BIOMEDICAL WASTE MANAGEMENT: A STUDY ON ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES AMONG ANAESTHESIOLOGISTS

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ABSTRACT

Background:
It is crucial for anaesthesiologists to know the hazards of biomedical waste [BMW] and its management from the initial generation to segregation and storage at site followed by disinfection and its final disposal. The present cross-sectional study was conducted to assess the levels of Knowledge, Attitudes, and Practices with respect to biomedical waste management (BMWM) amongst students and consultants in anaesthesiology working in government, corporate, private hospitals and own setups.

Method:
The study tool consisting of a questionnaire of 21 questions divided into 6, 7 and 9 questions on Knowledge, Attitudes and Practices respectively was distributed to 300 participants. Amongst them total respondents were 275 and 17 incompletely filled questionaires were excluded from the study. Thus, the analyses represents the answers of 258 respondents that represent consultants and post graduate students of anaesthesiology.

Results:
Majority (>50%) had PG degree (MD/DNB), working as consultants (>80%) with >10 years' experience. Amongst them 44% were working in Govt. set-up, 23% in Private, 22% in Corporate and 11% in own setup. Overall, knowledge, attitude and practice score amongst participants was 48.31%, 43.57% and 62.32% respectively. For knowledge, significantly higher (49.16%) with correct responses was observed for consultants working in Govt. setting. For attitude, significantly lower percentage with correct responses was observed for consultants working in Private (25.73%) and Own setting (13.69%). For practices, highest (64.97%) correct responses was observed for participants working in Corporate setup and >50% students follow safe BMWM practices. Overall combined KAP score of participants regarding BMWM was 50.89%, amongst which participants in Govt Setup performed better with highest number of correct responses.

Conclusion:
Overall knowledge was poor; attitude was unsatisfactory but practices towards BMW amongst anaesthesiologists was satisfactory. Thus, there is need to organise lectures/CME/training sessions in hospitals to bring more awareness on BMWM which will help in competent disposal of biomedical waste.

INTRODUCTION

Health care waste is a unique category of waste by its composition, source of generation, its hazardous nature and the need for appropriate protection during handling, treatment and disposal [1]. According to WHO, Healthcare Waste is categorized as: 1. General waste (Non-infectious waste) (80%), 2. Biomedical waste (Pathological and infectious waste) (15%) and 3. Other waste (5%) (Radioactive, cytotoxic, chemical and pharmaceutical waste 3% + Heavy metals 1% + Sharps 1%) [2]. India produces 600 metric tonnes of biomedical waste every day. Approximately 1-2kg/bed/day of biomedical waste is generated in India. Management includes all steps required to ensure that biomedical waste is managed in such a manner to protect health and environment against any adverse effects due to handling of such waste [3].

Biomedical waste management and handling rule 1998, prescribed by ministry of environment and forest, Government of India came into force on 28th July, 1998 and consisted of 10 categories of BMW [4]. The act is now superseded by BMW Rules 2016, amended in 2018 and 2019 which classifies biomedical waste into four color coded categories [3]. According to BMW and handling rules 1998 of India, biomedical waste is any waste produced during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining to or in the production or testing of biologicals or in health camps. It is critical that the different professionals engaged in the healthcare sector have adequate Knowledge, Attitudes and Practices (KAP) with respect to BMW which will help in the competent disposal of the waste in their respective organizations [2,3,5,6]. Many studies across the country have shown that there are still deficiencies in the KAP of the employees in different organizations and hence it is necessary to make appraisal for the same.

MATERIALS AND METHODS

In the present study, the population consisted of consultants and post graduate students of anaesthesiology from government, corporate, private hospitals and and own setups located in Nagpur, Maharashtra. The data were collected by face-to-face interviews with anaesthesiologists between May and July 2021. The total number of questionnaires distributed were 300, total respondents were 275, out of them 17 incompletely filled questionaires were excluded from the study. Thus, the analyses represents the answers of 258 respondents that represent consultants and post graduate students of anaesthesiology.

The study tool consisted of a questionnaire of 21 questions divided into three parts consisting of 6, 7 and 9 questions on Knowledge, Attitudes and Practices respectively: Part A: Knowledge of respondents about BMW; Part B: Attitudes of respondents towards BMW; Part C: Practices of respondents with respect to BMW. Details of the items in the questionnaire used to obtain information about KAP were as follows:

(A) Knowledge of BMW was assessed using 6 questions as follows: 1) How much Biomedical waste (BMW) is produced per bed/day in India? 2) How many types/categories of (BMW) are there? 3) Symbol for infectious BMW? 4)Who regulates safe transport of Biomedical Waste? 5) Is radioactive material under category of BMW? 6) Are the products of incineration of PVC medical equipment carcinogenic?

(B) Attitude towards BMW was assessed using 7 questions with Yes/No responses as follows: 1) How did you learn about Biomedical Waste Management? 2) Have you undergone any training regarding BMW Management? 3) Training in BMW management should be mandatory for hospital staff? 4) Does your hospital conduct regular training programme for BMW management? 5) In OT, Anesthetist team leader should look after proper disposal of BMW of OT? 6) It should be our highest personal responsibility to segregate BMW at the site of its generation as medical personnel. 7) Should Govt of India give high priority, have optimum financial provisions in budget for adequate BMW management to adopt safer and newer techniques?

(c) Practices with respect to BMW was assessed with 9 questions as follows: 1) Do you segregate different types of waste at site of its production at your working area? 2) Human tissue, soiled dressings are disposed in which colored bag? 3) Urine bags, syringes, tubings catheters to be discarded in which colored bags. 4) Where do you dispose needles, sharps and glasses? 5) Which container should contain hypochlorite solution? 6) Where do you dispose expired or outdated medicines? 7) Black bag is used for disposal of…? 8) Final disposal of BMW should be done before …hrs in 250 bedded hospitals? 9) Blood-stained gloves are treated with which solution at site of waste generation.?

Statistical Analysis

Statistical software STATA VERSION 10.0 was used for data analysis. All parameters were studied and analysed on the basis of percentages. Chi-square test was performed to test the association between the knowledge, attitude, and practices towards BMW and their working places. P 'value' of less than 0.05 was considered significant and p<0.001 highly significant.

RESULTS
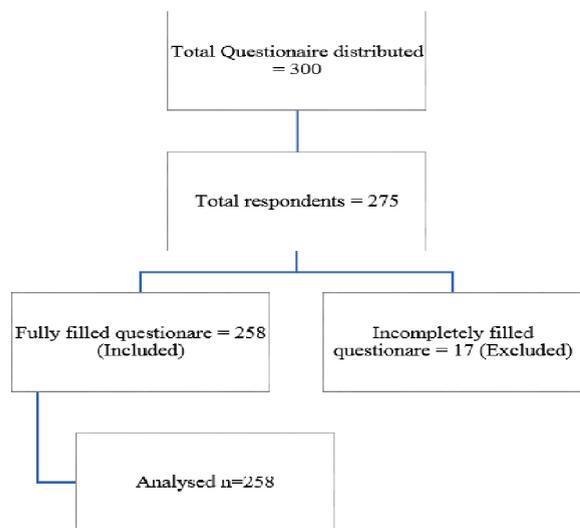
Consort Diagram

The study sample included almost equal male (51%) and female (49%) respondents, had mean age of 39.5±9.1 years (range 24- 63 years). Majority (>50%) had PG degree (MD/DNB), working as consultant (C) (>80%) and have >10 years' experience (Table 1). Among them 44% were working in Govt, set up, 23% in Private, 22% in Corporate and 11% in own hospitals.

Table 1: Distribution of participants by their working type and duration of working

Working as	Duration of working (Years)				
	<5	5-9	10-19	20+	Total
C	28 (13.53%)	49 (23.67%)	86 (41.55%)	45 (21.74%)	208 (100%)
S	50 (100%)				50 (100%)
Total	78 (29.18%)	49 (19.07%)	86 (34.24%)	45 (17.51%)	258 (100%)

C- Consultant; S- Student (all incuded in less then 5 years experience)

A. Knowledge About Bmwm

Table 2 show the participants responses for each knowledge question/item. Overall, knowledge score amongst participants was 48.31% as depicted in figure 1.

Table 2: Distribution of participants responses for each knowledge question/item

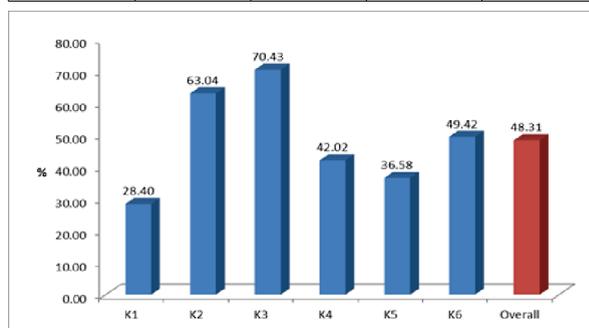| Items	A	B	C	D
K1	28.40	28.79	15.56	27.24
K2	9.34	63.04	5.06	22.57
K3	70.43	12.06	11.67	5.84
K4	37.74	20.23	42.02	0.00
K5	35.02	36.58	28.79	0.00
K6	49.42	24.12	26.46	0.00

Figure 1: Percentage of participants having correct knowledge about BMW

For knowledge, significantly higher 49.16% with correct responses was observed for consultants working in Govt. setting as shown in figure 2.
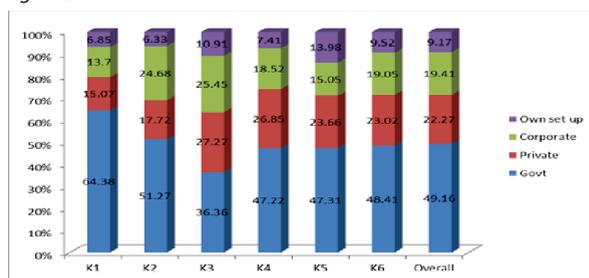

Figure 2: Percentage of participants with correct knowledge on BMWM according to working place

B) Attitude About Bmwm

Table 3 show the participants' responses for each attitude question/item. The overall attitude score amongst participants was 43.57% as depicted in figure 3.

Table 3: Distribution of participants' responses for each attitude question/item

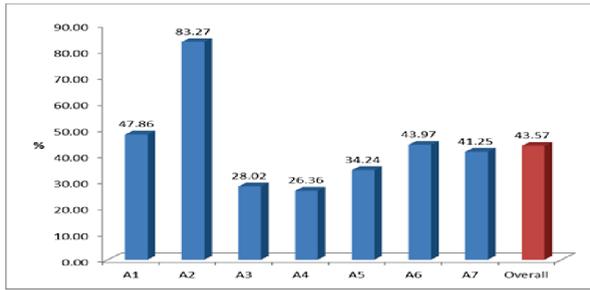| Items	A	B	C	D	E
A1	13.57	24.51	47.86	14.40	0.00
A2	17.05	83.27	0.00	0.00	0.00
A3	6.20	8.56	23.35	34.24	28.02
A4	26.36	35.02	38.91	0.00	0.00
A5	5.04	9.34	19.07	34.24	32.68
A6	3.10	3.50	14.01	43.97	35.80
A7	3.88	5.06	18.29	41.25	31.91

Figure 3: Percentage of participants having correct attitude about BMWM

For attitude, significantly lower percentage with correct responses was observed for consultants working in Private (25.73%) and Own setting (13.69%) as shown in figure 4.
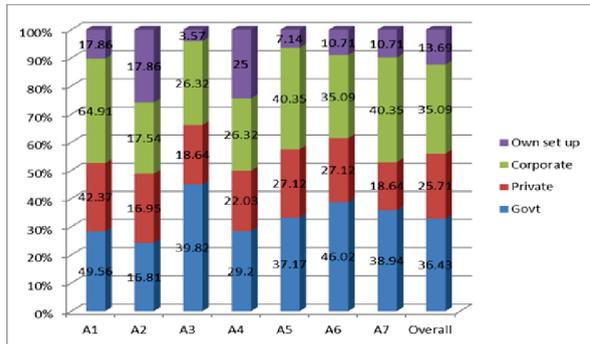

Figure 4: Percentage of participants with correct attitude on BMWM according to working place

C. Practices About Bmwm

Table 4 shows the participants' responses for each practice question/item. Overall Practice Score amongst participants was 62.32% as depicted in figure 5.

Table 4: Distribution of participants' responses for each practice question/item

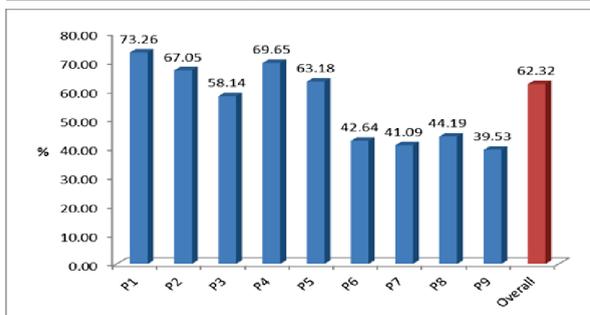| Items	A	B	C	D
P1	73.26	13.57	13.18	0.00
P2	13.57	67.05	13.18	6.20
P3	58.14	18.99	17.12	5.84
P4	7.00	11.28	12.45	69.65
P5	63.18	15.50	21.32	0.00
P6	6.98	42.64	21.32	29.07
P7	41.09	13.95	36.05	8.91
P8	7.36	44.19	30.62	17.83
P9	39.53	18.22	42.25	0.00

Figure 5: Percentage of participants having correct practice about BMW

For practices, highest 64.97% correct responses was observed for participents working in Corporate setting (64.97%) followed by government setting (59.94%), (Figure 6).
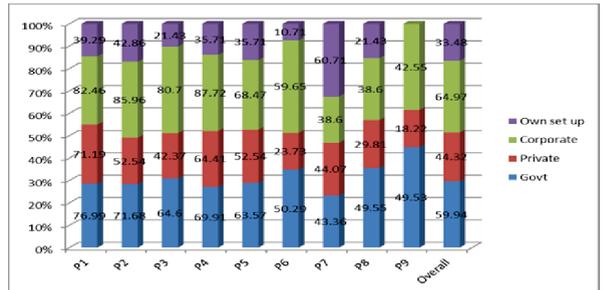

Figure 6: Percentage of participants with correct practices on BMWM according to working place

In the category of students amongst total participants, practice score was further studied, and it was observed that >50% students follow safe BMWM practices as depicted in figure 7.
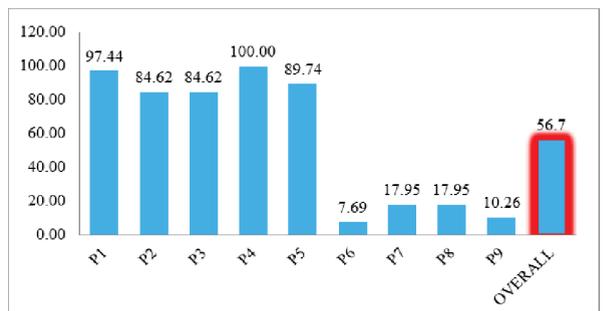

Figure 7: Percentage of students with correct practices about BMW

Overall combined KAP of participants regarding BMW was just average (50.89%) Participants in Govt Setup performed better with highest number of correct responses. For Knowledge, significantly higher (49.16%) correct responses were observed for consultants working in Govt. setting. For Attitude, significantly higher correct responses were observed for consultants working in Govt. setting (36.43%) and significantly lower (25.7%) in Private and Own (13.6%) setting. For Practices, significantly higher (64.97%) correct responses were observed for consultants working in corporate setting, (Table 5).

Table 5: Comparison of % of correct responses for Knowledge, Attitude and Practices by Consultant category

Correct %	Govt.	Private	Corporate	Own set up	Over all	p value
Knowledge	49.16	22.27	19.41	9.17	49.16	0.001
Attitude	36.43	25.71	35.09	13.69	43.57	0.001
Practices	59.94	44.32	64.97	33.48	59.94	0.002
KAP combined	48.51	30.76	39.82	18.78	50.89	0.004

Among knowledge attitude and practices, participants had better overall 59.94% of correct responses for practices as depicted in figure 8.
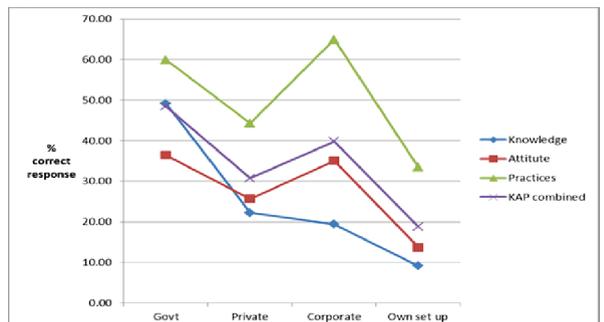

Figure 8: Comparison of correct responses (%) for knowledge,

attitude and practices amongst participants according to their working place

DISCUSSION

Proper management of biomedical waste is of utmost public health importance [7]. Statutory health care regulations of BMW management and careful supervision of their compliance cannot achieve the final goal unless they are supplemented by an approach of education, inspiration, and attitude change in all hierarchy of health practitioners [8]. An effective and successful BMW management program is primarily dependent on health care personnels' knowledge, attitude, and practices [9]. The present study investigated the KAP with respect to BMWM amongst anesthesiologists with the aim of contributing information useful in planning for improvements in the Biomedical Waste Management system.

Government of India has issued guidelines for proper management of healthcare waste [10, 11]. However, healthcare personnel's knowledge and perceived importance are crucial for its apt implementation. Findings of the present study reflected that overall knowledge score amongst anesthesiologists was 48.31% which was just average. This finding is correlated with the study done by Soyam GC et al, where the doctors having poor knowledge of colour coding when compared to nursing staff [13]. Ramkrishna M et al [14] also concluded that doctors had less knowledge score compared to other staff, which is contrary to few studies [15-18], where qualified personals like doctors have more knowledge than other staff. The study conducted in 2012 in a tertiary care hospital of West Bengal [19] showed lack of knowledge amongst junior doctors (as low as 29.5% in some aspects) in spite of BMWM inclusion in the MBBS curriculum. In present study, the responses (%) for knowledge was categorized into four groups according to their working place. For knowledge of BMW, significantly higher percent (49.16%) with correct responses was observed for consultants working in Govt. setting. It is advisable to conduct training at regular intervals for updates and improvement in knowledge and its implementation.

The overall attitude score amongst participants was 43.57% which was unsatisfactory, This finding correlated with the previous studies [20, 21]. For attitude, significantly lower percentage with correct responses was observed for consultants working in Private (25.73%) and Own setting (13.69%). Statutory guidelines alone cannot achieve the desired goal of proper BMW management. Health education for all hospital personnel in the form of multi-language seminars, pamphlets on waste hazards; encouraging studies on different aspects of medical waste and behavior change communication (BCC) of all strata of medical professionals specially doctors [19] will help in better implementation of the current guidelines on BMWM.

Overall practice score amongst participants was 62.32% which was satisfactory. For practices, highest 64.97% correct responses was observed for participants working in Corporate setting (64.97%) followed by government setting (59.94%), Among students practice score was further studied, and it was observed that >50% students follow safe BMWM practices.

The overall combined KAP score of participants regarding BMW and its management was just average (50.89%) amongst which participants in Govt Setup performed better with highest number of correct responses.

CONCLUSION

Overall, the knowledge was poor, attitude was unsatisfactory but practices towards biomedical waste management among anaesthesiologists were satisfactory. The comparatively better performance of anaesthesiologists in Govt Setup was associated with their knowledge, positive attitude, and good practices with respect to BMWM. Thus, the present study concludes that there is need to organise lectures/CME/training sessions in hospitals to bring more awareness on biomedical waste management.

Summary

This study was a modest attempt to evaluate the KAP of the anaesthesiologists towards BMW and its management. We recommend further studies on a larger strata of healthcare professionals across various hospitals to evaluate their awareness towards BMWM. Also strict supervision and surveillance should be followed during collection and disposal of biomedical waste in hospital on a daily basis.

Limitations

The present study did not collect direct observational data on BMWM practices amongst participants but relied on self-reporting. This may result in over reporting of correct responses. Actual knowledge, attitude and practices on BMWM may be low, but due to social desirability bias it came out to be high.

REFERENCES

1. Padmanabhan KK, Barik D. Health Hazards of Medical Waste and its Disposal. Energy from Toxic Organic Waste for Heat and Power Generation. 2019:99–118.
2. Singh A. Bio-Medical Waste Management and Handling Rules 1998. https://www.slideshare.net/AshishSingh226/bio-medical-waste-management-and-handling-rules-1998
3. Guidelines for Management of Healthcare Waste as per Biomedical Waste Management Rules, 2016. https://cpcb.nic.in/uploads/Projects/Bio-Medical Waste/Guidelines_healthcare_June_2018.pdf
4. https://npcb.nagaland.gov.in/wp-content/uploads/2016/03/BMW-rule-1998.pdf
5. Datta P, Mohi GK, Chander J. Biomedical waste management in India: Critical appraisal. J Lab Physicians. 2018;10(1):6-14.
6. Parida A, Capoor MR, Bhowmik KT. Knowledge, attitude, and practices of Bio-medical Waste Management rules, 2016; Bio-medical Waste Management (amendment) rules, 2018; and Solid Waste Rules, 2016, among healthcare workers in a tertiary care setup. J Lab Physicians 2019;11:292-9.
7. Mohapatra A, Gupta MK, Shivalli S, Mishra CP and Mohapatra SC. Biomedical waste management practices of doctors: an online snapshot. National Journal of Community Medicine 2012;2(3):227–31.
8. Aanandaswamy TC, Rajappa C, Venkatachala N, Kamath R. Assessment of knowledge, attitude, and practices regarding biomedical waste management among operation room personnel in a tertiary care center. Journal of Anaesthesiology. 2019;35(1):106–8.
9. Kumar M, Singh RK, Umesh VR. Awareness and practices about biomedical waste among healthcare workers in tertiary care hospital of Haldwani, Nainital. National Journal of Medical Research. 2015;159:72–73.
10. Government of India and Ministry of Environment and Forests, Bio-Medical Waste (Management and Handling) Rules, Gazette of India, 1998.
11. Government of India and Ministry of Health and Family Welfare (MoHFW), National Guidelines on Hospital Waste Management Based upon the Bio-Medical Waste (Management and Handling) Rules, MoHFW, New Delhi, India, 1998.
12. Vaught L. Medical waste disposal and the importance of color coding. October 2018, https://www.medsharps.com/medicalwaste-disposal-and-the-importance-of-color-coding
13. Soyam GC, Hiwarkar PA, Kawalkar UG, Soyam VC, Gupta VK. KAP study of bio-medical waste management among health care workers in Delhi. Int J Commun Med Publ Health. 2017;4(9):3332–7.
14. Mondal Ramkrishna, Satyanarayana P. Knowledge, Attitude and Practice (KAP) Study Regarding Bio-Medical Waste Management Am ong Staff in a Tertiary Care Hospital at Andhra Pradesh. Asian Journal of Management. 2018; 9(1):267-71.
15. Pandit NB, Mehta HK, Kartha GP, Choudhary SK. Management of Biomedical waste: Awareness and practice in a district of Gujrat. Indian J Public Health. 2005;49:245-7.
16. Saini S, Nagarajan SS, Sarma RK. Knowledge; attitude and Practice of biomedical waste management amongst staff of a tertiary level hospital in India. J Acad Hosp Adm. 2005;17:2.
17. Yadavannavar MC, Berad AS, Jagirdar PB. Biomedical Waste management: A study of Knowledge, Attitude, and Practices in a tertiary health care institution in bijapur. Indian J community Med. 2010;35(1):170-1.
18. Mathur V, Dwivedi S, Hassan MA, Misra RP. Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: A cross-sectional study. Indian Journal of Community Medicine. 2011;36(2):143–145.
19. Basu M, Das P, Pal R. Assessment of future physicians on biomedical waste management in a tertiary care hospital of West Bengal. J Nat Sci Biol Med. 2012; 3(1): 38-42.
20. Woromogo SH, Djeukang GG, Yagata Moussa FE, Saba Antaon JS, Kort KN, et al. Assessing Knowledge, Attitudes, and Practices of Healthcare Workers regarding Biomedical Waste Management at Biyem-Assi District Hospital, Yaounde: A Cross-Sectional Analytical Study. Advances in Public Health. 2020;56:1–7.
21. Karmakar N. A cross-sectional study on knowledge, attitude and practice of biomedical waste management by health care personnel in a tertiary care hospital of Agartala, Tripura. National Journal of Research in Community Medicine 2016;5.