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Factors associated with preventive behaviors of COVID-19 among adolescents: Applying the health belief model

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ABSTRACT

Background: The emergence of a new pandemic caused by a novel coronavirus (COVID-19) is a unique challenge for public health (all age and sex groups).

Objective: This study aimed to explore the adolescents' perceptions of preventive behaviors to avoid COVID-19 disease based on the health belief model (HBM).

Method: This cross-sectional study was conducted on 797 adolescents (aged between 12 and 18 years old), who were 7th-12th -grade students of 24 randomly selected schools from 28th May to June 28, 2020 in Isfahan, Iran. An online self-administered questionnaire was adapted to measure the adolescents' perceived threats, barriers, benefits, self-efficacy, and cues to action toward protective behaviors.

Results: Findings indicated that the adolescents' mean age was 14.7 (SD = 1.7) and 53.7% of them were female. Regardless of gender difference, there was a significant positive correlation between the adolescents' protective behaviors and their self-efficacy ($r = 0.62$, $P < 0.001$), perceived benefit ($r = 0.29$, $P < 0.001$), and perceived severity ($r = 0.15$, $P < 0.001$), while there was a significant negative correlation between the adolescents' protective behaviors and their perceived susceptibility ($r = -0.11$, $P < 0.001$), as well as their perceived barrier ($r = -0.21$, $P < 0.001$). The result of the Hierarchical regression analysis also revealed that the HBM model had a significant predictive power for preventing measures towards coronavirus disease in adolescents ($\text{Adj } R^2 = 0.46$, $p < 0.001$). The results also showed that self-efficacy was the strongest predictor ($\beta = 0.59$, $P < 0.001$) in explaining protective behaviors in adolescents.

Conclusion: In the context of coronavirus disease pandemic in adolescents, the health belief model could provide a useful framework for planners to develop educational programs. Moreover, in such a context, strategies to promote self-efficacy in adolescents should be considered more carefully to help them improve their protective behaviors.

Introduction

While COVID-19 continues spreading and its outbreak has been declared as a Public Health Emergency, the communities around the world need to take action to prevent its further transmission, reduce the impacts of the outbreak, and support control measures.¹ Although COVID-19 disease can affect all age groups, children are more likely to be infected due to overcrowding in schools and the possibility that they could transmit the virus to their families and classmates.^{2,3} Measures taken by schools can both prevent students and staff from being infected by COVID-19 and stop the virus from being spread by them. So, it is important to identify the factors associated with protective behaviors in

adolescents and educational facilities.^{4,5}

Communities around the world have been advised to stay in their homes as much as possible, avoid gatherings, frequently wash their hands or employ other hand hygiene techniques, remain at least 1–2 m away from others (social distancing), and avoid touching their faces to prevent or delay transmission of COVID-19.^{6,7} Unfortunately, adherence to these commands has declined over time among people a few months after the disease outbreak all over the world.⁸ Therefore, understanding the determinants responsible for protective measures against the virus spread is of great importance for the effectiveness of the proposed commands.^{9,10}

Moreover, community health planners are being encouraged to both consider how people's perspectives on COVID-19 may differ and modify

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Abbreviations

HBM	health belief model
PSUS	perceived susceptibility
PSEV	perceived severity
PBEN	perceived benefit
PBAR	perceived barrier
S-E	self-efficacy
PBEHAV	protective behavior

communication strategies accordingly. A variety of risk perception theories have been suggested to help us with understanding the causes of non-compliant health behaviors in people.^{11–13} These public health frameworks can act as a “checklist” that pharmacists and other health-care professionals can use to guide their communication and reinforce healthy behaviors. One such framework is the Health Belief Model (HBM).

The **Health Belief Model** is a theoretical model that can be used to guide health promotion and disease prevention programs. It is used to explain and predict individual changes in health behaviors. Key elements of the Health Belief Model focus on individual beliefs about health conditions, which predict individual health-related behaviors. The model defines the key factors that influence health behaviors as an individual's perceived threat to sickness or disease (perceived susceptibility), the belief of consequence (perceived severity), potential positive benefits of action (perceived benefits), perceived barriers to action, exposure to factors that prompt action (cues to action), and confidence in the ability to succeed (self-efficacy).^{14–16}

In this study, we aimed to explore the potential utility of explicitly applying the constructs of the HBM to explore the adolescents' perceptions of preventive behaviors to avoid COVID-19 disease.

Method

Participants

This cross-sectional study was performed from 28th May to June 28, 2020 on 797 adolescents aged between 12 and 18 years old. The estimated sample size was derived from the online Raosoft sample size calculator,¹⁷ with a confidence interval of 95% and a margin of error of 5% in a total population of 155,455 primary and secondary high school students (from 7th to 12th grade) so that the final required sample size was calculated to be 570 individuals.

Procedures

Following an extensive review of the literature, the leading research team developed the first draft of the questionnaire. Several sources were used to generate a pool of questions considered to be relevant to the study objectives.^{11,18–20} A panel of eight experts, including four health education specialists, two specialist physicians in infectious diseases, an epidemiologist, and a psychologist evaluated the content validity of the questionnaire in the next step. In the quantitative phase, the questionnaire was appraised regarding its content validity index (CVI) and content validity ratio (CVR). Clarity, simplicity, and relevance of the items were measured in the CVI assessment (according to Lawshe, CVIs more than 0.7 are acceptable).²¹ CVR was used to make sure that the items had been developed in the best possible way for measuring the mentioned factors (according to Waltz & Bausell, CVRs more than 0.75 are acceptable).²² To ensure face validity, the first draft of the questionnaire was evaluated by 25 adolescents from other schools that did not participate in this study. They informed the research team if any of the items in the questionnaire were not clear or difficult to comprehend.

Comments and feedback provided were considered by the research team and then incorporated where appropriate to develop the final version of the questionnaire. Finally, the research team revised the items as necessary to make them concise and to fit for online administration. Finally Cronbach's internal consistency was used to identify possible variables with a low contribution to the questionnaire. The final version of the questionnaire was organized into six main sections addressing different topics of interest (Table 1). Demographic characteristics assessed by questions included adolescent age, gender, grade and annual house-hold income. Two items measured *perceived susceptibility* (PSUS) to COVID-19 through the questions "how likely do you think you and your family will be contracting COVID-19 over the next 1 month" Using a four-point scale (4 = Most likely, 1 = very unlikely). *Perceived severity* (PSEV) investigated the personal belief regarding individual and their family suffering from the disease process and intensity of symptoms by three 4-point scale items. *Perceived benefits* (PBEN) included four 4-point scale questions about the benefits of protective behaviors for the individual and society including "Social quarantine and staying at home help us to avoid paying for unnecessary medications and preserve the environment. *Perceived barriers* (PBAR) approached the difficulties with respecting norms and instructions for protection against coronavirus infection through three 4-point scale items from strongly agree to strongly disagree including "It was very difficult for me to wear mask and gloves in ... and it cost me a lot to buy mask and...". Self-efficacy (S-E) (understanding one's ability to protect oneself against the coronavirus) was assessed by four 4-point scale questions (4 = "completely sure that I cannot do, 1 = completely sure that I can do it) about a person's confidence in adhering to protective behaviors such as social distancing, wearing mask and, disinfecting their hand frequently over the next few weeks". Protection behaviors (PBEHAV) included five 4-point scale questions about the actions one has taken in the last few weeks to prevent getting the Coronavirus such as "social distancing, wearing mask, disinfecting their hands and not attending parties and crowded places from always = 4 to never = 1. Cues to action: to examine information sources used by adolescents and evaluate the validity of these sources from their perspective, two open-ended questions were asked: what source do you use the most to get information about COVID-19, and which of these sources is more valid for you?

The final online questionnaires (made with the Porse-Line application) were sent to 1800 students in all the selected schools via WhatsApp and Telegram apps. We also set a timeline of four weeks, with two reminders after which the link was closed. This study received approval from the ethics committee of Isfahan University of Medical Sciences (IUMS) (Code: IR.MUL.RESEARCH.REC.1399.032) and the education department of Isfahan (No: 1700.468748.650).

Statistical analysis

Statistical analysis was performed using SPSS software Ver. 23. Quantitative results were reported either as mean \pm standard deviation (sd) or frequency (percentage) (%). Pearson correlation test was further used to examine the relationship between variables. Moreover, linear and hierarchical regression analyses were used to evaluate the predictive power of the model and the role of each variable in the model explaining in five steps.

Results

Out of 1800 questionnaires sent to students, 870 were completed from which 80 questionnaires were removed due to their deficiencies (failure to answer more than 25% of the questions). The remaining (797) questionnaires were statistically analyzed. The mean age of participants was found to be 14.7 years old (SD = 1.7, range = 12–18), 428 (53.7%) of them were females (Table 2). There are no associations between the mean PBEHAV and any demographic factors, including sex, education level, and perceived family income ($P > 0.05$). The mean, standard

Table 1
Number of questions and score range, Mean, scale CVI and CVR range, CITC and Cronbach's alpha for each scale.

Scales	number of items (score range)	CVI range	CVR range	CITC range	Cronbach's alpha
Perceived susceptibility	2(2–8)	0.70–0.73	0.73–75	0.39–0.61	0.66
Perceived severity	3(3–12)	0.75–0.78	0.80–83	0.65–0.74	0.74
Self-efficacy	4(4–16)	0.80–0.82	0.75–0.79	0.43–0.65	0.71
Perceived benefit	4(4–16)	0.72–0.75	0.72–0.74	0.49–0.58	0.72
Perceived barrier	4(4–16)	0.75–0.78	0.72–0.76	0.43–0.65	0.58
Behavior	5(5–20)	0.82–0.85	0.73–0.76	0.54–0.63	0.82

Table 2
Demographic Characteristic of the adolescent's variables.

Demographic Characteristic	Frequency (n)	Percentage (%)
Gender	Male	428
	Female	369
Educational level	7th	196
	8th	141
	9th	202
	10th	91
	11th	73
	12th	94
Perceived family income	Too bad	6
	relatively bad	53
	Medium	497
	good	204
	very good	32

deviation, and 95% confidence interval of health belief model constructs are described in Table 3.

On the other hand, a correlation analysis was performed to ascertain the presence, and subsequently the strength of the association between the HBM constructs and PBEHAV. The result showed significant positive correlations between the PBEHAV and the S-E ($r = 0.62, P < 0.001$), between the PBEHAV and PBEN ($r = 0.29, P < 0.001$), and between the PBEHAV and PSEV ($r = 0.15, P < 0.001$), while significant negative correlations were observed between the PBEHAV and PSUS ($r = -0.11, P < 0.001$) as well as between PBEHAV and PBAR ($r = -0.21, P < 0.001$) (Table 4).

Furthermore, a multivariate hierarchical regression analysis was conducted by entering five variables, including PSUS, PSEV, PBEN, PBAR, and self-efficacy respectively in five steps (Table 5). Overall, the five above variables accounted for 46% of the total variance in the PBEHAV. Entering the PSUS was found to account for 0.01% of the variance in the PBEHAV ($P < 0.001$) at the first step of hierarchical regression. At the second step, the inclusion of the PSEV variables significantly increased the R^2 and explained 0.03% of the variance in the PBEHAV ($P < 0.001$). In the third step, the inclusion of the PBEN significantly increased the explanatory power of the model (Adj $R^2 = 0.09, P < 0.001$). The inclusion of the PBAR variables, in the fourth step, also explained 0.11% of the variance in the PBEHAV, but it significantly reduced the PSUS predictive role ($\beta = 0.07, P = 0.05$). In the last step, the inclusion of the S-E significantly increased the predictive power of the final model (Adj $R^2 = 0.46\%, P < 0.001$); however, the predictive role of PSEV in the last step became almost insignificant ($\beta = 0.02, P = 0.51$).

As mentioned earlier, to find the most important cues to action and

Table 3
Mean, standard deviation, and 95% confidence interval of the health belief model dimension.

Dimension	Mean	Standard deviation	95% CI
Perceived susceptibility	3.2	1.3	13.1–13.4
Perceived severity	10.9	1.9	3.08–3.3
Perceived benefit	12.8	2.3	12.7–13.03
Perceived barrier	7.8	2.1	9.9–10.2
Self-efficacy	13.35	2.5	7.7–8.1

Table 4
Pearson's correlation coefficients matrix between HBM variables and PBEHAV.

	1	2	3	4	5
Perceived susceptibility	1				
Perceived severity	0.15 ^a	1			
Self-efficacy	-0.04	0.18 ^a	1		
Perceived barrier	0.15 ^a	0.05	-0.14 ^a	1	
Perceived benefit	-0.12 ^a	0.17 ^a	0.33 ^a	-0.11 ^a	1
Protective behavior	-0.11 ^a	0.14 ^a	0.62 ^a	-0.21 ^a	0.29 ^a

^a Correlation is significant at the 0.01 level (2-tailed).

their importance for adolescents, two open-ended questions were asked for obtaining information concerning COVID-19. The result showed that the national TV news was the most frequently used source of information (45.7%) followed by official sources of the ministry of health, including its websites and news agencies (22%). the internet and social networks (15.9%) were the third most common sources of information. The least common sources of information were the patients with a history of coronavirus (0.4%) and friends (1%). Furthermore, from the students' perspective, the information broadcasted on national television (31.4%) and the Ministry of Health (31.2%) had the highest validities (Table 6).

Discussion

The novelty of the coronavirus disease along with its uncertainties has urged health authorities to develop appropriate strategies to prepare and manage the public. Psychological theories could provide systematic explanations of the observable facts.^{11,14,23} In the current study, we evaluated the risk perception and behavioral response of Iranian students towards the COVID-19 outbreak based on HBM constructs.

Despite extensive national and international education on the high incidence of coronavirus, the current analysis indicated that most of the adolescents typically underestimate their risk perception of being infected by the COVID-19 virus (the students themselves and their families).

It is also noteworthy that despite the low-risk perception among adolescents, their perception of their ability to take protective measures (S-E) was found to be relatively high. There was also a negative correlation between the participants' overall risk perception and their overall engagement in protective behaviors. This is in agreement with a study conducted in China by Wang et al. that reported that despite low susceptibility, their respondents had taken precautionary measures, such as handwashing, respiratory hygiene against the outbreak of COVID-19²⁴. On the contrary, the results of some studies have shown that the higher the risk perception is, the more individuals take protective measures.^{25,26}

In the current study and studies with similar results,^{24,27} adopting protective measures by respondents might be since all of the samples had been taken from student populations, who both spend a great deal of their time on the social networks and are well-educated about protective measures via all kind of media; therefore, despite their low perception about the serious threat of this disease, adolescents are influenced by social networks to comply with social norms and peer group. Nevertheless, other theories to place more emphasis on fear and risk control

Table 5
Summary of Hierarchical Multiple Regression Analysis variables to predict PBEHAV.

Model	Variable	B	SE	Beta	t	Sig.	R ²	Adj R ²	Δ R ²	P-value	95% CI
Step 1	PSUS	-0.26	0.08	-0.11	-2.9	0.00	0.01	0.01	0.01	0.00	-0.43-0.09
Step 2	PSUS	-0.32	0.08	-0.13	-3.6	0.00	0.03	0.03	0.02	0.00	-0.49-0.14
	PSEV	0.23	0.06	0.14	4.01	0.00					
Step 3	PSUS	-0.22	0.08	-0.09	-2.6	0.01	0.09	0.09	0.06	0.00	-0.39-0.05
	PSEV	0.16	0.05	0.09	2.71	0.00					
	PBEN	0.37	0.05	0.26	7.54	0.00					
Step 4	PSUS	-0.17	0.08	-0.07	-1.92	0.05	0.12	0.11	0.02	0.00	-0.33-0.01
	PSEV	0.16	0.05	0.10	2.92	0.00					
	PBEN	0.35	0.05	0.24	7.18	0.00					
	PBAR	-0.25	0.05	-0.16	-4.8	0.00					
Step 5	PSUS	-0.14	0.07	-0.05	-2.05	0.04	0.43	0.42	0.3	0.00	-0.27-0.01
	PSEV	0.03	0.04	0.02	0.65	0.51					
	PBEN	0.11	0.04	0.07	2.58	0.01					
	PBAR	-0.15	0.04	-0.10	-3.65	0.00					
	S-E	0.76	0.03	0.59	20.35	0.00					

Table 6
The most frequent and valid sources for getting information about COVID-19 from the students' perspective.

Resources	The most used sources in receiving information in adolescents		The most valid sources used to receive information from adolescents view	
	Frequency (n)	Percent (%)	Frequency (n)	Percent (%)
Family members	39	4.9	28	3.5
Internet	127	15.9	79	9.9
Patients with a history of coronavirus	3	.4	8	1.0
physicians	39	4.9	122	15.3
Friends	8	1.0	8	1.0
International TV news	36	4.5	45	5.6
National TV news	364	45.7	250	31.4
Official sources of the Ministry of Health	175	22.0	249	31.2

should be considered to examine factors causing the negative relationship between PSUS and PBEHAV. . Some studies have shown that a person's perception of risk may be related to fear of the consequences of the disease. Therefore, future studies are suggested to emphasize fear and risk control more such as the extended parallel process model (EPPM).²⁸

Generally, most adolescents exaggerating their opinions and behaviors simply; therefore, their high self-efficacy is not unexpected. This can be the reason for the high correlation between self-efficacy and other constructs as well as the high power of self-efficacy in predicting PBEHAV in this study ($\beta = 0.59, P < 0.001$). Self-efficacy was also shown to be positively associated with various health-related practices, such as smoking cessation, drug-use prevention, and health-promoting lifestyle.^{29–32}

On the other side, adherence to a given behavior requires serious efforts to strengthen one's belief in one's ability to behave in a certain way. This could explain why S-E has been the strongest predictor of behavioral change in most studies.^{33,34} In the current study, S-E had a negative correlation with PBAR so that the more the barriers of social distancing and hand hygiene were perceived, the less likely the participants were to perceive self-efficacy. This is in agreement with other studies in which there were negative correlations between these constructs.³⁵

Findings of the present study also revealed that most of the students frequently used official sources of the Ministry of Health on the national TV news, among other sources. Further, results showed that despite our expectations, adolescents relied more on credible scientific sources than

social networks and their friends in critical situations. This is not in agreement with other studies' results suggesting that academic people such as students rely highly on different online sources to obtain the latest information on the COVID-19 outbreak.²⁵

This result is also in contrast with the findings obtained by Wang and colleagues, who stated that 93.5% of their respondents had acquired health information regarding COVID-19 from the internet.²⁴ However, it is important to state that in this study, the third most frequently used source of information was social media and the internet. These sources are in turn a serious concern because the information quickly circulates on social media leading to faster spreading of unreliable information and might mislead one's responses towards the outbreak. Perhaps the reason for more adolescents' trust in reputable resources in Iran is the widespread dissemination of political rumors and the unreliable atmosphere of these media in recent decades. On this account, despite the excessive use of these networks to obtain political and economic information, adolescents tend to use scientific sources on vital and critical issues.

Limitation: Although these findings gave us valuable insight into understanding the health behaviors among adolescents in Iran, several limitations of this work should not be ignored. For example, using online questionnaires might have led to selection bias. Another limitation of the present study was the possibility for participants to give socially desirable responses. As this study used self-reported data, it was possible that participants positively answered attitude and practice questions based on what they perceive to be expected of them. This has been also observed in other studies; however, due to our limitations in using other methods of questioning at the time of the COVID-19 outbreak as well as the large sample size, these results can be somewhat reliable.³⁶

Conclusion

Overall, the results of this study showed that adolescents' self-efficacy was the strongest predictor of protective behaviors in the COVID-19 pandemic even when they underestimate the risk of this disease. Given the negative relationship between PSUS and PBEHAV, it is necessary to further investigate the factors associated with low PSUS in students. To that end, the HBM's constructs of perceived threat, perceived barriers, perceived benefits, perceived self-efficacy, and cues to action can be immediately deployed to help reinforce COVID-19 limiting behaviors, such as social distancing and remaining in the home whenever possible.

Contribution: All the authors have contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Fathian-Dastgerdi, Z, Khoshgoftar, M, and Tavakoli, B. Also, all of the authors read and approved the final manuscript. Jaleh, M played an effective role in obtaining approval from the Education

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Author statement

The emergence of the novel coronavirus disease (COVID-19) pandemic is a unique challenge to public health for all age and sex groups. This study aimed to explore the perceptions of the adolescents on COVID-19-related to preventive measures based on the health belief model.

Contribution

All the authors have contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Fathian-Dastgerdi, Z, Khoshgoftar, M, Tavakoli, B, and Jaleh Maryam. Also, all of them read and approved the final manuscript. Jaleh, M played an effective role in obtaining approval from the Education department and distributing links to all schools and students.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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Appendix A. Supplementary data

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