

Assessment of Knowledge, Attitude, and Practices about Biomedical Waste Management among Nursing Professionals in a Tertiary Care Hospital, Bhubaneswar, Odisha.

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Abstract: Biomedical waste (BMW) management is an issue of major concern of all healthcare providers and healthcare establishments as the waste produced during the course of healthcare activities carries potential for infection and injury than any other type of waste. Biomedical waste management has recently emerged as an issue of present concern not only to hospitals, nursing home authorities but also to the environment. The bio-medical wastes generated from health care units depend upon a number of factors such as waste management methods, type of health care units, occupancy of healthcare units, specialization of healthcare units, ratio of reusable items in use, availability of infrastructure and resources etc. The proper management of biomedical waste has become a worldwide humanitarian topic today. Many studies across the country have shown that there are still deficiencies in the Knowledge, attitude and practices of the health care professionals in the organizations. Hence, A cross sectional study was carried out to assess the knowledge, attitude and practices regarding biomedical waste management among nursing professionals in a tertiary care hospital Bhubaneswar, Odisha. With due consideration to nursing personnel's availability, accessibility, feasibility, and resources, we decided to include (n=100) of them in our study. The number of nursing personnel was selected by simple random sampling in their respective department/specialty. A pretested self-administered questionnaire was used to assess the knowledge, practices and attitude of the nursing personnel regarding biomedical waste management. Overall, the knowledge, attitudes and practices towards biomedical waste management among the nursing professionals were satisfactory. Complete hepatitis B vaccine coverage among nurses (100%) in our study is attributed to hospital policy of free immunization to high risk groups. Such policy decisions do have a positive impact on work efficiency of nurses by creating a sense of being protected.

Keywords: Biomedical waste, Knowledge, Attitude, Practice, Nursing personnel

INTRODUCTION:

To enhance the quality of care and pursuing the aim of abating health problems, the healthcare facilities inevitably create waste that may itself be hazardous to health. Inadequate and inappropriate knowledge of handling of biomedical waste may have serious health consequences and a significant impact on the environment as well. Biomedical waste (BMW) produced in our country on an everyday premise is immense and contains infectious and hazardous materials. The hazardous impact of biomedical waste on the public and environment is enhanced manifold if adequate and appropriate handling of these wastes is not adopted. Biomedical waste management is an issue of vital concern of all healthcare providers and healthcare establishments as the waste generated during the course of healthcare activities carries potential for infection and injury than any other type of waste (1). Biomedical waste management is currently a burning issue, more so with the increasing health care facilities and increasing generation of hospital waste. It is assessed that every year, about 0.33 million tons of hospital waste is produced in India and, the waste generation rate ranges from 0.5 to 2.0 kg per bed per day (2). The proper management of such waste is not only a legal, but also a social responsibility of the hospitals. The waste generated in the hospital has significant health impact not only on the health care personnel but also on the general public. Improper handling of waste not only poses significant risk of infection due to pathogens like HIV, hepatitis B and C virus but also carries the risk of water, air and soil pollution thereby adversely affecting the environment and community at large (3). The hospital waste management has diverse ramifications as it not only affects the health of patients but also of healthcare workers and public.

Innovations in medical science & advancement in healthcare facilities have contributed significantly to the effective diagnosis of diseases & subsequent treatment of patients. While such facilities have brought about new hopes for combating the ever increasing health disorders & diseases, the process of diagnosis, analysis and treatment have led to production of wastes from various sources such as hospitals, nursing homes, clinics, pathological labs, blood banks, etc. these wastes termed as hospital wastes or biomedical wastes (BMW). Though bio-medical waste is a by-product of healthcare institutes constitutes a small portion of the municipal waste, yet they need special handling due to their highly toxic and infectious nature, which may pose a serious threat to human health as well as the environment if not managed properly (4). Improper biomedical waste management practices & indiscriminate disposal of hospital waste causes spread of illness leading to financial burden to society. Good biomedical waste disposal practices lead to reduction in medical expenditure, unsightly scenes at various disposal bins & dumping sites ultimately leading to healthier society. So it is the duty of every hospital to ensure safe handling & management of biomedical waste. As per the Biomedical waste management (BMW) rules, it is the duty of every biomedical waste generator to dispose the biomedical waste

safely. Hence it is important that all the healthcare workers should be well versed with the procedures to be followed in their institutions and the rules set by the government for hospital waste management under “Biomedical Waste (Management & Handling) Rules, 1998” as amended in June 2000 (5).

Segregation at the site of waste generation is the first and foremost important step in healthcare waste management. Biomedical waste should be segregated at source of origin into color-coded bags or containers and its collection and proper disposal should be a significant concern for both medical personnel and general community (6). It is highlighted as a means of ensuring that hazardous healthcare risk waste and healthcare general waste are segregated and stored in suitable containers. The significance of segregation is highlighted by the mere fact that only 10% to 25% of wastes produced in health facilities are hazardous. Failure of this crucial step turns nonhazardous waste into hazardous. Segregation also empowers those who handle the containers outside the hospital wards to identify and treat them appropriately. Since the implementation of BMW rules (1998), every concerned health personnel is expected to have proper knowledge, practice and capacity to guide others for waste collection and management, and proper handling techniques (5). However, due to laxity in implementation of the rules and lack of awareness due to inadequate training of health care personnel has led to the hospitals becoming a centre point of spreading diseases rather than working towards eradicating them.

Money saved in management of hospital acquired infections is much more than the money spent on treating those infections & spent on its control activities. Biomedical waste is a unique category of waste by the quality of its composition, source of generation, its hazardous nature and the need for appropriate protection during handling, treatment and disposal. Mismanagement of the waste affects not only the generators, operators but also the common people too (7). The improper management of biomedical waste poses significant hazardous risk to the patients, healthcare workers, the community and environments (WHO, 2007). The biomedical waste is defined as the waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological including categories mentioned in the schedule-I of Biomedical Waste (Management and Handling) Rules 1998, Government of India (8). As per the recent BMW Management Rules, 2016 (3) these rules apply to all persons who generate, collect, receive, store, transport, treat, dispose or handle BMW in any form including hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories, blood banks, Ayush hospitals, clinical establishments, research or educational institutions, health camps, medical or surgical camps, vaccination camps, blood donation camps, first aid rooms of schools, forensic laboratories and research laboratories by whatever name they are called to take all the steps to ensure that such waste is handled without any adverse effect to human health and environment.

According to WHO 2009, around 85% of the hospital waste is non-hazardous, 10% infective and remaining 5% non-infective but hazardous. Management of infectious waste is a major challenge to the hospitals. Concurrently, the health care providers should know the quantity of waste produced in their facility and try to minimize the waste generation in day-to-day work because lesser amount of biomedical waste means a lesser burden on waste disposal work and cost saving. Epidemiological studies demonstrate that an individual who encounters one needle stick injury from a needle used on an infected source patient has risks of 30%, 1.8%, and 0.3% respectively of becoming infected with HBV, HCV and HIV (9). During 2000, the World Health Organization assessed that injections with contaminated syringes caused 2 million hepatitis C virus infections, 260 000 cases of human immunodeficiency virus (HIV) infections and 21 million hepatitis B virus infections, (10). Cases with staphylococcal bacteriemia and endocarditis were reported among cleaning staff after needle stick injury (11). Healthcare providers are at risk of occupational dangers as they perform their jobs in hospitals. Serious diseases may develop in health care providers as well as patients and the general public.

Teaching institutes play a vital role in the health care setup as it is from these places that the future health care professionals and all those persons involved in the care giving to the community are educated (8). Different Studies have conveyed that there are gaps in the knowledge, lacunae in the attitudinal component and inconsistency in the practice aspects which are matters of concern among the health care professionals (12,13). Although legal provisions [Biomedical Waste (management and handling) Rules 1998], exist to lessen the effect of hazardous and infectious hospital waste on the community; still these provisions are yet to be fully executed (14). The absence of proper waste management, lack of awareness about the health hazards from biomedical wastes, insufficient financial and human resources, and poor control of waste disposal are the foremost critical problems connected with biomedical waste (15).

Appropriate management of biomedical waste management begins from the initial stage of generation of waste, segregation at the source, storage at the site, disinfection, and transfer to the terminal disposal site plays a vital role in the disposal of waste. The health personnel who involved in handling the biomedical waste at different point of generation in hospital include doctors, nurses, lab technicians, ward boy etc. Thus the knowledge regarding biomedical waste management among health care personnel have greater impact on health and environment. Nursing professionals play a critical role in biomedical waste segregation in the hospitals. Their knowledge, attitudes, and practices regarding biomedical waste management are vital for the prevention of biomedical waste related hazards. Even though, there's an increased global awareness among health professionals about the hazards and also appropriate management techniques, the extent of awareness in India is found to be below par (16, 17,18). Hence adequate knowledge, attitudes and practices of the staff of the health care institutes play a very important role (1, 12). Nursing professionals form the backbone of any hospital. Nursing professionals play a significant role in imparting health services in all level, protection,

prevention, promotion and treatment. Their level of awareness regarding biomedical wastes can go an extended way towards safe disposal of hazardous hospital waste & protect the community from its various adverse effects. Hence, this study aims to assess the knowledge, attitude and practices regarding biomedical waste management among nursing professionals in a tertiary care hospital in Bhubaneswar City, Odisha.

MATERIALS AND METHODS:

The hospital based cross-sectional study was carried out for a period of 3 months to assess the knowledge, attitude and practices among nursing professionals in tertiary care hospital in Bhubaneswar City, Odisha, India. It is a teaching hospital attached to a medical college, recognized by the Medical Council of India with a capacity of more than 1500 beds, and generates all types of medical wastes. All the nursing personnel working in various departments of the studied hospital formed the sampling frame. With due consideration to nursing personnel's availability, accessibility, feasibility, and resources, we decided to include (n=100) of them in our study. Assuming a non-response rate of 10%, we approached 110 nursing personnel, of whom 100 consented to voluntary participation. Random sampling was done. List of all the nursing personnel was obtained from human resource department and probability proportional to size was applied to decide the number of nurses to be selected from each department/specialty. The number of nursing personnel was selected by simple random sampling in their respective department/specialty. If the randomly selected person was not available or did not give consent to participate voluntarily then the next nursing person in the list was included.

A pretested self-administered questionnaire was used to assess the knowledge, practices and attitude of the nursing personnel regarding biomedical waste management. To ensure confidentiality and enhance the participation anonymity of the study participants was maintained. Necessary permission was obtained from medical superintendent of the hospital for conducting study in selected wards. Informed consent was taken from all the nursing personnel those were willing to participate in the study. The Questions related to demographic details like the participants name, age, sex, department they are currently working in, total years of experience, years worked in the current hospital, their training in biomedical waste management, years of experience, vaccination against Hepatitis, needle stick injury were also included. The questionnaire consisted of 19 questions of which 11 questions were to assess the knowledge, 5 were to assess attitudes, 3 questions assessing the practices with yes/ no responses and 1 was to assess each of hepatitis B vaccination status and training received regarding biomedical waste management. Knowledge assessment was done by questions pertaining to colored containers, segregation, and storage of various biomedical wastes, hazards of improper waste handling, and biohazard symbol. Attitudes were assessed by seeking their opinion regarding nurses' role in biomedical waste segregation, need for refresher training, necessity of wearing PPE, display of posters of healthcare waste segregation in hospital, and education of patients and their relatives about the same.

The questions on practices appraised if the study respondents had disposed the biomedical waste in specified colored bins, if disinfection of sharps were carried out at the point of generation and disposal of sharps in puncture proof containers, and reported any injuries due to improperly disposed sharps. The questionnaire was formulated according to the requirements of the study. To assess the knowledge of the respondents a scoring system was developed. Each correct response was awarded with one point and zero points were given for wrong response. To score maximum (i.e., 11 points), respondents should mention four colored coded bags, that is, red, blue/white, yellow, and black (1 point); mention maximum allowed waste storage time (1 point); tell the correct colored bag to segregate used needle (1 point), paper waste (1 point), used intravenous set (1 point), discarded medicine (1 point), Foley's catheter (1 point), and dressings or cotton (1 point); know at least 3 diseases which can spread by exposure to healthcare waste (1 point); enumerate at least 3 methods of waste disposal (1 point); and identify the biohazard symbol (1 point).

Study participants' knowledge was categorized as excellent, good, and poor based on their percentage scores of more than 70%, 50–70%, and less than 50%, respectively. The data was entered in MS- Excel spreadsheet and was analyzed using Statistical Package for the Social Sciences (SPSS) software. Chi square test was applied to judge the association of discrete and continuous study variables with the knowledge and attitudes of nurses, respectively.

RESULTS AND DISCUSSION:

Responsibilities of a hospital do not end up with medical treatment only. In this context, proper management of biomedical wastes is of utmost public health importance (19). The present study was an attempt to appraise nursing personnel in a tertiary care hospital of Bhubaneswar city regarding biomedical waste management. Various cross sectional studies have been done on the same as mentioned in our study (17, 20).

An appropriate BMW management system is very much essential for prevention of hospital-borne infection, to safeguard the environment and public health at large. However, healthcare personnel's knowledge and perceived importance are pivotal for its appropriate implementation. Recognizing the importance of this issue, the Government of India notified the biomedical waste (Management and handling) Rules, 1998, which were further amended in 2003. Infection prevention practices and hospital waste management systems need to be in place for assured quality of care in hospitals. Proper handling, treatment, and disposal of biomedical waste are necessary elements of healthcare infection control program. Statutory public health guidelines of biomedical waste management and close monitoring of its compliance alone cannot achieve the ultimate goal if it is not accompanied with social science approach of education, motivation, and change in mindset in all strata of healthcare personnel. Any system of treatment and disposal that is operated by well-trained and well-motivated staff can provide more protection for staff, patients, and the community than an expensive or sophisticated system that is managed

by staff who do not understand the risks and the importance of their contribution. The knowledge and practices of healthcare personnel regarding appropriate management of BMW have a serious impact on public health. It is also important to understand that all healthcare personnel are legally bound to follow appropriate practices as prescribed by the biomedical waste management rules, 1998.

The results of the present cross-sectional study were evaluated across 3 domains for all the nursing personnel of the study population. Hundred nursing personnel participated in the study and the majority (82%) of them were females. Mean age of the nurses was 25.35 ± 3.36 years and mean experience in nursing profession was 2.74 ± 2.09 years. Almost half (51%) of them were working in surgical departments and the remaining half (49%) were working in medical departments including emergency/casualty. All the nursing personnel were given induction training regarding biomedical waste management for one day at the time of appointment by a qualified hospital administrator. All the nursing personnel were immunized against hepatitis B as per the hospital policy. Almost half of the nurses (48%) had excellent knowledge ($>70\%$ score) about biomedical waste management. However, one-fifth (18%) of them displayed poor knowledge ($<50\%$ score) about the same. Mean knowledge score was $69.15\% (\pm 18.6)$ (**Table 1**).

The findings of our study reflected satisfactory knowledge of the nursing personnel regarding biomedical waste management. The present cross-sectional study recognized certain inadequacies in the knowledge component amongst the nursing personnel, though greater than 50% of the study respondents, demonstrated good knowledge, attitudes and practices. The studies have been conducted by Mathur, V et al., and Pandit, N.B. et al., to assess knowledge and practices of healthcare professionals and the studies reflected that the Knowledge about biomedical waste management is consistent on all the study participants (1, 16). Although induction training was given for all of them in our study, no refresher trainings were followed. The same was felt by most of the nursing personnel (86%). It is sensible to conduct refresher trainings at optimum intervals for sustainability improvement (18% had poor knowledge), and updating of knowledge and its implementation. Similar findings were also reported by Bansal, M., et al., in their study from Gwalior, India (20). Saini, S., et al., also reported positive attitudes and fair knowledge of nurses in a tertiary care set up in New Delhi (21). In another study on health care waste segregation by Deo, D., et al., nurses and lab technicians had better knowledge (90%) than medical staff like doctors (80.6%) (22). In a study conducted by Qureshi Waseem, M.D., et al., as much as 59% of the nurses gave positive response for healthcare waste management (23).

Effect of study variables such as age, sex, department of work, and nursing experience was assessed by comparing the mean knowledge scores among various categories. Knowledge was relatively better among those aged 25 years or more, female nursing personnel, and those with the experience of more than two years. These results suggest that with increase in age and experience there is significant increases in knowledge regarding biomedical waste management. Nonetheless, none of the observed differences were statistically significant ($P > 0.05$) (**Table 2**).

Attitudes of the nursing personnel were further assessed according to their age, gender, experience, specialty of work, and healthcare waste management knowledge levels (**Table 3**). All the nursing personnel were stressed upon “use of PPE” during biomedical waste segregation and “poster display” about biomedical waste segregation at in patient as well as outpatient areas. Nursing personnel were using gloves while nursing the patients and handling the waste. More than 90% of the nurses opined that proper healthcare waste management is imperative and could appreciate their vital role in it. Almost nine out of every ten nurses (86%) expressed the need of refresher training on biomedical waste management. Similar result were also observed in a study done on assessment of existing knowledge, attitude, and practices regarding biomedical waste management among the health care workers in a tertiary care rural hospital of B. G. Nagara which stated that 60% of nurses felt to go for training program on management of BMW (8). Less than half of the nurses (39%) highlighted the need of patient and their attendants’ education on biomedical waste management as Patients and their relatives are not supposed to be involved in healthcare waste segregation (Table 3). But, Patient and their attendants' orientation to healthcare waste and display of segregation information board in local language could further improve the segregation efficiency and lessen the burden on nursing personnel. Significantly ($P < 0.05$) higher number of nurses in surgical specialty (98%) could appreciate their vital role in healthcare waste management than their nonsurgical counterparts (85.7%) but differences observed for various attitudes within other study variables were not significant ($P > 0.05$).

Complete hepatitis B vaccine coverage among nursing personnel (100%) in our study is attributed to hospital policy of free immunization to high risk teams. Such policy decisions do have a positive impact on work potency of nursing personnel by making a sense of being protected. Lower level of hepatitis B vaccination among nursing personnel was reported from studies conducted in Iran (89.6%), (24), South Africa (68%) (25) and India (44.8%) (26). The work place practices of 100 nursing personnel were assessed. Regarding practices related to biomedical waste management among study participants were good. Availability and easy accessibility of all four colored containers are important for appropriate and sustained segregation practices of nursing personnel. Nursing personnel were having positive attitudes in their segregation practices in our study. In another study all the (100%) nurses were practicing according rules in a study by Saini, S., et al., (21) from New Delhi.

Four colored containers (i.e., yellow, blue, black, and red) were used at all the stations. To aid the nurses in proper segregation, instruction boards in English language were placed near the waste containers. Dressings and cotton were placed in yellow container, used intravenous sets and Ryle’s tube and so forth contaminated with blood or body fluid were segregated in red bin. Nurses isolated waste sharps like needles in a blue puncture-proof container. The Waste was collected from every station twice daily by the waste handlers. Regarding practices related to biomedical wastes, 70% practiced the disposal in specified color coded bins, while as 72% made

disposal of sharps in puncture proof containers but only 30% were reporting the injuries due to improper disposal of sharps. The details are depicted in **(Table 4)**.

Consistent figures have also been shown by other studies (Saini, S., et al., Madhukumar, S. and Ramesh, G.,) the practice of reporting of injuries resulting from improperly disposed biomedical waste was found to be miserably low among the technical staff and was found to be completely absent among the nontechnical sanitary staff. (21, 27). Stein, A.D., et al., (2003) in their study reported that among doctors and nurses, only 37% reported that they ever suffered needle stick injury (28). Low reporting of injuries may be attributed to the fact that most of the doctors and other technical and nontechnical staff are unaware about a formal system of injury reporting which should be established within all the health facilities. The practice of non-reporting of injuries due to sharps is low among nurses of this hospital. Low reporting in our study is possibly due to unawareness about formal system of injury reporting due to sharps in a health care setting.

In our hospital the segregation of BMW was being done at the site of generation in colour coded polythene bags as per the BMW (management and handling) Rules, 1998. For the easy accessibility of the staff, the colour coded bags were being placed inside similar colour coded bins and colored posters showing the segregation of BMW in local language were being displayed at the site of segregation of waste in the hospital. As per the hospital protocol, segregation of biomedical waste was being done at the site of generation in almost all the areas of the hospital in color coded polythene bags. The different types of waste being collected were infectious solid waste in red bag, soiled infectious waste in yellow bag and sharp waste in puncture proof container and blue bag. The different type of waste produced from our hospital was: infectious solid waste such as catheters, intravenous sets, gloves, universal containers, urine bags, syringes without needles, vacutainers, cartridge, dropper, tips, rapid cards and culture plates collected in red coloured plastic bags. The soiled waste such as cotton, dressings, plaster casts, swabs, masks, cap, dipstick, discarded medicines, cytotoxic drugs, human anatomical waste and animal waste collected in yellow coloured plastic bags. Sharp waste such as needles, needles from needle tip burner, scalpels, blades, lancet, glass slide, cover slips, broken glass, tubes or any other contaminated sharp object that may cause puncture and cuts such as used and unused sharps (reagent/chemical bottle/IV infusion bottles) collected in puncture proof, leak proof translucent containers/blue bag. Lastly, the general waste such as paper, packing material, general municipal waste and leftover food was collected in black plastic bag.

Segregation is an important requirement in the entire process of waste management. Proper segregation of biomedical waste was practiced in majority of the areas in our hospital highlighting the effectiveness of education by the Infection Control Committee. To increase compliance towards biomedical waste management in our hospital, the following was done: i) coloured posters showing the segregation of biomedical waste in local language was being

displayed at the site of segregation in all the areas of the hospital so that it is easy for the staff to refer to, in case of doubt; and ii) colour coded bags were being placed inside similar colour coded bins for the convenience of housekeeping staff and the care givers. Continuous surveillance of segregation practices by hospital infection control committee and inspiring prompt reporting and also ensuring appropriate medical care for the accidental exposures among nursing personnel to be increased.

CONCLUSIONS:

This study was a modest attempt to evaluate the Knowledge, attitude and practices of the nursing professionals towards biomedical waste management. All the nursing personnel were given induction training regarding biomedical waste management for one day at the time of appointment by a qualified hospital administrator. All the nursing personnel were immunized against hepatitis B as per the hospital policy Almost half of the nurses (48%) had excellent knowledge (>70% score) about biomedical waste management. However, one-fifth (18%) of them displayed poor knowledge (<50% score) about the same. Knowledge was relatively better among those aged 25 years or more, female nurses, and those with the nursing experience of more than two years. These results suggest that with increase in age and experience there is significant increases in knowledge regarding biomedical waste management. All the nursing personnel were stressed upon “use of PPE” during biomedical waste segregation and “poster display” about biomedical waste segregation at in patient as well as outpatient areas. Nursing personnel were using gloves while nursing the patients and handling the waste. More than 90% of the nurses opined that proper healthcare waste management is imperative and could appreciate their vital role in it. Almost nine out of every ten nurses (86%) expressed the need of refresher training on biomedical waste management. Regarding practices related to biomedical wastes, 70% practiced the disposal in specified color coded bins, while as 72% made disposal of sharps in puncture proof containers but only 30% were reporting the injuries due to improper disposal of sharps. Overall, the knowledge, attitudes and practices towards biomedical waste management among the nursing professionals were satisfactory. There is a need of refresher trainings at optimum intervals to ensure sustainability and further improvement. Even though the knowledge, attitude and practice of biomedical waste management are satisfactory among the participants of this study, it can be further improved by conducting programs stressing not only on the knowledge and practice but also should stress about the attitude of the nursing personnel towards biomedical waste management by educating them about the importance of it and by enlightening them about the hazardous effects of improper management of biomedical waste management on the environment, public health and also on health of the health care workers themselves. The biomedical waste management cannot be successfully implemented without the willingness, self-motivation and co-operation from all sections of employees of any healthcare establishments. This should be incorporated with effective implementation of rules and regular monitoring by authorities.

RECOMMENDATIONS:

Training programs need to focus on empowering the nursing professionals on biomedical waste management with broad scope and practical knowledge in all aspects. The right practices and other activities of biomedical waste management and its ramifications in the form of avoiding of injuries, importance of vaccinations and following of universal precautions can be achieved when adequately supported by IEC (information, education and communication) strategies like handouts, stickers, charts, celebrations of various days like hand hygiene day and other days can help in improving the practices of the employees of the organizations. Training the staff with Checklists and regular inspections can bring about accountability in the staff. We recommend further studies on a larger stratum across hospitals to evaluate the awareness of nursing professionals towards biomedical waste management.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Table 1: Knowledge level of Nursing personnel about biomedical waste management (n=100)

Knowledge(% score)	Number	Percentage (%)
Excellent ($\geq 70\%$)	48	48
Good (50-70%)	34	34
Poor (<50%)	18	18

Table 2: Knowledge of Nursing personnel about Biomedical waste management according to their age, gender, department of work and nursing experience (n=100)

Study Variable	N%	Knowledge Level						X ²	P
		Poor		Good		Excellent			
		n	%	n	%	n	%		
Age									
<25 years	52	13	25	16	30.8	23	44.2	2.561	0.277
≥ 25 years	48	6	12.5	17	35.41	25	52		
Gender									
Male	18	6	33.3	7	38.9	5	27.8	4.254	0.119
Female	82	13	15.9	28	34.14	43	52.4		
Department of Work									
Medical	49	12	24.5	12	24.5	25	51	4.41	0.110
Surgical	51	7	13.7	21	41.2	23	45.09		
Experience in Nursing									
≤ 2 years	61	14	23	20	32.8	27	44.2	3.28	0.194
>2 years	39	4	10.2	14	35.8	21	53.8		

Table 3: Attitude of the Nursing personnel towards biomedical waste management according to their age, gender, department of work, nursing experience and knowledge level (n=100)

Attitudes of nurses	Age (years)		Gender		Specialty		Experience		Knowledge level		
	<25	>25	M	F	Med	Surg	<2yrs	>2yrs	poor	Good	Excellent
	n=52	n=48	n=18	n=82	n=49	n=51	n=61	n=39	n=18	n=34	n=48
Nurses play vital role in Biomedical waste segregation	90.4	94	89	92.7	86	98	92	92.3	90	94.1	95
Need of refresher training	83	90	89	85.4	80	92	88	84.8	85.1	88.2	84.2
Wearing PPE during waste segregation	98.1	100	100	98.8	98	100	98.4	100	100	100	98
Display of posters of biomedical waste segregation	100	100	100	100	100	100	100	100	100	100	100

Requirement of Patients and their attendants education	38	40	45	37.8	35	43.	39	39	36.3	47	31.7
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Table 4: Biomedical waste management practices followed by Nursing personnel (n=100)

Biomedical waste management practices	Nursing personnel (n=100)
Disposal in specified color coded containers	73(73%)
Disposal of sharps in puncture proof container	72(72%)
Reporting of injuries due to improperly disposed sharps	30(30%)