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Fear and COVID-19 Protective Behaviors among High School Students in Hamadan, Iran; Application of an Extended Parallel Process Model

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ABSTRACT

Aims Throughout the ongoing COVID-19 pandemic, the role of students in transmitting the infection has received special attention aiming at protecting the younger generation against COVID-19 and other known respiratory diseases. This research aimed to specify factors related to Covid-19 preventing behaviors in high school students.

Instrument & Methods This cross-sectional study was conducted on 2852 students aged 13 to 18 in Hamadan in 2020. Participants were selected using the multistage cluster sampling method. The data were collected with a researcher-made EPPM questionnaire. Data were analyzed statistically by Stata 14.2 software using the Chi-square and Fisher's exact tests.

Findings The vast majority of students (67.02%) were in the danger control response phase. The response efficacy (77.3%) and perceived efficacy (75.3%) had the highest percentage of the mean from the maximum obtainable score among constructs of the model. There was a significant difference between categories of the EPPM model with doing healthy behaviors. Moreover, the proportion of doing health behaviors was significantly higher in students in the danger control phase.

Conclusions The predominance of the perceived threat of COVID-19 on the perceived efficacy affects preventive health behaviors. Therefore, a theory-based behavioral modification program can be developed based on gender among high school students. Higher grade students and poor socioeconomic status require intense educational interventions to modify their hygienic behaviors.

Keywords Student; Health Behavior; COVID-19; Educational Models

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Introduction

COVID-19 became a public worldwide health threat to people in late 2019 [1]. Until February 1, 2021, COVID19 has been detected in 219 countries with 104,400,796 laboratory-established cases and 2,262,854 deceases [2].

At present, a variety of pharmaceutical treatments and behavioral strategies are available to control COVID-19. Evidence indicates that although medications are the most effective strategy for disease control and treatment, the production processes of vaccines and antiviral drugs are very long. These methods, therefore, cannot control the prevalence of this new pathogen in the early stages [3]; hence the observance of behavioral strategies to reduce the risk of infection is of great importance in the current situation [3].

Since the COVID-19 pandemic, the Center for Disease Control and the World Health Organization (WHO) has developed a series of effective behavioral strategies to prevent and control this epidemic. These strategies advise the general public, particularly high-risk groups, to stay home, wash their hands frequently with soap and water, wear masks, and observe social distance [4]. These behaviors have been reported to inhibit the aerosol spread and protect the population exposed to the risk of COVID-19 by creating a barrier [3].

Current observations suggest that all age groups are susceptible to COVID19. During the epidemic period, however, the role of students in transmitting the infection has received special attention aiming at protecting the younger generation against COVID19 and other known respiratory diseases [5].

The epidemiological surveillance analysis from European Centre for Disease Prevention and Control showed that, on August 1 November 29, 2020, a total of 2,871,828 (3.7% of cases) laboratory-confirmed cases of COVID-19 in European adolescents aged 12-15 years old [6]. Also, from March 1 to December 12, 2020, a total of 2,871,828 laboratory-confirmed cases of COVID-19 in children, adolescents, and young adults aged 0–24 years were reported in the United States. Among these cases, the majority (57.4%) occurred among young adults aged 18–24 years; children and adolescents aged 14–17 years accounted for 16.3% of cases, those 11–13 years for 7.9% [7]. On average, in Iran, 11.2% of patients with Covid-19 are 13-20 years [8].

Since adolescents tend to have longer and more physical contact with each other [9], the transmission risk of the infection is very high among them. If these people do not follow the recommended health behaviors, they will be disease carriers, unwantedly transmitting the disease to other students, their family members, and the community, thereby increasing the spread of the disease [10].

According to existing research findings, an epidemic of a serious health risk, such as an epidemic of infectious diseases, the arousal of perceived fear and threat of individuals increases their tendency to perform protective behaviors against the health risk. In such situations, however, essential elements such as perceived efficiency to maximize effectiveness and avoid unwanted consequences, such as anxiety and disease-related stigma, should be seriously taken into consideration [11].

Theories that make predictions involving how people respond to fear messaging are particularly relevant to COVID-19 prevention because governments and media often employ these tactics hoping to keep their citizens from engaging in unsafe behaviors [12]. Studies have shown that EPPM can help to predict when and why people will follow COVID-19 prevention recommendations [13-16].

The Extended Parallel Processing Model (EPPM) is one of the best models that predict the recommended health (protective) behaviors against health hazards through the analysis of perceived threat and perceived effectiveness [11]. In the EPPM, people feel frightened once being threatened seriously and try to hold in the menace by choosing one of the two danger control or fear control responses.

In the mentioned model, perceived threat and perceived efficacy are the two major components of danger perception. The former comprises two essential aspects: severity (being susceptible to the significance or extent of the menace) and susceptibility (one's opinion in susceptibility to the menace). There are two essential aspects in perceived efficacy: response efficacy (effectuality of the recommended advice presented to prevent or counteract the perceived threat) and self-efficacy (one's opinion in their capability of following instructions) [11]. The procedures and aftermath of danger control in high-threat/high-efficiency situations develop positive alterations in attitudes, aims, and conduct. Fear control procedures and their consequences, such as defensive avoidance or reactance, emerge in high threat/low efficacy situations [11] (Figure 1).

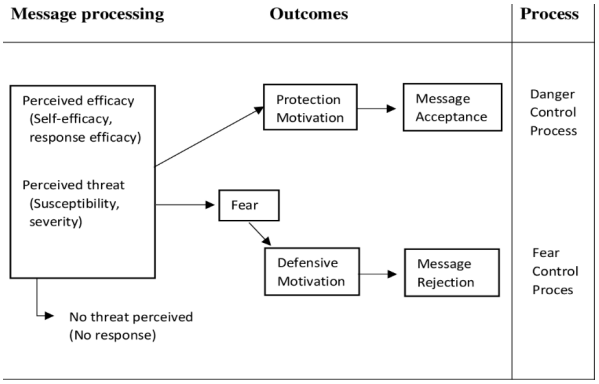

Figure 1) The extended parallel process model

Due to the outbreak of coronavirus infection in Iran and the high importance of infection control in student, the aim of this study was to determine the factors associated with Covid-19 preventive

behaviors in high school students' using a model of EPPM.

Instrument & Methods

This Descriptive-cross sectional research was accompanied from May 21 to June 21, 2020, in Hamadan, the western city of Iran. The current survey examined factors influencing COVID-19 preventing behaviors among high school students aged 13-18 years. The sample size was calculated for an infinite population where P was taken as 25%. Due to the novelty of the disease and the fact that no study has so far been done in this regard, we obtain this amount of P according to the small pilot study on 100 students [17]. The necessary accuracy of the estimation (d) was set at 0.025 with a confidence interval of 95%. A sample size of 1152 students was estimated using the abovementioned formula. Then, the design effect of 2.4 was added. Then, the non-response error of 3% was added. Totally, two thousand eight hundred fifty two high school students were recruited as the required sample size. Samples of the study were selected by cluster sampling after selecting schools randomly from two educational districts (Districts 1 and 2). Out of 87 high schools, ten high schools (five for girls and five for boys) were selected randomly in each district. All students from these ten schools entered the study. To take a survey, a text message invitation was sent to 3800 students in Hamadan on May 25, 2020. This invitation message was sent through the SHAD system to all school students selected by school principals. This is a specialized system for virtual learning of students and their related activities in Iran. This investigation was implemented in Persian. The inclusion criterion was no having a history of systemic disease.

The data collection instrument included a questionnaire consisting of two general sections of demographics and EPPM structures. The EPPM questionnaire was designed and constructed based on the previous studies [14-18]. Demographic variables included in the questionnaire were grade, gender, parental education, and parental occupation (6 questions). Parental education was categorized nominally (primary or lower, guidance, high school, and Academic). Parental occupation also had nominal categories (worker, self-employed, and employee). In addition to demographic questions, the questionnaire consisted of model constructs (by 5 Likert scale arranged in the options of strongly agree=5 to strongly disagree=1). The constructs were: perceived severity (3 questions, e.g., Coronavirus can cause death), susceptibility (2 questions, e.g., I am unlikely to get coronavirus), Response efficacy (5 questions, e.g., Wearing masks is effective in preventing coronavirus), Self-efficacy (5 questions, e.g., Wearing masks is effective in preventing coronavirus). Also, the Preventive Behaviors of COVID-19 were examined (4 questions, e.g., I wear a mask, when I am out of the house). The "Perceived efficacy" construct was determined via the sum of the participants' responses efficacy and self-efficacy. To evaluate the perceived threat, the sum of susceptibility and perceived severity scores were used. Measurements of danger control responses were performed using Witte discriminating values [19]. In respective order, low and high levels of threat and perceived efficacy were obtained by the median level of individual structures. Levels of the perceived threat and the perceived efficacy were used to create four EPPM classes, including low threat and efficacy (LT/LE), low threat and high efficacy (LT/HE), high threat and low efficacy (HT/LE), and lastly high threat and efficacy (HT/HE). The content validity of the tool was performed using the opinions of eight experts in the field of health and health promotion and two teachers (School consultant), and the necessary corrections were applied (CVI=0.78, CVR=0.81). Also, the Face validity of the questionnaire was measured by 30 students whose characteristics were resembled the target study sample. Before starting the main process, the questionnaire was filled out by the participation of 100 students as a pilot duration of 20 days. Finally Cronbach's alpha retest was confirmed for each construct (Susceptibility=0.70, perceived severity=0.72, response efficacy=0.74, self-efficacy=0.77, preventive behavior=0.75).

The Ethics Committee of Hamadan University of Medical Sciences approved this study. All students gave verbal consent after taking information about study objectives, being confidentially, and voluntarily participating in the study. All data were collected from the study participants anonymously. The participants in this study were not paid any direct benefits or rewards for their participation. The design of the software application was such that the students were required to provide answers to entire questions; otherwise, they were not given an affirmation in the end. For those with no completion of the questionnaire within ten days, the invitation message was sent anew on May 4, 2020. Data were gathered for ten days until May 14, 2020.

According to the demographic variables, COVID-19-associated actions of preventive behavior were compared using the $\chi 2$ test. Assessment of correlations among EPPM constructs was done by Pearson's correlation coefficient. A comparison was made between the performances of the four preventing behaviors surveyed at the levels created by the model (LT/LE, HT/LE, LT/HE, HT/HE) by Fisher's exact test. The levels produced by the model (danger control and fear control paths) were also utilized to compare four preventing behaviors with the $\chi 2$ test. Data were analyzed statistically by Stata 14.2 software. Significant differences were reported at $p<0.05$.

Findings

In total, 2852 (68%) completed electronic questionnaires were received. There were 1988 (69.7%) girls among participants, and 1508 (52.8%) subjects were in 10-12 education degrees. Among them, 37.7% of their fathers and 36.2% of their mothers had academic education. Moreover, 86.6% and 63% of students' mothers were housekeepers and self-employed, respectively (Table 1).

There were significant associations between students' gender, grade, mother and father education, and their father's occupation, with avoiding handshake and using a mask ($p<0.05$). Furthermore, their fathers' occupations were significantly associated with all the investigated health behaviors ($p<0.05$, Table 1).

The vast majority of students (67.02%) were in the danger control response phase, and this proportion was significantly higher in students of grades 7-9 ($p<0.05$; Diagram 1).

Table 1) Results of the number (percent) of demographic variables of students and their association with doing healthy behaviors related to the COVID-19 epidemic

Variable	N (%)	Washing hands			Enough distance			Close contact			Using Mask		
		Never	Sometimes	Always	Never	Sometimes	Always	Never	Sometimes	Always	Never	Sometimes	Always
Gender													
Boy	864 (30.2)	12 (1.5)	178 (22.7)	592 (75.7)	59 (7.5)	266 (34.0)	457 (58.4)	66 (8.4)	211 (26.9)	505 (64.5)	44 (5.6)	234 (29.9)	504 (64.4)
Girl	1988 (69.7)	18 (1.0)	422 (23.5)	1356 (75.5)	106 (5.9)	604 (33.6)	1086 (60.4)	93 (5.1)	476 (26.5)	1227 (68.3)	108 (6.0)	628 (34.9)	1060 (59.0)
p-value		0.48			0.26			0.005			0.03		
Grade													
7-9	1344 (47.1)	16 (1.3)	288 (23.3)	929 (75.3)	88 (7.1)	397 (32.2)	748 (60.6)	96 (7.7)	317 (25.7)	820 (66.5)	74 (6.0)	361 (29.2)	798 (64.7)
10-12	1508 (52.8)	14 (1.0)	312 (23.2)	1019 (75.7)	77 (5.7)	473 (35.1)	795 (59.1)	63 (4.6)	370 (27.5)	912 (67.8)	78 (5.8)	201 (37.2)	766 (56.9)
p-value		0.82			0.14			0.004			<0.001		
Father's Education													
Primary	551 (19.3)	7 (1.4)	116 (23.3)	374 (75.2)	26 (5.2)	170 (34.2)	301 (60.5)	33 (6.6)	170 (34.2)	294 (59.1)	36 (7.2)	186 (37.4)	275 (55.3)
Guidance	558 (19.5)	6 (1.1)	139 (27.4)	362 (71.4)	30 (5.9)	184 (36.2)	293 (57.7)	37 (7.3)	127 (25.0)	343 (67.6)	39 (7.6)	186 (36.6)	282 (55.6)
High school	667 (23.3)	9 (1.4)	143 (23.6)	452 (74.8)	43 (7.1)	201 (33.2)	360 (59.6)	35 (5.7)	159 (26.3)	410 (67.8)	26 (4.3)	212 (35.1)	366 (60.6)
Academic	1076 (37.7)	8 (0.8)	202 (20.8)	760 (78.3)	66 (6.8)	315 (32.4)	289 (60.7)	54 (5.5)	231 (23.8)	685 (70.6)	51 (5.2)	278 (28.6)	641 (66.0)
p-value		0.11			0.67			0.001			<0.001		
Mother's Education													
Primary	594 (20.8)	11 (2.0)	128 (23.8)	398 (74.1)	34 (6.3)	173 (32.2)	330 (61.4)	27 (5.03)	163 (30.3)	347 (64.6)	36 (6.7)	209 (38.9)	292 (54.3)
Guidance	464 (16.2)	5 (1.1)	113 (26.6)	306 (72.1)	33 (7.7)	159 (37.5)	232 (54.7)	42 (9.91)	128 (30.1)	254 (59.9)	36 (8.4)	138 (2.5)	250 (58.9)
High school	761 (26.6)	4 (0.5)	151 (22.0)	529 (77.3)	32 (4.6)	235 (34.3)	417 (60.9)	36 (5.26)	163 (23.8)	485 (70.9)	33 (4.8)	234 (34.2)	417 (60.9)
Academic	1033 (36.2)	10 (1.0)	208 (22.2)	715 (76.6)	66 (7.0)	303 (32.4)	564 (60.4)	54 (5.79)	233 (24.9)	646 (69.2)	47 (5.0)	281 (30.1)	605 (64.8)
p-value		0.13			0.12			<0.001			0.001		
Father's Occupation													
Self-employed	1798 (63.0)	24 (1.4)	365 (22.6)	1226 (75.9)	124 (7.6)	547 (33.8)	944 (58.4)	116 (7.18)	447 (27.6)	1052 (65.1)	118 (7.3)	553 (34.2)	944 (58.4)
Worker	248 (8.7)	0 (0.0)	71 (31.5)	154 (68.4)	5 (2.2)	81 (36.0)	139 (61.7)	10 (4.44)	70 (31.11)	154 (64.4)	9 (4.0)	103 (45.7)	113 (50.2)
Employee	806 (28.2)	6 (0.8)	164 (22.2)	568 (76.9)	36 (4.8)	242 (32.7)	460 (62.3)	33 (4.47)	170 (23.0)	535 (72.4)	25 (3.3)	206 (27.9)	507 (68.7)
p-value		0.008			0.005			0.002			<0.001		
Mother's Occupation													
Hose keeper	2444 (86.6)	28 (1.2)	525 (23.7)	1662 (75.0)	141 (6.3)	741 (33.4)	1333 (60.1)	136 (6.14)	603 (27.2)	1476 (66.6)	139 (6.2)	752 (33.9)	1324 (56.7)
Self-employed	78 (2.7)	1 (1.4)	21 (30.8)	46 (67.6)	6 (8.8)	22 (32.3)	40 (58.8)	5 (7.35)	17 (25.0)	46 (67.6)	4 (5.8)	25 (36.7)	39 (57.3)
Employee	330 (11.5)	1 (0.34)	54 (18.3)	240 (81.3)	18 (6.1)	107 (36.2)	170 (57.6)	18 (6.10)	67 (22.7)	210 (71.1)	9 (3.0)	85 (28.8)	201 (68.1)
p-value		0.06			0.81			0.55			0.04		
Total	2578 (100)	30 (1.1)	600 (23.2)	1948 (75.5)	165 (6.4)	870 (33.7)	1543 (59.8)	159 (6.17)	687 (26.6)	1732 (67.1)	152 (5.9)	862 (33.4)	1564 (60.4)

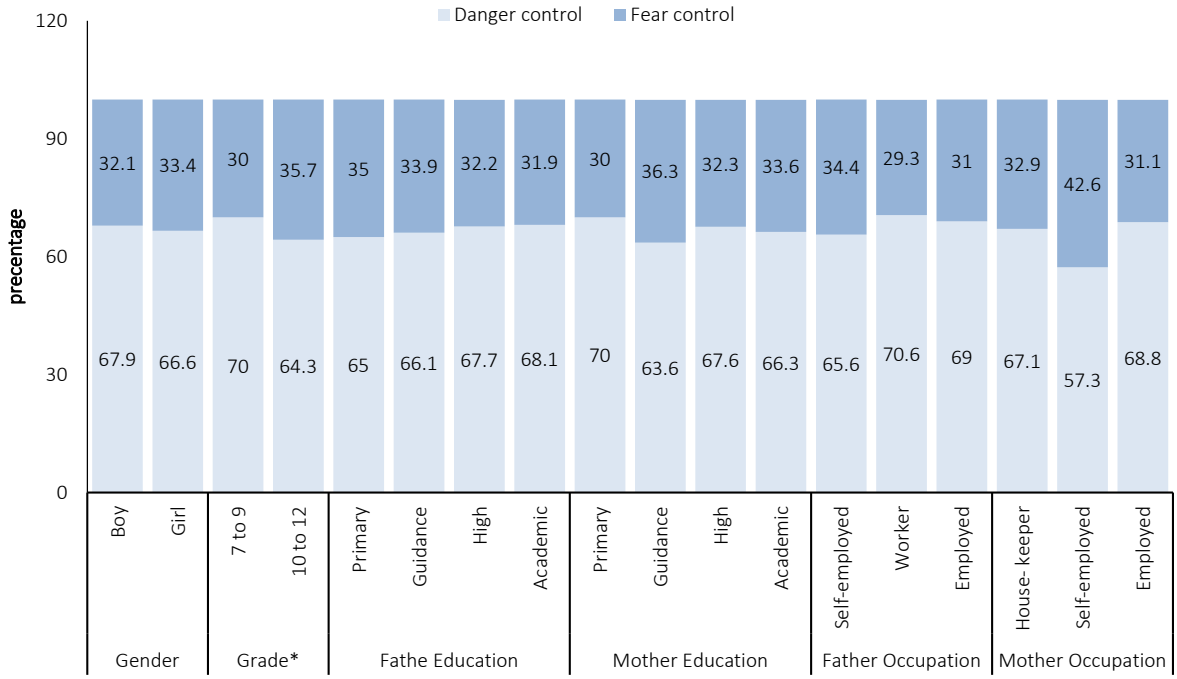

Diagram 1) Response status of students to COVID-19 epidemic according to demographic variables of participates (*p<0.05)

Table2) Results of the constructs scores of the EPPM

Variables	Mean±SD	Percentage	Range
Susceptibility	6.8±1.47	60.0	2-10
Perceived Severity	11.56±2.44	71.3	3-15
Response Efficacy	20.45±3.71	77.3	5-25
Self-Efficacy	19.66±4.91	73.3	5-25
Perceived threat	18.36±3.03	66.8	5-25
Perceived efficacy	40.11±7.81	75.3.	10-50
Preventive Behavior	12.72±2.22	77.2	4-12

Table 3) Results of the Pearson correlation coefficients among the constructs of the EPPM

Variables	1	2	3	4	5	6	7
7. Preventive Behavior	-0.02*	0.22	0.39	0.58	0.17	0.53	1
6. Perceived efficacy	0.12	0.31	0.87	0.93	0.31	1	
5. Perceived threat	0.61	0.88	0.35	0.23	1		
4. Self-Efficacy	0.09	0.24	0.63	1			
3. Response Efficacy	0.14	0.35	1				
2. Perceived Severity	0.16	1					
1. Susceptibility	1						

*p>0.05

Table 4) Students' categorization in different levels of the EPPM and their relation with doing healthy behaviors regarding COVID-19 epidemic

Response type	N (%)	Washing hands			Enough distance			Close contact			Using Mask		
		Never	Sometimes	Always	Never	Sometime	Always	Never	Sometimes	Always	Never	Sometimes	Always
LT/LE	949 (36.8)	21 (2.2)	338 (35.6)	590 (62.1)	98 (10.3)	399 (42.0)	98 (10.3)	105 (11.0)	352 (37.0)	492 (51.8)	112 (11.8)	424 (44.6)	412 (43.5)
LT/HE	658 (25.5)	1 (0.1)	75 (11.4)	582 (88.4)	3 (0.4)	178 (27.0)	3 (0.4)	10 (1.5)	109 (16.5)	539 (81.9)	6 (0.9)	163 (24.7)	489 (74.3)
HT/LE	369 (14.31)	5 (1.3)	107 (29.0)	257 (69.6)	48 (13.0)	148 (40.1)	48 (13.0)	33 (8.9)	127 (34.4)	209 (56.6)	24 (6.5)	144 (39.0)	201 (54.4)
HT/HE	602 (23.5)	3 (0.5)	80 (13.2)	519 (86.2)	16 (2.6)	145 (24.0)	16 (2.6)	11 (1.8)	99 (16.4)	492 (81.7)	10 (1.6)	131 (21.7)	461 (76.5)
Fear control	850 (32.9)	22 (2.5)	291 (34.2)	537 (63.1)	120 (14.1)	347 (40.8)	120 (14.1)	98 (11.5)	310 (36.47)	442 (52.0)	106 (12.4)	356 (41.8)	388 (45.6)
Danger control	1727 (67.0)	8 (0.4)	309 (17.8)	1410 (81.6)	45 (2.6)	523 (30.2)	45 (2.6)	61 (3.5)	377 (21.83)	1289 (74.6)	46 (2.6)	506 (29.3)	1175 (68.0)

The response efficacy (77.3%) and perceived efficacy (75.3%) had the highest percentages of the mean from the maximum obtainable scores among constructs of the model (Table 2).

There was a positive and significant correlation between all variables ($p<0.05$) except preventive behavior with susceptibility ($p>0.05$; Table 3).

Following the EPPM, the proportions of participants with both low perceived threat and efficacy (LT/LE), low threat-high efficacy (LT/HE), high threat-low efficacy (HT/LE), and both high perceived threat and efficacy (HT/HE) were 36.8%, 25.5%, 14.31%, and 23.5%, respectively (Table 4).

In terms of the abovementioned behaviors, there were significant differences between the categories of the EPPM model ($p<0.001$). Moreover, the proportion of doing health behaviors was significantly higher in students in the danger control phase ($p<0.001$; Table 4).

Discussion

The present study results showed that 67% of the subjects were in the risk control path. Lower-grade students were more at in the risk control path than the other groups. Studies state that performing preventive behaviors against the spread of respiratory infections, such as hand washing, social distancing, and masks, are paramount in infection control [3, 20]. The present results revealed that 60.4% of students always use a mask, 67.1% avoid close contact with others, 59.8% observe the social distance, and 75.5% wash their hands frequently. They performed these behaviors much lower than expected. This may be due to the age of the participants. Young people often think that most deaths are related to the elderly or people with underlying diseases [21]. Therefore, it seems necessary to monitor the observance of protective behaviors in adolescents.

While the use of the mask was unacceptable among both girl and boy students, there is a need to monitor this behavior among girls than boys further. The findings of many studies have shown that women have less tendency to engage in risky activities. Hence they are more likely to follow health advice, and therefore they were more inclined to wear masks upon the spread of respiratory illnesses such as H1N1 flu and SARS [22, 23].

Our observations indicated that the rate of mask use was lower among girls than boys. This difference can be attributed to the adolescent age of the participants in this study. During this period, girls psychologically invest more in their physical appearance than boys and are more interested in being attractive [24], while masks veils their attractiveness.

On the other hand, the refusal to shake hands and contact each other's tools was more observed in girls than boys, which necessitates further monitoring and training this behavior in boys. Alternatively, the strong relationship between masculinity and handshake has caused a more positive effect on the evaluation of social interactions in men than in women. Therefore men have a more positive perception of a handshake than women and shake hands more with each other [25]. Similar to a previous study [26], the findings of this study showed that lower grade students often performed the recommended behaviors, which seems logical due to the reduction of protective behaviors and attitudes with growing age and further ability of parents to control and monitor young adolescents [27].

As with other studies [3, 26], our data demonstrated that the rate of doing recommended behaviors in high school students significantly correlated with their parent's education levels and occupations. The recommended protective behaviors were less followed by students from families with lower socioeconomic status, which may be due to the low abilities of such families in the education and supervision of their children because of financial, cognitive constraints, or poverty pressures [28].

Based on the present results, 67% of the participants were in the risk control path. This rate is very low considering the high disease transmissibility and the risk exposure of all age groups. Therefore, there is a pressing need to implement effective interventions to increase efficiency and perceived threat of students regarding COVID19 due to the low perceived efficiency (62.3% and 51.1% of students respectively had low perceived threat and perceived efficiency) the imminent reopening time of schools. These interventions should include providing health motivational messages, such as fear-containing messages to increase perceived sensitivity and intensity, and strategies for performance enhancement to improve self-efficacy and response efficiency. The same as most studies [14, 16, 29], our results show that the EPPM efficiency dimension has a more positive effect on doing recommended health behaviors than the threat dimension. In such epidemics, therefore, it seems that more emphasis should be placed on the efficiency dimension to perform the intervention and provide health messages.

This study has several important advantages. Given that the health messages distributed in this pandemic situation have not successfully influenced high school students' perceptions, this study determined the control path. Specific target groups can be identified based on the results, and the necessary interventions can be tailored according to the control path. One of the limitations of this study was the application of self-administered questionnaires, which may induce recall bias and social desirability bias.

Although the sample size is large, it is still inadequate. Only 20 schools were included here, and the participation rate of boys was lower than girls. Moreover, the cross-sectional studies do not determine a cause-effect relationship.

Conclusion

The predominance of the perceived threat of COVID-19 on the perceived efficacy affects preventive health behaviors. Therefore, a theory-based behavioral modification program can be developed based on gender among high school students. Higher grade students and poor socioeconomic status require intense educational interventions to modify their hygienic behaviors.

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