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Original Article

Assessment of Biomedical Waste Management Practices and Paramedical Staff Knowledge and Attitude at Healthcare Facilities in Lahore, Pakistan

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ABSTRACT

Healthcare waste refers different natures of wastes, biological, and non-biological which are useless& do not desired to re-use again. Healthcare (Biomedical) waste can be defined that all waste generates from healthcare settings. **Objective:** To analyze the awareness, attitudes & Para medical's work practically related to the management of BMW at Public, Private, DHQ and THQ Hospitals, RHC and BHU of Lahore, Punjab. **Methods:** The methodology was cross-sectional and consisted on the data (survey based) and talk to the heads of the Institutions, persons concerned with waste (handling and transportation). The data about medical waste management were taken from ten HCFs. **Results:** The results showed that <50% has knowledge about categories, color coding and different wastes that are not included in Biomedical Waste Management Rules, 2016. Attitude shows good results. >50% has faulty practice regarding bio medical waste. The findings about the awareness & practice about the management of waste among Intern Nurses and sanitary workers were poor, periodic training and their evaluation is mandatory for better outcome. Total percentage of the knowledge items was 57%. The attitude percentage was 44%. The overall level of practice was considered unsafe because only 9.4% respondent who practice always during waste management. **Conclusions:** Research revealed the improper practices, irregularities, and shortcomings in the overall system of the WM. The study found inconsistencies during waste management in hospitals are generally because of low amount of financial resources, poor awareness & trainings at the administrative level.

INTRODUCTION

Medical centers have high criterion of safety and hygiene, as the workplace for medical treatment as well as betterment for health, though, healthcare staff is faced by countless professional risks because of different type of the nature of work [1]. The importance of this study is based on the attention to the health and life in general, especially in underdeveloped countries because these countries are vulnerable to different types of waste produced by different activities in the HCFs and what the underdeveloped countries are already facing difficulties in dealing with this waste and how to manage it for various reasons related to resources, awareness and management [2]. The hospital is a basic institution that is visited by all people who lived in a society Sans discrimination among

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race, gender, age, etc. Medical waste (MW) is an important and very serious issue for human health as well as an environment which draws heed world-wide i.e., developed as well as underdeveloped nations [3]. Therefore people must work together for reduction the quantity & toxicity of all waste produced by the medical field, to assure the adequate disposal as well as separation of health-care waste, & to eradicate the inadequate practices of burning introducing as well as enforcing substitutes [4], In order to the health care ethic to 'first do no harm' relevant authorities charged with protecting public health, together with the medical sector have liability to dispose of waste in such a ways that safeguard the staff who works in hospitals, waste handling staff, As well as scavengers, the environment masses in general [5]. In today's world, there are different methods being used for the WM from segregation to final disposal like incineration, microwave disinfection, steam disinfection, autoclave disinfection, and chemical/mechanical disinfection [6]. Monitoring System is the key factor under private administration to ensure standard management and keep a proper check & balance on activities for complete the all steps required for the management SOPs [7, 8]. For effective monitoring of contractors LWMC has placed different monitoring systems for the betterment of the current situation [9]. Practically implementation was absent. For the training purposes we can use audio visual aids according to the HCWs educational level [10]. Ensure the presence of color-coded bins at every waste generation point & provision of the all types those bins according to the waste category [11].

METHODS

The present study is cross-sectional & quantitative in nature using a sample size of 360 participants, calculated by the WHO sample calculator with the estimated population size 15000 and a confidence interval of 95%. Non-probability purposive sampling was done to gather the data. The goal of my research is to examine the BMWM, the specific objectives are to identify and to assess the knowledge, attitude, practices and if there is any regulations and procedures regarding medical waste and to what extent it's applied within health care settings, to identify the current MW handling practices at the different levels of health care providers like Public, Private, DHQ and THQ Hospitals, RHC and BHU of Lahore, Punjab, to investigate the difficulties which the hospital encounters in managing medical wastes, to draw relevant recommendation to enhance medical waste management. Due to quantitative research the tool questionnaire is used to measure the knowledge and skills. All HFs were selected by randomizer or lottery method. Likert scale was used to assess the level of knowledge attitude and practices. And a pilot study of 20 respondents was conducted before starting the data collection., work related direct observations and methods to find out the results are included. Health-care workers were the study population in this research who working in selected health care settings. Purposive sampling techniques were used for selection the sample population in which the subjects are being analyzed and it depends on the researcher's judgmental methods. Paramedics who fit for the present study were Lab. Technicians, OT. Technicians, Nursing Interns, LHVs, midwives, TBAs and sanitary workers from Public, Private, DHQ and THQ Hospitals, RHC and BHU of Lahore, Punjab. The inclusion criteria for the study were subjects who agreed to participate, were relevant to the health departments, present at the institute during data collection, and completely filled the questionnaire, while the exclusion criteria included subjects who were newly appointed within the current month, absent or on leave during the study, or currently occupied with hospital affairs at their duty places. The identification of the participants was omitted. Privacy was maintained by managing peaceful & calm environment for the study participants during the data collection and analysis. They also had the right to give up this study when they want to withdraw. A modified & very clear questionnaire was created for this study as tool filled by the all participant. There were no difficulties faced during the data collection phase. The questionnaire designed in English language and also converted into the Urdu as well. Therefore, all participants could read easily. The questions related to KAP included 37 items. To assess the knowledge, 13 questions were organized with yes/no responses. For the assessment of the Attitudes total 14 items having agree/disagree, and the last one was practical work assessed by the study population's replies & direct observation (10 questions) related to their concerning personal protection measures, proper biomedical waste disposal practices, as well as personal hygiene having always, sometimes response. Total percentage of the knowledge items was 57%. This score was not good and satisfactory completely. The overall level of attitude was considered unfavorable. The attitude percentage was 44%. The overall level of practice was considered unsafe because only 9.4% respondent who practice always during waste management. HODs were not part of our study, only we took permission to conduct interviews of their workers. The collected data were put into SPSS Version 21.0 for obtaining more reliable results. Numerical variables i.e. age was presented minimum & maximum with ± SD. To compare the association of knowledge, attitude & practices, Chi – square test was applied.

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RESULTS

This part shows the results from this study by table 1 showing socio-demographics of the study, table 2 for the level of knowledge of the respondents and attitude and practices were calculated in table 3 and table 4 respectively. The table 1 provides a comprehensive overview of the socio-demographic characteristics, including gender, age, marital status, profession, qualification, type of work, and training status, among the respondents participating in the study.

Table 1: Socio-demographic Characteristics of Respondents (N=360)

Parameter	Frequency (%)
Gender	
Female	205 (56.9)
Male	155 (43.1)
Total	360(100)
Age	
17-28 years	165 (45.8)
29-39 years	86 (23.9)
40-50 years	83 (23.1)
51-61 years	23 (6.4)
62-72 years	3 (.8)
Marital status	
Single	142 (39.4)
Married	215 (59.7)
Divorced	1 (.3)
Widowed	2(.6)
Profession	
Lab. Tech	60 (16.7)
OT. Tech	60 (16.7)
Nursing Interns	90 (25.0)
LHVs	10 (2.8)
LHWs	30 (8.3)
TBAs	20 (5.6)
S. Ws	90 (25.0)
Total	360(100)
Qualification	
Primary	24 (6.7)
Middle	19 (5.3)
Metric	108 (30.0)
Higher	148 (41.1)
No schooling	61 (16.9)
Qualification	
Morning	163 (45.3)
Evening	19 (5.3)
Night	03 (.8)
All shifts	140 (38.9)
Others	35 (9.7)
Training on WM	
Yes	25(6.9)
No	335(93.1)
Would you like to attend a training on WM	
Yes	257(82.5)
No	63(17.5)

The table 2 indicates the awareness levels of different paramedical staff members regarding various aspects of biomedical waste management, including the symbol of Biohazard, waste categories, color codes for containers, waste disposal methods, container requirements for sharp objects, general waste composition, and diseases transmitted through needle stick injuries.

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Table 2: Knowledge of Respondents about HCWM

Awareness item (Items correctly answered)	Lab. Tech N=60	OT. Tech N=60	Nursing Interns N=90	LHVs N=10	LHWs N=30	TBAs N=20	S. Ws N=90
Knowledge about Means of waste disposal							
Which of the following is the symbol of Biohazard? 	3(5.0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Which wastes are not included in biomedical waste management rules?	17(28.3%)	21(35.0%)	44(48.9%)	8(80.0%)	0(0%)	6(30.0%)	29(32.2%)
Knowledge about the color codes for different waste containers?	11(18.3%)	9(15.0%)	5(5.6%)	2(20.0%)	0(0%)	5(25.0%)	13(14.4%)
Awareness of different waste disposal methods?	0(0%)	1(1.1%)	1(1.1%)	0(0%)	0(0%)	0(0%)	0(0%)
Containers of sharp should be Resistant to puncture, tightly closed by a lid, properly labeled or all of above?	0(0%)	1(1.7%)	3(3.3%)	0(0%)	0(0%)	0(0%)	1(1.1%)
General waste includes all except Kitchen waste, Noninfectious plastics, Cardboards or gloves?	45(75.0%)	41(68.3%)	61(67.8%)	9(90.0%)	2(6.7%)	14(70.0%)	48(53.3%)
Diseases likely to spread through needle stick injuries are: HBV, HCV, HEV or HIV- 1&2	24(40.0%)	21(35.0%)	12(13.3%)	2(20.0%)	0(0%)	0(0%)	2(2.2%)

The table 3 provides insights into the attitudes of different paramedical staff members regarding proper handling and disposal of biomedical waste. The percentages indicate the proportion of respondents who correctly answered each attitude item.

Table 3: Participant's Attitude about HCWM

Attitude item (Items correctly answered)	Lab. Tech N=60	OT. Tech N=60	Nursing Interns N=90	LHVs N=10	LHWs N=30	TBAs N=20	S. Ws N=90
Attitude of for proper handling of BMW:							
Is it important to properly dispose of the HCW?	60(100%)	58(96.7%)	78(86.6%)	10(100%)	28(93.3%)	19(95.0%)	65(72.2%)
Participant's opinion on Disposal of hospital waste:							
Use of glove can minimize damage to hand?	56(93.4%)	56(93.4%)	83(92.2%)	10(100%)	30(100%)	17(85.0%)	78(86.7%)
Use of mask can minimize the risk of respiratory organs?	40(66.7%)	43(71.7%)	70(77.7%)	8(80.0%)	27(90.0%)	17(85.0%)	45(50.0%)
Use of rubber boots can minimize the risk of feet?	60(100%)	60(100%)	86(95.5%)	10(100%)	30(100%)	19(95.0%)	79(87.7%)
Use of apron can minimize the risk of our body?	25(41.6%)	27(45.0%)	59(65.5%)	9(90.0%)	16(53.3%)	14(70.0%)	26(28.9%)
Having shower after work reduces diarrheal diseases?	28(46.7%)	17(28.3%)	41(45.5%)	7(70.0%)	13(43.3%)	8(40.0%)	17(18.9%)
Take shower after working in the hospital helps to refresh mind?	60(100%)	60(100%)	89(98.9%)	9(90.0%)	30(100%)	20(100%)	88(97.7%)
Wearing clean cloth during working can prevent dermal diseases?	35(58.3%)	26(43.3%)	50(55.5%)	7(70.0%)	26(86.7%)	13(65.0%)	26(28.9%)
Attitude item (Items correctly answered)	**Lab. Tech N=60**	**OT. Tech N=60**	**Nursing Interns N=90**	**LHVs N=10**	**LHWs N=30**	**TBAs N=20**	**S. Ws N=90**
Participant's opinion on Disposal of hospital waste:							
Changing cloth after work gives you aesthetical satisfaction	60(100%)	58(96.6%)	86(95.5%)	10(100%)	30(100%)	20(100%)	74(82.2%)
Safe WM is a team work?	59(98.3%)	57(95.0%)	81(90.0%)	10(100%)	26(86.7%)	14(70.0%)	81(90.0%)
Safe management increases the financial burden of hospital?	13(21.7%)	10(16.7%)	16(17.8%)	3(30.0%)	9(30.0%)	7(35.0%)	22(24.4%)
Biomedical WM is an extra burden on work?	17(28.3%)	30(50.0%)	41(45.6%)	7(70.0%)	25(83.3%)	15(75.0%)	59(65.5%)
An appropriate sentence for BMW	13(21.7%)	14(23.3%)	16(17.8%)	1(10.0%)	2(6.7%)	2(10.0%)	8(8.9%)
In case of blood spillage sodium hypochlorite can be used & method	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)

The table 4 provides information on the practice of waste management and hygiene practices among different paramedical

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staff members. The items in the table represent various waste disposal practices and behaviors, and the percentages indicate the proportion of respondents who reported engaging in each practice.

Table 4: Practice of the workers about HCWM

Practice item (Items correctly answered)		Lab. Tech N=60	OT. Tech N=60	Nursing Interns N=90	LHVs N=10	LHWs N=30	TBAs N=20	S. Ws N=90
	Standard waste disposal							
Do you Practice waste segregation at source?	Always	22(36.7)	29(48.3)	30(33.3)	8(80.0)	0(0)	5(25.0)	19(21.5)
	Sometimes	22(36.7)	23(38.3)	29(32.2%)	1(10.0)	0(0)	6(30.0)	56(62.2)
Do you use specific punctures proof containers Disposal of sharps?	Always	50(83.3)	45(76.7)	59(65.6%)	10(100)	0(0)	13(65.0)	40(44.4)
	Sometimes	8(13.3)	10(16.7)	29(32.2)	_	0(0)	_	34(37.8)
Do you use specified color-coded containers Disposal of hospital waste?	Always	25(41.7)	26(43.3)	22(24.4)	7(70.0)	0(0)	4(20.0)	21(23.3)
	Sometimes	17(28.3)	24(40.0)	39(43.3)	_	0(0)	_	45(50.0)
Latex gloves used when handling wastes?	Always	3(5.0)	5(8.3)	4(4.4)	_	_	1(5.0)	2(2.2)
	Sometimes	56(93.3)	55(91.7)	84(93.3)	10(100)	29(96.7)	18(90.0)	87(96.7)
Do you Wash your hands with soap after work?	Always	9(15.0)	10(16.7)	29(32.2)	_	_	_	17(18.9)
	Sometimes	51(85.0)	48(80.0)	60(66.7)	10(100)	30(100)	20(100)	67(74.4)
Do you Change your work clothes after work?	Always	27(45.0)	37(61.7)	35(38.9)	_	_	_	42(46.7)
	Sometimes	33(55.0)	23(38.3)	55(61.1)	10(100)	30(100)	19(95.0)	48(53.3)
Do you Wash your work clothes daily after work?	Always	2(3.3)	2(3.3)	3(3.3)	_	_	_	1(1.1)
	Sometimes	57(95.0)	58(96.7)	86(95.6)	10(100)	30(100)	20(100)	89(98.9)
Do you Take shower daily after work?	Always	59(98.3)	60(100)	89(98.9)	10(100)	30(100)	18(90.0)	86(95.6)
	Sometimes	1(1.7)		1(1.1)	_	_	2(10.0)	4(4.4)
Do you Share your work clothes & PPEs with your colleagues?	Always	1(1.7)	_	_	0(0)	_	0(0)	_
	Sometimes	_	1(1.7)	3(3.3%)	0(0)	1(3.3)	0(0)	4(4.4)
Do you take tea or eat lunch/ dinner on work place?	Always	_	1(1.7)	5(5.6)	_	3(10.0)	2(10.0)	12(13.3)
	Sometimes	42(70.0)A	49(81.7)	72(80.0)	10(100)	24(80.0)	14(70)	72(80.0)

DISCUSSION

The present section shows the results from this study "Comparative assessment of awareness, knowledge, attitude and practices of health care WM among paramedical staff: Findings from Lahore, Pakistan". The total sample size was (N=360). The interpretation of the collected after coded & organized data as analyzed and finally results were described. In this section using descriptive & inferential statistics found results. The information collected from health care workers to assess their awareness, attitude and practices about BMWM because they all are directly with the contact of waste handling procedures like, Burying, Burnings in pits, Composting, Recycling, Incineration, Chemical disinfection & Sanitary landfill etc. BMW of every health facility in every region at every level depends upon its regulations and guidelines & some other things like level of sensitivity of the health administrative management committee and current HCWM legislation & available resources at local level. Hospital WM rules in Pakistan were issued in 2005 & later on Solid Waste Management (SWM) practices in Lahore, provincial capital of Punjab, were privatized in 2016. Privatization has improved some components of the system. While our study highlighted the gap between attitude and practices of waste management among population who are directly involved in cleaning and waste management [12]. Pamučar *et al.*, in a recent study 2023, evaluated monitoring system has been the key innovation under private sector. It has enabled better allocation, management and channelization of available resources [13] while our study focused on need to improvement about disposal of waste and administrative structure of waste management in the city Lahore, province & country as well. The present study shows solid WM not liquid BMWs were studied because of time & financial constraint. Also, the current research is done in a short area; that's why it cannot be generalized nationwide. All HAFs observed in a single time. That was also inadequate for the authentic information for the taking actions & solid steps. One thing is also considerable this study was the use of cross-sectional data in this analysis. The disadvantage of using cross sectional data is that facility type, divisions and management authority did not truly reflect the real situation of proper disposal of BMWM. We conclude that the facility type, divisions and management authority used in this study were not the

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exact representative of their final disposal of BMWM. Therefore, a strength of the present research is that regional variations (e.g., rural urban or divisional. A lot of work has been done on Biomedical Waste Management Practices to assess the knowledge or practices, there is no any data who present the sanitary works knowledge and their practices, who has direct contact of hospital waste, especially in Pakistan. A study by Zolnikov *et al.*, and Islam emphasize on improper or wrong practices were observed at every step during handling of BMW. Mostly the main reasons are lack of appropriate legislation, shortage of expert clinical staffs, absence of knowledge & proper control [14, 15] Furthermore, mostly Health Care Facilities (HCFs) in poor countries have faced money (finance) related issues. Therefore, they try to adopt cost effective methods for waste disposal. [16] In comparison our study the respondents who did "always" proper practice during HCWM were 34(9.4%) only. And 185(51.4%) did "sometimes" right practice. 120(33.3%) respondents were not agree about the proper way of handling the BMW and they "never" handled the waste in the right way at every step from collection to final disposal. 21(5.8%) with "no response". In practice section total included questions were 10. Each question had different percentages (results) of always practice by the HCWs. Here %ages given against each practice: Another study strongly recommend that the Government should strongly consider the importance of HCWM & launching ideas in practice for convert " waste to energy" as a way of curbing the menace of WM and solving the energy needs of the public as well [17, 18]. Rich nations produce on average up to 0.5 kg of harmful waste per HCF per patient daily, according to the WHO Poor nations generate merely 0.2 kg per hospital bed per day, though the figure is very low yet medical waste usually not segregated into harmful or non-harmful wastes, making the actual amount of harmful waste potentially much higher[19, 20].

CONCLUSIONS

Management of BMW (biomedical waste) is a burning intention that has been neglected, especially in developing countries. But according to my findings we (HCWs) have not enough knowledge, nor did satisfactory attitude/practices. "The overall findings of this study indicated that the majority of HCWs did not apply the recommended healthcare waste management practice set by WHO."

Authors Contribution

Conceptualization: AR
Methodology: FM, MI, FS, MNT
Formal analysis: MS, FS
Writing-review and editing: SS, SNF, JS, AA
All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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