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Research Article

Biomedical waste

A study to assess the practice of biomedical waste management and its influencing factors among health care providers at selected hospitals of Kolkata, West Bengal

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Background: Mismanagement of healthcare waste puts the community, the patients and healthcare workers at risk, both in terms of the risks from inadequate storage, transportation and disposal of infectious waste and from the environmental risks arising from hazardous burning. A descriptive survey was undertaken to assess the practice of Biomedical Waste Management and its influencing factors among health care providers. **Method:** Quantitative, non-experimental Survey Research Design was adopted. A total of 105 health care providers, namely the Staff Nurses, Doctors and Group-D staff, were selected by convenient sampling technique from three government hospitals. Descriptive and inferential statistics were used for data analysis. **Result:** The study findings revealed that the mean practice scores for Staff Nurses, Doctors and Group-D staff were 16.66, 14.77 and 16.03, respectively. There was a statistically significant association between the practice score of Staff Nurses and their age ($\chi 2(1) = 8.11$, $p<0.05$) and period of working experience in the hospital setup ($\chi 2(1) = 8.24$, $p<0.05$). The factors like unawareness (28.6%), lack of training or in-service education (41.9%), overload of work (61%), lack of supervision (36.2%), lack of audit (36.2%), lack of supplies (61.9%) as expressed by the health care providers also emerged from the study which is probably the negative factors leading to their average practice and poor practice. **Conclusion:** From the study findings, it can be concluded that only a few of the practices of health care providers were good, of which Staff Nurses were the majority group who adhere to good practices.

Keywords: Biomedical Waste Management, Factors influencing, Health Care Providers, Practice

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Introduction

A hospital is a specialized setting where numerous clinical activities are carried out to deliver health care to patients. These all activities produce a considerable amount of unusable left-over called hospital waste. Mismanagement of healthcare waste puts the community, the patients and healthcare workers at risk, both in terms of the risks from inadequate storage, transportation and disposal of infectious waste and from the environmental risks arising from hazardous burning in open pits or badly maintained incineration equipment. Many findings in developing countries on healthcare wastes management revealed that segregation, collection of waste using recommended colour-coding containers and storage of waste in the isolated area were not satisfactory. Personal protective equipment and accessories were not provided and not used by H.C.W.s [1].

The first Bio-Medical Waste Management and Handlings Rules (1998) followed by the Second Amendment (2000) states that every occupier of an institution generating biomedical waste, including hospitals, nursing homes, clinics, dispensary, veterinary institutions, animal house, pathological laboratories, blood banks are supposed to take steps to ensure that such wastes are handled without any adverse effect to human health and environment. The rules apply to all those who generate, collect, receive, store, transport, treat, dispose or handle biomedical waste and also to every institution that generates biomedical waste. [2,3].

Waste segregation is the key to waste minimization, efficient collection, transportation and disposal. Nowadays, segregation of biomedical waste is done by using yellow bags for human anatomical waste, specimens, surgical waste, and discarded medicine, blue bags for plastic items, and black bags for general health care wastes and puncture-proof containers for sharp wastes. The wastes of yellow bags are finally disposed of by incineration and deep burial. The wastes of blue bags are sent for autoclaving, and the sharps of the puncture-proof container are sent for autoclaving after chemical treatment.[4]. From the investigator's experience, it has been seen that the health care providers are not correctly practising hospital waste management despite having much literature

On biomedical waste management. There are a few influencing factors like lack of in-service education, workload, lack of supervision, structural problem, an insufficient supply of equipment, audit on biomedical waste management, which hinders them from the practice of biomedical waste management. Therefore, the present study was initiated to assess the practice of biomedical waste management and identify the factors influencing that practice that inhibits all health care providers from proper practise of biomedical waste management.

Problem Statement A study to assess the practice of biomedical waste management and its influencing factors among health care providers at selected hospitals of Kolkata, West Bengal.

Objectives

01. To identify the existing practices related to biomedical waste management among health care providers.
02. To determine the factors influencing biomedical waste management practices among health care providers.
03. To find out the association between practices of biomedical waste management and selected demographic factors.

Operational Definitions

Biomedical waste: Biomedical waste is any solid, fluid or liquid waste, including container and any intermediate product, generated during diagnosis and treatment in the hospitals.5 In this study, referred to the biomedical wastes of the selected hospital where data collection took place.

Practice: Practice refers to the activities performed by the health care providers related to biomedical waste management as measured by a structured observation checklist. It was planned to observe the activities as the following:

01. For Staff Nurses: Procedure, disposal into proper receptacle, supervision and record-keeping.
02. For Doctors: Procedure and disposal into the appropriate receptacle.
03. For Group-D staffs: Collection and segregation, transport and disposal.

Factors influencing practice: The factors are referred to the selected determinants of the practice of biomedical waste management (expressed

By the health care providers) as measured by a structured interview schedule. The determinants were:

01. ***Unawareness***: It is the lack of attention of the health care providers in dealing with biomedical waste management.
02. ***Lack of in-service education:*** It is the inadequate or absence of teaching on biomedical waste management among health care providers after working in the hospital setup.
03. ***Workload:*** It is the number of tasks that the health care providers have to accomplish during their duty hours.
04. ***Lack of supervision***: It refers to negligence or absence in looking after the health care providers by their immediate superiors in dealing with biomedical waste management in the working area, which is done weekly, once in two weeks or once a month.
05. ***Insufficient equipment supply:*** The unavailability of soap, tissue paper, masks, plastic apron, gloves, shoes, caps and different colour-coded plastic bags for collecting biomedical waste in the ward.
06. ***Structural problem*:** It is the physical structure of the ward which is hindering the health care providers in their practice of biomedical waste management where the health care providers are performing their duty. e.g. All colour-coded waste bins are not kept together in one area, or the ward is too big, so the distance between the patient's bed and the waste bins are more.
07. ***Lack of Audit:*** It is the inadequacy of the concerned heads on documenting the practice of biomedical waste management by the health care providers.

Research Methodology

Research Approach: Quantitative Research, Non-experimental survey design

Descriptive research design: Descriptive research design

Population: The target population is the health care providers, namely the Staff Nurses, Doctors and Group D staffs/sweepers of West Bengal.

Sample size:

The sample consisted of 105 health care providers, of which 35 were Staff Nurses, 35 Doctors and 35 Group D staff/sweepers, working in Surgical Units of IPGME&R, S.S.K.M. Hospital, Bangur Institute of Neurosciences and N.R.S. Medical College and Hospital.

Sampling Technique: Non-probability convenient sampling.

Description of Tool

The tool consists of 3 parts:

Tool -I: Structured interview schedule of Demographic characteristics: The agency comprised of 6 items, namely age, gender, academic qualification, professional qualification, years of experience in hospital setup and training on biomedical waste management for doctors and nurses. The item regarding professional qualification was omitted when data collection was done for the Group D staff. It was collected by interviewing method.

Tool II: Observation Checklist of Practice on biomedical waste management: It consisted of 23 items to assess the practice of three categories of health care providers, but the particular items vary from one group to other. Parts of observation checklist to access the practice of biomedical waste management of **Part I** Procedure, Disposal, Supervision and Record-Keeping by Staff Nurse**. Part II** Procedure, Disposal by Doctors and **Part III-**Collection, Segregation, Transport and Disposal by Group D staff

Scoring was planned next. Each item had a "Yes" and "No" column to their right. It was decided to give tick mark (√) and accord a score of "1" If the health care provider correctly performed the procedure, and cross mark (X) would be given carrying score "0" if not performed correctly. Maximum score - 23. An arbiter categorization was made for

"Good" practice score more than 80% i.e.19-23, "Average" practice score- 60% to 80% i.e. 14-18 and "Poor" practice score less than 60% i.e. 0-13. Collected by observation method

(Tool-III) Structured interview schedule: Factors influencing practiCe of biomedical waste management.

This tool was developed in the areas like awareness,

Training or in-service education, supervision, supply of equipment, workload, structural problem, needle stick injuries, audit, and some other factors influencing the practice of biomedical waste management. Data was collected by interviewing

Validity: Content validity was established by seeking suggestions from 9 experts from the field of Medical-Surgical Nursing, Medicine, Department of Health Education and Department of Epidemiology. 5. Items were modified according to the experts' opinion, and the final draft was prepared. 6. The Bengali version of the tool for the Group D staff was prepared as per the advice of the experts, and language validity was established by retranslating it into English and Bengali with the help of language experts.

Reliability of the observation checklist: The observation checklist was administered to 6 Staff Nurses, 6 Doctors and 6 Group D staff to establish the internal consistency of reliability. The reliability of the observational list was established by inter-rater reliability. The coefficient of correlation (r) was calculated by Spearman's rank-order method, which was found to be 0.88 for Part I of Tool II, 0.87 for Part II of Tool II and 0.85 for Part III of Tool II. The figures indicated that the tool was reliable.

Try out of the tool: Try out was done on 6 Staff Nurses, 6 Doctors and 6 Group-D staffs after obtaining formal permission from the concerned authority and looking into the ethical consideration to find out the: Clarity of language, Ambiguity of statements, Difficulty in understanding any item. The time to complete the observation checklist was approximately 25 to 30 minutes per participant.

Final Data Collection Procedure: The procedure was conducted at N.R.S.M.C and H. and S.S.K.M. Hospital from 28/12/13 to 25/01/14. All formalities were fulfilled before performing the final study. Ethical Committee approval was obtained, administrative permission was sought from the authority. The investigator herself made the introduction to explain the purpose of the study, rapport was established, and informed consent was taken from the respondents. The estimated sample size was 105 and was selected using a convenient sampling technique. On the day of data collection, Staff Nurses, Doctors and Group D staffs were interviewed. The interview was taken in English and Bengali versions. The interpreter's help was taken for the Bengali version. Four

To five samples approximately (2 Staff Nurses, 2 Doctors, and 1 Group D staff) were interviewed per day using a structured interview schedule and observation checklist. Data were collected from six surgical units of three hospitals on separate days. After completing the total procedure, the investigator thanked each sample for their co-operation. The average time for each subject to complete the observation checklist was 60- 90 minutes, and the structured interview was 25-30 minutes approximately.

Plan for Data Analysis: The obtained data were planned to be analyzed with the help of both descriptive and inferential statistics based on the study's objectives. The following data analysis plan according to the objectives was developed with the opinion of experts (statisticians).

01. Demographic characteristics of samples (Staff Nurses, Doctors and Group D staffs), Practice of Biomedical Waste Management of samples and Identification of the factors influencing the practice of Biomedical Waste Management will be analyzed by frequencies and percentages.
02. Association between biomedical waste management practices with demographic variables would be analyzed by Chi-square test.

Results

Fig No 1: Finding related to the practice score of Biomedical Waste Management by Staff Nurses, Doctors and Group D Staffs.

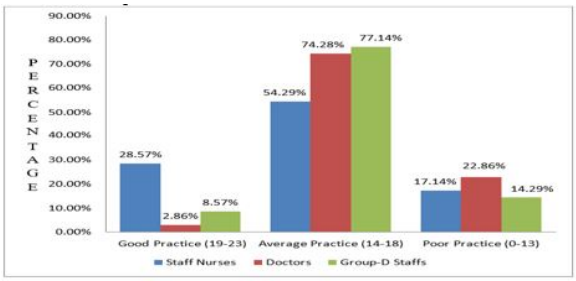

Figure No 1 depicted that finding related to the practice score of Biomedical Waste Management.

For Staff nurses: Good – 28.57%, Average – 54.29%, Poor – 17.14%

For Doctors: Good – 2.86%, Average– 74.28%, Poor – 22.86%

For Group-D staffs: Good – 8.57%, Average – 77.14%, Poor – 14.29%

Table 1: Findings Related to Demographic Characteristics of Staff nurses, Doctors and Group D staffs.

n = 105 (35+35+35)						
Sample Characteristics	Staff Nurses		Doctors		Group D Staffs	
	fr.	%	fr.	%	fr.	%
1. Age						
20-29 years	12	34.3	31	88.6	7	20
30-39 years	18	51.4	4	11.4	18	51.4
Above 40 years	5	14.3	Nil	-	10	28.6
2. Gender						
Male	Nil	-	27	77.1	18	51.4
Female	35	100	8	22.9	17	48.6
3. Period of working experience						
< 1 year	2	5.7	19	54.3	Nil	-
1-2 years	1	2.9	4	11.4	3	8.6
3-4 years	15	42.8	7	20	6	17.1
5 years or more	17	48.6	5	14.3	26	74.3

Staffs-18 Staff Nurses out of 35 (51.4%) are in the age group of 30-39 years,100% are female,88.6% have G.N.M. qualification and 48.6% staff nurses have working experience of 5 years or more.

Doctors-31 doctors out of 35 (88.6%) are younger (20-29 years), 77.1% are male, and 54.3% have M.B.B.S. qualification. The majority of the doctors (54.3%) have work experience of less than one year.

Group-D staffs: 18 Group D staffs out of 35 (51.4%) are of younger age group (30-39 years), and 51.4% are male, and 85.7% have academic qualification between primary level to IX standard, and 74.3% have work experience of 5 years or more.

Table 2: Findings Related to factor influencing Hospital Practice on Biomedical Waste Management by Staff Nurses, Doctors and Group D Staffs

Hospital Practice on Biomedical waste management						
1. Is an audit done for Biomedical Waste Management in your ward?						
	Staff Nurses		Doctors		Group D Staffs	
a. Always	2	5.7	1	2.9	11	31.4
b. Sometimes	15	4.9	7	20	4	40
c. Rare	10	28.6	7	20	Nil	-
d. Do not know	8	22.8	20	57.1	10	28.5
2. Who supervises you for biomedical waste management in the ward?						
a. DNS/ Sister In-charge	100	19	54.2	Nil	-	
b. Head of Department	Nil	-	8	22.9	Nil	-
c. Housekeeping Supervisor	Nil	-	Nil	-	35	100
d. None	Nil	-	8	22.9	Nil	-
3. How many times are you being supervised by your immediate superior?						
a. Once a week	32	91.4	2	5.7	33	94.3
b. Once in two weeks	2	5.7	3	8.6	Nil	-
c. Once a month	Nil	-	6	17.1	2	5.7
d. Do not know	1	2.9	24	68.6	Nil	-
4. Does structural problem interfere with the practice of biomedical waste management?						
a. Always	7	20	13	37.1	2	5.7
b. Sometimes	19	54.3	20	57.1	6	17.1
c. Rare	2	5.7	1	2.9	8	22.9
d. Never	7	20	1	2.9	19	54.3
5.Does insufficient supply of equipments interfere with the practice of biomedical waste management?						
a. Always	9	25.7	9	25.7	7	20
b. Sometimes	11	31.4	22	62.8	7	20
c. Rare	1	2.9	3	8.6	2	5.7
d. Never	14	40	1	2.9	19	54.3
6.Is there a protocol for wearing personal protective equipments in your hospital?						
a. Yes	16	45.7	16	45.7	29	82.9
b. No	15	42.8	9	25.7	2	5.7
c. May be	3	8.6	8	22.9	2	5.7
d. Do not know	1	2.9	2	5.7	2	5.7
7. Is personal protective equipments available in your ward?						
a. Always	13	37.1	9	25.7	32	91.4
b. Sometimes	16	45.7	20	57.1	3	8.6
c. Rare	3	8.6	5	14.3	Nil	-
d. Never	3	8.6	1	2.9	Nil	-
8. Is there a protocol for managing Needle stick injury in your hospital?						
a. Yes	22	62.9	25	71.4	26	74.3
b. No	8	37.1	3	8.6	Nil	-
c. Maybe	Nil	-	5	14.3	1	2.9
d. Do not know	5	14.2	2	5.7	8	22.8
9. Does your institution take the initiative to respond to the injury (Needlestick injury)?						
a. Always	18	51.4	25	71.4	29	82.8
b. Sometimes	6	17.1	4	11.4	5	14.3
c. Rare	4	11.4	3	8.6	1	2.9
d. Never	6	17.1	3	8.6	Nil	-

Table 2: Findings Related to factor influencing Hospital Practice on Biomedical Waste Management depicted that

01. Staff Nurses (28.6%) thought that audit for biomedical waste management was rare in the hospital. The majority of the Doctors (57.1%)

01. did not know whether an audit for biomedical waste management was done or not. Group-D staff (40%) have expressed that audit on biomedical waste management was sometimes done.
02. DNS or Sister In-charge supervised 100% of Staff Nurses. The majority of Doctors (54.2%) were also supervised by DNS or Sister In-charge, and 22.9% by their Head of Department. The housekeeping Supervisor supervised 100% of Group-D staff. The majority of Staff Nurses (91.4%) and Group-D staffs (94.3%) are supervised once a week, while the majority of doctors (68.6%) do not know how many times they are being supervised.
03. Staff Nurses (40%) and Group-D staffs (54.3%) think that insufficient supply of equipments have never interfered with the practice of biomedical waste management. For most doctors (62.8%), an inadequate supply of equipments have sometimes interfered with the practice of biomedical waste management.
04. Staff Nurses (45.7%), Doctors (45.7%) and Group D staffs (82.9%) have expressed that there is a protocol for wearing personal protective equipments in their hospital.

Table 3: Finding related to factor influencing own practice of Biomedical Waste Management by Staff nurses, Doctors and Group D staffs depicted that

Own practice on Biomedical Waste Management						
1. Does lack of knowledge interfere with the practice of biomedical waste management?	Staff Nurses		Doctors		Group D Staffs	
a. Always	17	48.6	20	57.1	24	68.5
b. Sometimes	7	20	12	34.3	7	20
c. Rare	3	8.6	0	0	1	2.9
d. Never	8	22.8	3	8.6	3	8.6
2. Do you feel the need for proper supervision on biomedical waste management?						
a. Always	26	74.3	24	68.6	26	74.3
b. Sometimes	9	25.7	10	28.6	9	25.7
c. Rare	Nil	-	1	2.8	Nil	-
d. Do not know	Nil	-	Nil	-	Nil	-
3. Does workload interfere with the practice of biomedical waste management?						
a. Always	7	20	13	37.1	1	2.9
b. Sometimes	16	45.7	19	54.3	8	22.8
c. Rare	7	20	3	8.6	4	11.4
d. No	5	14.3	Nil	-	22	62.9
4. Do you feel the need to wear personal protective equipments?						
a. Always	22	62.9	27	77.1	22	62.9
b. Sometimes	13	22.8	8	22.9	13	37.1
c. Rare	Nil	-	Nil	-	Nil	-
d. No	Nil	-	Nil	-	Nil	-
5. Do you report needle stick injury during the practice of biomedical waste management?						
a. Always	19	54.2	16	45.7	30	85.7
b. Sometimes	6	17.1	9	25.7	4	11.4
c. Rare	4	11.4	5	14.3	1	2.9
d. Never	6	17.1	5	14.3	Nil	Nil
6.Undergone training on Biomedical Waste Management						
Yes	19	54.3	18	51.4	24	68.6
No	16	45.7	17	48.6	11	31.4
If yes, when? 1 year back	7	20	3	8.5	9	25.7
2 years back	4	2	12	34.3	12	34.3
3 years back	2	5.7	1	2.9	Nil	-
4 years back or more	6	17.1	2	5.7	3	8.6
7. Awareness of biomedical waste management 1. Is your hospital registered under Biomedical Waste (Management and Handling) Rules 1998?						
a. Yes	17	48.6	30	85.7	28	80
b. No	Nil	-	Nil	-	Nil	-
c. Maybe	Nil	-	3	8.6	Nil	-
d. Do not know	18	51.4	2	5.7	7	20
8. Why do you think biomedical waste management is useful?						
a. Safety	13	37.1	15	42.9	21	60
b. Hospital policy	Nil	-	Nil	-	4	11.4
c. Government Rules	1	2.9	Nil	-	1	2.9
d. All the Above	21	60	20	57.1	9	26.7
Training is given on Biomedical waste management 9. Undergone training/in-service programme on the practice of biomedical waste management?						
	Staff Nurses		Doctors		Group D Staffs	
a. Always	Nil	-	Nil	-	1	2.9
b. Sometimes	9	25.7	7	20	11	31.4
c. Rare	10	28.6	11	31.4	12	34.3
d. Never	16	45.7	17	48.6	11	31.4
8. Do you want proper training on biomedical waste management?						
Yes	31	88.6	26	74.3	23	65.7
No	2	5.7	3	8.6	10	28.5
May be	2	5.7	6	17.1	1	2.9
Do not Know	Nil	-	Nil	-	1	2.9

Table 3: Finding related to factor influencing own practice of Biomedical Waste Management by Staff nurses, Doctors and Group D staffs depicted that

01. Staff Nurses (48.6%), Doctors (57.1%) and Group-D staffs (68.5%) think that lack of knowledge have always interfered with their practice of biomedical waste management.
02. Staff Nurses (74.3%), Doctors (68.6%) and Group-D staffs (74.3 %) have always felt the need for proper supervision on biomedical.
03. Staff Nurses (45.7%) and Doctors (54.3%) workload have sometimes interfered with the practice of biomedical waste management. For the majority of Group-D staffs (62.9%), workload did not interfere with the practice of biomedical waste management.
04. Staff Nurses (62.9%), Doctors (77.1%) and Group- D staffs (62.9%) always feel the need to wear personal protective equipments.
05. Staff Nurses (54.2%), Doctors (45.7%) and Group-D staffs (85.7%) have always reported needle stick injury during the practice of biomedical waste management.
06. **Staff Nurse**-Out of 35, 19 of them (54.3%) had training on biomedical waste management, and most of them (20%) had their training one year back.
07. **Doctor**- Out of 35, 18 Doctors (51.4%) had training on biomedical waste management, and most of them (34.3%) had their training 2 years back.
08. **Group D Staffs**-Out of 35, 24 Group D staffs (68.6%) had training on biomedical waste management, and most of them (34.3%) had their training 2 years back.

Table 4 Chi-square tests of association between practice of Staff Nurses and selected demographic variables of Staff Nurses

					n = 35
Socio-demographic indicators of Staff Nurses	Practice		χ2	df	Significance
	< median	≥ median			
1. Age					
< 30 years	2	10	8.11	1	Significant
≥ 30 years	14	9			
2. Professional Qualification					
GNM	14	17	0.48	1	Not Significant
Post Basic B. Sc Nursing	2				2
3. Period of working experience in a hospital setup.					
≤ 4 years	5	13	8.24	1	Significant
> 4years	12	5			
4. Undergone training on biomedical waste management					
Yes	8	11	0.22	1	Not significant
No	8	8			

Yate's correction considered, χ2df (1) =3.84; p<0.05

Table 4 showed that the Chi-square value is computed at df (1) to find out the association between two variables which is found to be significant at 0.05 level of significance. So it can be concluded that the practice score of the Staff Nurses is dependent on their age and period of working experience in a hospital set up. In fact, with an increase in age, the staff nurses seem to relax in their practice.

Table 5 Chi-square tests of association between practice of doctors and selected demographic variables of doctors

					n = 35
Socio-demographic indicators of doctors	Practice		χ2	df	Significance
1 Age					
< 30 years	4	17	0.51	1	Not Significant
≥ 30 years	2	2			
2. Professional Qualification					
MBBS	8	11	0.65	1	Not Significant
MD/MS/PGT	8	8			
3. Period of working experience in a hospital setup.					
≤ 4 years	12	18	1.75	1	Not Significant
> 4years	3	2			
4. Undergone training on biomedical waste management					
Yes	6	12	2.29	1	Not Significant
No	10	7			

Yate's correction considered, χ2df (1) =3.84; p<0.05

Table 5 showed that no significant association between the practice score of doctors with selected Demographic variables of doctors

Table 6 Chi-square tests of association between practice of Group D staffs and selected demographic variables of Group D staffs

					n = 35
Socio-demographic indicators of Group D Staffs	Practice		χ2	df	Significance
1. Age					

< 30 years	1	5	3.02	1	Not Significant
≥ 30 years	13	16			
2 Academic Qualification					
Primary level to IX standard	15	16	0.12	1	Not Significant
≥ Secondary level (X-XII)	1	3			
2. Period of working experience in a hospital setup.					
≤ 4 years	3	2	0.04	1	Not Significant
> 4years	13	17			
3. Undergone training on biomedical waste management					
Yes	9	15	3.26	1	Not Significant
No	7	4			

Yate's correction considered, $\chi 2df\ (1) = 3.84$; $p<0.05$

Table 6: showed that no significant association between practice score of Group D staffs with selected Demographic variables of Group D staffs

Discussion

The findings related to the factors influencing the practice of Biomedical Waste Management among health care providers:

A similar study was conducted by Mostafa GM, Shazly MM, Sherief WI (2007) on the development of a waste management protocol based on an assessment of knowledge and practice of hearth care personnel in surgical departments of Al-Mansoura University Hospital, Egypt. They found that only 27.4% of the nurses, 32.81% of the housekeepers, and 36.8% of the doctors had satisfactory knowledge. Concerning practice, 18.9% of the nurses, 7.1% of the housekeepers, and none doctors had a good practice. So, the majority of the doctor's nurses and have insufficient knowledge and inadequate practice related to health care waste management.[5].

Verma LK, Mani S, Sinha N, Rana S (2008) conducted a study on Biomedical waste management in nursing homes and smaller hospitals in Delhi. A survey was undertaken during 2005-2006. Data were collected through a questionnaire and field visits. The survey results show that there had been a marked improvement in the segregation practices of biomedical waste in small private hospitals and nursing homes. The majority of nursing homes and hospitals were found to be using a service provider for the collection, management, and disposal of healthcare wastes.[6].

A cross-sectional study was employed to describe healthcare waste management practices of healthcare workers. A total of 260 healthcare workers from 11 healthcare facilities were included in this study using a simple random sampling technique. A semi-structured questionnaire and observational checklist were used to collect data. Data were entered and analyzed using S.P.S.S. version 16. Results: From the assessment done, 31.5% of the respondents had health care waste management practices. Knowledge on types of healthcare waste (OR: 6.36: 95%CI: 1.71, 23.63) and diseases transmission with healthcare waste (OR: 5.19; 95% CI: 2.23, 12.07) and training (OR: 2.29; 95%CI: 1.24, 4.24) were significantly associated with healthcare waste management practices of healthcare workers segregation of waste was not practised in the surveyed healthcare facilities. None of the healthcare facilities had coloured-coded containers and healthcare waste management documents. The majority of healthcare workers did not practice healthcare wastes management. Hence, providing adequate numbers of waste bins, regular training and supervision on healthcare waste management are recommended to improve the problems of poor management of healthcare wastes.[1]. El-Sayed SH, Zakaria AM, Gheith NA (2012) conducted a study on intervention programs for nurses about health care waste management at Mansoura University Hospital. The study's findings showed that all nurses had inadequate practices in most areas of waste management before the implementation of the educational training programme. The results could be explained by the facts that there was the unavailability of instructional handouts, lack of training courses and programs, inadequate supplies, lack of supervision, lack of incentive for safe waste management, nurses did not think of biomedical waste management as an essential prerequisite for a good patient care service, some also had felt that it was not their duty to find out whether or not such system exists. Biomedical waste management was the responsibility of the administration and sanitary staff, not the nurses. After implementing the programme, there were significant improvements in the number of participants who achieved an adequate score in the post and follow-up periods (99.3%, 96.2%, respectively) [8].

Similar findings were obtained by Mathur V, Dwivedi S, Hassan M, Misra R (2011), who conducted a study on knowledge, attitude, and practices about Biomedical Waste Management among Healthcare Personnel: A Cross-sectional Study. They found that doctors, nurses, and laboratory technicians have better knowledge than sanitary staff regarding biomedical waste management. Knowledge regarding the colour coding and waste segregation at source was found to be better among nurses and laboratory staff than doctors. Regarding practices related to biomedical waste management, sanitary staffs were ignorant on all the counts. However, injury reporting was low across all the groups of health professionals [9].

Kaur K. (2001) conducted a comparative study on nurses' knowledge and practices regarding Biomedical Waste Management in selected Government Hospitals. It was found that nurses in the hospital had a better understanding of biomedical waste policies and segregation. In contrast, nurses in Hospital II had better knowledge regarding waste transportation than the other two hospitals. Nurses of hospital III were found to be entirely responsible for biomedical waste management in the hospital. Those nurses knew various aspects of waste segregation inward, beginning from indenting for biomedical waste management articles, the infrastructure required for waste segregation, to standing operative procedures for segregation in the ward [10].

The findings related to the association between the practices of biomedical waste management and selected demographic variables among health care providers:

The subsequent studies supported the present study: The result is supported by a cross-sectional study conducted by Shafee M, Kasturwar NB, Nirupama N (2010) on the study of knowledge, attitude and practice regarding Biomedical Waste among Paramedical Workers in Karimnagar town, Andhra Pradesh. Out of 500 study subjects, 40.2% were males, 59.8% were females, 47.4% were nurses, and 26.2% were housekeeping staff. Totally 266 (53.2%) study subjects knew about BMW correctly, of which 51.8% were nurses, and 5.26% were housekeepers. It had been found that the nurses practised BMW management better than the technical and housekeeping staff, and a significant difference was found ($x2=9.48$, $P<0.01$, $df=1$). The nurses had better knowledge and attitude.[7].

Implications: The results obtained from the study helped the researcher to derive specific implications which are of vital concern to the nursing practice, nursing education, nursing administration and nursing research.

Nursing Practice: Nursing-in-charge should emphasize biomedical waste management in their ward, which all groups of health care providers will maintain. Periodic evaluation of the practices regarding biomedical waste management is necessary. There should be continuing and intensified efforts to ensure that health care providers can practise proper biomedical waste management, i.e. with adequate supplies.

Nursing Education: There is a need for an in-service and continuing education programme for the health care providers.

The nursing curriculum and the students can be taught in the clinical fields also.

01. The postgraduate students can arrange learning experiences like workshops, seminars for the undergraduate students, which would serve a dual purpose by promoting their learning.
02. The hospital personnel should be educated to report any acute injury to the concerned authority.

Nursing personnel working in various health care settings should be given in-service education to update their knowledge and thereby result in good practice.

01. The nursing administrators should take the initiative for arranging a programme for education on biomedical waste management.
02. Constant supervision should be done. The nursing audit is necessary to monitor proper practices for quality care.
03. The administration should ensure equipment and facilities for biomedical waste management.
04. A team should be constituted to develop practice, standards, protocol and manual for practice and facilitate the utilization of standards.

Nursing Research: Research can be conducted:

01. To further study the different treatment facilities, infection control and its cost-effectiveness.

01. In education and health care providers about identification, management and preventing biomedical waste hazards.

Recommendations: Based on these findings, the following recommendations were made for further research:

01. A similar study can be conducted to assess the knowledge and attitude of health care providers regarding biomedical waste management.
02. A comparative study can be carried out in two different settings like a government hospital and a private hospital.
03. A study can be done to improve knowledge and practice for the health care providers using Self Instructional Module, computer Assisted Instructions and video film etc.
04. A similar kind of study can be conducted by taking a large group of health care providers.

New Findings: According to the findings, doctors practice scores on the practice of Biomedical Waste Management were lesser than Staff Nurses and Group D. Period of working experience in a hospital set up has a significant relationship practice score.

Conclusion

From the study findings, it can be concluded that only a few of the practices of health care providers were good, of which Staff Nurses were the majority group who adhere to good practices. The mainly average pattern was observed among Staff Nurses, Doctors and Group-D staffs. There were some negative and positive factors influencing the course of Biomedical Waste Management, which were identified from the study. They were unaware of biomedical waste management rules, lack of training or in-service education, lack of supervision, an insufficient supply of equipments, overload of work, structural problems, lack of audit, which might be responsible for hindering the practice of biomedical waste management.

Contribution: Introduction, Results and tool development by Ngamning Ngoruw Moyon. Research, Methodology and Discussion contributed by Khumukcham Anupama Devi.

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