

## Evaluation of Biomedical Waste Management Management and Effect of Biomedical Waste Management Audit on NSI Rate

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**Abstract:** In a hospital, biomedical waste (BMW) waste management is of utmost importance, as improper disposal can lead to increased chances of needlestick injury (NSI). The proper management starts at the point of segregation itself. The study was carried out to evaluate the condition of BMW disposal and indirect effect of BMW audit on NSI, in a tertiary care hospital in North India. A checklist consisting of 16 parameters related to functions carried out at the source of generation was used to conduct the audit and a team was constituted for the same. A total of 20 visits were made to areas covered. Mean percentage score was calculated for the parameters and also area wise assessment was done. Also, chi square test was used to analyze the effect of audit on NSI rate. The score for all the categories was high except 'mutilation of recyclable waste'. Area wise, all areas had comparable mean percentage score except ICUs; where the score was low. The p value was insignificant for the BMW audit effect on NSI rate. More emphasis needs to be given on sharps handling and mutilation of recyclable plastics. Continuous training sessions and surprise audits can play a role in proper BMW disposal and hence NSI rate

**Keywords:** BMW, NSI, audit, waste bins, segregation, sharps.

### INTRODUCTION

In a healthcare setting, the waste produced during the patient activities, that has the potential to cause harm to human beings and environment is called BMW. BMW comprises just 15-25% of total waste generated in hospital, remaining being the general waste.

Proper management of biomedical waste (BMW) generated in a healthcare facility is one of the most important functions of a healthcare worker, as its improper management poses risk to human beings and environment [1].

Due care shall be exercised while handling and disposing BMW, because of its well documented propensity to cause transmission of HIV, HBV and HCV amongst other pathogens. Healthcare workers (HCWs) are at direct risk of exposure to blood and other body fluids during the course of their job. Occupational exposure to blood can result from percutaneous (needle stick or other sharps injury) and mucocutaneous injury (splash of blood or other body fluids into the eyes, nose or mouth), or blood contact with non-intact skin [2]. Needle stick injury (NSI) is the most common form of occupational exposure to blood which results in transmission of blood borne infections [3].

Various literatures have described BMW in different ways. The U.S. EPA, 1986 and Centers for Disease Control, despite their discrepancies in clarifying the term infectious waste, have designated pathological waste, blood and blood products, contaminated sharps (scalpels, needles and blades) and microbiological waste (cultures and stocks) as infectious waste. OTA, 1998. Biomedical wastes are considered a special area where hazards and risks not just confined to the health of generators and operators of hospitals but also the health of general people. In general, hospital waste is broadly grouped into infectious waste and non-infectious waste.

Sharps or 'needlestick' injury, a cut or puncture wound resulting in penetration of the skin by a hypodermic needle, surgical blade, fragment of glass or metal or other sharp item including rigid plastic, is the primary hazard for those working with healthcare wastes [4]. Healthcare wastes contain a wide range of microorganisms among which hepatitis B virus (HBV),

hepatitis C virus (HCV) and HIV are the most significant pathogens. HBV infection may follow sharps injury, contamination of pre-existing skin lesions or splash inoculation to the eyes or mucous membranes. Infection may be transmitted by blood or bloodstained body fluids, even where bloodstaining is minimal and not visually apparent [4].

Needle stick injuries are an important and common occupational injury amongst healthcare workers and have a significant impact on the morbidity and mortality of these workers through the transmission of bbp [5]. Needle-stick injuries have been widely recognised as a source of exposure to bloodborne pathogens for workers in healthcare occupations [6]. There are more than 20 bloodborne pathogens that can be transmitted from contaminated needles or sharps, including HBV, HCV, and HIV; [17]. The risk of transmission of HIV following a hollow needle injury is approximately 0.3%, compared with 3% for HCV and 30% for HBV. worldwide, more than 100 healthcare workers have contracted HIV from work-related needle-stick injuries and many thousands have contracted HBV or HCV [7].The world health organization has estimated that exposure to sharps in the workplace accounts for 40 % of infections with HBV and HCV and 2-3 % of HIV infections among health care workers [8].

Numerous modifiable and non-modifiable factors, place HCWs at risk of NSI. The most common reasons are two-handed recapping, and the unsafe collection and disposal of sharps waste [3].

There are proper guidelines issued by state and central bodies governing waste disposal depending upon type and infectiousness. Segregation of waste is the most crucial step for proper management of BMW as waste segregated into various colour-coded containers is finally taken to different sites for disposal. Presence of a wrong kind of waste in a particular container will obviously nullify the efforts of appropriate disposal of waste.

There are primarily four broad functions of BMW management at point of generation [1].

- Placement of color coded bags namely red, yellow, blue, black and sharp container (white and puncture proof).
- Proper segregation of waste as per color coding (defined by Punjab pollution control board (PPCB) 2016 guidelines).
- Sharp disposal and handling
- Mutilation of recyclable waste e.g. plastic bottles, gloves etc.

All sharp items capable of causing injury must be discarded to robust tamper-proof and puncture-

resistant containers. Soft wastes are discarded to thin-walled plastic sacks that afford no protection against penetration by sharps or spillage of fluids. Effective segregation at source and the correct use of waste containers provide the most effective safeguards [4].

PEP may be indicated after sharps injury or other significant exposure, with prolonged follow-up and serological testing until seroconversion can be excluded. the psychological impact of sharps injury may precipitate severe stress/anxiety and disabling post-injury morbidity, adversely affecting the lives of those suffering injury and of their partner or family group and may force job change or result in an inability to work [9].The psychological consequences for affected individuals, even when seroconversion does not occur, highlight the need for much greater care in wastes disposal to prevent these entirely avoidable injuries.

O Malley *et al.* reported in their observational study that in almost every case, injuries were associated with unsheathed hypodermic needles in waste sacks intended only for soft wastes. Some healthcare professionals fail in their duty of care to protect the welfare of others. The direct financial costs associated with occupational exposure to blood and body fluids may be substantial though the implications of seroconversion carry a cost that is immeasurably greater [10].

In recognition of adverse physical and psychological consequences and financial burden on the institutions, prevention measures have been the focus of hazard reduction for health care professionals [11].

## **MATERIALS AND METHODS**

We carried a 5 month study to assess the effect of BMW audit on the NSI rate, if any. It started in july 2017 and data was collated till nov 17. All the patient care areas; which deal with BMW (plastics and sharps) were included. The routine OPD areas which do not deal with patient interventions were excluded.

A checklist that consisted of 16 parameters related to various functions carried out at the source of generation was prepared and used to record observation in the areas of study. A team of concerned staff, namely, infection control nurse, housekeeping supervisor and nursing educator (as she dealt with trainings) was constituted and areas were divided amongst them. A total of 20 visits was made to each area; once every week. The auditors preferred to visit the areas in random hours so that the staff is unaware of their visits. Besides checking the BMW bins for the content and their condition, the staff was also observed for their methodology of disposal.

The areas were exchanged between the team members so as to exclude any kind of biasing. The BMW audit was carried out with the concurrently ongoing training. This was followed by compilation of

the positive effects of the same on our NSI number, and also the overall BMW disposal strategies.

A total of 16 parameters were included in the checklist; 4 under “sharps related”, 4 under “proper waste segregation”, 4 under “condition of safety bins” and 2 under “mutilation of recyclable waste” category. The remaining 2 were miscellaneous. Each good observation was assigned 1 mark while undesirable was given ‘0’ mark.

**Sample checklist for BMW management practices audit**

- Sharp and sharp container related
  - sharp disposal is done in sharp containers
  - sharp bins are labelled with date and time of start of usage
  - sharp containers are not filled more than 3/4<sup>th</sup> level
  - needles are discarded appropriately
- Mutilation of waste
  - plastic IV set and tubings are cut before disposal
  - gloves (are they being torn before disposal)
- Proper segregation of waste
  - discarded medicine disposed off in yellow bags
  - plastic being discarded in red bag
  - glass bottles disposed off in blue bags
  - general waste in green bags
- Condition of waste bins
  - are all the bins available
  - are the bins covered
  - are the posters depicting the color coded segregation available in all areas
  - are the dustbins overfilled

- Misc.
  - syringe/needles present on bedside
  - is the personnel aware about appropriate disposal of BMW?

**DATA ANALYSIS**

The score obtained in 20 visits for a particular category of waste management was divided by 20 to obtain the mean score and then percentage mean score was calculated. We analyzed the audit data category wise and also area wise. To assess the effect of audit on NSI rate, we used chi square test as it was a short period study. P-value ≤ 0.05 was used as a cut point to determine significance.

**RESULTS**

Category wise, the mean percentage score of ‘proper waste segregation’ was 91%, ‘condition of waste bins’ was 93%, ‘sharp and sharp related’ was 87% and ‘recyclable plastic waste mutilation’ was 80%. The overall mean percentage score for BMW management was around 88%. Area wise, the scores of emergency, ICUs, OTs, all wards, and dressing room OPDs were 88%, 84%, 89%, 87% and 91% respectively (table 1).

If we compare the data, it showed that while the scores of ‘condition of waste bins’ and ‘waste segregation’ were almost same for the areas, the scores were different for the ‘plastic waste mutilation’ and ‘sharp related issues’.

The chi square test done for the effect of our BMW audit showed p value to be insignificant (our p value was 0.155) but still the NSI injuries amongst housekeeping staff due to improper disposal was nil.(table 2)

**Table-1: Mean percentage score of different categories of BMW management in different areas**

	Emergency	ICU	OT	Wards	Dressing Area OPD	Overall Score of category
Condition of waste bins	92%	94%	93%	93%	92%	93%
Mutilation of recyclable plastic	80%	72%	84%	78%	87%	80%
Waste Segregation	90%	89%	92%	90%	93%	91%
Sharp related issues	89%	84%	88%	85%	84%	87%
Overall Score of area	88%	84%	89%	87%	91%	

**Table-2: Incidence of NSI amongst housekeeping staff**

MONTH	HOUSE KEEPING	TOTAL NSI
APRIL	0	0
MAY	2	5
JUNE	2	3
JULY	0	1
AUGUST	0	2
SEPTEMBER	0	2
OCTOBER	0	0
NOVEMBER	0	1

**DISCUSSION**

Proper waste segregation is a very crucial step in order to achieve a foolproof BMW management. Any negligence or wrong disposal doesn't have only serious implications but that can also lead to occupational injury i.e NSI. This begins with the site of generation of waste i.e waste bins.

The overall score for condition of waste bins was 93%. In our hospital, this was an expected result as the overall placement and presence of biohazard symbol are seriously taken care of. The bins were well placed, with lids and stickers. The parameter which was not met in places was overfilling of bins. Various studies reported the poor condition of bins. In a south Indian study, the segregation was a bit difficult due to presence of just one color coded bins [12]. Another study at a tertiary care hospital in north India reflected good waste receptacle condition with a score of 87% [1].

Our score for waste segregation; 91% is satisfactory but certain issues need to be addressed viz mixing of glass waste in yellow or blue bags; glass bottles shall be discarded in blue box while cytotoxic bottles in yellow. Also the problem of improper segregation was observed with the disposal of syringes in sharp container, rather being in red bag. Area wise, the scores were comparable. Various studies showed varying results. While Rajiv *et al.* [1] study showed an overwhelming score of 96%, Rao *et al.* [12] showed a low 40.3%. Few studies didn't mention the exact scores [13]. As per Lohani *et al.* study, the overall mean score for "condition of waste receptacles" was 44.3%. The mean score for segregation of waste was 77% and for mutilation of recyclable waste the mean score was 88% [14]. As per their study, there was a great scope for BMW segregation improvement. . It is not wrong to say that we still need to work harder on this aspect as it is the most important and crucial aspect of BMW management.

The worrisome issue is mutilation of recyclable plastic and sharp related issues. The problems faced mainly in ICU and general ward and dialysis ward were disposal of gloves and IV tubings

without cutting. This happened despite regular classes and trainings of HCWs. The less attention given to cutting of plastic bottles and syringes and tearing of gloves shall be rigorously worked upon. Our score was 84% which is less as compared to Rajiv *et al* study.

The sharp related score of 87% was due to wrong disposal of glass shreds and syringes along with needles. But the optimistic finding was improved disposal of needles in sharp container itself. A Pakistan study [15] showed low score for sharp disposal due to wrong practices by doctors.

Pandey *et al* suggested that the health care providers should know the quantity of waste generated in their facility and try to reduce the waste generation in day-to-day work because lesser amount of BMW means a lesser burden on waste disposal work and cost saving [16].

A positive effect of our BMW audit was seen on the number of NSI though the value was insignificant but the number of NSI cases amongst housekeeping staff was negligible, when compared to NSI amongst housekeeping staff in the months of May and June 2017. The ongoing audit raised awareness and increased concern amongst the staff.

**CONCLUSION**

The present short study was done to curb the improper BMW disposal in our patient care areas which indirectly led to increased NSI. This study also gave us an insight about the actual deficiencies in our institution. More emphasis shall be made on sharp related issues and recyclable plastic destruction. Also the ICU area and wards need continuous classes and training sessions on BMW disposal. We may continue our work along with ongoing trainings to all HCW and hope to streamline the BMW disposal strategy soon.

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