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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 = 0.59, P < 0.001), and perceived severity (r = 0.55, 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 (Adj R² = 0.46, P < 0.001). The results also showed that self-efficacy was the strongest predictor (β = 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. 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. Measures taken by schools can both prevent students and staff from being infected by COVID-19 and stop the virus from spreading. So, it is important to identify the factors associated with protective behaviors in adolescents and educational facilities.

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. Unfortunately, adherence to these commands has declined over time among people a few months after the disease outbreak all over the world. Therefore, understanding the determinants responsible for protective measures against the virus spread is of great importance for the effectiveness of the proposed commands.

Moreover, community health planners are being encouraged to both consider how people’s perspectives on COVID-19 may differ and modify...
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 organized into six main sections addressing different topics of interest (Table 1). Demographic characteristics assessed by questions included adolescent age, gender, grade and annual household 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.MUI.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 ± 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

| Abbreviations | Definition |
|---------------|------------|
| HBM           | health belief model |
| PSUS          | perceived susceptibility |
| PSEV          | perceived severity |
| PBEN          | perceived benefit |
| PBAR          | perceived barrier |
| S-E           | self-efficacy |
| PBEHAV        | protective behavior |
correlations were observed between the PBEHAV and PSUS (r = 0.51). The inclusion of the PSEV variables significantly increased the R² and explained 0.03% of the variance in the PBEHAV (P < 0.001). In the third step, the inclusion of the PBEN variables accounted for 0.01% of the total variance in the PBEHAV (P < 0.001), and between the PBEHAV and PSUS (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 R² 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 R² = 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 (β = 0.07, P = 0.05). In the last step, the inclusion of the PSEV significantly increased the predictive power of the final model (Adj R² = 0.46%, P < 0.001); however, the predictive role of PSEV in the last step became almost insignificant (β = 0.02, P = 0.51).

As mentioned earlier, to find the most important cues to action and 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-19.\(^{24}\) 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 1

| Scales                          | number of items (score range) | CVI range | CVR range | CITC range | Cronbach’s alpha |
|--------------------------------|-------------------------------|-----------|-----------|------------|------------------|
| Perceived susceptibility       | 2(2-8)                        | 0.70-0.73 | 0.73-0.75 | 0.39-0.61  | 0.66             |
| Perceived severity             | 3(3-12)                       | 0.75-0.78 | 0.80-0.83 | 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 | 0.72-0.76 | 0.54-0.63  | 0.82             |

#### Demographic Characteristic of the adolescent’s variables.

| Demographic Characteristic | Frequency (n) | Percentage (%) |
|----------------------------|---------------|----------------|
| Gender                     |               |                |
| Male                       | 428           | 53.7           |
| Female                     | 369           | 46.3           |
| Educational level          |               |                |
| 7th                        | 196           | 24.6           |
| 8th                        | 141           | 17.7           |
| 9th                        | 202           | 25.3           |
| 10th                       | 91            | 11.4           |
| 11th                       | 73            | 9.1            |
| 12th                       | 94            | 11.8           |
| Perceived family income    |               |                |
| Too bad                    | 6             | 0.8            |
| relatively bad             | 53            | 6.6            |
| Medium                     | 497           | 62.4           |
| good                       | 204           | 25.6           |
| very good                  | 32            | 4              |

### Table 4

Pearson’s correlation coefficients matrix between HBM variables and PBEHAV.

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

\(^\text{a}\) Correlation is significant at the 0.01 level (2-tailed).

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**Table 3**

| 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 2**

| Demographic Characteristic | Frequency (n) | Percentage (%) |
|----------------------------|---------------|----------------|
| Gender                     |               |                |
| Male                       | 428           | 53.7           |
| Female                     | 369           | 46.3           |
| Educational level          |               |                |
| 7th                        | 196           | 24.6           |
| 8th                        | 141           | 17.7           |
| 9th                        | 202           | 25.3           |
| 10th                       | 91            | 11.4           |
| 11th                       | 73            | 9.1            |
| 12th                       | 94            | 11.8           |
| Perceived family income    |               |                |
| Too bad                    | 6             | 0.8            |
| relatively bad             | 53            | 6.6            |
| Medium                     | 497           | 62.4           |
| good                       | 204           | 25.6           |
| very good                  | 32            | 4              |
should be considered to examine factors causing the negative relationship between PSUS and PBEHAV. Some studies have shown that a high level of self-efficacy was the strongest predictor of protective behaviors in the HBM. 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.

### 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 Research Committee of the University of Tehran.

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**Table 5**

Summary of Hierarchical Multiple Regression Analysis variables to predict PBEHAV.

| Model | Variable | B         | SE | Beta | t        | Sig. | R²     | Adj R² | Δ R² | 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 |
|        | PSEV     | 0.23      | 0.06 | 0.14 | 4.01     | 0.00 | 0.03   | 0.03   | 0.02 | 0.00   | 0.12−0.35 |
| Step 2 | PSUS     | −0.32     | 0.08 | −0.13 | −3.6     | 0.00 | 0.00   | 0.00   | 0.00 | 0.00   | −0.49−0.14 |
|        | PSEV     | 0.16      | 0.05 | 0.09 | 2.71     | 0.00 | 0.09   | 0.09   | 0.06 | 0.00   | 0.04−0.27 |
|        | PBEN     | 0.37      | 0.05 | 0.26 | 7.54     | 0.00 | 0.12   | 0.11   | 0.02 | 0.00   | 0.27−0.46 |
| Step 3 | 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 | 0.05   | 0.05   | 0.28 | 0.00   | 0.25−0.44 |
|        | PBEN     | 0.35      | 0.05 | 0.24 | 7.18     | 0.00 | 0.25   | 0.25   | 0.44 | 0.00   | −0.35−0.15 |
|        | PBEAR    | −0.25     | 0.05 | −0.16 | −4.8     | 0.00 | 0.43   | 0.43   | 0.42 | 0.00   | −0.27−0.01 |
| Step 4 | PSUS     | −0.14     | 0.07 | −0.05 | −2.05    | 0.04 | 0.43   | 0.43   | 0.42 | 0.3    | −0.27−0.01 |
|        | PSEV     | 0.03      | 0.04 | 0.02 | 0.65     | 0.51 | 0.12   | 0.12   | 0.11 | 0.01   | −0.06−0.12 |
|        | PBEN     | 0.11      | 0.04 | 0.07 | 2.58     | 0.01 | 0.15   | 0.15   | 0.14 | 0.02   | 0.02−0.18 |
|        | PBEAR    | −0.15     | 0.04 | −0.10 | −3.65    | 0.00 | 0.15   | 0.15   | 0.14 | 0.02   | −0.24−0.07 |
|        | S-E      | 0.76      | 0.03 | 0.59 | 20.35    | 0.00 | 0.49   | 0.49   | 0.43 | 0.00   | 0.69−0.83 |

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**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         | 3             | 4.0         | 8             | 1.0         |
| coronavirous 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        |

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department and distributing links to all schools and students.

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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 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**

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sapharm.2021.01.014.

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