cronbach's alpha for barriers was 0.68.

We measured cues to action by assessing the agreement of respondents to the following four statements: (1) "I see my family and friends washing their hands frequently", scored from 0 "Strongly disagree" to 4 "Strongly agree"; (2) "Health authorities urge me to wash my hands frequently", scored from 0 "Strongly dis-

agree" to 4 "Strongly agree"; (3) "My family and friends stay at home to prevent spread of infection", scored from 0 "Strongly disagree" to 4 "Strongly agree"; (4) "Government authorities urge me to stay at home", scored from 0 "Strongly disagree" to 4 "Strongly agree". Additionally, respondents were asked "Do you know someone in your social circle who has been infected with the novel coronavirus?", scored as yes (1) or no (0). Higher scores indicated higher cues for adopting COVID-19 preventive behaviors. Cronbach's alpha for cues to action was 0.70.

We also assessed health motivation by asking a single question: "If a vaccine becomes available, I will get it", scored from 0 "Strongly disagree" to 4 "Strongly agree". A higher score denotes health motivation. Finally, self-efficacy was assessed by asking: "I know how to protect myself from coronavirus", scored from 0 "Not at all" to 4 "Very much so". Higher scores imply higher self-efficacy.

Other independent variables

Perceived knowledge about COVID-19 was assessed by asking two questions: "How do you rate your knowledge level on novel coronavirus?" and "How do you rate your knowledge on how to prevent spread of the novel coronavirus?", scored from 0 "No knowledge at all" to 4 "Very good knowledge". Higher scores indicate better knowledge. Cronbach's alpha for perceived knowledge was 0.77. Actual knowledge was measured by asking respondents to respond "Correct", coded as (1); "Incorrect"; or "Don't know", each coded as (0), to 22 statements. Examples of knowledge questions include "The elderly/pregnant women/children/individuals with chronic disease are at risk of severe illness related to the novel coronavirus"; "Fever/cough/sore throat/shortness of breath etc. can be a symptom of novel coronavirus"; "Novel coronavirus is transmissible via droplets through coughing, sneezing, or intimate contact"; "There is a drug to treat the novel coronavirus", and "There is a vaccine for the novel coronavirus". Higher scores suggest better knowledge.

Age, gender, education level, employment status, family monthly income, nationality, and presence of any chronic illnesses were assessed. Participants were asked about the highest level of education they have attained, and responses included, elementary, middle school, high school, bachelor's, and graduate degrees. Respondents who reported elementary or middle or high school degrees were grouped as "≤high school degree". Employment status was categorized as students, employed, and unemployed. The family's monthly income in Saudi Riyal was coded as <5000, 5001–9000, 9001–15,000, 15,001–20,000, and >20,000. The first two values were consolidated into one group, ≤9000.

Data analysis

The SurveyMonkey data were exported into Statistical Package for the Social Sciences software (IBM SPSS 27.0.1.0.) for analysis. Age, HBM constructs and the outcome, adopting COVID-19 preventive behaviors, were treated as continuous variables. Descriptive statistics in the form of means and standard deviations were calculated for continuous variables and frequencies and percentages were calculated for categorical data. We used independent t-test to examine associations between adopting COVID-19 preventive behavior and respondents' characteristics with two values and one-way ANOVA for variables with ≥2 values. The association between age and adopting COVID-19 preventive behaviors, was tested using Pearson correlation. Cronbach alpha was used to measure the reliability of COVID-19 knowledge and HBM constructs. We calculated Pearson correlation coefficient to examine associations between the HBM constructs and adopting preventive behaviors. We used linear regression to identify predictors of adopting COVID-19 preventive behaviors. All reported tests were significant at $P \leq$

Table 1
Characteristics of study participants, N = 1027.

Variable	Mean (SD)/frequency (%)
Age	30.16 (12.17)
Gender	
Male	545 (53.07)
Female	482 (46.93)
Nationality	
Saudi	916 (89.19)
Non-Saudi	111 (10.81)
Highest educational attainment level	
≤High school diploma	216 (21.03)
Bachelor's degree	587 (57.16)
Graduate degree	224 (21.81)
Employment status	
Students	62 (6.04)
Employed	815 (79.36)
Unemployed	150 (14.61)
Household monthly income (SAR)	
≤9000	246 (23.95)
9001–15,000	234 (22.78)
15,001–20,000	241 (23.47)
>20,000	306 (29.80)
Chronic illness	
Yes	264 (25.71)
No	763 (74.29)
Knowledge about COVID19	
Perceived	3.15 (0.75)
Actual	15.48 (2.88)
Adopting COVID-19 health preventive behaviors	9 (1.09)
Health Belief Model constructs	
Susceptibility to COVID19	1.45 (1.17)
Severity/seriousness of COVID19	2.41 (0.75)
Benefits of adopting COVID19 preventive behavior	0.97 (0.07)
Barriers of adopting COVID19 preventive behavior	1.24 (0.71)
Cues to action for adopting COVID19 preventive behavior	0.78 (0.14)
Self-efficacy for adopting COVID19 preventive behavior	2.71 (0.69)
Health motivation	3.29 (0.58)

Abbreviation: SD, standard deviation; SAR, Saudi Arabian Riyal.

0.05 and all confidence intervals (CIs) were reported at the 95% level.

Results

Characteristics of study participants

A total of 1027 complete surveys were available for analysis. The mean age of participants was 30.2 years. About 47% of participants were females, 11% were non-Saudi, and 26% reported having a chronic illness. Perceived and actual knowledge means were 3.2/4 and 15.5/22, respectively. About 38% of respondents adopted all 10 COVID-19 preventive behaviors, 37% adopted 9 out of 10 behaviors, and 24% adopted at least 8 behaviors. The mean for adopting COVID-19 preventive behaviors was 9. The characteristics of study participants and mean scores for the HBM constructs are presented in Table 1.

Associations between participants' characteristics and COVID-19 prevention practices

Table 2 presents the associations between respondents' characteristics and the adoption of COVID-19 preventive behaviors. Respondents' education, employment status, and family income were associated with adopting COVID-19 preventive behaviors. Students compared to employed and unemployed participants were less likely to adopt COVID-19 preventive behaviors. Respondents with the highest levels of education and income were less likely to adopt COVID-19 preventive behaviors compared to those in the lower ranks of education and income.

Table 2

Associations between participants' characteristics and adopting COVID19 health behaviors, N = 1027.

Variable	N	Statistic (SD)	p-Value
Age[‡]	1027	0.05	0.11
Gender[†]			0.75
Female	482	9.01 (1.08)	
Male	545	8.99 (1.11)	
Nationality[†]			0.81
Saudi	916	9 (1.10)	
Non-Saudi	111	9.03 (1.08)	
Highest educational level[††]			0.000
(a) ≤High school diploma[c]	216	9.15 (1.05)	
(b) Bachelor's degree[c]	587	9.06 (1.02)	
(c) Graduate degree[a,b]	224	8.70 (1.26)	
Employment status[††]			0.000
(a) Students[b,c]	62	8.52 (1.17)	
(b) Employed[a]	815	9 (1.10)	
(c) Unemployed[a]	150	9.19 (0.95)	
Family monthly income[††] (SAR)			0.000
(a) ≤9000[c,d]	246	9.26 (0.86)	
(b) 9001–15,000	234	9.03 (1.15)	
(c) 15,001–20,000[a]	241	8.94 (1.14)	
(d) >20,000[a]	306	8.82 (1.14)	
Chronic illness[†]			0.25
Yes	264	8.94 (1.21)	
No	763	9.03 (1.05)	

Abbreviation: SD, standard deviation; SAR, Saudi Arabian Riyal.

Superscript letters denote significance between values within the same variable at $p < 0.05$.

[‡] Pearson correlation used to test for significance.

[†] Independent t-test used to test for significance.

[††] One-way ANOVA used to test for significance.

Table 3

Associations between the HBM and adoption of COVID19 preventive behaviors.

HBM constructs/modifying factors	Pearson correlation coefficient	p-Value
Susceptibility to COVID19	0.037	0.236
Severity/seriousness of COVID19	0.05	0.107
Benefits of adopting preventive behavior	0.166	0.000
Barriers to adopting preventive behavior	−0.143	0.000
Cues to adopting preventive behavior	0.127	0.000
Health motivation	0.091	0.003
Self-efficacy of adopting preventive behavior	0.01	0.738
Knowledge about COVID19 (perceived)	0.00	0.877
Knowledge about COVID19 (actual)	0.035	0.269

Abbreviation: HBM, Health Belief Model.

The Health Belief Model and COVID-19 prevention practices

Table 3 illustrates correlations between the HBM constructs and the adoption of COVID-19 preventive behaviors. Benefits of and barriers to adopting COVID-19 preventive behaviors, cues to action, and health motivation were correlated with adopting COVID-19 preventive behaviors. Respondents who perceived a benefit from adopting preventive behaviors were more likely to comply with these behaviors compared to those who did not ($r = 0.166$, $p = <0.001$). Respondents who were inconvenienced by adopting the preventive behaviors were less likely to follow them compared to those who felt that the behaviors were unproblematic to perform ($r = −0.143$, $p = <0.001$). Cues to action were positively associated with preventive practices ($r = 0.127$, $p = <0.001$).

Table 4 illustrates the associations between adopting COVID-19 preventive behaviors and HBM adjusted for participants' characteristics. Perceived benefits ($p = 0.001$), perceived barriers ($p = 0.004$) and cues to action ($p = 0.046$) were the only three HBM constructs that kept their significant association with adopting COVID-19 preventive behaviors after adjusting for participants' characteristics.

Participants' level of education and income were also significantly associated with adopting COVID-19 preventive practices.

Discussion

The HBM has been applied extensively to study key health beliefs that explain, predict, and influence behaviors, and several studies have used it to predict adherence to COVID-19 preventive practices [13–15]. We found that perceived benefits, perceived barriers, and cues to action were the best model constructs that predicted adherence to COVID-19 prevention practices during the pandemic.

Our results agree with findings from a study conducted in China which used the HBM to assess six COVID-19 precautionary measures. These measures were handwashing, wearing masks, social distancing, avoiding touching the face, carrying hand sanitizer, and closing toilet lids before flushing. None of these measures were compulsory and no penalty was imposed for nonadherence. The study found that HBM benefits and barriers were associated with the first three health behaviors, whereas cues to action were associated with social distancing and closing toilet lids before flushing [14]. Another study from Jordan utilized the HBM to examine adherence to home quarantine during the COVID-19 pandemic. Benefits, barriers, severity, and cues to action (government advice) were correlated with home quarantine. Economic loss, social distancing, freedom to practice religion, and health concerns were major barriers to home quarantine [16].

Previous studies have shown that tailored messages can be effective in promoting the perceived benefit and barriers of health behaviors in specific target groups [17]. Clearly, health messages that focus on the benefits of adherence to COVID-19 preventive behaviors, "protecting individuals from getting the COVID-19 virus and protecting their loved ones by preventing the spread of the virus to them", can be effective in promoting the required behaviors in specific target groups. Compliance with behaviors such as wearing masks, social distancing, curfew orders, or complete lockdown, which were enforced by the Saudi government and penalized for noncompliance, were considered by many an inconvenience that requires effort and resources to overcome [14,18]. They do not conform to the cultural norms in the country and violate self-autonomy. Efficient general health messages to engage all members of the society and tailored messages for distinct demographic groups, such as the highly educated or students, should be prioritized to facilitate adherence, mitigate the negative impact, and minimize possible resentment toward public health regulations. The Saudi government used SMS text messaging, social media applications, and public digital advertising screens to communicate risk and educate the public during COVID-19 pandemic [19]. Personalized messages and those directed at target populations may act as cues, or "triggers" to activate the desired health behavior when appropriate beliefs are held.

Our findings show that perception of risk (perceived susceptibility and perceived severity) was not sufficient to moderate COVID-19 preventive behaviors. Previous studies on COVID-19, MERS and other infectious diseases reported positive associations between risk perception and engagement in protective behavior [9,20–22]. However, the factors that predict an individual's perception of risk and the impact this risk perception may have on promoting or sustaining protective behaviors are not yet fully explored [23]. Risk communication plays a central role in forming individuals' risk beliefs which are correlated with preventive behavior. Enhancing the public's perceived risk through carefully deliberated risk communication messages that employ cognitive and affective strategies are more effective in influencing the required behavior [24]. People need not only to be aware of the

Table 4
Linear regression model of the HBM and adoption of COVID19 preventive behaviors.

Parameter	B (SE)	t-Test	p-Value	95% CI
Intercept	6.697 (0.511)	13.117	0.000	5.695–7.699
Gender				
Female	0.04 (0.073)	0.549	0.583	−0.103 to 0.183
Male (referent)				
Highest educational level				
≤High school diploma	0.334 (0.111)	3.013	0.003	0.117–0.552
Bachelor's degree	0.283 (0.086)	3.293	0.001	0.114–0.452
Graduate degree (referent)	0.0			
Employment status				
Students	−0.473 (0.163)	−2.897	0.004	−0.793 to −0.153
Employed	−0.017 (0.105)	−0.16	0.873	−0.223 to 0.189
Unemployed (referent)	0.0			
Family monthly income (SAR)				
≤9000	0.356 (0.096)	3.705	0.000	0.168–0.545
9001–15,000	0.163 (0.095)	1.706	0.088	−0.024 to 0.35
15,001–20,000	0.081 (0.092)	0.881	0.379	−0.099 to 0.261
>20,000 (referent)	0.0			
Knowledge about COVID19 (perceived)	−0.029 (0.058)	−0.491	0.623	−0.143 to 0.086
Health Belief Model constructs				
Susceptibility to COVID19 infection	0.038 (0.028)	1.348	0.178	−0.017 to 0.093
Severity/seriousness of COVID19	0.029 (0.045)	0.652	0.515	−0.059 to 0.117
Benefits of adopting preventive behavior	1.708 (0.490)	3.482	0.001	0.746–2.67
Barriers to adopting preventive behavior	−0.146 (0.051)	−2.867	0.004	−0.246 to −0.046
Cues to adopting preventive behavior	0.493 (0.247)	1.998	0.046	0.009–0.978
Health motivation	0.057 (0.031)	1.807	0.071	−0.005 to 0.118
Self-efficacy of adopting preventive behavior	−0.025 (0.052)	−0.473	0.636	−0.127 to 0.078

Abbreviations: HBM, Health Belief Model; SE, standard error; CI, confidence interval; SAR, Saudi Arabian Riyal.

existing health risks but also to feel themselves at risk in order to adopt protective measures [23].

In contrast to previous findings that found women and the elderly to be more health conscious than men and younger adults, we did not find a difference based on gender or age regarding the preventative measures taken to combat COVID-19 [5–9]. Similarly, Lin et al. did not find any differences in preventative behavior by gender; they speculated that all individuals who thought COVID-19 posed a significant threat were motivated to practice prevention behaviors [22]. Furthermore, older people in Ethiopia were less likely to practice hand hygiene and more likely to engage in potentially risky cultural practices, like handshaking [25].

Contrary to studies which found a positive correlation [8,26] or no association [6,7] between income or education and COVID-19 preventive practices, we found that individuals with higher income and education were less likely to adopt the full protective behaviors compared to those in lower income and education groups. In one study, education was only positively associated with adopting precautionary measures in the presence of a strong cue to action, such as a relative testing or suspected positive of COVID-19 [27]. Thus, higher levels of education may not be a significant determinant of an individual's adherence to COVID-19 preventive practices. COVID-19 is a novel, unfamiliar disease that generates excessive public concern and uncertainty because of its unprecedented nature. Lack of complete understanding of COVID-19 and its mode of transmission, treatment, and prevention may explain the skepticism of highly educated individuals', and hence their poor adherence to most COVID-19 regulations. This skepticism may be attributed to a lack of trust in information shared by experts, governments, or the media. Trust allows individuals to evaluate the threat posed by COVID-19 in the absence of reliable data, thus the tendency of these highly educated individuals to not fully engage in protective practices and to analyze contradictory health advice could be indicative of their lack of trust in their respective health experts, governments, and news outlets [23]. Furthermore, individuals from higher income and education backgrounds exhibit high levels of self-esteem, which is related to lower perceived risks of COVID-19 infection and lower fear arousal compared to those with

lower income or education levels [22,28]. Restoring the public's trust requires a comprehensive national plan that is coordinated and enforced by various governmental departments and based on continuous epidemiologic surveillance and updated scientific evidence.

Our study has limitations. Our survey was shared using WhatsApp, an application based on a non-probability convenient sample, to study the beliefs and preventative practices of people toward COVID-19 pandemic. Therefore, the findings of this study may not represent the views or practices of the whole population. In addition, our findings provide a snapshot of the beliefs and practices at the time of the survey. Nonetheless, our findings elucidate effective HBM strategies to combat COVID-19 and characterize individuals at risk for COVID-19 transmission and infection. Finally, only correlations but not causal associations were examined due to the cross-sectional design of this study.

Conclusion

The present study applied the HBM to examine adherence to COVID-19 prevention practices among a convenient sample of adults in Saudi Arabia. The HBM perceived benefits, perceived barriers, and cues to action were correlated with adherence to COVID-19 preventive behaviors. Individuals from higher education and income backgrounds were less likely to adopt all protective measures. Key health beliefs and relevant strategies to enhance behavioral adherence to COVID-19 precautionary measures were discussed.

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Competing interests

None declared.

Ethical approval

Not required.

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