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Improvement in the knowledge of health care workers following the structured training sessions under swachhta action plan: Pre-post study

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Abstract---Introduction Of the total bio- medical waste generated only 10- 15 % is hazardous. Improper waste management poses hazardous effect on health care workers and patients. Health care workers play pivotal role in waste management. Thus, this training aimed at strengthening the knowledge of participants to improve their practices on Cleanliness, Sanitation & Hygiene and Infection control. Methodology The training was conducted in a tertiary care centre of Patna to assess the improvement in knowledge of nursing officers and sanitary staffs. A total of seven sessions were held for nursing officers and eight sessions for sanitary staffs. The training was attended by 189 nursing staffs and 180 sanitary staffs. Pre and post session assessment of knowledge was done using google forms, different for nursing and sanitary staffs. Results Marked improvement in

knowledge related to policy and bio- medical waste segregation was observed in nursing officers except for blood bag and sharp objects. Only 12.8% participants knew about the correct sequence of wearing personal protective equipment (PPE). Also, about 30% of the participants had knowledge of avoiding needle- stick and proper use of multi- dose vial. About 90% of participants knew correct steps of hand- washing following training. Significant improvement in knowledge of sanitary staffs about sanitation and hygiene practises was noted after training. About 70% of the sanitary staff were aware of Hepatitis B vaccination and use of PPE irrespective of training. The mean score after training improved from 9.5 to 12.4 for nursing officers and 6 to 8.3 for sanitary staffs. Conclusion This training emphasises the importance of regular, skill- based training to sustain the bio- medical waste management practices.

Keywords---biomedical waste management, health care workers, knowledge-based assessment.

Introduction

Bio- medical waste management gained focus in late eighties in United States when children were spotted playing with blood vials dumped openly and two of which were infected with human immunodeficiency virus.[1] This was one of the numerous instances which attracted the legislative effort for the formulation of Bio- medical waste management rules in United States. Bio medical waste is defined as any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biologicals or in health camps.[2] In India, the need was felt in late nineties and Bio medical waste management rules came into existence in 1998. After undergoing amendments, currently, Bio medical waste management rules, 2016 (BMWM) under the Ministry of Environment, Forest and Climate, is being followed. This rule has simplified segregation norms with improved segregation, transportation and disposal methods to decrease environmental pollution.[2]

Of the total bio- medical waste generated only 10- 15 % is hazardous which may be infectious, radioactive, or toxic.[2] The improper handling and treatment of these wastes may inflict sharp- related injuries, unintentional chemical release from pharmaceutical products, thermal burns, and air pollution due to incineration of infected waste. Decades after the implementation of BMWM rules, around 33800 new HIV infections, 1.7 million hepatitis B infections and 315 000 hepatitis C infections were caused due to unsafe injection practises in 2010 worldwide.[3] Health care workers and patients are specifically exposed to health risks pertaining to improper waste management.

One of the dimensions of the quality of care is cleanliness of health care facility was introduced with the launch of Swachh Bharat Abhiyan (SBA)” on 2nd October 2014.[4] Maintenance of hygiene not only inculcates satisfaction in patients but also reduces chances of hospital acquired infections. SBA is crucial

for attaining the Sustainable Development Goal 6 which is committed to achieve access to adequate and equitable sanitation and hygiene for all.[5] Ministry of Health & Family Welfare launched “Kayakalp” initiative on 15th May 2015 to complement these efforts. Waste management is one of the six thematic areas of Kayakalp and reference books are provided under the initiative for training of Health care workers (HCWs).[6]

Despite the legislative efforts, lack of awareness about health hazards of health-care waste, inadequate training in proper waste management, absence of waste management and disposal systems, insufficient financial and human resources, and the low priority given to waste management are cited as a few reasons for improper waste management.[7] Health care workers play pivotal role in waste management as the waste segregation and disposal is carried out by them. For sustainable waste management practice among HCWs, the stepping stone is to identify knowledge gaps and deepen the understanding, followed by building a positive attitude towards waste management. Thus, HCWs should be trained for promoting practices that reduce volume of wastes generated and ensure proper waste segregation. Thus, this training aimed at strengthening the knowledge of participants to improve their practices on Cleanliness, Sanitation & Hygiene and Infection control.

Methodology

The training on cleanliness and bio- medical waste management was conducted in a tertiary care centre of Patna to assess the improvement in knowledge of nursing officers and sanitary staffs in the form of pre and post-test. The training sessions were arranged for nursing officers and sanitary staffs separately. A total of seven sessions were held for nursing officers and eight sessions for sanitary staffs. The training was attended by 189 nursing officers and 180 sanitary staffs. The questionnaire used for assessing the knowledge was different for nursing and sanitary staffs. Also, the one used for sanitary staffs was converted in Hindi language.

The topics discussed in the training sessions comprised of overview of Kayakalp and Swachh Bharat Mission, Hospital Acquired Infections, Recent guidelines on Bio- Medical Waste Management Rule (2016) followed by hands- on practise, Injection Safety and Personal Protective Equipment and Spill Management: Protocol of mercury and blood management. Besides these topics, the training of sanitary staffs also included lecture on sanitation and hygiene accompanied by demonstration of correct cleaning technique including vacuum cleaning. The participants were also given certificate of participation on completion of the training sessions. The knowledge, thus imparted to the participants during training was assessed through Post- test after end of the session.

The questionnaire used for assessment of the knowledge were compliant with the topics discussed in the training session. However, the questionnaire used for sanitary staffs mainly comprised of questions on sanitation and hygiene maintenance. The questionnaire was administered through google form by using the platform of google classroom. The responses were received on google spreadsheet. Consent of the participants was taken prior to their enrolment in the

training and while pre and post-test. The total number of objective questions was 20 for nursing officers and 14 for sanitary staffs. Each question had a single correct response and each correct response was given equal weightage. Thus, maximum marks of the test were 20 and 14 respectively for nursing officers and sanitary staffs.

Ethical approval for conducting the training and publication of its result was obtained from the Institutional Research Committee and Institutional Ethical Committee (Ref No. Ref No. AIIMS/Pat/ IEC/2020/687) The data was conceived in google spreadsheet through google forms. The correct responses were expressed as percentage and a pre- and post- test scores were compared using chi- square or fisher's exact test. The mean of individual pre and post test scores were compared using paired t- test.

Results

Knowledge – based assessment for cleanliness and biomedical waste management among Nursing Officers: [Table 1]

The participants were enquired about the recent guidelines of Bio- medical waste management rule followed in India and about half of the participants knew that it is 2016 rule before training and it improved to approximately more than 90%. World Health Organization reports that cost of Rs 6500 per person is borne by Government due to lack of cleanliness and hygiene and the knowledge of this fact improved to more than 90% after training. However, there was no significant improvement noticed in knowledge about frequency of Kayakalp training. The participants were trained elaborately along with hands- on practise in Bio- medical Waste Management and significant improvement was seen in their post- test score compared to pre- test when asked about categorisation of bio- medical waste and disposal of urine bags, catheters and soiled dressings. About four- fifth of the participants were aware about disposal of medicine vials irrespective of training. However, only little improvement was noticed in knowledge regarding disposal of blood bags. The most missed question was regarding disposal of sharp waste, but significant proportion knew the time interval of changing the sharps container which also holds importance. Knowledge regarding personal protective equipment (PPE) is essential to safeguard health professionals from acquiring infection and thereby reducing the chances of transmission of infection. Most of the participants knew the importance of wearing PPE but surprisingly the proportion of participants knowing the correct sequence of wearing it reduced from one- fifth to one- tenth. Similarly, the proportion of participants having correct knowledge of avoiding needle- stick and proper use of multi- dose vial was less than two- fifth in spite of training. Significant improvement was noted in knowledge regarding management of mercury spills and blood/ body fluid after training. Similarly, more than 90% of participants were able to recall correct steps of hand- washing following training. The pre- and post- test score was matched individually to compare the improvement and it was noticed that the mean score improved from 9.5 in pre- test to 12.4 ($p < 0.00$) out of 20. [Table 2]

Knowledge- based assessment regarding Hospital Waste Management & Cleanliness among Sanitary Staffs [Table 3]

A total of 180 sanitary staffs attended the training session. However, because of time- constraint and their duty timing only 128 appeared in the post- test. The knowledge of sanitary staffs was assessed mainly for the sanitation and hygiene practises and significant improvement was noted in this domain. In spite of significant improvement, most of the participants with correct knowledge ranged between 40- 65% even after training. The participants were mainly enquired about frequency of mopping the doctor's room, high risk area, frequency of changing the mop, high- dusting, time interval for changing sharps container. About 70% of the sanitary staff were aware of essential vaccination irrespective of training, which is Hepatitis B vaccination.

Similar to nursing officers, the individual- level mean pre- and post- test score was compared using paired t- test. The mean score improved from 6 in pre- test to 8.3 ($p < 0.00$) in post- test out of 14. [Table 4] Pictorial demonstration of improvement of pre and post-test scores is represented by box- plot (Fig 1). Among nursing officers, the median score in pre-test was 10 (range: 3- 16) which improved to 13 out of 20 (range: 1- 17). Outliers are depicted by red dots which shows post- test score as low as 1. Similarly, the median score of 7 (range: 0- 13) in pre- test improved to 9 (range: 1- 14) in post- test among sanitary staffs.

Discussion

The current study ascertains that there is significant improvement in the knowledge of nursing officers. This is apparent in the improvement of mean score from 9.5 to 12.4 for nursing officers and 6.3 to 8.4 for sanitary staffs. A Cross-sectional study conducted on 400 participants in the Government and private hospital of Ujjain city also observed improvement in knowledge post training.[8] About three- fourth nursing officers and more than half of the sanitary staffs were aware about BMW rules, 2016, colour coding and segregation of bio- medical wastes. Thus, the knowledge of nursing staffs was better than the sanitary staffs. Adherence to segregation of waste on the basis of colour- coded bins is one of the most pivotal steps in bio- medical waste management. Comparable findings were reported in various studies conducted in different states of the country.[8–12] The difference in knowledge could be attributed to low educational status of the sanitary staffs.

However, there is no denial of the fact that the improvement in practice-based questions was meagre following training. In present study, it was found that participants did not fared well in the questions related to disposal of blood bags, sharp objects, and knowledge to avoid needle- stick injury. This presents a worrisome situation because improper disposal increases the likelihood of disease transmission. It was also observed that only a few participants knew the correct sequence of wearing PPE. Similar findings were reported by a cross- sectional study conducted with pre-tested structured questionnaire among the respondents of the health care workers of a tertiary care rural hospital. This study found that only 31% of the health- care workers had correct knowledge of disposal of waste-sharps. Also, ignorance towards injection safety reflected in recapping of the

syringe by the health workers.[13] Country- wide assessment of Bio- medical waste management also documented the improper handling of waste- sharp in one- fourth health centres surveyed.[14] The findings of the current study was corroborated by a cross- sectional study conducted by Das and Biswas using observatory checklist. Injuries inflicted by the sharp waste predisposes the person to infection with blood- borne virus, Hepatitis B, Hepatitis C and HIV. Health care personnel are most vulnerable to the injury caused by improper disposal of bio- medical waste. Beside this, they also act as reservoir of infection causing risk of transmission for others.

Apart from low awareness regarding injection safety and waste disposal, significant improvement in knowledge regarding high-risk areas, spill management and proper hand washing was observed. In the post- training assessment, 93% of the nursing staffs demonstrated correct steps of hand washing technique. Likewise, more than 90% of health workers were reportedly aware of correct technique of hand washing in a cross- sectional study conducted in a tertiary health care centre, Raichur.[15] Adherence to proper hand hygiene technique by nursing officers reduce the chances of cross- transmission of micro- organism in the health care setting.

The knowledge of sanitary staffs improved significantly regarding sanitation and hygiene compared to their knowledge about recent BMW guidelines and rules. Skill- based assessment of the study participants was also conducted and more than four- fifth of the observations were found in accordance with BMW rules, 2016. Of the incorrect practices, about one- fifth of the observations involved inadequate handling of needle sharps. Although small in number, such findings imply risky and casual behaviour. Similar findings were reported by a walk survey conducted in a tertiary care rural medical college.[16] The strength of the study lies in the fact that the training of the nursing officers and sanitary staffs were conducted in accordance with the Kayakalp initiative and along with knowledge assessment, on- site skill-based assessment was also conducted.

Conclusion

In the present study, marked improvement in the knowledge regarding policy, biomedical waste management, spill management and hospital acquired infection among nursing officers and sanitation and hygiene among sanitary staffs was noticed. However, only minimal improvement was observed in waste segregation practices for sharp objects, blood bags, multi- dose vials. This finding emphasizes on the need of regular comprehensive skill- based training. As rightly said cleanliness is not an act but a habit. Thus, proper planning for training of health care workers should be undertaken by the hospital administration and its timely supervision should be carried out.

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Author's contribution

Pallavi Lohani: Analysis and interpretation of data, drafting the article.

Kritika: Contribution to planning and conduction of training sessions. Reviewing the article.

Pankaj Kumar Pathak: Contribution to planning and conduction of training sessions.

Shamshad Ahmad: Substantial contribution to conception of training, its planning, organisation, acquisition of data, analysis and interpretation and revising the article for intellectual content.

Pragya Kumar: Substantial contribution to conception of training, its planning, organisation, acquisition of data, analysis and interpretation and revising the article for intellectual content.

Neeraj Agarwal: Substantial contribution to conception of training, its planning, organisation, acquisition of data, analysis and interpretation and revising the article for intellectual content.

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Table 1: Knowledge – based assessment for cleanliness and biomedical waste management among Nursing Officers

Knowledge- based questions	No. (%) of participants with correct response		P-value (Chi-square test)
	Pre- Test [N= 189]	Post-Test [N= 187]	
<i>Questions related to Policy: Kayakalp & Swachh Bharat Mission</i>			
Knowledge on Current Biomedical Rule followed in India	96 (50.8)	175 (93.6)	<0.00
Financial Benefit to GOI by ensuring proper sanitation and hygiene	39 (20.6)	171 (91.4)	<0.00
Minimum frequency of Training of Health Care Workers	22 (11.6)	28 (15.0)	0.341
<i>Questions related to Recent guidelines on Bio- Medical Waste Management Rule (2016)</i>			
Colour of bins for Hospital Waste Management	69 (36.5)	140 (74.9)	<0.00
Categorisation of Biomedical waste	72 (38.1)	137 (73.3)	<0.00
Colour of bin for disposal of soiled dressing and plaster cast	150 (79.4)	176 (94.1)	<0.00
Colour of bin for disposal of Urine catheter & Urine bags	145 (76.7)	159 (85.0)	0.041
Colour of bin for discarding Blood Bags	81 (42.9)	95 (50.8)	0.123
Colour of bin for discarding Sharp object like needle	0	0	
Colour of bin for discarding medicine vials & ampoules	148 (78.3)	146 (78.1)	0.957
<i>Questions related to Injection Safety & Personal Protective Equipment</i>			
Knowledge on use of personal protective equipment	158	155	0.854

while handling hospital waste	(83.6)	(82.9)	
Correct sequence of wearing personal protective equipment	42 (22.2)	24 (12.8)	0.017
Time interval for changing the sharps container	129 (68.2)	155 (82.9)	0.001
Knowledge about multi- dose vial septum cleanliness	70 (37.0)	63 (33.7)	0.497
Knowledge to avoid Needle- stick injury	59 (31.2)	66 (35.3)	0.401
Knowledge regarding administration of multi- dose injectables	133 (70.4)	143 (76.5)	0.181
<i>Questions related to Spill Management</i>			
Knowledge on management of Mercury Spill	81 (42.9)	128 (68.4)	<0.00
Knowledge about cleaning small volumes of blood/ body fluids	68 (36.0)	109 (58.3)	<0.00
<i>Questions related to Hospital – Acquired Infections</i>			
Knowledge on high- risk area in a hospital	156 (82.5)	170 (90.9)	0.017
Correct steps of hand washing as mentioned under Kaya- Kalp guidelines	96 (50.8)	174 (93.0)	<0.00

Table 2: Comparison of mean scores of Pre & Post Tests among Nursing Officers
[N= 174]

	Total Score	Mean (SD)	[95% Conf. Interval]	Significance
Pre- test	20	9.5 (2.8)	(9.047- 9.884)	<0.00
Post- test		12.4 (2.5)	(12.028 - 12.765)	

Table 3: Knowledge- assessment regarding Hospital Waste Management & Cleanliness among Sanitary Staffs

Knowledge- based questions	No. (%) of participants with correct response		Significance
	Pre- Test [N= 180]	Post- Test [N= 128]	
Questions related to Policy: Kayakalp & Swachh Bharat Mission			
Financial Benefit to GOI by ensuring proper sanitation and hygiene	39 (21.7)	85 (66.4)	<0.00
Which vaccine is essential for sanitary staffs	128 (71)	90 (70.3)	0.879
Questions related to Recent Guidelines on Bio- Medical Waste Management (2016)			
Colour of bins used for hospital waste	80 (44.4)	70 (54.7)	0.76
Method of disposal of hospital waste	97 (53.9)	73 (57.0)	0.58
Questions related to Sanitation and Hygiene			
Area to be cleaned after soaking the mop once	47 (26.1)	82 (64.1)	<0.00
Frequency of dipping the mop in solution	54 (30)	71 (55.5)	<0.00
Knowledge regarding changing the solution	64 (35.6)	60 (32.9)	0.046

used for dipping the mop			
Frequency of changing the mop in High-risk Area	77 (42.8)	75 (58.6)	0.006
Frequency of changing the sharps container	48 (26.7)	70 (54.7)	<0.00
Frequency of cleaning the Doctor's room	56 (31.1)	63 (49.2)	0.001
Frequency of high dusting	20 (11.1)	50 (39.1)	<0.00
Miscellaneous			
Knowledge on identification of high-risk area	74 (41.1)	68 (53.1)	0.037
Individual at risk of hospital waste	135 (75)	107 (83.6)	0.07
Use of Personal Protective Equipment	132 (73.3)	93 (72.7)	0.89

Table 4: Comparison of mean scores of Pre & Post Tests among Sanitary Staff [N= 114]

	Total Score	Mean (+SD)	[95% Conf. Interval]	Significance
Pre- test	14	6 (2.7)	(5.499 - 6.501)	<0.00
Post- test		8.3 (3.5)	(7.672- 8.959)	

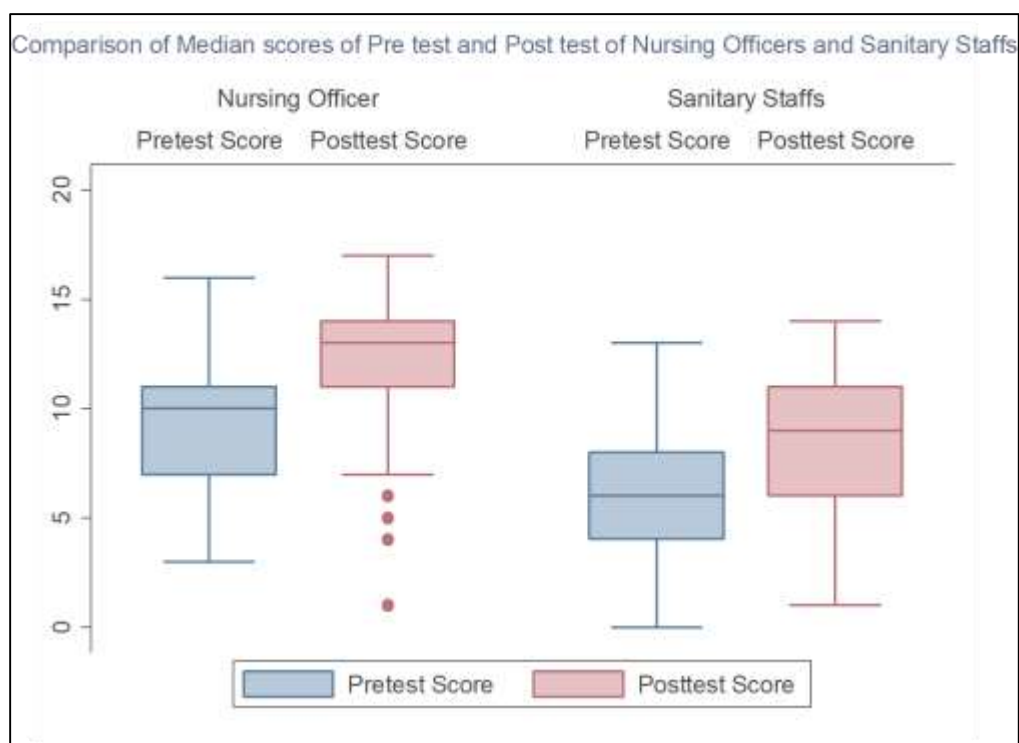


Fig1: Comparison of Pre-test and Post-test score of Nursing Officer and Sanitary Staffs