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BIOMEDICAL WASTE MANAGEMENT, MERCURY HYGIENE PRACTICES AND ASSOCIATED FACTORS AMONG DENTISTS AND DENTAL STUDENTS

By

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Abstract

Introduction: Dental care facilities produce large quantities of Biomedical Waste (BMW) such as surgical needles, wires, extracted teeth, and dental materials that are heavily loaded with blood and saliva. Ineffective waste management increases the health risk to the public, patients, and dental professionals. It also contributes to environmental pollution. **Aim of Work:** To investigate the knowledge level of BMW, observed proper mercury hygiene, BMW management practice, and associated factors among dentists and dental students at the Faculty of Dentistry, Ain Shams University, Egypt. **Materials and Methods:** An analytical cross-sectional study was conducted using a standardized self-administered questionnaire distributed among 257 respondents selected by convenience sampling. **Results:** Only 23 % of participants had a Good knowledge of BMW management and 13.2% had Good BMW management practices. More than half (59.1%) of respondents discarded leftover amalgam scrap incorrectly and the majority (73.5%) did not practice proper mercury hygiene. Regarding the different sociodemographic variables, the educational year was the only significant factor related to the knowledge level (p= 0.03). Higher mercury hygiene practice score was reported among dentists compared to dental students (p=0.02). Higher BMW management practice scores were observed among older participants (p=0.03), with participants with more years of experience (P=0.01) and those with extra work (P=0.02). Lastly, a Good knowledge score was significantly associated with a Good BMW practice score among the studied group. **Conclusion and Recommendations:** Most of the studied group had poor knowledge and practice of proper mercury hygiene and BMW management.

An urgent need for training of dental health personnel on proper BMW handling and disposal is highly warranted.

Keywords: knowledge level, Biomedical waste management, Mercury hygiene, and Dentists.

Introduction

Waste management is one of the key ecological challenges faced by the modern world. The healthcare sector generates enormous amounts of biomedical waste (BMW) and dental waste forms a subset of this hazardous waste. The World Health Organization (WHO) defines healthcare waste as any waste produced by healthcare facilities, laboratories, and research centers (WHO, 2024).

Dental wastes are products that have been used in dental offices but are thrown out because they are no longer needed, dental clinics generate large amounts of cotton, plastic, sharps, extracted teeth, latex, and other materials, most of which may be contaminated with body fluids (Khubchandani et al., 2020).

One of the most often used dental materials is gypsum, which is used to make dental casts and dies that are used to further manufacture indirect dental restorations. Natural gypsum minerals are used to make gypsum products based on their characteristics and applications (Hamdy et al.,2020).

Personal protective equipment (PPE) is special covers intended to shield the skin and the mucous membranes of the mouth, nose, and eyes from pathogens. Gloves, surgical masks, safety glasses, face shields, and protective apparel (such as disposable gowns) are all included. Additionally, PPE can stop microbes from infecting people through Dental health care personnel (DHCP) (CDC, 2024).

Another major concern in the dental field is mercury disposal which has been employed as a direct restorative material known as amalgam for more than 15 decades. Amalgam particles have the potential to be discharged into solid waste and wastewater, which could lead to hazardous environmental contamination. In addition, improper amalgam disposal and other dental waste can cause harm to dentists, waste handlers, and others who have direct contact with amalgam (Spaveras and Antoniadou., 2023).

To minimize the negative consequences described above, dental clinics should follow proper waste handling procedures and strictly

comply with international regulations in this regard. From this starting point, several studies were carried out to evaluate dental waste management knowledge and practices in different countries. A cross-sectional study was conducted among dental staff working at public hospitals in Lagos State, Nigeria revealed that only 17.2% of respondents had Good knowledge of BMW management/legislation, 4.1% had Good BMW practice, and 92.2% did not follow proper mercury hygiene (Makanjuola, et al., 2021). Another study conducted among 314 dental healthcare workers in Jeddah, Saudi Arabia revealed that only 33% had Good knowledge of BMW management varying by gender, specialty, and years of experience (Sabbahi et al.2020).

Despite the growing concern over the use of dental amalgams worldwide, few published literature on poor mercury hygiene standards in poorer nations were available (Khan et al.,2022). Hence this study was designed to assess knowledge levels of BMW, observance of proper mercury hygiene and BMW management practices, and associated factors among dentists and dental students at the Faculty of Dentistry, Ain Shams University, Egypt.

Materials and Methods

Study design: An analytical cross-sectional design was employed to achieve study objectives.

Place and duration of study: The study was conducted at the Faculty of Dentistry, Ain Shams University Hospitals during the period from June to September 2024. Dentists from different departments of the faculty and dental students within clinical educational years (third, fourth, and fifth) and interns who agreed to participate in the study were included in this research. First and second-year dental students were excluded as they did not have direct contact with patients yet. In addition, participants who failed to complete all answers in the questionnaire were also excluded from the study.

Study Sample: A convenience sampling method was used. The sample size calculation was conducted using the PASS 15, with a confidence level of 95% and a margin of error of 5%, this calculation estimated that a sample size of 220 participants would be needed to detect an expected prevalence rate of 17.2% for Good knowledge of biomedical waste management (Makanjuola, et al., 2021). The required sample size was 220 participants. To accommodate potential dropout rates, an extra 18% was added. The final sample size targeted was calculated to be 260 respondents. Three members

were excluded as their questionnaires were incomplete, so the final sample size was 257

Study methods: A well-structured, self-administrated questionnaire was used for data collection. It was adopted from the standardized English version of the Biomedical Waste Management Awareness & Knowledge (BWMAK) Questionnaire, which was used in a previous study by (Khubchandani et al., 2020). The questionnaire was composed of 37 closed-ended questions: The first section consisted of questions inquiring about sociodemographic characteristics related to respondent's age, sex, qualification, and years of experience (6 questions). The other sections of the questionnaire were designed to collect information on the knowledge level of BMW management (14 questions), respondents' mercury hygiene practices (10 questions), and respondents' BMW management practices (7 questions). The scores of BMW management knowledge and practices, as well as mercury hygiene practices, were graded as either Poor or Good. Grades were assigned based on the percentage of overall correct answers; based on < 70% and ≥70% was defined as Poor and Good grades, respectively. A pilot study was carried out among twenty dental personnel comprising 8 dentists and 12 dental students in different educational years to check the feasibility and relevance of the prepared questionnaire; they found that the questionnaire was easy to read, clear, and filled out in approximately 15 minutes.

Consent

Consent was obtained from all participants after informing them about the study objectives and assuring that all information collected would be treated confidentially for statistical interest only.

Ethical approval

Ethical approval for the study was obtained from the Ethics Committee of the Faculty of Medicine at Ain Shams University (No of acceptance: FWA 000017585).

Data management

Data was analyzed using the Statistical Package for Social Sciences version 27. Simple descriptive analysis was used to ascertain sample characteristics in the form of means and standard deviations for quantitative data, and frequency and percentage for qualitative data, inferential statistics were applied using suitable statistical tests such as the chi-square test and independent t-test. The P-value of 0.05 was considered as the significance level.

Results

In the present work, more than half of the studied participants were females (61.5%), dental students (61.9%), had no extra private job (74.7%), and 92.6% had less than 5 years of experience. The mean age was 23.44 ± 1.85 years (data was not tabulated).

Table 1: knowledge level of biomedical waste management among the studied participants(No=257)

Variables	Number No	Frequency %
Presence of Biomedical Waste Management Policy in Egypt		
NO	20	7.8
Yes	103	40.1
Don't know	134	52.1
A clear biomedical waste management policy in your hospital/clinic		
NO	26	10.1
Yes	189	73.5
Don't know	42	16.3
Generation of biomedical waste in your hospital/clinic		
NO	37	14.4
Yes	151	58.8
Don't know	69	26.8
Maintaining biomedical waste records in your hospital/clinic		
NO	37	14.4
Yes	137	53.3
Don't know	83	32.3
Different colored bags are used to dispose of different types of waste		
NO	29	11.3
Yes	216	84
Don't know	12	4.7
Disposal of used disposable plastic items should be in		
Yellow bag#	49	19.1
Red bag	80	31.1
Black bag	54	21
Don't know	74	28.8
Disposal of contaminated dressings should be in		
Blue/white bag	42	16.3
Red bag#	84	32.7
Black bag	46	17.9
Don't know	85	33.1

Disposal of used sharps should be in		
Yellow bag	31	12.1
Rigid/puncture-proof container#	170	66.1
Red bag	31	12.1
Don't know	25	9.7
Disposal of extracted teeth and human tissue should be in		
Yellow bag#	21	8.2
Red bag	113	44
Black bag	34	13.2
Don't know	89	34.6
Hazardous health effects due to improper waste management		
NO	8	3.1
Yes#	237	92.2
Don't know	12	4.7
Safe management of biomedical waste is the responsibility of:		
Government only	20	7.8
Medical staff, organization and government#	215	83.7
Don't know	22	8.6
Receiving training in BMW management		
NO	126	49
yes	131	51
Need more training regarding dental waste management		
NO	28	10.9
Yes	229	89.1
BMW management Knowledge score		
Poor	198	77
Good	59	23

#: Correct answer

As shown in Table 1, only (40.1%) of the studied participants knew about the presence of BMW policy in Egypt. However, a significant proportion indicated that their workplace had a clear policy regarding Biomedical waote management (73.5%) and that BMW was generated at their job (58.8%). More than half of the participants (53.3%) knew that maintaining BMW management records is mandatory, and the majority (84%) agreed that different colored bags should be used to dispose of different types of waste. About (77%) had poor knowledge levels of BMW management. A small percentage were aware that contaminated dental dressings (32.7%) should be disposed of in red bags; extracted teeth (8.2%) and used plastic items (19.1%) should be disposed off in yellow bags. However, the majority agreed that improper waste management can lead to hazardous health effects (92.2%). Only (51%) had training in dental waste management, while 89.1% believed that they needed more training.

Table 2: Mercury hygiene practices levels among the studied participants (No=257)

Variables	Number No.	Frequency %
Regular cleaning of air-conditioning filter		
NO	117	45.5
Yes	140	54.5
Periodic environmental monitoring of mercury vapor.		
NO	245	95.3
Yes	12	4.7
Mercury spill kit availability		
NO	247	96.1
Yes	10	3.9
Using amalgam for restoration of defective teeth		
NO	233	90.7
Yes	24	9.3
Removal of old defective amalgam restoration tooth		
NO	14	5.4
Yes	243	94.6
Protective devices used during amalgam handling		
Gloves	253	98.4
Clinical coat	251	97.7
Mask	254	98.8
Eye goggles	111	43.2
Hair cap	128	49.8
Using rubber dam		
NO	33	12.8
Yes	224	87.2
Place of storage for leftover amalgam scrap		
Sink	42	16.3
Airtight container	99	38.5
Left on the tray	37	14.4
In regular trash	73	28.4
Do not deal with amalgam	6	2.3
Recycling of amalgam scraps.		
NO	233	90.7
Yes	24	9.3
Mercury hygiene practices level		
Poor	189	73.5
Good	68	26.5

As shown in Table 2, most participants (73.5%) had poor mercury hygiene practices, and 54.5% regularly cleaned air-conditioning filters, 4.7% reported periodic mercury environmental monitoring, and 3.9% were using mercury spill kits. Although few participants were still using amalgam for restoration (9.3%), removing old amalgam restorations was highly prevalent (94.6%). Most of the studied participants were using protective devices while handling amalgams, such as gloves (98.4%), clinical coats (97.7%), and masks (98.8%), although fewer were using eye goggles (43.2%) and hair caps (49.8%). Rubber dams were also extensively used (87.2%). Only 38.5% used airtight containers for the storage of leftover amalgam scrap.

Table 3: Biomedical waste management practices level among the studied group (No=257)

Variables	Number No.	Frequency %
Usage of gloves and mask during handling of BMW		
NO	9	3.5
Yes	248	96.5
Segregation of waste at the point of origin		
NO	50	19.5
Yes	207	80.5
Treatment of infectious waste before disposing	132	51.4
NO	125	48.6
Yes		
Site of Disposal of sharps in your clinic/hospital		
Puncture proof container	203	79
Yellow bag	26	10.1
Red bag	28	10.9
Site of disposal of contaminated gloves and gauze		
Red bag with hazardous waste	95	37
Regular trash	50	19.5
Blue/white bag	37	14.4
Unaware of the site of disposal	75	29.2
Site of disposal of plastic of Paris		
Yellow bag	94	36.6
Red bag	108	42.0
Black bag	55	21.4
Taking hepatitis B vaccine		
NO	81	31.5
Single dose	30	11.7
Two doses only	37	14.4
Full three doses	109	42.4
BMW management practice level		
Good	34	13.2
Poor	223	86.8

Table 3 revealed that most of the participants (96.5%) used gloves and masks while handling BMW, and 80.5% practiced waste segregation at the point of origin. However, less than half of them (48.6%) treated infectious waste before disposal. Regarding sharps disposal, 79% disposed of sharps in puncture-proof containers. Only 37% disposed of contaminated gloves and gauze as hazardous waste in red bags. Regarding hepatitis B vaccination, less than half of the participants (42.4%) received the three doses, while almost one-third (31.5%) did not receive any vaccination. About 86.8% had poor BMW management practice levels.

Table 4: Association between biomedical waste management knowledge level, mercury hygiene, BMW practices, and sociodemographic characteristics (No=257).

Variables	Knowledge level of BMW management		Mercury hygiene practices level		Practices level of BMW management	
	Poor	Good	Poor	Good	Poor	Good
Age	23.3 ± 1.9	23.8 ± 1.8	23.3 ± 1.9	23.8 ± 1.7	23.3 ± 1.8	24.2 ± 1.9
t (p-value)	- 1.6 (0.1)		**- 2.1 (0.04)***		**- 2.3 (0.03) ***	
Gender Males Females	78(78.8) 120(75.9)	21(21.2) 38(24.1)	77(77.8) 112(70.9)	22(22.2) 46(29.1)	91(91.9) 132(83.5)	8(8.1) 26(16.5)
χ^2 (p-value) OR (95% CI)	0.28 (0.6) 1.2(0.6-2.2)		1.5 (0.2) 1.4(0.8-2.6)		3.7 (0.05) 2.2(1-5.2)	
Level of education 3rd year 4th year 5th year Interns & postgraduates	56(90.3) 39(69.6) 31(75.6) 72(73.5)	**6(9.7)*** 17(30.4) 10(24.4) 26(26.5)	51(82.3) 42(75) 32(78) 64(65.3)	11(17.7) 14(25) 9(22) **34(34.7)***	59(95.2) 48(85.7) 34(82.9) 82(83.7)	3(4.8) 8(14.3) 7(17.1) 16(16.3)
χ^2 (p-value)	**8.7 (0.03) ***		**5.3 (0.02) ***		5.2 (0.2)	
Current job Dental student Dentist	126(79.2) 72(73.5)	33(20.8) 26(26.5)	125(78.6) 64(65.3)	34(21.4) 34(34.7)	141(88.7) 82(83.7)	18(11.3) 16(16.3)
χ^2 (p-value) OR (95% CI)	1.1 (0.3) 1.4(0.8-2.5)		5.5 **(0.02) *** 1.9(1.1-3.4)		1.3 (0.3) 1.5(0.7-3.2)	
Extra private job NO Yes	152(79.2) 46(70.8)	40(20.8) 19(29.2)	144(75) 45(69.2)	48(25) 20(30.8)	172(89.6) 51(78.5)	20(10.4) 14(21.5)

χ^2 (p-value) OR (95% CI)	1.9 (0.2) 1.6(0.8-2.9)		0.8 (0.4) 1.3(0.7-2.5)		5.2 **(0.02)** * 2.4(1.1-5)	
Years of experience						
Less than 5 years	184(77.3)	54(22.7)	173(72.7)	65(27.3)	210(88.2)	28(11.8)
5-10 years	14(73.7)	5(26.3)	16(84.2)	3(15.8)	13(68.4)	6(31.6)
χ^2 (p-value) OR (95% CI)	Fisher exact test (0.8) 1.2(0.4-3.5)		1.2 (0.3) 0.5(0.1-1.8)		6.02 **(0.01)** * 3.5(1.2-9.3)	

*: Statistically significant

Table 4 revealed a significant association between mercury hygiene and BMW management practices and age. Older age groups had better practices (p=0.04, 0.03 respectively) while age did not significantly impact the knowledge level (p=0.1). Level of education was significantly associated with both knowledge level and mercury hygiene practices (p=0.03, 0.02) respectively. A Higher educational level was associated with better knowledge and practices. Also, the current job was significantly associated with mercury hygiene practices as dentists had better practices than students (p=0.02). The presence of extra jobs and years of experience of more than five years were associated with better BMW practices (p=0.02, p= 0.01 respectively). Otherwise, there were no significant associations between other variables and BMW knowledge, BMW practices, and mercury hygiene practices levels.

Table 5: Association between knowledge level and mercury hygiene and BMW practices among the studied group (No = 257).

	Knowledge level of BMW		**χ^2**	**P**	**OR (95%CI)**
	Poor	**Good**			
Mercury hygiene practices					
Poor	143(72.7)	46(78)	0.8	0.4	0.7(0.4-1.5)
Good	55(27.8)	13(22)			
BMW management practices					
Poor	180(90.9)	43(72.9)	12.9	**<0.001***	3.7(1.8-7.9)
Good	18(9.1)	16(27.1)			

*: Statistically significant

Table 5 showed a significant difference in BMW management practices between participants with Good and Poor knowledge levels (p<0.001). Good knowledge level was associated with higher levels of BMW management practices OR = 3.7, (95% CI: 1.8-7.9).

Discussion

Dental care facilities produce large quantities of Biomedical Waste (BMW), which increases health risks to the public, patients, and dental professionals. The current study was done to investigate the knowledge level of BMW, observe proper mercury hygiene and BMW management practice, and associated factors among dentists and dental students at the faculty of dentistry at Ain Shams University, Egypt. The present work showed that 40.1% of respondents believed that there was a certain policy provided by the Egyptian government for BMW management, while more than half (52.1%) were unaware of this policy (Table 1). This might be because the majority 61.9% of those surveyed was undergraduate students and had limited information regarding the presence of this policy. Similar results were reported by Tanuja et al, 2018 where less than half of the students knew about the rules established by the Nepali government for BMW management. Against the results of the current study; Aravind et al., 2020 found that the majority of respondents (88%) were aware of the legislation governing BMW handling in India.

The current work showed that 73.5 % of respondents agreed that their hospital or clinic generates BMW (Table 1), whereas some earlier researchers have found as much as 100% of participants agreed with this statement in Amritsar, India (Narang et al., 2012). This variation in response cannot be easily explained, however, lack of knowledge regarding the classification of biomedical waste among students newly entering the faculty may be affecting this response.

Regarding the importance of maintaining BMW records, more than half 53.3 % of the studied participants agreed that keeping BMW records is mandatory (Table 1). A higher agreed response rate (88%) was reported among dental, medical, and nursing students in India (Sharma et al., 2020). This difference could be attributed to the fact that the recording of BMW generation is primarily the responsibility of the auxiliary personnel, whereas dentists and dental students may not be directly involved in this documentation. Concerning the color-coded segregation of BMW, 84% believed they were familiar with the color-coding system (Table 1). However, in the assessment, most of them could not answer the subsequent questions regarding this item correctly. Similarly, a previous study conducted among dental and

medical students at Taif University, Saudia Arabia; concluded that the awareness level regarding color-coded segregation was inadequate (AL-Thomali et al., 2019). On the contrary, a higher proportion of dentists in Nepal (95%) were adequately aware of the color-coding system of BMW according to the study conducted by Gautam et al., 2020.

Currently, almost all studied participants (92.2%) agreed that improper waste handling can cause serious health hazards (Table 1). This is slightly higher compared to the results obtained by Rajeev et al., 2016 from India, who reported that 61% of their studied group agreed with this statement.

In addition, 83.7% of studied respondents approved that BMW management was a teamwork responsibility (Table 1). A similar result was reported by Solomon et al., 2019 in their study of waste management among health workers in Kampala City, Uganda where 83.2% of their studied group declared that appropriate harmonization between government, HCWs, and medical institutions is essential for proper waste management. It is noteworthy that while most respondents were aware of the negative effects of inappropriate waste management, 77% scored poorly on the assessment of their knowledge level (Table 1).

As regards training courses provided, 51% of the studied population have attended training programs on dental waste management (Table 1), which was higher than the results obtained by Khubchandani et al., 2020 from India, whereas only 19% of dental staff received training in BMW management. About 89% of participants in the current study felt they needed more training (Table 1). A similar finding from India was reported by Puri et al., 2019 whereas the majority (89.9 %) agreed that faculty should organize training courses on the same topic. Also, another study conducted by Quratulain et al., 2022 reported that 94.3% of dental students believed in the need for educational programs on BMW management to be included in the curriculum.

Another major concern in the dental field is the disposal of mercury. Although the use of amalgam restoration has been reduced in recent years, it is still utilized in some dental schools (Jebur et al., 2023). Accordingly, it was important to

shed light on mercury hygiene practices among study participants as it has high toxicity. The present work showed that most of the participants did not use amalgam for the restoration of defective teeth, however, the majority (94.6%) were still involved in the removal of old defective amalgam restoration teeth (Table 2). A similar finding was reported by Ramesh et al., 2019 in South India, where authors stated that only a minor section of dental practitioners still prefer dental amalgam as a restorative material. According to the American Dental Association (ADA), excess amalgam should be stored in airtight containers for recycling by specialized agencies to retrieve the silver component within; it should not be given for incineration to avoid the release of toxic mercury fumes (Ajiboye and Mossey, 2020). Current results revealed that only 38 % discarded amalgam properly in airtight containers (Table 2), however, recycling was rarely applied. Regarding other mercury hygiene practices, almost all participating dentists and students were not strictly following the recommended ADA guidelines, especially for periodic mercury environmental monitoring, usage of mercury spill kits, and recycling of amalgam scraps (Table 2). Such conditions might lead to an increased possibility of toxic mercury exposure, as the findings of a previous Egyptian study (Afify et al., 2011). It was highly encouraging to know that in the present study, a large proportion of respondents were satisfactorily adopting universal standard barrier techniques while handling amalgam, such as wearing gloves 98.4 %, face masks 98.8%, clinical coat 97.7%, and to a lesser extent, eye goggles 43.2% (Table 2). As regards rubber dam application, 87.2 % of them claimed that it was always applied (Table 2). Similarly, Sadig and Khairuldean, 2017 revealed that 98% of dental practitioners were always using masks, gloves, and aprons in their clinic. However, rubber dam application was markedly deficiently applied only by 10.6 % of the respondents.

Regarding BMW management practice assessment, WHO, 2000 stated that different wastes must be disposed off after collecting in different containers with different color codes. In the present study, 80.5% of participants agreed to practice waste segregation (Table 3). Similar results were reported by Khubchandani et al., 2020 from India where 83% of dentists segregated different wastes according to the BMW handling laws. Nearly 20 % of the

studied participants did not segregate different waste generated during their work; this negligence might subject garbage collectors to a high risk of contracting any waste-related infection.

Moreover, it was found that about 21% of those surveyed discarded contaminated needles improperly (Table 3), which was different from the study done by Al-Oufi and Saker, 2018 where 100% of dental practitioners in Saudi Arabia used puncture-proof containers for discarding contaminated needles. Ideally, contaminated needles should be burned first by needle destroyers as recommended by WHO, 2000, but this was not available in the current study setting. In addition, only 37% of studied respondents discarded contaminated gauze and gloves correctly in red colored bags (Table 3), which was lower than the findings of Puri et al., 2019 from India, in which 60.2% of their studied group did so. Furthermore, gypsum products such as Plaster of Paris were still used in the dental field for numerous purposes like study cast preparation and were not properly managed in the present study (Table 3). If gypsum products are discarded in landfills, it will lead to hydrogen sulfide gas release which is toxic to the respiratory system. For this reason, the disposal of gypsum in mixed landfills was banned in 2009, an ideal method for disposal is recycling through a specialized waste plaster disposal service (Shubham et al., 2024).

The present study showed that most of the participants (96.5%) used protective barriers including masks, gloves, and aprons during handling BMW (Table 3), which was comparable with Monica et al., 2022 whereas more than 95 % of their studied dentists wear masks and gloves during waste disposal. Only 42.4% of the studied participants (Table 3), completed the three doses of the hepatitis B vaccine. All health care workers including dental staff should take immunization against Hepatitis B as important universal precautions (CDC, 2015).

Among the different sociodemographic variables investigated in the present work, the educational year was the only significant variable associated with the BMW knowledge score (Table 4). Interns and postgraduates had a better knowledge score compared to their correspondents. This was incongruent with Anirbanet al., 2021 who found a significant relationship between level of knowledge and gender, educational qualification, and professional experi-

ences, this difference could be attributed to different sample sizes and study settings.

As regards the demographic factors that might affect BMW management practices, satisfactory BMW management practice scores were observed among older members, with more years of experience and those with additional private work (Table 4). However, Frank et al., 2022 did not find any significant difference between ages, years of experience, and BMW practice level.

Regarding mercury hygiene practices, the present study showed that dentists had better mercury hygiene practices on how to properly handle the dental amalgam during restorative treatment compared to dental students (Table 4), which was similar to the results of (Ramesh et al., 2019) from India. These findings might explain the importance of clinical experience.

The other finding worth highlighting was related to knowledge, a significant association between knowledge level and BMW management practice was found. Participants who had good knowledge levels were more likely to practice waste management properly than those with poor knowledge (Table 5). Similar results were obtained by Abhishek et al., 2016 from India. So, providing educational programs for all dental staff is highly recommended to improve BMW management.

Conclusion

Considerable deficiency was detected in the present work regarding BMW knowledge, as well as laxity in performing standard mercury hygiene and BMW management practices among dentists and dental students at the faculty of dentistry at Ain Shams University, Egypt. In addition, a statistically significant association was found between knowledge and practice of BMW management among the studied group.

Recommendations

Based on current research, we suggest that dental faculties should compulsorily integrate BMW management and hazards associated with improper waste disposal as part of the undergraduate curriculum for dental students. A strong emphasis on understanding different categories of BMW and selecting suitable color-coded bags for their disposal during clinical and academic training of students is highly warranted. Also,

comprehensive training programs should be regularly arranged for all dental staff to update their knowledge. In addition, more efforts should be made to improve mercury hygiene practices. Making recent instruments required to dispose of specific waste readily available such as needle burners, plaster of Paris and mercury recycling equipment. Lastly, urgent surveillance and vaccination programs should be held to ensure that all dental staff and students are fully vaccinated with the three doses of the Hepatitis B vaccine.

Study limitations

Data was collected from a single public institute and a convenient sample was used which can affect the generalization of the study results.

Conflict of Interest

The authors declared that they have no conflict of interest.

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