

Knowledge about biomedical waste management among health care professionals in a tertiary care teaching hospital, Telangana

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Abstract:

Background: Biomedical waste (BMW) management is the need of the hour. Hospitals generate a large quantity of waste that should be properly collected, segregated, stored, transported, and safely disposed. Efforts are made to sensitize, motivate, and practice proper waste management through training programs and auditing the hospital.

Objectives: 1. To assess the existing knowledge and attitude about biomedical waste management among health care professionals of a tertiary care hospital, Telangana. 2. To stipulate trainings for improvement of awareness about BMW.

Materials & Methods: A descriptive cross-sectional study was conducted among the health care professionals working at Niloufer Hospital for Women and Children, Hyderabad. An identical pre and post-training questionnaire was designed and given before and after the training session. The questionnaire assessed the knowledge and attitude about BMW and awareness about needle stick injury. A series of training sessions were conducted by trained staff.

Statistical Analysis: Responses to the questionnaire were coded, entered into Excel Sheet and analyzed using epiinfo software 7.1.5 version and significance was assessed by Chi Square test. Comparison of the pre and post test scores was done with the help of paired t – test.

Results: A total of 175 health care professionals participated in the study. This study showed that only one fourth of them were aware of general information about BMW and half of them were aware of color coding. Almost all the participants opined BMW management is an important issue requiring teamwork. The increase post test scores when compared to pre –test scores was found to be statistically significant (p-value-<0.0001) It was alarmingly found that only 53% of participants were fully vaccinated with Hepatitis B vaccination.

Conclusion: Awareness regarding bio-medical waste management was substantially increased by conducting training programs. The data provided by the study can direct the hospital authorities to develop strategies for improving BMW management.

Key words: Awareness, Bio medical waste, Health care Professionals, Training

I. Introduction

“Let the wastes of the sick not contaminate the lives of the healthy” rightly quoted by K. Park was the inspiration for this study. Biomedical waste management has recently emerged as a major issue and the primary onus of its proper disposal lies with the generator. The proper management of biomedical waste has become a worldwide significant health care topic today. Inadequate Bio-Medical waste management causes environmental pollution, unpleasant smell, growth and multiplication of vectors like insects, rodents and worms and may lead to the transmission of diseases like typhoid, cholera, hepatitis and AIDS through injuries from contaminated syringes and needles¹. To avoid these hazards, a rigorous waste management system should be implemented in hospital infrastructure².

According to the Bio-Medical Waste (Management and Handling) Rules of India, Biomedical waste means any waste which is 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 biological³. This involves management of range of activities, which are mainly engineering functions, such as collection, transportation, operation or treatment of processing systems and disposal of wastes.

It is estimated that annually about 0.33 million tons of hospital waste is generated in India and, the waste generation rate ranges from 0.5 to 2.0 kg per bed per day⁴. Alarmingly, the World

Health Organization (WHO) reported a 50% re-use in India of syringes and needles that are meant for single use⁵. WHO states that 85% of hospital wastes are actually non-hazardous, whereas 10% are infectious and 5% are non-infectious but they are included in hazardous wastes. About 15% to 35% of Hospital waste is regulated as hazardous waste. This range is dependent on the total amount of waste generated⁶. But when hazardous waste is not segregated at the source of generation and mixed with non-hazardous waste, then 100% waste becomes hazardous. Inappropriate segregation ultimately results in an incorrect method of waste disposal.

Currently the implementation of Bio-Medical waste management in many hospitals is unsatisfactory, disposing the waste in improper and indiscriminate manner. Although, there is an increased global awareness among health professionals about the hazards and also appropriate management techniques but the level of awareness in India is found to be unsatisfactory^{7,8,9}. With this background, the present study was designed to assess the awareness on biomedical waste management and also to update the knowledge among health care professionals at Niloufer Hospital for Women & Children, Osmania Medical College, Hyderabad, Telangana.

II. Aim

To know the existing knowledge and attitude about biomedical waste management among health care professionals of a tertiary care teaching hospital, Telangana. To stipulate trainings for improvement of awareness about BMW.

III. Materials & Methodology

A descriptive cross-sectional study was conducted for the period of four months from August to November 2015 at Niloufer Hospital for Women & Children, Osmania Medical College, Hyderabad, Telangana. A total of 175 health care professionals were included in the study, of which 51 were post-graduates, 41 were interns, 27 were staff nurses and 56 were student nurses. As these personnels were the active members for delivering medical care in a tertiary teaching hospital, they were included in the study. All the participants were briefed about the study and consent was taken. An identical pre and post-training questionnaire was designed which was pre-tested & pre-structured and given to the above mentioned subjects before and after the training session. Questionnaire was designed to assess knowledge on various aspects of BMW such as its hazards, rules, management, the color coding for segregation and methods used for disposal, needle stick injury and prophylactic vaccination. A series of training sessions were conducted by trained staff with power point presentation and video demonstration.

3.1 Statistical Analysis:

Questionnaires were collected anonymously after completion from the participants. Responses to the questionnaire were coded and entered into Excel Sheet and were analyzed using epiinfo software 7.1.5 version and significance was assessed by Chi Square test. p value <0.05 was considered significant, d.f 1 and level of significance 5%. Comparison of the pre and post - test scores was done with the help of paired t -test.

IV. Results

One hundred and seventy five participants were successfully enrolled in the study which included Post graduates, Interns, Staff Nurses and Student Nurses working in Niloufer Hospital for Women & Children. Fig. 1 depicts the relative distribution of the participants.

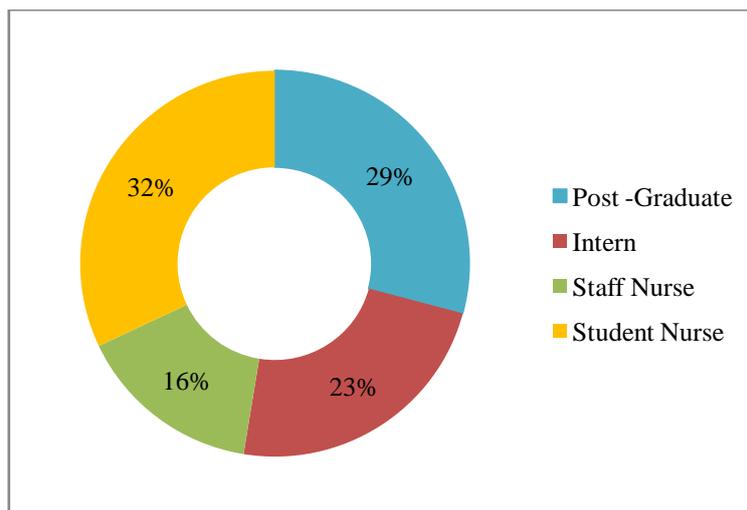


Figure 1. Distribution of Participants in the Study

The data was analyzed broadly under four sections i.e., general information on biomedical waste management, color coding, attitude and the needle stick injury practices

4.1 Analysis of general information: Only 24% of the participants knew the definition of biomedical waste in pre – test which increased significantly to 89% in post- test. The biomedical waste management and Handling Rules, 1998 of India was known only to 21% of them in pre – test and 96% in post – test. The ten categories of biomedical waste, the fact that 10 – 25% of Biomedical waste is hazardous were known to 32% and 26% of subjects respectively in the pre – test . Sparing the student nurses, the rest of the participants had fair knowledge about the biomedical symbol and the need for segregation to be done at the source.

Table 1: Knowledge about Biomedical Waste (BMW) Management

Survey Question	Post graduate (n = 51)			Intern (n = 41)			Staff Nurse (n = 27)			Student Nurse (n = 56)		
	Pre Test	Post-Test	p – Value	Pre Test	Post-Test	p – Value	Pre Test	Post-Test	p – Value	Pre Test	Post-Test	p – Value
Awareness about BMW definition	15 (29)	47 (92)	<0.0001	10 (24)	37 (90)	<0.0001	7 (26)	23 (85)	<0.0001	8 (17)	50 (89)	<0.0001
BMW legislation year	10 (24)	49 (96)	<0.0001	8 (20)	40 (98)	<0.0001	6 (22)	25 (93)	<0.0001	10 (18)	53 (95)	<0.0001
Percentage of BMW hazardous	19 (27)	47 (92)	<0.0001	10 (24)	37 (90)	<0.0001	10 (37)	22 (81)	<0.0001	10 (18)	48 (86)	<0.0001
BMW Segregation done at Source	38 (75)	50 (98)	0.0005	22 (54)	39 (95)	0.0001	16 (59)	25 (93)	0.004	25 (45)	51 (91)	<0.0001
Biohazard Symbol Identification	41 (80)	51 (100)	0.0008	32 (73)	40 (98)	0.006	20 (74)	27 (100)	0.004	15 (37)	50 (89)	<0.0001
Number of BMW category	20 (39)	48 (94)	<0.0001	16 (39)	36 (88)	<0.0001	8 (30)	25 (93)	<0.0001	10 (18)	48 (86)	<0.0001

(Figure in parenthesis indicate percentage)

4.2Analysis of data on color coding: On all counts, post graduates and staff nurses had better knowledge than interns followed by student nurses regarding color coding. The pre and post – test values of student nurses were 29% and 88% respectively which shows significant increase in their knowledge after training(p value was <0.0001). Segregation of human anatomical waste in yellow bags and disposal by incineration was known to a substantial 65% of the participants.

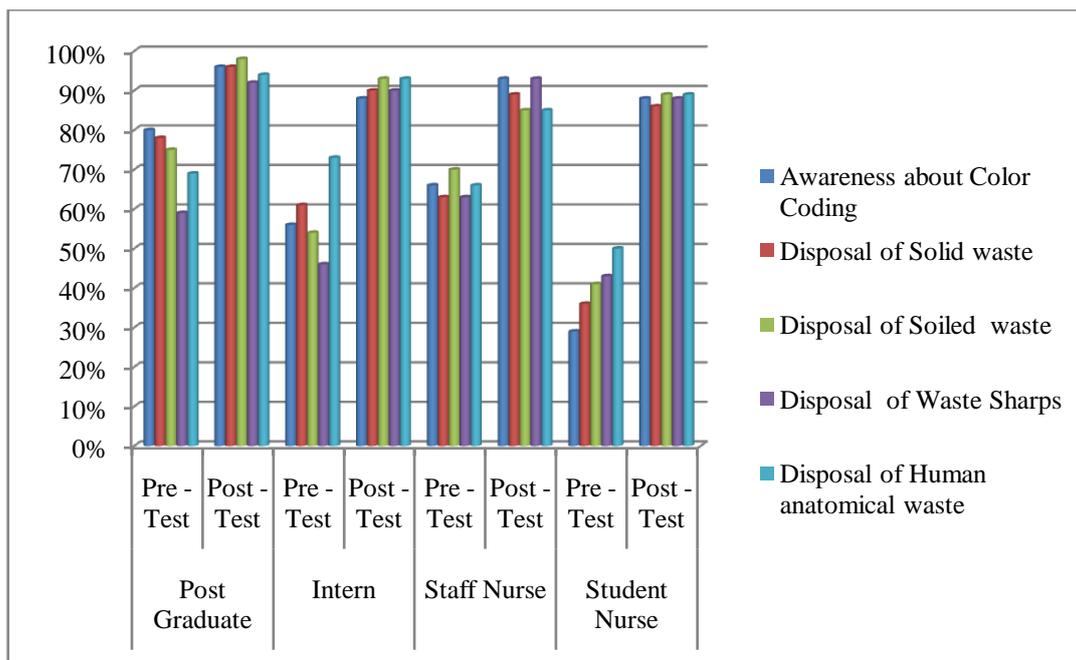


Figure 2: Comparison of Pre and Post - test Scores on Color coding

Table 2: Knowledge about Color coding

Survey Question	Post graduate (n = 51)			Intern (n = 41)			Staff Nurse (n = 27)			Student Nurse (n = 56)		
	Pre Test	Post-Test	p -Value	Pre Test	Post-Test	p -Value	Pre Test	Post-Test	p - Value	Pre Test	Post-Test	p - Value
Awareness about Color Coding	41 (80)	49 (100)	0.013	23 (56)	36 (88)	<0.0001	18 (66)	25 (93)	0.018	16 (29)	49 (88)	<0.0001
Disposal of Solid waste	40 (78)	49 (96)	0.007	25 (61)	37 (90)	0.002	17 (63)	24 (89)	0.025	20 (36)	48 (86)	<0.0001
Disposal of Soiled waste	38 (75)	50 (98)	0.0005	22 (54)	38 (93)	<0.0001	19 (70)	23 (85)	0.19	23 (41)	50 (89)	<0.0001
Disposal of Waste Sharps	30 (59)	47 (92)	<0.0001	19 (46)	37 (90)	<0.0001	17 (63)	25 (93)	0.0008	24 (43)	49 (88)	<0.0001
Disposal of Human anatomical waste	35 (69)	48 (94)	0.0009	30 (73)	38 (93)	0.018	18 (67)	23 (85)	0.11	28 (50)	50 (89)	<0.0001

(Figure in parenthesis indicate percentage)

4.3 Anaysis of Attitude: Attitude-based questions were very well-responded by all the healthcare professionals. 90% of student nurses and all the post graduates, interns and staff nurses believed that biomedical waste management is an important issue. 97% of the participants opined that it is a team work and only 12% felt that it is an extra burden on their work. Almost all the participants felt the need for trainings on biomedical waste management and wanted to get updated.

Table 3: Attitude towards BMW management among the participants in Pre - test

Survey Question	Post - graduate	Intern	Staff Nurse	Student Nurse
BMW is an important issue	100%	100%	100%	90%
BMW is team – work	100%	98%	96%	92%
BMW is extra burden on work	4%	7%	12%	24%
Need for compulsory training on BMW	100%	100%	100%	96%
Improper BMW management is hazardous	98%	98%	96%	85%

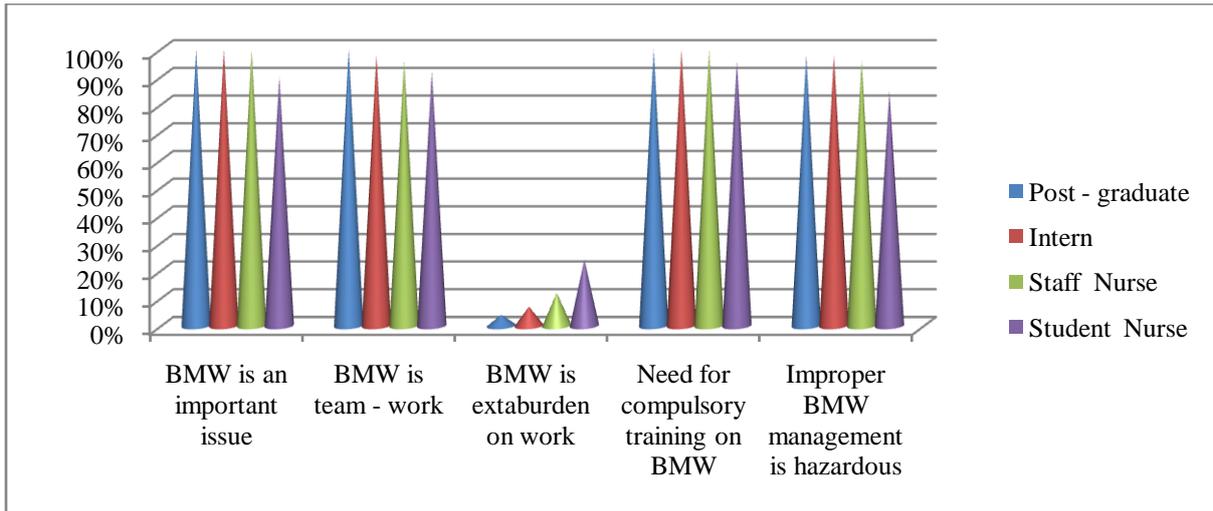


Figure 3: Comparison of Attitude on BMW among the participants

4.4 Analysis of needle stick injuries: Interestingly though 92% of participants were concerned about needle stick injury, 59% of them recapped the needle. After the training the concept of recapping the needle was found to be significantly reduced(p-value <0.0001). The awareness of infections transmitted by needle stick injuries was found to be 96% among the post – graduates but it was only 28% in student nurses in the pre – test. Used needles should be collected in a puncture proof container after burning their tips in a needle cutter, these details of awareness about disposal of used needles was 53% in pre - test and 91% in post – test.

Figure 4: Comparison of Pre and Post-test scores on Needle stick injuries

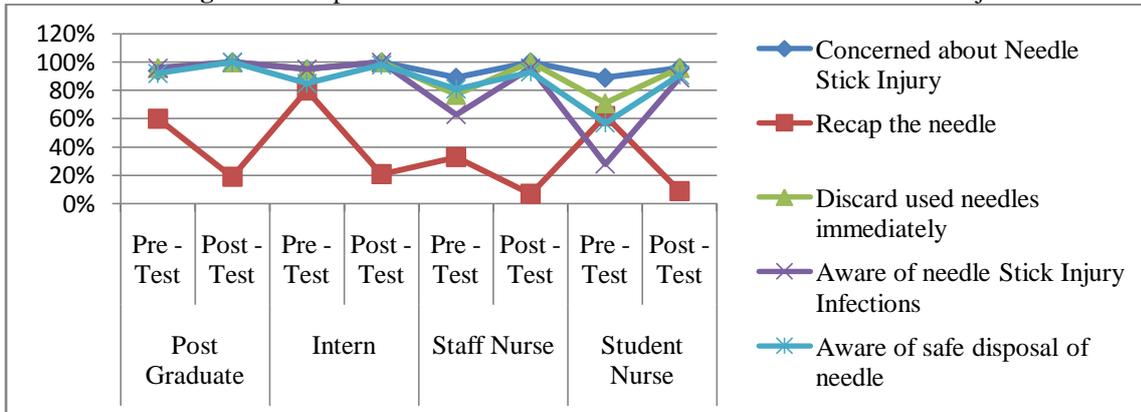


Table 4: Needle Stick Injury Practices

Survey Question	Post graduate (n = 51)			Intern (n = 41)			Staff Nurse (n = 27)			Student Nurse (n = 56)		
	Pre Test	Post-Test	p -Value	Pre Test	Post-Test	p -Value	Pre Test	Post-Test	p -Value	Pre Test	Post-Test	p -Value
Concerned about needle stick injury	48 (94)	51 (100)	0.078	39 (95)	41 (100)	0.15	24 (89)	27 (100)	0.074	50 (89)	54 (96)	0.014
Recap the Needle	31 (60)	12 (19)	<0.0001	33 (80)	9 (21)	<0.0001	9 (33)	2 (7)	0.017	35 (62)	5 (9)	<0.0001
Discard the used needle immediately	49 (96)	51 (100)	0.15	39 (95)	41 (100)	0.15	21 (77)	27 (100)	0.0128	40 (71)	54 (96)	0.0003
Aware of needle Stick Injury Infections	49 (96)	51 (100)	0.15	39 (95)	41 (100)	0.15	17 (63)	26 (96)	0.0009	16 (28)	50 (89)	<0.0001
Aware of safe disposal of needle	30 (59)	47 (92)	<0.0001	19 (46)	37 (90)	<0.0001	17 (63)	25 (93)	0.0008	24 (43)	49 (88)	<0.0001

(Figure in parenthesis indicate percentage)

4.5 Vaccination Status: It was alarmingly observed that only 42% of student nurse and 56% of the staff nurse were fully vaccinated with Hepatitis B vaccination, on the other hand 80% of the post- graduates and 72% of interns were vaccinated. All the participants were explained the importance of vaccination and advised for completing their vaccination for free of cost at the vaccination center in the hospital.

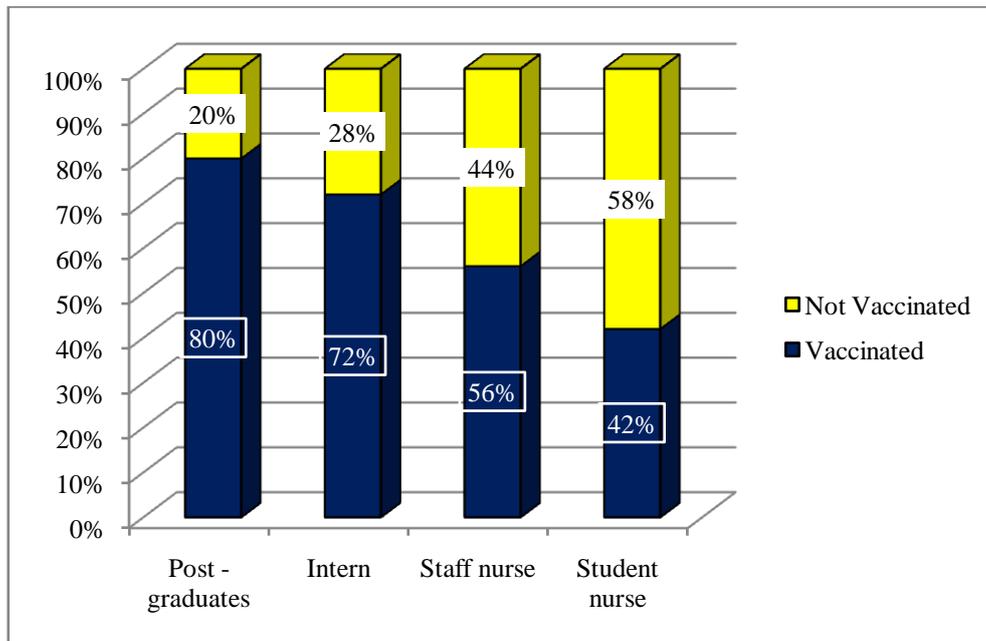


Figure 5: Vaccination status among the participants

The study participants were given marks out of 35. The scores widely ranged from 0 to 28 in pre-test and from 26 to 35 in post-test among all the study participants. The details of the pre-test and the post-test scores and the increase in the scores are shown in Fig. 6.

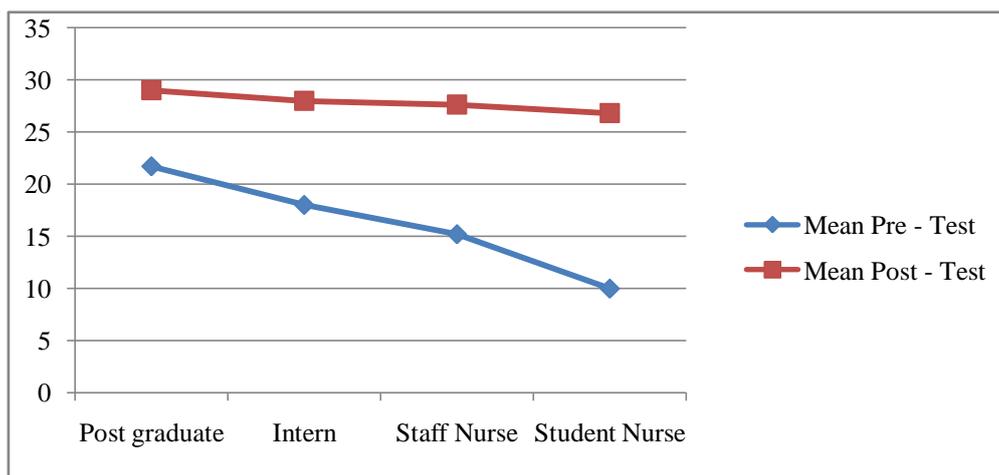


Figure 6: Comparison of Pre-test and Post-Test scores

The mean and standard deviation (SD) of these scores and the p-values are shown in Tab. 5. It was observed that though the student nurses had poor pre-test scores when compared with other participants but their post-test performance was at par excellence with other participants.

Table 5:Details of scores of the study participants

Study Participants	Mean		Standard Deviation		Paired t test Value	p – value
	Pre - Test	Post – Test	Pre - Test	Post - Test		
Post graduate	21.7	31.8	3.46	0.56	4.369	0 .00006
Intern	18	31.9	2.436	0.312	6.668	< .00001
Staff Nurse	15.2	31.8	5.408	0.506	4.739	0.00006
Student Nurse	10	30.9	5.971	1.366	3.7907	< .00001

V. Discussion

The study was conducted on post-graduates, interns, staff nurses and nursing students as they form the core team for delivering the medical care and thus are the important generators of biomedical waste. The study assessed their knowledge and attitude on biomedical waste management and awareness about needle stick injuries. A predesigned questionnaire and a cross-sectional study design was selected which was adopted in other studies^{10,11,12}.

Awareness about biohazard symbol was 76% among Post graduates, interns and staff nurse. Similar results were observed in studies conducted by Mohapatra *et al.*,¹³ and by Shakeerkahn P. *et al.*,¹⁴ which showed 60% and 78% respectively. However in the present study, only 37% of student nurses were aware of biomedical symbol.

The study also showed that only 24% of the subjects were aware of know about the Bio-Medical waste (Management & handling) rules before the training and the knowledge was significantly increased to 96% after training and was found to be statistically highly significant. A similar study conducted on health care personnel at Bagalkotcity¹² showed that 53.28% of the subjects did not know about Bio-Medical waste (Management & handling) rule before the training and the knowledge was significantly increased to 93.44% after the training. Similar results were found in a study conducted in Agra¹⁵, which indicated a lack of knowledge and awareness towards legislation on BMW and even more recently in a study in a dental hospital/clinics in Amritsar¹⁶.

Contrary to these studies, Bathma *et al.*,¹⁷ showed that 92.1% of doctors and 54.5% of nurses were aware about the existence of BMW management and handling rules 1998 which was only 29% and 22% respectively in the present study.

The awareness regarding the color coding for segregation and treatment options of BMW was 58% in pre – test and 92% in the post - test. B.S.Mannapure *et al.*,¹² revealed that more than half (54.92%) of the study subjects were unaware about color coding of BMW. After training the awareness was raised to 80.33%. Another study revealed the awareness about color coding was present in about half of the participants¹³. Satyanarayan Dash,¹¹ observed color coding to be correct in about one fourth study participants during pre- test that increased to about three fourth of the study participants during post – test.

The segregation of bio-medical waste at the point of generation is very important for the proper disposal of waste. This study showed that this fact was known to 58% when compared to only 22.95% in B.S.Mannapure *et al.*, study¹².

Almost all the participant showed positive attitude in management of biomedical waste and agreed that it is a team work and not an extra burden on their work. A study at Lucknow¹⁸ also showed the similar scenario. The awareness regarding infectious diseases transmitted through needle stick injuries was 96% among doctors which was identical with results shown by other studies^{14,19}. The awareness about correct disposal method of used needle was present in 53% of the study participants during pre - test. The post –test results showed that majority could mention the correct method of disposal of used needle during the post –test which was very similar to results of Satyanarayan Dash¹¹.

It was alarmingly found that only 53% of the participants were fully vaccinated with Hepatitis B vaccination. Former studies showed 51.64%¹² and 40%¹⁴. This predicts a considerable proportion of health care staff is at risk and requires immediate attention to vaccinate them by the administrators of the hospitals.

There was a statistically significant rise in the post test scores (75% - 100%) among the study participants in comparison with the pre- test scores (0-80%) . Wide range of results (0-75%) has also been reported by other studies^{11,20,21}.

VI. Conclusion

The present study concludes that overall majority of the post graduate students , interns and staff nurses were aware about the practical aspects of Biomedical waste management. But student nurses were lacking the knowledge in all aspects probably because of unaware of the topic in the curriculum

and never had trainings about biomedical waste management. Therefore, greater emphasis must be given on the topic in the study curriculum of both medical and nursing students.

In addition it was observed that the awareness of biomedical waste management was increased evidently in the post - test after the training. Hence it is recommended that such training sessions should be frequently organized to improve the awareness and update knowledge on biomedical waste. Training has to include both technical knowledge and sensitization for behavioral modification. These training sessions should not become merely a one-time activity but should be a continuous learning process to keep the health care staff updated and motivated.

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