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ORIGINAL RESEARCH

Factors Associated with Infection-Control Behavior of Dental Health–Care Workers During the COVID-19 Pandemic: A Cross-Sectional Study Applying the Theory of Planned Behavior

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Objective: The objective of this study was to evaluate the usefulness of the extended theory of planned behavior (TPB) in predicting COVID-19-infection prevention and control (IPC) among a sample of dental health–care workers (DHCWs) in Saudi Arabia and to examine their behavioral beliefs, normative beliefs, and control beliefs to better understand their views about COVID-19 IPC.

Methods: An online cross-sectional survey was administered among DHCWs in Saudi Arabia using convenience sampling. A questionnaire collected data on demographic characteristics and the 43 items from the TPB construct. One-way ANOVA and Independent sample *t*-tests were used to establish factors associated with TPB-construct scores. Multiple regression analyses with adjusted effects were used to identify significant predictors for intention from attitudes, subjective norms, and perceived behavioral control variables. The significance level was set at 0.05.

Results: A total of 324 study participants completed the questionnaire for a response rate of 40.5%. The majority of respondents were male (59.8%) and aged 25–30 years (32.7%), followed by 31–35 years (31.2%). Only 28.4% reported having participated in IPC activities. With a mean of 41.60±6.26), it was evident that study participants had a favorable attitudes toward COVID-19 IPC. Subjective norms and perceived behavioral control subscale scores were low, with the means of 28.95±5.44) and 34.89±6.49), respectively. The constructs of attitude toward behavior ($p<0.001$) and subjective norms ($p<0.001$) significantly predicted the DHCWs' intention to practice COVID-19 IPC behavior, accounting for 44.3% of the variance.

Conclusion: The current study suggests that the attitudes and subjective norms of DHCWs significantly predicted their intentions regarding COVID-19 IPC behavior. As such, it is recommended that comprehensive education and training programs on infection control pertaining to COVID-19 be implemented among DHCWs in Saudi Arabia so that their attitudes and behavior toward infection prevention are amplified.

Keywords: COVID-19, infection prevention and control, oral health providers, dental health–care workers, theory of planned behavior

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Introduction

The current COVID-19 pandemic has placed us in unprecedented times. Within 1 month of the first case identification in China, the virus had spread internationally to affect over 20 countries, including countries from Asia, Europe, North America, and

the Middle East.[1] At the time of writing, (May 25, 2020), the number of people infected by the virus has surpassed 5,500,000, with over 347,000 deaths.[2] The public health authorities have rightfully directed their focus toward the care of patients and communities, and countries that were better than others in dealing with this situation have thoughtfully decided to consider reopening businesses, including dental services. However, the threat of cross-infection still exists and the dental health–care workers (DHCWs) are invariably at greater risk of contracting a viral infection, such as COVID-19.

In Saudi Arabia, clusters of health-care workers positive for COVID-19 have been identified in hospital settings and long-term care facilities, but no clusters have yet been reported in dental settings or personnel.[3] The country has experienced a situation similar to this in 2012, when the emergence of MERS-CoV (Middle East respiratory syndrome coronavirus) outbreak resulted in a major public health crisis, involving 2,494 laboratory-confirmed cases and 858 mortalities.[4–6] However, the current infection is manyfold more fatal, especially due to the long latency of SARS-CoV-2 and its ability to go undetected. On March 2, 2020, the Ministry of Health confirmed the first case of COVID-19 in the country. As of today (May 25, 2020), there are more than 72,560 cases, with 34,520 recoveries and 390 deaths.[7]

The means of spread of this dreadful infection is primarily through respiratory droplets via close human-to-human contact. Airborne transmission from person to person over long distances is unlikely.[8] However, there is evidence of the contribution of aerosols or droplet nuclei to close-proximity transmission.[9] Also, the virus has been shown to survive in aerosols for hours and on surfaces for days.[10] There are also indications that patients may be able to spread the virus while still presymptomatic or asymptomatic.[11] It is worthy of note that the practice of dentistry involves the use of rotary dental and surgical instruments, such as handpieces or ultrasonic scalers and air–water syringes. These instruments create a visible spray that contains large-particle droplets of water, saliva, blood, microorganisms, and other debris.[9] This spatter travels a short distance and settles quickly, landing on the floor, nearby operating surfaces, DHCWs, or patients. This infers that infection-control principles and practices, such as the use of personal protective equipment, are extremely necessary to prevent cross-contamination in a dental setting.[9] The intention to be at the forefront in using precautionary measures to prevent infection transmission will not only keep DHCWs safe but also their patients.[12] Patient safety in the dental clinic is a critical discipline that is associated with oral health treatment and prevention of undesired events in a dental setting.[13,14]

The theory of planned behavior (TPB) is a structure developed by Icek Ajzen in 1991 that emphasizes attitudes, subjective norms, and perceived behavioral control (PBC) to predict human behavior and behavioral intentions.[15,16] It consists of six main constructs, ie, behavior beliefs, attitude toward the behavior, normative beliefs, subjective norm, control beliefs, and perceived behavioral control.[31] The current study is the first to utilize the TPB as a theoretical framework to assist in examining DHCW compliance with COVID-19 infection-control policies during delivery of dental care. The objective was to evaluate the usefulness of the extended TPB in predicting COVID-19 infection prevention and control (IPC) among a sample of DHCWs in Saudi Arabia and to examine their behavioral beliefs, normative beliefs, and control beliefs to better understand their views on COVID-19 IPC.

Methods

Study Design and Sample

The current study utilized an online cross-sectional survey to assess COVID-19 IPCbehavior among DHCWs (dentists, dental hygienists, and assistants) in Saudi Arabia, regardless of their place of work (dental schools, private clinics, hospitals, or health centers).

Data-Collection Process

An online survey was conducted in April 2020, and a prevalidated questionnaire via Google Forms was sent to the target sample to collect the data. The online survey link was disseminated through social media (WhatsApp, Facebook, and Twitter) and email among a convenience sample of DHCWs. Once the link was accessed, participants were able to view a brief description of the study, and the questionnaire began only after obtaining informed consent from each of the study participants. The survey was open for 20 days, and anonymity of responders was maintained. Data collection commenced after the ethics approval had been obtained from the Institutional Review Board (CODJU2004F) at the College of Dentistry of Jazan University.

Study Instrument

The questions in the survey were developed after reviewing pertinent literature and COVID-19 infection-control recommendations by the Centers for Disease Control and Prevention.[9] The questionnaire was in English and recorded information on demographics and the six TPB

constructs of infection control. Two dental public–health professors at Jazan University were asked to review the questions and then provide suggestions to improve clarity and accuracy. In addition, a pretest was conducted by email among 20 oral providers to confirm the reliability and validity of the questionnaire (ICC=0.94).

Study Variables and Measures

The first part of the questionnaire included questions on sex, age, workforce type, work affiliation, nationality, education, years of experience, and participation in infection-control activities. The second part comprised 43 items to examine the constructs of the TBP (intention, two questions; attitudes, ten questions; subjective norms, eight questions; PBC, ten questions; and knowledge and practice, 13 questions) in explaining COVID-19 IPC by DHCWs.

The second part of the survey included questions about knowledge, practice, and TBP constructs regarding COVID-19 IPC. Thirteen statements were used to assess knowledge and practice using such items as "How would you rate your knowledge of IPC of the new COVID-19?" "and "During theCOVID-19 pandemic, how often have deferred dental treatment for nonemergency treatment or removed personal protective equipment (PPE) carefully?" Knowledge scores ranged from 0 to 15. The cutoff was set at 12 points (representing 80%), and scores <12 represented poor knowledge and ≥12 good knowledge. The maximum score for the practice scale was 50, with higher scores indicating better practices. The cutoff for practice was set at 40 (representing 80% of the total mean), and scores of <40 represented poor practice and ≥40 good practice. Two statements were used to assess intention of the participants: "I intend to practice COVID-19 IPC in my clinic on a regular basis" and "I intend to practice infection control regarding COVID-19 in my facility on a regular basis." Response options were measured using five-point semantic differential scales ranging from unlikely to likely. The maximum score for this scale was 10, with higher scores indicating positive intentions. The cutoff of 8 represented 80% of the total mean, and <8 was set as negative intentions and ≥8 as positive intentions.

Ten statements were used to assess attitudes, consisting of behavior beliefs and evaluation of behavioral outcomes. Five statements were used to assess behavior beliefs, eg, "Practicing COVID-19 IPC will help me gain a better understanding of infection prevention and control", "Practicing COVID-19 IPC will protect the staff in the dental clinic", and "Practicing COVID-19 IPC will help in preventing spread of viral disease in the dental clinic." Response options were measured using five-point semantic differential scales ranging from unlikely to likely. Five statements were used to assess evaluation of behavioral outcomes, eg, "For me, to gain a better understanding of COVID-19 infection prevention and control in my dental clinic is . . .", "For me, to prevent spread of viral infections, such as COVID-19, in the dental clinic is . . .", and "For me, to prevent bacterial growth in the dental clinic is . . .." Response options were measured using five-point semantic differential scales ranging from not important to important. The maximum score for attitudes was 50, with higher scores indicating favorable attitudes. The cutoff of 40 represented 80% of the total mean: <40 was set as less favorable attitudes and ≥40 as favorable attitudes.

Eight statements were used to assess subjective norms, which consist of normative beliefs and motivation to comply. Four statements were used to assess normative beliefs, eg, "Most colleagues who are important to me think that I should perform COVID-19 IPC practice in my dental clinic" and "Most colleagues who are important to me practice COVID-19 IPC regularly in their dental clinic." Response options were measured using five-point semantic differential scales ranging from strongly disagree to strongly agree. Four statements were used to assess motivation to comply, eg, "How much do you care whether your colleagues think you should perform COVID-19 IPC practice in your dental setting?" and "How much do you care whether your colleagues who are practicing COVID-19 IPC practice regularly in their dental clinic?" Response options were measured using five-point semantic differential scales ranging from not at all to very much. The maximum score for this scale was 40, with higher scores indicating high subjective norms. The cutoff of 32 represented 80% of the total mean, and <32 was set as less subjective norms and ≥40 high subjective norms.

Finally, ten statements were used to assess PBC, which consists of control beliefs and perceived power. Five statements were used to assess control beliefs, eg, "I am confident that I have enough experience to practice COVID-19 IPC on a regular basis in my clinic," "I have enough time and resources to practice COVID-19 IPC on a regular basis in my clinic," and "I am confident that funding and support of administration will help me to practice COVID-19 IPC on a regular basis in my clinic." Response options were measured using five-point semantic differential scales ranging from strongly disagree to strongly agree. Five

Table 1 Descriptive statistics of study participants (n=324)

	N (%)
Sex	
Male	244 (75.3)
Female	80 (24.7)
Age, years	
25–30	106 (32.7)
31–35	101 (31.2)
36–40	54 (16.7)
41–45	37 (11.4)
46–50	12 (3.7)
>50	14 (4.3)
Dental workforce types	
Dentists	220 (67.9)
Not dentists (assistants, hygienists)	4 (1.2)
Interns/students	100 (30.9)
Current position	
Academic	60 (18.5)
Clinical	160 (49.4)
Intern/student	104 (32.1)
Current work affiliation	
Public	240 (74.1)
Private	56 (17.3)
Both	28 (8.6)
Nationality	
Saudi	304 (93.8)
Non-Saudi	20 (6.2)
Education	
Below bachelor's	104 (32.1)
Bachelor's	132 (40.7)
Above bachelor's	88 (27.2)
Experience	
0–5 years	212 (65.4)
6–10 years	64 (19.8)
11–15 years	32 (9.9)
16–20 years	0
>20 years	16 (4.9)
Participation in dental infection–control activities	
Yes	92 (28.4)
No	232 (71.6)

statements were used to assess perceived power, eg, "Having enough experience would make practicing COVID-19 IPC on a regular basis in my clinic . . .", "Having enough time and resources would make practicing COVID-19 IPC on a regular basis in my clinic . . .", and "Funding and support of administration would make practicing COVID-19 IPC on a regular basis in my clinic . . .". Response options were measured using five-point semantic differential scales ranging from much easier to more difficult. The maximum score for PBC was 50, with higher scores indicating favorable attitudes. The cutoff of 40 represented 80% of the total mean, and <40 was set as low PBC and ≥40 high PBC.

Data Analyses

The questionnaire was precoded for entry into the database from a coding sheet. Subsequently, descriptive statistics (percentages and means) were utilized to provide an overview of each variable. One-way ANOVA and *t*-tests were used to establish factors associated with TPB-construct scores. Multiple regression analyses with adjusted effects were used to identify significant predictors for intentions from the attitudes, subjective norms, and PBC variables. The significance level was set at 0.05, and all analyses were performed using SPSS version 25.0.

Results

There were 600 overall responders, and 324 completed the questionnaire. These were considered the final sample, for a response rate of 54%. Table 1 shows the characteristics of the study sample. The majority of respondents were male (59.8%) and aged 25–30 years (32.7%), followed by 31–35 years (31.2%). Most (67.9%) were working as dentists in clinical specialities (49.4%). Nearly 74% of the study participants worked in the public sector, and 93.8% were Saudi nationals. With regard to qualifications, 27.2% had higher than a bachelor's degree, 40.7% a bachelor's degree, and 32.1% less than a bachelor's degree (eg, diplomas and certificates). As for experience, 65.4% had 5 years or less experience and about 4.9% had >20 years of experience. Only 28.4% reported having participated in infection-control activities.

Table 2 presents the distribution of means and SDs for intentions, attitudes, subjective norms, PBC, knowledge, and practice of COVID-19IPC) behavior, with Cronbach's α of 0.94 for behavioral intention. Behavioral intention scores ranged from 2 to 10, with a mean of 8.38±1.57). This indicated that the DHCWs had positive intentions toward COVID-19 IPC behavior. Cronbach's α for the DHCW attitudes toward positive behavior was 0.91. With a mean of 41.60±6.26) it was evident that study participants had favorable attitudes toward COVID-19 IPC. Cronbach's α for subjective norms and PBC was 0.95 and 0.88, respectively. Subjective norm and PBC subscale scores were low, with the

Table 2 Distribution of range, means and standard deviation of intention, attitude, subjective norm, perceived control, knowledge and practice as predictors of COVID-19 infection prevention and control (n= 324)

Construct	Final items, n	Mean	SD	Minimum score	Maximum score	Possible range	Cronbach's α
Intention	2	8.38	1.57	4	10	2–10	0.94
Attitudes	10	41.60	6.26	23	50	5–50	0.91
Subjective norms	8	28.95	5.44	11	35	8–40	0.95
PBC	10	34.89	6.49	21	50	10–50	0.88
Knowledge	3	10.42	2.15	5	15	3–15	0.64
Practice	10	14.19	20.06	10	50	10–50	0.85

Abbreviation: PBC, perceived behavior control.

means of 28.95±5.44) and 34.89±6.49), respectively. Cronbach's α for knowledge was 0.64, and the mean for overall knowledge of COVID-19 IPC among the practitioners was good (10.42±2.15). Finally, Cronbach's α for practice was 0.85, with a very low mean of 14.19±20.06).

Table 3 shows results of independent *t*-tests and one-way ANOVA to determine if there were significant differences in means of the six TPB-construct scores based on sex, age, workforce type, current position, work affiliation, nationality, years of experience, and participation in dental infection–control activities. Age (p=0.02), workforce type (p=0.004), and work affiliation (p=0.02) were significantly associated with intentions toward COVID-19 IPC behavior. The older age-group and academic field professionals (public and private) showed significantly more positive intentions than the younger age-group and those who worked in the clinical field. DHCW current position and experience were also significantly associated with attitudes toward COVID-19 IPC behavior (p<0.05). Providers who worked in academic fields as student or faculty were more likely to practice COVID-19 IPC than those who worked in private dental clinics. In addition, providers with ≤5 years' experience were more likely to practice COVID-19 IPC behavior than other groups. Subjective norms, however, were associated only with age (p=0.0.5), ie, the older age-group showed significantly better subjective norms than the younger age-group. Providers aged -41–45 years and 46–50 years showed significantly better PBC than the other age-groups. The findings also indicated that dental assistants and hygienists had better PBC than dentists, interns or students.

Multiple linear regression was conducted to investigate predictors of COVID-19 IPC behavior in DHCWs. Constructs of attitudes towards behavior (p<0.001) and subjective norms (p<0.001) significantly predicted participants' intentions regarding COVID-19 IPC behavior, accounting for 44.3% of the variance. The finding also showed standardized coefficients of 0.098, 0.090. and 0.003 for attitudes, subjective norms, and PBC, respectively. It can then be interpreted that for each percentage increase in these variables, the intention to practice COVID-19 IPC behavior will increase by about 9.8%, 9.0%, and 0.3%, respectively (Table 4).

Discussion

The current study provides an insight on the intentions of DHCWs toward COVID-19 IPC from investigating the factors that had an influence on these. Findings demonstrated that the DHCWs had positive intentions toward COVID-19 IPC. This is attributed to their sound knowledge on COVID-19. Recent studies in a similar study population are in accordance with this and substantiate that the DHCWs in Saudi Arabia have an acceptable level of knowledge about COVID-19.[17–19] This is also supported by a study conducted by Nguyen et al in 2019.[20] In their report, the strongest relationship with intentions was demonstrated by knowledge and attitudes. The current study found that there was a significant difference in attitudes regarding COVID-19 IPC by workforce type and years of experience. This finding is consistent with two earlier studies.[21,22] Intentions toward positive COVID-19 IPC behavior was also significantly associated with the age, current position, and work affiliation of the DHCWs. The older age-group work in the academic field in both public and private sectors demonstrated greater positive intentions than the younger age-group. This could be because of the increased experience of the older participants with similar viral infections, such as SARS CoV1 and MERS, that had occurred earlier in Saudi Arabia. However, these findings were not comparable with other findings, due to lack of availability of similar reports.

The current study also found a significant difference in mean COVID-19 IPC subjective norms by age: older DHCWs had greater subjective norms than their younger counterparts. This can be attributed to social pressure from colleagues or managers, older and more experienced DHCWs, by comparing their work with peers

Table 3 Associations of theory of planned behavior and participant characteristics

	n (%)	Behavioral intention		Attitude toward behavior		Subjective norm		PBC	
		Mean (SD)	*p*	Mean (SD)	*p*	Mean (SD)	*p*	Mean (SD)	*p*
Sex									
Male	44 (75.3)	8.39 (1.47)	0.83[a]	41.74 (5.97)	0.51[a]	32.70 (6.43)	0.36[a]	5.15 (6.96)	0.08[a]
Female	80 (24.7)	8.35 (1.86)		41.20 (7.11)		33.45 (5.78)		33.70 (4.68)	
Age, years									
25–30	106 (32.7)	8.22 (1.46)	**0.02**[b]	41.09 (6.81)	0.48[b]	31.55 (5.68)	**0.01**[b]	32.35 (5.33)	**<0.001**[b]
31–35	101 (31.2)	8.09 (1.85)		41.11 (7.05)		32.54 (7.25)		35.22 (6.56)	
36–40	54 (16.7)	8.69 (1.49)		42.28 (5.43)		33.63 (6.59)		35.16 (6.55)	
41–45	37 (11.4)	8.92 (1.30)		43.16 (4.53)		35.08 (5.17)		38.11 (7.20)	
46–50	12 (3.7)	8.50 (0.90)		42.50 (4.52)		34.00 (3.62)		38.50 (4.52)	
>50	14 (4.3)	9.00 (0.88)		41.57 (3.20)		35.93 (3.15)		36.86 (7.13)	
Dental workforce type									
Dentists	220 (67.9)	8.31 (1.66)	0.40[b]	41.36 (6.41)	0.48[b]	33.20 (6.71)	0.43[b]	35.69 (6.56)	**<0.001**[b]
Not dentists	4 (1.2)	9.90 (0.00)		40.00 (0.00)		32.00 (0)		38.00 (0)	
Intern/student	100 (30.9)	8.52 (1.37)		42.20 (6.03)		32.24 (5.32)		32.72 (5.98)	
Current position									
Academic	60 (18.5)	8.80 (1.34)	**0.004**[b]	42.93 (5.54)	**0.04**[b]	34.60 (5.97)	0.07[b]	36.53 (7.15)	**<0.001**[b]
Clinical	160 (49.4)	8.10 (1.72)		40.75 (6.63)		32.50 (6.84)		35.54 (6.28)	
Intern/student	104 (32.1)	8.58 (1.37)		42.15 (5.91)		32.50 (5.38)		32.65 (5.87)	
Work affiliation									
Public	240 (74.1)	8.40 (1.59)	**0.02**[b]	41.57 (6.45)	0.53[b]	32.59 (6.74)	0.12[b]	34.57 (6.55)	0.56[b]
Private	56 (17.3)	8.00 (1.53)		41.18 (6.25)		33.03 (4.38)		35.22 (6.05)	
Both	28 (8.6)	9.00 (1.27)		42.79 (4.46)		35.14 (4.94)		35.79 (6.83)	
Nationality									
Saudi	304 (93.8)	8.35 (1.60)	0.22 [a]	41.59 (6.38)	0.89[a]	32.93 (6.44)	0.61[a]	34.72 (6.49)	0.47[a]
Non-Saudi	20 (6.2)	8.80 (1.01)		41.80 (4.23)		32.20 (2.93)		35.80 (6.57)	
Education									
<Bachelors	104 (32.1)	8.52 (1.37)	0.09[b]	42.20 (6.03)	0.23[b]	32.24 (5.32)	0.31[b]	32.72 (5.98)	**0.001**[b]
= Bachelors	132 (40.7)	8.12 (1.74)		40.79 (6.62)		32.73 (7.03)		35.48 (6.55)	
> Bachelors	88 (27.2)	8.59 (1.51)		42.22 (6.03)		33.91 (6.18)		36.00 (6.59)	
Experience									
0–5 years	212 (65.4)	8.30 (1.64)	0.18[b]	42.00 (6.25)	**0.01**[b]	32.87 (6.14)	0.66[b]	34.23 (6.29)	0.21[b]
6–10 years	64 (19.8)	8.31 (1.66)		41.44 (7.78)		32.69 (7.31)		36.00 (7.36)	
11–15 years	32 (9.9)	8.75 (1.11)		41.74 (3.40)		34.00 (5.59)		35.50 (5.16)	
16–20 years	0	0		0		0		0	
>20 years	16 (4.9)	9.00 (0.73)		36.75 (4.64)		31.75 (4.97)		35. 75 (7.32)	
Participation in dental infection–control activities									
Yes	92 (28.4)	8.57 (1.48)	0.19[a]	42.04 (6.73)	0.43[a]	33.87 (6.35)	0.08[a]	35.83 (6.63)	0.07[a]
No	232 (71.6)	8.31 (1.60)		41.43 (6.07)		32.50 (6.22)		34.37 (6.40)	

Notes: [a]*t*-test used for significance; [b]ANOVA used to test for significance. Bold *p*-values indicate significant relationships.
Abbreviation: PBC, perceived behavior control.

who are younger and more enthusiastic. The result is further elaborated with the perspective of their workplace culture, which was related to positive IPC behavior.[23] As such, to facilitate positive behavior, readily accessible infection-control products are essential in the DHC settings.

Table 4 Adjusted estimates for COVID-19 infection prevention and control as predicted by the behavior intention and PBC (n=324)

	β	SE (*β*)	*t*	*p*
Attitude	0.098	0.013	7.643	**<0**
Subjective norms	0.090	0.015	6.778	**<0**
PBC	0.003	0.011	0.730	0.466

Notes: R^2=0.443; adjusted R^2=0.438; n=324. Bold P-values indicate significant relationships.
Abbreviation: PBC, perceived behavior control.

Attitudes and subjective norms significantly predicted DHCW intentions regarding COVID-19 IPC behavior. Intentions correlated with their behavior, and attitudes seemed to be a greater contributor to intentions and behavior than subjective norms.[24] Finally, an important finding from the current study is that a fairly high number of DHCWs in Saudi Arabia did not take part in infection-control activities or conferences, and this finding was in contrast to another study concurs with.[25] Baseline levels of intentions and attitudes toward COVID-19 IPC behavior in DHCWs of Saudi Arabia can be viewed as favorable, with fair levels of subjective norms and PBC. Age of participants was a significant predictor of intentions, subjective norms, and PBC. In addition, intentions toward COVID-19 IPC were associated with current position and work affiliation. Attitudes were significantly associated with current position and years of experience. It is imperative that additional factors or possible variables be added to further enhance the theory application in predicting intentions to practice COVID-19 IPC behavior.[26]

The following are the strengths of this study. As a cross-sectional study, it allowed the researchers to capture a snapshot of the target population regarding intentions toward COVID-19 IPC behavior at a time that movement was restricted. Cross-sectional studies serve as a quick and inexpensive method of collecting useful information. This study was particularly useful in planning and designing appropriate measures for weak aspects of the DHCWs that could hamper their ability to comply with the infection-control policies during the COVID-19 pandemic. However, there are certain limitations to discuss. The study sample consisted of more males (60%) than females, which might be explained by the greater number of male DHCWs in Saudi Arabia.[27] A low response rate resulted in a smaller-than-expected sample, based on the number of DHCWs in the country — >16,000.[27] This could have been caused by the short period of data collection. This means that those who were active on social media during the short period of data collection were the only ones that had the chance to participate in the study. Although the response rate was low, it is approximately similar to response rates in two earlier studies.[28,29] Lastly, cross-sectional data collection can be interpreted only as an association, rather than a cause–effect relationship.In future, studies should report on effective strategies and training for improving oral health providers' infection-control practices. This is corroborated by Ferdous et al,[30] who highlighted the need for continuous training in COVID-19 knowledge and attitudes so that health providers are able to understand and apply safe practices.

Significance of the Study

The recent COVID-19 outbreaks have had a tremendous impact not only on the health of the public and health-care facilities but also on health-care workers, in particular dental professionals. To the best of our knowledge, this is the first study to evaluate COVID-19 IPC using TBP among DHCWs in Saudi Arabia. Due to the scarcity of data, proper education and training programs by governmental authorities are difficult to implement. This study provides measures for future investigations by academicians and practitioners alike. It reports gaps that exist in the actual practice of COVID-19 IPC by predicting the intentions of DHCWs and enhancing the scope of IPC-related policies.

Conclusion

To conclude, the current study is the first to apply the TPB to determine factors that influence the intention of DHCWs toward practicing infection-control measures during the COVID-19 pandemic. Attitudes and subjective norms significantly predicted intentions regarding COVID-19 IPC behavior. It is recommended that comprehensive education and training programs on infection-control policies pertaining to COVID-19 be implemented so that attitudes of DHCWs toward IPC are enhanced for subsequent prevention of undesired events.

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Author contributions

All authors made a significant contribution to the work reported, whether in conception, study design, execution,

acquisition of data, analysis and interpretation, or in all these areas, took part in drafting, revising, or critically reviewing the article, gave final approval to the version to be published, have agreed on the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

Disclosure

The authors do not have any conflict of interest to declare.

References

1. Holshue ML, DeBolt C, Lindquist S, et al. First case of 2019 novel coronavirus in the United States. *N Engl J Med*. 2020;382(10):929–936. doi:10.1056/NEJMoa2001191
2. Worldmeter. Reported cases and deaths by country, territory, or conveyance; 2020. Available from: https://www.worldometers.info/coronavirus/#countries
3. Ministry of Health M. Health authority of Saudi Arabia. Saudi Arabia: Media Center; 2020.
4. World Health Oganzation. Middle East respiratory syndrome coronavirus (MERS-CoV); 2020. Available from: https://www.who.int/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-(mers-cov)
5. Balkhair A, Al Maamari K, Alawi FB. The struggle against MERS-CoV (the novel coronavirus). *Oman Med J*. 2013;28(4):226. doi:10.5001/omj.2013.66
6. Chafekar A, Fielding BC. MERS-CoV: understanding the latest human coronavirus threat. *Viruses*. 2018;10(2). doi:10.3390/v10020093
7. Worldmeter. World/Countries/Saudi Arabia/Coronavirus cases; 2020. Available from: https://www.worldometers.info/coronavirus/country/saudi-arabia/
8. World Health Organization. *Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations: scientific brief, 27 March 2020*. World Health Organization; 2020.
9. Center for Disease Control and Prevention (CDC). Interim infection prevention and control guidance for dental settings during the COVID-19 response; 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html
10. National Institutes of Health (NIH). New coronavirus stable for hours on surfaces; 2020. Available from: https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces
11. Wei WE, Li Z, Chiew CJ, Yong SE, Toh MP, Lee VJ. Presymptomatic transmission of SARS-CoV-2—Singapore, January 23–March 16, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(14):411. doi:10.15585/mmwr.mm6914e1
12. Centers for Disease Control and Prevention (CDC). Strategies to optimize the supply of PPE and equipment; 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/index.html
13. Yamalik N, Perea Pérez B. Patient safety and dentistry: what do we need to know? Fundamentals of patient safety, the safety culture and implementation of patient safety measures in dental practice. *Int Dent J*. 2012;62(4):189–196. doi:10.1111/j.1875-595X.2012.00119.x
14. Ibrahim NK, Alwafi HA, Sangoof SO, Turkistani AK, Alattas BM. Cross-infection and infection control in dentistry: knowledge, attitude and practice of patients attended dental clinics in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. *J Infect Public Health*. 2017;10(4):438–445. doi:10.1016/j.jiph.2016.06.002
15. Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process*. 1991;50(2):179–211. doi:10.1016/0749-5978(91)90020-T
16. Asare M. Using the theory of planned behavior to determine the condom use behavior among college students. *Am J Health Stud*. 2015;30(1):43.
17. Quadri M, Jafer M, Alqahtani A, Al Mutahar S, Daghriri A, Tadakamadla S. Novel corona virus disease (COVID-19) awareness among the dental interns, dental auxiliaries and dental specialists in Saudi Arabia: a nationwide study. *J Infect Public Health*. 2020;13(5):856–864. doi:10.1016/j.jiph.2020.05.010
18. Sarfaraz S, Shabbir J, Mudasser MA, et al. Knowledge and attitude of dental practitioners related to disinfection during the COVID-19 pandemic. *Healthcare (Basel)*. 2020;8(3). doi:10.3390/healthcare8030232
19. Khurshid Z, Asiri FYI, Al Wadaani H. Human saliva: non-invasive fluid for detecting novel coronavirus (2019-nCoV). *Int J Environ Res Public Health*. 2020;17(7):2225. doi:10.3390/ijerph17072225
20. Nguyen T-M, Nham PT, Hoang V-N. The theory of planned behavior and knowledge sharing: a systematic review and meta-analytic structural equation modelling. *J Inf Knowl Manag Syst*. 2019;49(1):76–94. doi:10.1108/VJIKMS-10-2018-0086
21. Saqlain M, Munir MM, Ur Rehman S, et al. Knowledge, attitude, practice and perceived barriers among healthcare professionals regarding COVID-19: a cross-sectional survey from Pakistan. *J Hosp Infect*. 2020;105(3):419–423. doi:10.1016/j.jhin.2020.05.007
22. Javed M, Khan A, Nawabi S. Dental faculty's knowledge and attitude regarding COVID-19 disease in Qassim, Saudi Arabia. 2020;
23. De Bono S, Heling G, Borg M. Organizational culture and its implications for infection prevention and control in healthcare institutions. *J Hosp Infect*. 2014;86(1):1–6. doi:10.1016/j.jhin.2013.10.007
24. Kretzer EK, Larson EL. Behavioral interventions to improve infection control practices. *Am J Infect Control*. 1998;26(3):245–253. doi:10.1016/S0196-6553(98)80008-4
25. Kamate SK, Sharma S, Thakar S, et al. Assessing knowledge, attitudes and practices of dental practitioners regarding the COVID-19 pandemic: a multinational study. *Dent Med Prob*. 2020;57(1):11–17. doi:10.17219/dmp/119743
26. Cianetti S, Pagano S, Nardone M, Lombardo G. Model for taking care of patients with early childhood caries during the SARS-Cov-2 pandemic. *Int J Environ Res Public Health*. 2020;17(11):3751. doi:10.3390/ijerph17113751
27. Ministry of Health. Health statistical year book. Health Mo. Ministry of Health; 2018. Available from: https://www.moh.gov.sa/en/Ministry/Statistics/book/Pages/default.aspx
28. Khader Y, Al Nsour M, Al-Batayneh OB, et al. Dentists' awareness, perception, and attitude regarding COVID-19 and infection control: cross-sectional study among Jordanian dentists. *JMIR Public Health Surveill*. 2020;6(2):e18798. doi:10.2196/18798
29. Althomairy SA, Baseer MA, Assery M, Alsaffan AD. Knowledge and attitude of dental health professionals about middle east respiratory syndrome in Saudi Arabia. *J Int Soc Prev Community Dent*. 2018;8(2):137. doi:10.4103/jispcd.JISPCD_9_18
30. Ferdous MZ, Islam MS, Sikder MT, Mosaddek ASM, Zegarra-Valdivia J. Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladeshi people: an online-based cross-sectional study. *medRxiv*. 2020.
31. LaMorte WW. he Theory of Planned Behavior. Boston University School of Public Health. Available from: https://sphweb.bumc.bu.edu/otlt/mph-modules/sb/behavioralchangetheories/BehavioralChangeTheories3.html. Accessed September 9, 2019.