



# Dentists' knowledge, beliefs and behaviours on preventing Covid-19 transmission in Turkey: A Health Belief Model study

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## Abstract

**Aim:** This study aimed to evaluate the knowledge, beliefs, and behaviors of dentists in preventing Covid-19 transmission using the Health Belief Model.

**Materials and Methods:** This descriptive study was conducted on 432 dentists who returned to the study tool in an electronic environment. The data were collected by a questionnaire and Health Belief Model Form for protection from Covid-19 (HBMF-COVID-19).

**Results:** Most participants had knowledge about Covid-19, including its symptoms, transmission path, and incubation period. More than 90% of the participants knew the precautions to be taken in a dental clinic. Although the participants were largely aware of all preventive behaviors, the rate of performing these behaviors were lower. Wearing a protective overall (31%), wearing an FFP (filtering facepiece) mask (61.8%), and patient isolation (70.4%) were the measures least taken. The total mean score of HBMF-Covid-19 was  $3.71 \pm 0.33$ . Barrier perception had the lowest sub-dimension median score (2.50).

**Conclusion:** Although dentists know the measures, they have not taken enough precautions to protect themselves and patients from Covid-19. Having low barrier perception scores point to, there are situations that prevent dentists from performing preventive behaviors at workplaces. It is recommended to use the Health Belief Model to determine the factors that prevent and facilitate dentists' preventive behaviors. Considering the results, training and awareness activities can be planned by public health nurses.



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## Introduction

COVID-19 is an important public health problem that emerged in Wuhan, China in December 2019 and spread rapidly worldwide [1]. Since the most common route of its transmission is via small droplets that spread from the nose or mouth when a COVID-19-positive person coughs or exhales, health workers, especially dentists, constitute the most important risk group in terms of transmission and spread [2]. Due to the COVID-19 outbreak, it is expected for dentists to carry out many preventive behaviors [3]. Although the dentists are aware of the necessary precautions, they may experience problems in maintaining the usual protocols due to the constantly updating pandemic guidelines [4]. Moreover, no matter how stringently these measures are recommended, a fraction of people may not believe that they can or should act in ways that will limit

the threat [5]. This situation can be a risk to both dentists and their patients [6].

To develop and maintain a behavior, it is first expected that a person will have full faith in this change; therefore, the most important factors in carrying out and maintaining health protection behaviors are health beliefs [7]. The Health Belief Model (HBM) has been encountered as a comprehensive model in the investigation of health beliefs toward behavioral changes. According to this model, individuals will comply with a medical advice in two conditions. First one, there is a perceived threat to personal health. Second one the individual is convinced that the benefits of compliance with advice to protect their health outweigh the barriers that will be encountered [8]. The barriers and benefits perceived in HBM are considered as the robust dimensions explaining diverse preventive behaviors, and this is followed by the sensitivity perceived [9].

In literature, there are studies in which HBM was used to examine the behavior of health workers related to protec-

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tion against infections [10-12]. In a study by Siavashani et al. [10], HBM-based interventions have been found to be effective in changing the dentistry students' knowledge and behaviors toward infection control. Sedigh et al. [12] investigated the effect of HBM on the reduction of needle injuries in nurses and concluded that when the behaviors' score increased, needle stick injuries decreased. According to Moon and Hong [11], an effective infection control could be achieved by elevating the health belief in dental hygienists.

At present, there are few studies which evaluated the knowledge, beliefs, or behaviors of dentists related to protection from COVID-19 infection [13-15]. Moreover, only one study examined these variables based on HBM, and this was conducted in Saudi Arabia [16]. For this reason, this study aimed to assess the knowledge, beliefs, and behaviors of dentists for the prevention of COVID-19 transmission based on HBM.

#### Research Questions

- What is the knowledge level of dentists about COVID-19?
- What are the behaviors of dentists to prevent the transmission of COVID-19?
- What are the health beliefs of dentists regarding protective from COVID-19?

## Materials and Methods

### *Study design and participants*

This descriptive study was performed on May 13 to June 2, 2020 (about three weeks before the first pandemic restrictions on June 1 were lifted in Turkey). The participants were dentists who work in an institution in Turkey (university, public, or private). The sample size was computed as 378 dentists by means of G-Power 3.1.9.7 for 0.95 power and alpha level set to .05 [17]. Among the 436 dentists who returned in this study, four were not included based on the exclusion criteria. The study was completed with 432 participants. Following the announcement of the first cases of COVID-19 in the country in March 2020, preventative measures were taken to improve the preventive behaviors (social distancing, non-essential contact with others, and all unnecessary travel). For this reason, the participants were invited to the study through social media platforms (Facebook, WhatsApp, and Twitter). A snowball sampling technique was used, starting from known professional and social media groups and individuals. The link (<https://forms.gle/a39CXQpWKCye8eR7A>) includes the standardized instructions about the purpose of the study and the procedure for the completion of the survey. The questionnaire could be sent when all questions were answered. Therefore, there was no unfilled or partially filled questionnaire. Inclusion criteria: Being a dentist working in an institution in Turkey and willing to participate in this study. If a participant filled and submitted the form, it was considered as a consent to participate. Exclusion criteria: Being a dentist with psychiatric illness.

### *Data collection*

The data were collected from a self-reported online survey instrument created via Google Forms. These were

questionnaire and Health Belief Model Form for protection from COVID-19. The survey could not be taken twice from the same electronic device, and it could be completed in 10 min.

### *The questionnaire*

The questionnaire was prepared by reviewing the literature [10,18,19]. This form included 17 closed-ended questions related to the dentists' socio-demographic characteristics (age, gender, and profession), health status (chronic diseases and psychiatric illnesses), and the knowledge on COVID-19 (its symptoms, transmission, and infection control measures).

Health Belief Model Form for protection from COVID-19 (HBMF-COVID-19) This form was an HBM-based questionnaire developed by researchers to evaluate the dentists' health beliefs regarding COVID-19 prevention behaviors [7,20,21]. The form included a total of 36 items and five subscales: perceived sensitivity (nine items), perceived severity (seven items), perceived benefits (eight items), perceived barriers (four items), and self-efficacy (eight items). A Likert-type scale was used for all item responses, and it ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). Eight items [11, 12, 23, 24, 25, 26, 27, and 28] were reverse-coded. The minimum and maximum score to be taken from the scale was 1 and 5, respectively. A higher score indicates a greater level of positive beliefs [22]. The process of creating an HBMF was carried out in two stages. In the first stage, the form created by researchers was evaluated by three independent experts and rearranged in line with the recommendations. In the second stage, 10 dentists (people working in different institutions) took the pre-test and were asked to provide feedback on the comprehensibility of each statement. Based on the feedbacks, some minor adjustments on the survey instrument were performed. These dentists were not included in this study. Cronbach's alpha was .74 for the scale in general, .78 for perceived sensitivity, .61 for perceived severity, .62 for perceived benefits, .51 for perceived barriers, and .77 for self-efficacy perception.

### *Ethical consideration*

This study was conducted in full accordance with the World Medical Association Declaration of Helsinki. The Ethics Committee of Kocaeli University approved all the study procedures (Ethics Code: 2020/103-12.05.2020). All participants were taken information about the study on the first page of the questionnaire and participated voluntarily.

### *Statistical analysis*

The statistical analysis was performed using a commercially available software program (SPSS 20.00; SPSS, Chicago, IL, USA). The summary statistics included the number (n), percentage (%) and mean ( $X \pm SD$ ). The Shapiro-Wilk test was used for the distribution of numerical variables. The numerical variables, which didn't display normal distribution, were given as median (25th – 75th percentile). The Independent-Samples t-test and Mann Whitney-U test were used to compare the two

**Table 1.** HBMF-COVID-19 total and sub-dimension scores.

Scales	$\bar{X} \pm SD$ (Min - Max)	Median (25p%-75p%)
HBMF total score	3.71 ± 0.33 (2.56-4.61)	3.72 (3.50-3.91)
<b>HBMF sub-components</b>		
Perceived sensitivity	4.09 ± 0.61 (2.11-5.00)	4.11 (3.66-4.55)
Perceived seriousness (severity)	3.17 ± 0.59 (1.57-5.00)	3.14 (2.71-3.57)
Perceived benefits	3.76 ± 0.54 (1.80-5.00)	3.80 (3.40-4.20)
Perceived barrier	2.43 ± 0.68 (1.00-5.00)	2.50 (2.00-2.93)
Self-efficacy perception	3.74 ± 0.67 (1.50-5.00)	3.75 (3.37-4.25)

\* $\bar{X}$ : Mean, SD: Standard deviation, Min-Max: Minimum-Maximum values.

groups, and one-way ANOVA and Kruskal Wallis test were used to compare more than two groups. Multiple post hoc comparisons were conducted using Tukey test (homogeneous variables) or Games-Howell test (heterogeneous variables). In all cases, the level of significance was set at  $p < .05$ .

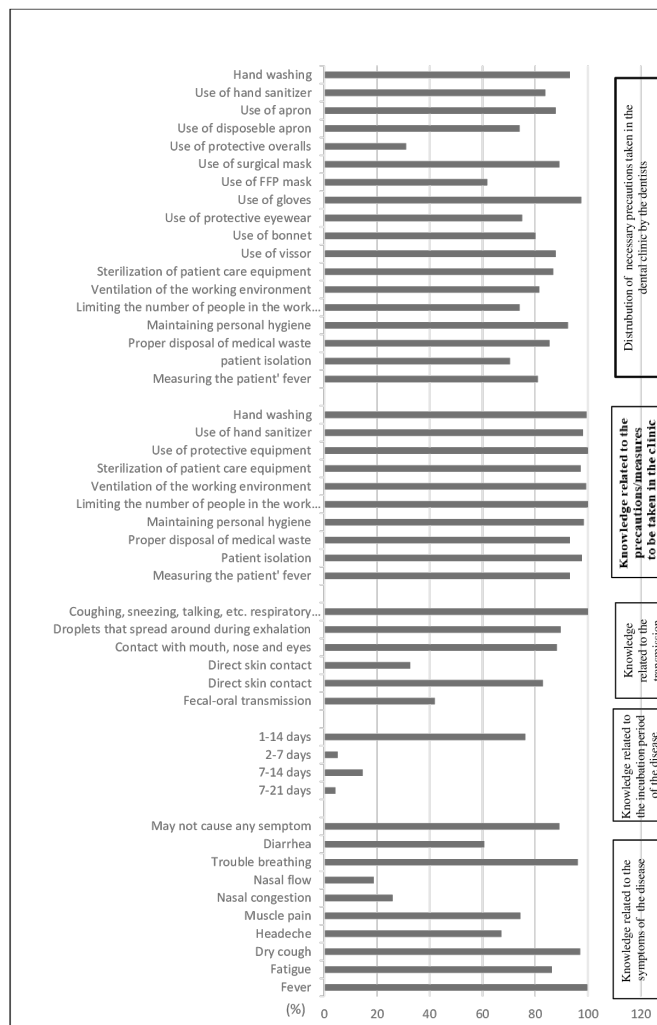
**Results**

A total of 432 dentists joined in this survey. The mean age of subjects was  $36.53 \pm 9.43$  years, 62.5% were female, 56.5% had no specialization, 18.5% had a chronic disease, and only 7.4% had no experience in working with patients with an infectious disease.

The frequency of participants' knowledge and behaviors related to COVID-19 is presented in Figure 1. More than 95% of the participants knew the basic symptoms (fever, dry cough, and trouble breathing) of COVID-19. While 99.8 % of dentists reported that fever is a symptom of the disease, nasal flow was reported by only 81 subjects (18,8 %) as COVID-19 symptom. All participants (100%) agreed with "the respiratory droplets that spread" as the transmission path of COVID-19. However, direct skin contact was considered the least in terms of transmission path. In terms of the knowledge level on incubation period, the most reported score was "1-14 days" (76.2%), followed by "7-14" (14.6 %), "2-7" (5.1 %), and "7-21" (4.2 %).

More than 90% of the participants knew the precautions to be taken in a dental clinic. Hand washing, use of protective equipment and limiting the number of people in the working area, were reported by almost 100% of dentists. However, measuring the fever was less frequently reported. Overall, the participants were largely aware of all preventive behaviors. In contrast, the rate of performing these behaviors was lower. Wearing a protective coverall (31%), wearing an FFP mask (61.8%), and patient isolation (70.4%) were the measures least taken (Figure 1).

Table 1 shows the HBMF scores. The mean HBMF total score and all sub-dimension scores, except the "perceived sensitivity," was  $< 4$ . "Perceived sensitivity" had the highest mean score ( $4.09 \pm 0.61$ ), and "perceived barrier" had the lowest mean score ( $2.43 \pm 0.68$ ). Additionally, the



**Figure 1.** Knowledge and behaviours of dentists' related to disease.

mean of HBMF total score was  $2.43 \pm 0.68$ , and significant differences were found in terms of age ( $p < .001$ ) and gender ( $p = .040$ ). Dentists over the age of 41 had a significantly higher HBMF total score ( $p < .001$ ). Furthermore, female dentists had a significantly higher HBMF total score compared to male dentists. Specialty, institution served, and chronic disease did not affect the HBMF total score ( $p > .05$ ).

With regard the sub-dimension scores of the HBMF, institution served affected all the sub-dimension scores of the HBMF except "perceived seriousness" ( $p < .05$ ). "Perceived benefit", "perceived barrier" and "self-efficacy perception" were also affected by the specialty ( $p < .05$ ). Additionally, chronic disease affected only the "self-efficacy perception" ( $p < .05$ ) (Table 2).

The distribution of the participants' answers to the HBMF is presented in Table 3.

**Discussion**

This study evaluated the knowledge, beliefs, and behaviors of dentists regarding COVID-19 using an HBM to prevent transmission. The first case of a COVID-19-positive dentist was reported on January 23, 2020, at the Department of Preventive Dentistry in the Wuhan University. Even-

**Table 2.** Distribution of HBMF-COVID-19 scores in terms of descriptive features (N=432).

Features	N	%	HBMF total X̄ ± SD	Perceived Sensitivity	Perceived Seriousness	Perceived Benefits	Perceived Barrier	Self-efficacy Perception	
				M (25p%-75p%)	M (25p%-75p%)	M (25p%-75p%)	M (25p%-75p%)	M (25p%-75p%)	
Age	1- 20-30	154	35.6	3.67 ± 0.33	4.22 (3.77-4.77)	3.14 (2.71-3.57)	3.80 (3.40-4.20)	2.50 (2.00-2.75)	3.75 (3.12-4.00)
	2- 31-40	146	33.8	3.67 ± 0.32	4.00 (3.66-4.55)	3.14 (2.71-3.42)	3.60 (3.40-4.20)	2.25 (2.00-3.00)	3.87 (3.37-4.25)
	3- ≥41	132	30.6	3.80 ± 0.31	4.11 (3.66-4.55)	3.42 (3.00-3.71)	3.80 (3.40-4.20)	2.50 (2.00-2.75)	3.87 (3.50-4.34)
				F = 6.649 X <sup>2</sup> = 6.850 P<.001	p = .033	X <sup>2</sup> = 10.924 p = .004	X <sup>2</sup> = 1.637 p = .441	X <sup>2</sup> = .505 p = .777	X <sup>2</sup> = 12.164 p = .002
Gender	Female	270	62.5	3.74 ± 0.32	4.22 (3.77-4.69)	3.14 (2.85-3.57)	3.80 (3.55-4.20)	2.50 (2.00-2.75)	3.87 (3.37-4.25)
	Male	162	37.5	3.67 ± 0.33	3.88 (3.44-4.33)	3.14 (2.71-3.57)	3.60 (3.40-4.00)	2.50 (2.00-3.00)	3.75 (3.37-4.15)
				t = 2.55 p = .040	Z = -4.539 p < .001	Z = -.044 p = .965	Z = -3.171 p = .002	Z = -.926 p = .354	Z = -.463 p = .643
Speciality	Yes	188	44.5	3.74 ± 0.32	4.11 (3.77-4.66)	3.21 (2.71-3.42)	3.80 (3.60-4.20)	2.50 (2.00-3.00)	4.00 (3.50-4.37)
	No	244	56.5	3.68 ± 0.33	4.11 (3.66-4.55)	3.14 (2.75-3.57)	3.60 (3.40-4.00)	2.25 (2.00-2.75)	3.75 (3.25-4.00)
				t = 1.923 p = 0.055	Z = -1.424 p = .154	Z = -.852 p = .394	Z = -3.071 p = .002	Z = -2.129 p = .033	Z = -4.228 p < .001
Institution Served	1-Private institution	115	26.6	3.67 ± 0.32	3.77 (3.44-4.22)	3.14 (2.85-3.57)	3.60 (3.40-3.80)	2.50 (2.25-3.00)	3.87 (3.50-4.25)
	2-Government institution	181	41.9	3.73 ± 0.33	4.33 (3.77-4.66)	3.14 (2.71-3.57)	3.80 (3.40-4.20)	2.00 (1.75-2.50)	3.75 (3.12-4.00)
	3-University	136	31.5	3.72 ± 0.33	4.16 (3.66-4.66)	3.28 (2.85-3.42)	3.80 (3.40-4.20)	2.50 (2.00-3.00)	3.87 (3.37-4.25)
				F = 1.129 X <sup>2</sup> = 24.348 p = 0.324	p < .001	p = .969	p < .001	p < .001	p = .002
					1-2, 1-3		1-2, 1-3	1-2, 2-3	1-2, 2-3
Chronic Disease	Yes	80	18.5	3.74 ± 0.31	4.22 (3.77-4.55)	3.14 (2.71-3.57)	3.60 (3.40-4.15)	2.25 (2.00-2.75)	4.00 (3.62-4.37)
	No	352	81.5	3.70 ± 0.33	4.11 (3.66-4.55)	3.14 (2.85-3.57)	3.80 (3.40-4.20)	2.50 (2.00-3.00)	3.75 (3.25-4.12)
				t = 0.919 p = 0.358	Z = -.806 p = .420	Z = -.466 p = .641	Z = -.177 p = .860	Z = -1.651 p = .099	Z = -2.744 p = .006

\* X̄: Mean, SD: Standard deviation, M: Median, t: Independent-t test, Z: Mann-Whitney U test, F: One-way ANOVA, X2: Kruskal Wallis-H test

\*\*The numbers 1,2,3 indicate which two groups have a statistically significant difference.

tually, the transmission of the disease to eight other oral healthcare professionals was identified [23]. It is evident that dentists have an important role in COVID-19, as they are an important link in receiving and transmitting the disease.

Although patients diagnosed with COVID-19 are not supposed to take dental treatments, dental emergencies can occur, and close contact would be inevitable. Furthermore, both the relatively prolonged incubation period of the disease and post-infection duration make it challenging for the medical staff to recognize the existence of COVID-19 infections, which could increase the transmission of the

disease during these lay periods<sup>24</sup>. Khader et al. [24] and Al-Ansari [25] reported the rate of 1-14 days of incubation period to be lower (36.1% and 36%, respectively) among Jordanian dentists. Similar to other studies, in this study, the awareness of dentists about the incubation duration was not at the desired level. It is essential to know the right incubation period because of its role in determining the safe period to treat the suspected patients.

The latest findings indicate that asymptomatic patients and patients in incubation period might be carriers. However, symptomatic COVID-19 patients are the still the main contagion source; therefore, being aware of the symp-

**Table 3.** The distribution of the percentages of the responses to HBMF-COVID-19 (N=432).

Sensitivity perception	Strongly disagree n (%)	Disagree n (%)	Hesitant n (%)	Agree n (%)	Strongly agree n (%)
1.I think I have a high probability of catching COVID-19	14 (3.2)	26 (6.0)	70 (16.2)	139 (32.2)	183 (42.4)
2.I'm worried about catching COVID-19	23 (5.3)	40 (9.3)	78 (18.1)	142 (32.9)	149 (34.5)
3.The thought of catching COVID-19 scares me	18 (4.2)	51 (11.8)	75 (17.4)	150 (34.7)	138 (31.9)
4.Causing my patients to be infected with COVID-19 causes me to remorse	2 (0.5)	4 (0.9)	19 (4.4)	99 (22.9)	308 (71.3)
5.I could catch COVID-19 in the coming days	2 (0.5)	25 (5.8)	119 (27.5)	160 (37.0)	126 (29.2)
6.Even if my patient does not show symptoms of COVID-19, I think the disease can be transmitted	1 (0.2)	9 (2.1)	18 (4.2)	126 (29.2)	278 (64.4)
7.I think even if I take care of a single patient, I can catch COVID-19	27 (6.3)	25 (5.8)	59 (13.7)	123 (28.5)	198 (45.8)
8.Even if I don't go to the clinic / hospital / polyclinic every day (by going some days), I think I can catch COVID-19	10 (2.3)	19 (4.4)	61 (14.1)	148 (34.3)	194 (44.9)
9.I think that even if I do not care for a patient in a clinical setting, I think that protective equipment should be used	19 (4.4)	41 (9.5)	75 (17.4)	103 (23.8)	194 (44.9)
<b>Severity perception</b>					
10.COVID-19 is a serious public health problem	1 (0.2)	0 (0.0)	11 (2.5)	49 (11.3)	371(85.9)
11.COVID-19 is not fatal in young people	91 (21.1)	139 (32.2)	110 (25.5)	75 (17.4)	17 (3.9)
12.COVID-19 kills only the elderly and those with chronic diseases	116 (26.9)	157 (36.3)	79 (18.3)	58 (13.4)	22 (5.1)
13.COVID-19 is a disease that can cause labelling in the community	67 (15.5)	100 (23.1)	74 (17.1)	125 (28.9)	66 (15.3)
14.COVID-19 is the worst disease a person can catch	148 (34.3)	176 (40.7)	76 (17.6)	22 (5.1)	10 (2.3)
15.Being a COVID-19 patient makes it difficult for me to do daily activities	12 (2.8)	36 (8.3)	96 (22.2)	151 (35.0)	137 (31.7)
16.Being a COVID-19 patient disrupts my relationships with the family / social environment	34 (7.9)	61 (14.1)	71 (16.4)	123 (28.5)	143 (33.1)
<b>Benefit perception</b>					
17.Using protective equipment significantly reduces the risk of catching COVID-19	1 (0.2)	4 (0.9)	31 (7.2)	145 (33.6)	251 (58.1)
18.Having adequate protective equipment increases my motivation for treatment	2 (0.5)	15 (3.5)	40 (9.3)	143 (33.1)	232 (53.7)
19.Having of adequate protective equipment ensures that work in the workplace continues routine / smoothly	20 (4.6)	26 (6.0)	101 (23.4)	136 (31.5)	149 (34.5)
20.Working in an environment where precautions for the disease are taken fully enables me to communicate with my family / social environment more easily	6 (1.4)	35 (8.1)	88 (20.4)	139 (32.2)	164 (38)
21.The fewer patients are cared for, the lower the risk of catching COVID-19	14 (3.2)	19 (4.4)	84 (19.4)	149 (34.5)	166 (38.4)
22.Having chronic disease or being old is a reason not to compromise on preventive measures	22 (5.1)	17 (3.9)	20 (4.6)	114 (26.4)	259 (60.0)
23.If COVID-19 infects me, I'll be immune to the disease as soon as possible	60 (13.9)	90 (20.8)	209 (48.4)	54 (12.5)	19 (4.4)
24.If the entire community is infected with COVID-19, the effect of the disease decreases in a short time / the entire community becomes immune	69 (16.0)	92 (21.3)	176 (40.7)	62 (14.4)	33 (7.6)
<b>Barrier perception</b>					
25.Working using extra protective equipment is more tiring than ever	3 (0.7)	10 (2.3)	12 (2.8)	111 (25.7)	296 (68.5)
26.Working using extra protective equipment complicates the treatment process	6 (1.4)	24 (5.6)	28 (6.5)	113 (26.2)	261 (60.4)
27.Taking extra protective measures makes me think that 'I'm offending my patient'	178 (41.2)	138 (31.9)	66 (15.3)	29 (6.7)	21 (4.9)
28.I'm worried about saying that I can't do/ will postpone a non-emergency treatment (from the possibility of experiencing violence, etc.)	62 (14.4)	82 (19.0)	75 (17.4)	111 (25.7)	102 (23.6)
<b>Self-efficacy perception</b>					
29.I believe I can ask if the patient I'm treating is COVID-19 positive	0 (0.0)	9 (2.1)	31 (7.2)	130 (30.1)	262 (60.6)
30.I believe I can fully question the symptoms of COVID-19 of the patient I am treating	2 (0.5)	18 (4.2)	63 (14.6)	150 (34.7)	199 (46.1)
31.I believe that I will work by taking all protective measures until the pandemic process is over	10 (2.3)	23 (5.3)	94 (21.8)	133 (30.8)	172 (39.8)
32.I believe that I will not care for patients unless protective equipment is provided during the pandemic process	15 (3.5)	32 (7.4)	87 (20.1)	110 (25.5)	188 (43.5)
33.I believe that I will use rubber-dam in every treatment during the pandemic process	128 (29.6)	71 (16.4)	142 (32.9)	52 (12.0)	39 (9.0)
34.I believe that I will use rubber-dam correctly during the pandemic process	124 (28.7)	61 (14.1)	135 (31.3)	62 (14.4)	50 (11.6)
35.I believe that if the necessary protective measures are interrupted in the clinic where I work during the pandemic process, I will share the situation with the institution managers	12 (2.8)	15 (3.5)	50 (11.6)	143 (33.1)	212 (49.1)
36.I believe that if necessary protective measures are interrupted in the clinic where I work during the pandemic process, I will share the situation with a higher institution if necessary	29 (6.7)	36 (8.3)	95 (22.0)	103 (23.8)	169 (39.1)

toms, especially temperature monitoring in cases with fever, which was the most reported symptom, before dental treatment becomes important [26,27]. Almost all dentists in this study (99.8 %) reported that fever is a symptom of the disease, and the majority (93.1 %) of them reported that measuring the temperature is important. However, some dentists (19 %) did not measure the temperature in the clinic, contrary to the recommendations. Before directing the patients to the dental chair, it is recommended to measure their body temperature first using a contact-free forehead thermometer. Additionally, the patients must be questioned about risk factors for a potential infection. Finally, the patient can sit on the dental chair only if all parameters are negative [14,28]. Similar to our research, Al-Ansari [25] evaluated the dentists' thought on COVID-19 and reported that majority were aware of the symptoms (98.6% fever, 91% cough and 86% shortness of breath). Despite that, in the same research, only 18% of dentists reported that COVID-19 was very dangerous and 38% reported that COVID-19 was not a critical public health problem. Additionally, half of the dentists reported that they would treat patients with COVID-19 and ask them to go to a hospital. These results were interpreted as the dentists' perception of the seriousness of COVID-19, which was low, similar to a study in Jordan by Al-Ansari [25]. COVID-19 forced all healthcare professionals to do many new preventive behaviors [29]. However, no matter how stringently these measures are recommended, a fraction of people may still not believe that they should act in ways that will limit the threat [5]. This situation can be a risk to both healthcare professionals and patients under treatment [6].

In this study, the beliefs and behaviors of dentists regarding COVID-19 to prevent transmission was searched using an HBM. HBM is a health behavior change model, which was developed to explain and predict health-related behaviors [30]. The only study that used an HBM on dentists for the preventive measures against COVID-19 was conducted by Nasir et al. [16] In this study, most dentists (70.8%) believed that performing COVID-19 measures is beneficial (perceived benefit), while 50% believed that there are situations that prevent (perceived barrier) them from performing the measures. In a study of Jose et al. [31] using an HBM, which mostly consisted of young people, they reported that although there was a good perceived knowledge (88%) about the situation of the COVID-19 pandemic, the perceived knowledge for preventive measures (38%) was poor, indicating the need for behavioral changes. Similar to our study, the measures taken in dentists' own clinic were not as high as their knowledge rates. While 97.7% of dentists reported the necessity of patient isolation, the rate of performing it in their own clinic fell to 70.4%. Likewise, although all dentists reported the necessity of limiting the number of people and using all the protective equipment in a working environment, the rate of performing them fell to 74.1% and 31%, respectively. Moreover, the hand washing rate decreased from 99.5% to 93.1%. The precautions here are particularly compulsory extra universal safety precautions for COVID-19 [32]. This situation can be a risk to both healthcare workers and patients who will receive dental treatment. For this reason,

it is necessary to determine the reasons why dentists do or do not follow the preventive behaviors when working in close contact with other people. It is also important to provide solutions for them.

In the present study, the health belief score of dentists was  $3.71 \pm 0.33$ . Additionally, the perceived seriousness (severity), perceived benefits, and self-efficacy perception sub-dimension scores were less than four, and the perceived barrier sub-dimension score was less than three. These findings might explain why dentists know the recommended preventive measures but do not perform them all. In a study carried out by Siavashani et al. [10], the dental students of the endodontic department were trained for infection control in dentistry to prevent the transmission of dangerous diseases, such as AIDS and hepatitis, based on HBM. There was a significant increase in the knowledge and performance scores of students who were trained compared to those who were not. Another study by Sedigh et al. [12] reported the positive changes in many health beliefs and preventive behaviors for needle injuries and blood-borne pathogens in nurses after the training program based on HBM. All these results suggest that health beliefs should also be considered when planning the attempts to improve the healthcare workers' preventive behaviors toward infections.

A certain level of sensitivity perception is a driving force in performing the preventive behaviors [33]. In this study, the sub-dimension with the highest score level was sensitivity perception (4.11). If COVID-19 infection is considered in the framework of HBM, it could be interpreted that a person would comply more likely with the recommended preventive behaviors if he/she perceives being susceptible to the infection (perceived susceptibility) and thinks that the infection could lead to serious consequences (perceived severity). The infectious disease outbreaks are frequently characterized by an overall climate of fear [34]. There was a global shortage of personal protective equipment at the beginning of the COVID-19 pandemic [29]. The lack of appropriate preventive measures was a source of concern and stress for healthcare professionals [35]. As a result, in this study, some of the preventive behaviors' scores (proper medical waste disposal, maintaining personal hygiene, use of visors, use of surgical mask, use of apron, etc.) were above 85%. Similarly, in a study by Moon and Hong [11], the dental hygienists with an increased perception of sensitivity and decreased perception of barrier did the expected performance more. However, the perception of seriousness (severity) score (3.14) in this study was not as high as the perception of sensitivity score. This might be one of the reasons why not all preventive behaviors were performed. In another study conducted with dentistry students, it was reported that the oral health beliefs significantly affected the oral health behaviour. In addition, the sensitivity and severity perceptions were reported to be the determinant variables on preventive behaviors [36].

The barrier perception of dentists was the lowest sub-dimension score in this study (2.50). This result can be interpreted as dentists believe that there are situations preventing them from performing the preventive behaviors at a high level. When the responses related to barrier perception were examined, over 80% of dentists responded, "I

agree” or “strongly agree” that working with an extra protective equipment is more tiring than ever, and “working with an extra protective equipment complicates the treatment process.” Similarly, Ong et al. [37] reported that over 82% of healthcare professionals (nurse, doctor, and paramedical staff) had headache related to the use of N95 face mask and protective eyewear. In a similar study conducted in Saudi Arabia, 70.8% of dentists believed that the measures against COVID-19 are beneficial, whereas 50% believed there are barriers to perform these measures [16]. These results show that it is important to identify the perceptions of barrier in order to identify the situations that prevent the healthcare personnel from performing the preventive behaviors and to provide solutions for them.

## Conclusion

This study provides important insights about dentists’ knowledge, beliefs and behaviors regarding covid-19 transmission. Most dentists had knowledge about COVID-19 (its symptoms, contagion path, and incubation period) and knew the precautions to be taken in a dental clinic. The participants were largely aware of all preventive behaviors, but the rate of performing these behaviors was lower. The belief and behaviour scores regarding COVID-19 measures were not found at the desired level to prevent further transmission. Having high barrier perceptions point to, there are situations that prevent dentists from performing preventive behaviors in working areas.

It is important for dentists who had continued to provide their health services during the pandemic to adapt to behavioural changes towards preventing disease transmission in a short time. Health beliefs are the key to help better adopt preventive behaviors. Therefore, determining their perceptions that encourage or prevent them from performing the preventive behaviors in their clinics is important. Particularly, public health nurses or occupational health nurses play a pivotal role in preventing infection transmission in the workplace. Nurses can demonstrate situations that encourage dentists to incorporate preventive measures and understand how competent they feel about implementing the measures, how seriously they consider and deal with the disease, how much they believe in the benefits of the measures, and the obstacles associated with taking the precautions on the basis of available evidence by using models such as the Health Belief Model. They can share these data and their reflections on the job with administrators. Therefore, they can enable them to make arrangements in accordance with pandemic conditions in matters such as material supply, ventilation of the working environment, number of patients, and working time. They can fill the communication gaps between employees and the management by identifying perceptions that underlie the behaviors and that dentists are generally reluctant to share with their managers. Taking into account the factors that facilitate and prevent dentists from implementing preventive measures, they can plan initiatives such as education and awareness studies. Infection control procedures should be frequently evaluated to identify the barriers against preventive behaviors and to improve dentist and patient safety. In conclusion, we recommend the use of the Health Belief Model to guide more interventions towards improving the preventive measures. Using

the form (HBMF-COVID-19) developed in the study, it is recommended to develop new measurement tools that have been validated and reliable for different occupational groups, including nurses. Such initiatives can also contribute to the creation of evidence-based guidelines and public health policies.

## Limitations

This study had some limitations. First, the data were collected from the digital environment due to the limited conditions caused by the pandemic. Hence, it did not allow for random sampling to select individuals. Second, the data were collected within a specific time period during the pandemic. Thus, it may be argued that the knowledge, beliefs, and behaviors of dentists might change with the emerging research and possible treatment for COVID-19. Third, the data were based on self-reports. Fourth, this study was conducted only on dentists working in Turkey. Therefore, the results of this study can only be generalized to the individuals included in this study.

## Ethics approval

This study was conducted in full accordance with the World Medical Association Declaration of Helsinki. The Ethics Committee of Kocaeli University approved all the study procedures (Ethics Code: 2020/103-12.05.2020).

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