A Web-based Survey to Assess the Knowledge and Practice Regarding Biomedical Waste Management during COVID-19 among Oral Health Professionals

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Abstract

Objectives: The study aimed to assess the knowledge and practice of biomedical waste (BMW) management among dental practitioners in India during the coronavirus disease-2019 (COVID-19) pandemic era.

Materials and methods: This descriptive, cross-sectional study was conducted *via* a web-based questionnaire survey done among 1,500 dentists across the country, and responses were collected between the months of May 2020 to June 2020. The use of descriptive statistics such as percentage analysis and frequency analysis of the survey respondents was done to describe the data. The Chi-square test was used to detect any correlation between the dentists' responses concerning their gender and level of education and age. Variables with $p < 0.05$ were considered statistically significant.

Results: The study engaged a total of 1,093 responses out of the 1,500 invited dentists, forming a response rate of 72.86%. Among these were 69.9% female and 30.1% male dentists. A 100% correct response was observed with the questions on the source of infection of COVID-19, frequency of disinfection of the dental chair, and cross-infection related to the disposal of BMW. The questions regarding the practice of donning off and disposing of personal protective equipment (PPE) were mostly incorrect with a percentage of 16.1 and 26.9%, respectively. The association between practice score and knowledge score concerning either gender was not significant ($p > 0.05$) whereas, the association with the level of education and age was found to be statistically significant ($p < 0.05$).

Conclusion: The dentists in India were well informed of the hazardous waste generated in hospitals and clinics and were aware that it should be disposed off properly, especially in times of COVID-19. However, they lacked proper knowledge of the guidelines for disposing of specific types of waste during this pandemic.

Keywords: Biomedical waste management, Coronavirus disease-2019 pandemic, Infection control, Questionnaire.

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Introduction

The rampant escalation of COVID-19 disease had its origin in Wuhan, China, and from there it spread rapidly across countries as a pandemic.[1] World over, the tally of confirmed cases as per World Health Organization (WHO) exceeds 187 million (as of 13 July 2021).[2] The Central Pollution Control Board (CPCB) has revised its guidelines for BMW management in the critical worldwide scenario of COVID-19. As per the BMW rules of 1998, BMW is defined as "Any waste that is generated during the diagnosis, treatment, or immunization of human beings, animals and research activities which may include human tissues, items soiled with blood, body fluids such as dressings, plaster casts, cotton swabs, beddings contaminated with blood or body fluid, blood bags, needles, syringes, or any other contaminated sharp object."[1,3]

As per the recent guidelines, health-care organizations and common biomedical waste management treatment and disposal facilities (CBMWTFs) should maintain a meticulous record of waste produced from COVID-19 isolation wards, operation theatres, and COVID-19 intensive (ICU) wards which should then be reported regularly to the respective pollution control board (PCB) and CBMWTFs.[4] The guidelines advise for separate color-coded bins or containers, meticulous segregation of biowaste as per the BMW management rules and CPCB guidelines, as well as the use of double-layered bags for collection of waste from COVID-19 isolation wards to prevent accidental spills.[4] Furthermore, bags or containers

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which are used for collecting BMW from COVID-19 wards should be correctly labeled as COVID-19 waste so as to enable CBMWTFs

for priority management and prompt disposal. Also, the states have been notified to use dedicated trolleys and collection bins in COVID-19 isolation wards which should be disinfected daily with a 1% sodium hypochlorite solution.[5] The CPCB has also suggested similar recommendations for the sample collection center and labs for COVID-19 suspected or diagnosed patients. The CBCP has also recommended the opening/use of the COVID-19 wards, sample collection centers, and laboratories to be appropriately notified to the state pollution control boards (SPCBs).[6] Despite the well-laid-down regulations and rules, there is complacency seen among dental professionals in following the protocols of BMW management. As reported in the literature, this laxity is seen due to a lack of awareness of the current regulations and a subsequent lack of comprehension and enforcement to practice the same in routine dentistry.[7–10] However, there are scarce studies on this aspect during the COVID-19 pandemic where it is critical to follow the BMW management rules which have been revised. This study aimed to evaluate the knowledge and practices of BMW management among dental practitioners in India during and after COVID-19.

MATERIALS AND METHODS

Study Design and Period

A descriptive, cross-sectional questionnaire online survey was conducted to collect data from dentists. The questionnaire comprised 26 closed-ended questions developed in the English language, and it was divided into three broad categories. The first of which consisted of six questions about the basic sociodemographic details of the participants; their age, gender, level of education, workplace whether they are attached to a hospital, clinic, or any institution. The second and third categories had 20 questions on knowledge and practice of BMW guidelines. This study design and methodology were reviewed by the Institutional Review Committee and requisite permission was obtained. The survey was available online for 4 weeks from the first week of May to the first week of June 2020.

Population

The questionnaire was sent to 1,500 dentists working in government hospitals and private clinics across India, out of which only 1,093 responded. Those who voluntarily gave their permission were asked to share their e-mail addresses with the primary author. The link to the survey was sent by e-mail to each participant. Three reminder emails were sent thereafter to each participant at the 1-week interval, in case they did not respond in time.

Data Processing and Analysis

The study was validated by a subject expert for content and construct validity which included relevance, clarity, and completeness of each question following the aim of the study. Modifications and revisions were incorporated and a pilot testing of the questionnaire on 30 study subjects was done. The responses received were analyzed using a content validity index score (CVI-S) and a CVI-S of 0.89 was obtained which is adequate.

The estimated sample size for the study was 1,000 which was calculated using a sample size calculator assuming an accepted 5% margin of error, 95% confidence interval, 80% power, and population proportion as 60%.

The collected data were analyzed with SPSS statistics software 23.0 version. Cumulative knowledge and practice scores were

Table 1: Sociodemographic details of the respondents

Variables	Frequency (N)	%
Age		
≤30 years	705	64.5
≥30 years	386	35.5
Gender		
Male	324	30.1
Female	764	69.9
Level of education		
Graduate	764	69.9
Postgraduate	329	30.1
Place of work		
Government hospital	752	68.8
Private hospital	153	14.0
Private clinic	188	17.2

recorded as mean with standard deviation. The association between age, gender, and level of education with their respective knowledge and practice scores was assessed using the Chi-square test. A level of significance less than 0.05 was taken.

RESULTS

This study included a total of 1,093 responses from various dentists among which 69.9% were females and 30.1% were males forming a response rate of about 72.86% (1,093 participants out of 1,500 invited dentists). The sociodemographic data of the participants are given in Table 1. The gender distribution in the study comprised more females as compared to males with more respondents aged below 30 years. The study comprised maximum respondents at the graduate level from essentially the government hospital as compared to a private hospital and private clinic.

Table 2 shows the details of the responses regarding the knowledge of the participants. A 100% correct response was seen with the questions about the source of infection, frequency of the disinfection of the dental chair, and cross-infection related to the disposal of BMW. The questions regarding the knowledge of donning off and disposal of PPE were mostly incorrect with a percentage of 16.1 and 26.9%, respectively.

Table 3 shows the details of the responses regarding the practice of the participants. The practice score of the respondents was higher than the knowledge score with a cumulative mean of 8.19 ± 1.41 and 5.81 ± 1.08, respectively.

Table 4 shows the association between various parameters with knowledge and practice scores. The association concerning either gender was not statistically significant ($p > 0.05$) whereas the association with the level of education and age was found to be significant ($p < 0.05$).

DISCUSSION

The focus of this study was on the knowledge and practice regarding BMW management among dentists during COVID-19 in India. The transmission of highly infectious severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from one person to another occurs *via* droplets, contact, and saliva due to which dentists, patients, and dental auxiliaries can be easily exposed to novel coronavirus infections.[7–9] Owing to its high infectivity and

Table 2: Knowledge assessment

S. no.	Questions	Options	Correct response N (%)	Incorrect response N (%)
1	What is the causative organism of COVID-19?	• SARS-CoV • SARS-CoV-2 √ • MERS-CoV	928 (84.9)	165 (15.1)
2	What is the most important source of infection encountered by a dentist in an operatory?	• Aerosols √ • Needle stick injury • Examination of oral cavity	1,093 (100%)	0 (0)
3	What are the components of PPE?	• Goggles, face shield, mask, gloves, coverall/gowns, head cap, and shoe cover √ • Goggles, face shield, mask, gloves, coverall/gowns, and head cap • Goggles, mask, sanitizer, gloves, coverall/gowns, head cap, and shoe cover	1,022 (93.5)	71 (6.5)
4	What is the correct sequence of donning PPE?	• Shoe cover, gloves, head cap, mask, coverall/gown, goggles, face shield, and second gloves • Scrub, shoe cover, gloves, mask, coverall/gown, goggles, face shield, and second gloves √ • Scrub, shoe cover, gloves, head cap, coverall/gown, mask, goggles, face shield, and second gloves	693 (63.4)	400 (36.6)
5	What is the correct sequence of doffing PPE?	• Change gloves, coverall with outer gloves, face shield/goggles, mask, head cap, shoe cover, inner gloves, scrub, and with hand washing at each step √ • Coverall with outer gloves, face shield/goggles, mask, head cap, shoe cover, inner gloves, scrub, and with hand washing at each step • Change gloves, coverall with outer gloves, mask, face shield/goggles, head cap, shoe cover, and inner gloves	553 (50.6)	540 (49.4)
6	Which type of mask is used for examining a dental patient?	• Triple-layered surgical mask • N-95 mask √ • N-99 mask	670 (61.3)	423 (38.7)
7	All components of PPE must be disposed in yellow BMW bags?	• Yes √ • No • Don't know	294 (26.9)	799 (73.1)
8	How long can the BMW be stored at a health-care facility?	• 24 hours √ • 48 hours • 72 hours	200 (18.3)	893 (81.7)
9	Can improper BMW disposal lead to cross-infection?	• Yes √ • No • Don't know	1,093 (100)	0 (0)

MERS-CoV, Middle East respiratory syndrome

Table 3: Practice assessment

S. no.	Questions	Options	Correct response N (%)	Incorrect response N (%)
1	When do you wear a complete PPE	• Dental procedure involving aerosol production √ • Talking to the patient • Oral examination of the patient	905 (82.8)	188 (17.2)
2	COVID-19 testing is done for patients having fever before dental procedure	• Yes √ • No • Don't know	917 (83.9)	176 (16.1)
3	How many steps of hand washing are to be followed before and after treatment?	• 9 • 12 • 8 √	411 (37.6)	682 (62.4)
4	Where do you dispose the used N95 face mask?	• Yellow bin√ • Red bin • Black bin	905 (82.8)	188 (17.2)
5	How do you disinfect thermal scanner after every use?	• With soap and water • With dry cloth • With cotton damped with 1% sodium hypochlorite √	1,093 (100)	0 (0)
6	The pretreatment time with a prescribed disinfectant for used instruments before disposal	• 30 minutes √ • 20 minutes • 10 minutes	541 (49.5)	552 (50.5)
7	Time in cases of spills of blood/body fluid, it should be soaked in 1% sodium hypochlorite	• 20 minutes • 30 minutes • 10 minutes √	388 (35.5)	705 (64.7)
8	How frequently should the N95 mask be changed?	• In 1 hour • In 2–3 hours √ • In 4–6 hours	905 (82.8)	188 (17.2)
9	How frequently is the dental chair disinfected after patient care?	• After every patient √ • After treatment of all patients • After every three patients	1,093 (100)	0 (0)
10	What is the choice of preprocedural mouth rinse before starting a dental procedure?	• Water • Normal saline √ • 1% hydrogen peroxide	776 (71)	317 (29.1)
11	The dental operatory should be well ventilated	• Well ventilated √ • Closed • Don't know	1,022 (93.5)	71 (6.5)

Table 4: Relationship between demographic variables and knowledge and practice score

Variables	Knowledge score	p-value	Practice score	p-value
Gender				
Male	5.5 ± 0.9	0.100	8.2 ± 1.47	0.927
Female	5.9 ± 1.1		8.1 ± 1.40	
Level of education				
Graduate	5.8 ± 1.04	0.980	7.9 ± 1.3	0.007(S)
Postgraduate	5.8 ± 1.18		8.7 ± 1.31	
Age				
≤30 years	5.8 ± 1.07	0.838	7.8 ± 1.40	0.001(S)
≥30 years	5.8 ± 1.12		8.8 ± 1.23	

low mortality rate, the transmission of the SARS-CoV-2 virus and its prevention along with management finds precedence. This is precisely why the virus has now become a sought-after subject of attention for the media. Other than the management of patients and the dental aerosol generation, a big question has been raised on the amount of BMW which may be hazardous to all those who encounter this waste. The transmission of the virus in dentistry can be extensively managed by proper management of BMW. Appropriate methods of dental waste disposal are the call of the hour. Although BMW management guidelines are established, it is imperative that such policies undergo frequent renewal and update with the passing of time, especially with regard to dental waste and its disposal.

This study emphasizes the level of knowledge and practice of BMW management amongst Indian dentists, particularly during

the COVID-19 outbreak in 2020. While all the participants were aware of the virus causing the pandemic, female dentists are believed to be very well informed about the Coronavirus when compared to male dentists who bear a cautious attitude toward the same. The overall knowledge score of the female participants was 5.9 + 1.1 which was higher than the male dentists who participated in this study. The findings of this study show disparity with the findings of a similar survey done in Italy by Putrino et al. in which they found that male dentists showed a better knowledge of the subject. The results of this survey also showed that the level of education and the age of the participants did not have any significant influence on the knowledge scores whereas, the practice scores of participants with a postgraduate degree and those who were above the age of 30 years showed a higher mean score of 8.7 + 1.31 and 8.8 + 1.23, respectively, and the difference was statistically significant. The finding of our study was like the results of the survey done by Sarfaraz, in which they found that young dental health professionals had insufficient knowledge regarding COVID-19.[11–13]

In questions related to BMW, most of the participants, 97.8%, had a positive attitude toward the safe management of BMW, whereas only 73% of respondents were aware of the guidelines for disposing of the PPE kit. Regarding pretreatment of the wastes before disposal in the clinic, less than 50% were aware; this shows that there is a lack of strict protocol in BMW management.

As for the question requesting to identify the mask effective against COVID-19, the majority were able to answer correctly however, the knowledge regarding the disposing of the N95 masks was less, that is, only 82.8% of respondents knew about the proper disposal.

The results of this study were a clear indication that while most dentists were well-versed in the fact that the management and disposal of BMW serve as a health hazard, the appropriate method of disposal was not very concise. There are special services for disposing of waste in most localities, but dentists are required to obtain relevant information about them.[14–22]

CONCLUSION

It is a known fact that the COVID-19 pandemic is one of the most lethal and feared viral pandemics of modern times. Since there is no specific treatment available for it, diligent prevention and prompt containment can help to confine it. The results of this study show that dentists in India are well-informed about the fact that health-care facilities generate hazardous waste, and the fact that it should be disposed off. However, participants are not aware of the proper guidelines for disposing of specific types of waste during this pandemic. There is a dire need that the universities providing dental education to consider this subject seriously as well as include in their curriculum adequate educational material about BMW management along with the requisite training to reduce the burden of disease for generations to come.

AUTHORS' CONTRIBUTIONS

All authors contributed to the study conception, data collection, data acquisition and analysis, data interpretation, and manuscript writing. All the authors approved the final version of the manuscript for publication.

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