

## ORIGINAL ARTICLE

# Quantum of Biomedical waste (BMW) before and during COVID, and the challenges it presented

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### ABSTRACT

#### Aims and Objectives:

1. To find out the quanta of BMW before and during Covid 19, and the challenges presented during its management.
2. To assess the knowledge, attitude and practices of health care workers (HCW) related to infection control practices (ICP) during scientific management of bio medical waste (BMW) to overcome the challenges of Covid BMW (CBMW).

#### Material and Methods:

Records for Non Covid BMW(NBMW) generated in the healthcare facility (HCF) were analysed. Covid BMW (CBMW) was added from 23<sup>rd</sup> March 2020 & records pertaining to it were also analysed. Questionnaires were administered to HCWs regarding ICP for NBMW & CBMW management, and the challenges faced in this regard. Their responses were scored. Random audits of ICP by the HCW were conducted by direct observation also. Records of Hepatitis B & Covid vaccination were obtained for ICP scoring.

#### Results and observations:

Yellow bag NBMW generation showed an anticipated slight increase in 2020, compared to 2019. Red bag non NBMW showed a slight decrease. Covid BMW was added on 23 March 2020. Separate records were maintained for this. Both yellow & red bag CBMW showed variations in different months of the year 2020 & 2021. CBMW showed an increase in June & July of 2020, & again in November & December of 2020. In 2021, a single peak of CBMW was seen in April & May.

#### Discussion:

The CBMW needed a system of segregation and disposal separate from NBMW, as per CPCB rules. This posed an additional burden on the existing system. The demand for Personal Protective Equipment (PPE), increased multi folds. Plastic micro waste generation also increased. Changes were made in the shifts and working hours of BMW waste handlers. Double work of separate register entries for NBMW & CBMW, and urgent handing of waste to CBWTF, in double bags placed an additional load on all HCWs. Some HCWs, were not vaccinated for Hepatitis B. Re training sessions had to be carried out for the vaccination drive and to strengthen various other ICP like six steps of hand hygiene as per World Health Organization (WHO), donning and doffing of PPE, & Covid specific BMW management. Laboratory BMW management program was strengthened. Specimens from suspected/ confirmed Covid patients were appropriately disposed of as CBMW.

**Conclusion:**

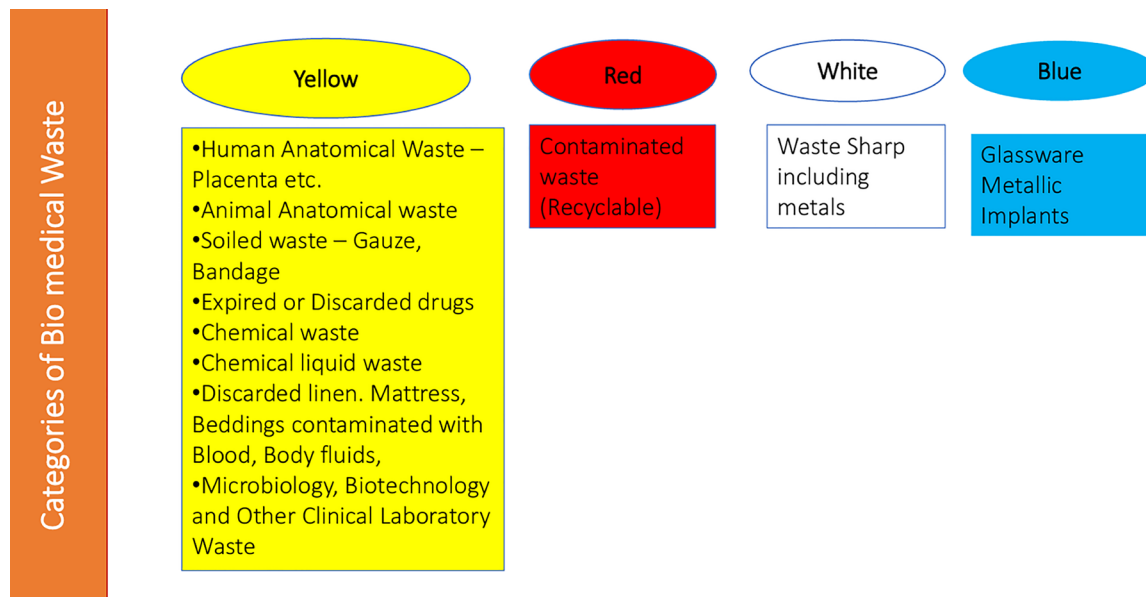
The rapidly spreading Covid pandemic increased the receptivity of HCWs to better ICP & BMW management. The increased micro plastic and other biomedical waste led to more frequent removal of waste from the site and motivated HCW to improve techniques for balling up PPE during doffing to reduce the volume of waste. The laboratory also devised safety norms for handling Covid & later fungal suspect/ confirmed samples and appropriate BMW disposal of such samples.

**INTRODUCTION**

According to *Biomedical Waste (Management and Handling) Rules, 1998 of India* “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 biologicals.

Bio Medical Waste (BMW) is generated from human, animal health care facilities, medical teaching colleges / institutes, medical research, biological/ pharmacological laboratory waste and other facilities. BMW must be stored in a safe, secure environment at all times, before ultimate disposal. Solid BMW should not be mixed with chemical, radioactive or other hazardous HW. Appropriate colour coded containers for BMW are used for segregated collection before ultimate disposal. The Government of India specifies that BMW is a part of hospital hygiene and maintenance activities and is auditable <sup>1</sup>.

Categories of BMW for disposal: There are 04 categories of infectious solid waste for disposal purpose in SCHEDULE 1 (National Health System Resource Centre)



**Figure 1:** Categories of Biomedical Waste

**Covid specific BMW disposal (CPCB)**

Keep separate colour coded bins (with foot operated lids)2/bags/containers in wards and maintain proper segregation of waste as per BMW Rules, 2016 as amended and CPCB guidelines for implementation of BMW Management Rules

- As precaution double layered bags (using 2 bags) should be used for collection of waste from COVID-19 isolation wards so as to ensure adequate strength and no-leaks; - Collect and store biomedical waste separately prior to handing over the same to CBWTF. Use a dedicated collection bin labelled as “COVID-19” to store COVID-19 waste and keep separately in temporary storage room prior to handing over to authorized staff of CBWTF. Biomedical waste collected in such isolation wards can also be lifted directly from ward into CBWTF collection van.
- In addition to mandatory labelling, bags/containers used for collecting biomedical waste from COVID-19 wards, should be labelled as “COVID-19 Waste”. This marking would enable CBWTFs to identify the waste easily for priority treatment and disposal immediately upon the receipt
- Maintain separate records of waste generated from COVID-19 isolation wards.
- Use dedicated trolleys and collection bins in COVID-19 isolation wards. A label “COVID-19 Waste” to be pasted on these items also.
- The (inner and outer) surface of containers/bins/trolleys used for storage of COVID-19 waste should be disinfected with 1% sodium hypochlorite solution daily.
- Report opening or operation of COVID-19 ward and COVID-19 ICU ward to SPCBs/PCCs and respective CBWTF located in the area.
- Register in CPCB mobile application namely ‘COVID19BWM’ to update the details of COVID-19 biomedical waste generation.
- Depute dedicated sanitation workers separately for biomedical waste and general solid waste so that waste can be collected and transferred timely to temporary waste storage area.

Collect used PPEs such as goggles, face-shield, splash proof apron, Plastic Coverall, Hazmet suit, nitrile gloves into red bag; 3 - Collect used mask (including Triple layer mask, N95 mask etc.), head cover/cap, shoe-cover, disposable linen Gown, non-plastic or semi-plastic coverall in yellow bags.

## MATERIALS AND METHODS

1) Bio-Medical Waste (BMW), collected daily at the hospital BMW storage site is weighed accurately and a record kept, along with entry on a Mobile App connected to centralized records. The records were reviewed to check for comparison of pre Covid BMW and Covid BMW. The following records were studied: January to December BMW 2019, 2020 and January to October BMW 2021. Following facts were found

**Table 1:** Comparison of total BMW in the last 3 years

Total BMW per month in the years 2019, 2020, and 2021 in Kg. per month			
	<u>2019</u>	<u>2020</u>	<u>2021</u>
<b>Jan</b>	11180	10489	9131.16
<b>Feb</b>	10260	11595.18	9808.24
<b>Mar</b>	11004	12162.34	12751.72
<b>Apr</b>	11000	8799.38	12602.86
<b>May</b>	11487	10452.89	10396.79
<b>Jun</b>	10925	11292.81	6354.6
<b>Jul</b>	11072	11625.39	11806.1
<b>Aug</b>	10544	11491.05	14069.93
<b>Sep</b>	9925	11805.13	14743.26
<b>Oct</b>	10251	11800.44	14975.63
<b>Nov</b>	9077	10761.05	
<b>Dec</b>	8919	11284.2	
<b>Averages</b>	<b>10470.33</b>	<b>11129.91</b>	<b>11664.03</b>

The average total BMW generated in the hospital (10470.33 Kg. in 2019, 11129.91 Kg. in 2020 & 11664.03 Kg from Jan to Oct 2021) increased slightly every year.

2) All HCWs, including BMW & sanitation staff were trained extensively, by demonstration on site, in class rooms, through video presentations, in 1. Hand Hygiene 2. Personal Protective Equipment (PPE) donning and doffing, 3. Needle Stick injury 4. Blood spill management, 5. Immunizations. 6. Scientific NBMW, CBMW management. The attendees recorded their demographic details, and later participated in audits done via interviews, random audits (observations by the Infection Control Nurses). Records received from various unit in charges regarding Hepatitis B & Covid vaccination were scored. All scores were compiled for statistical analysis.

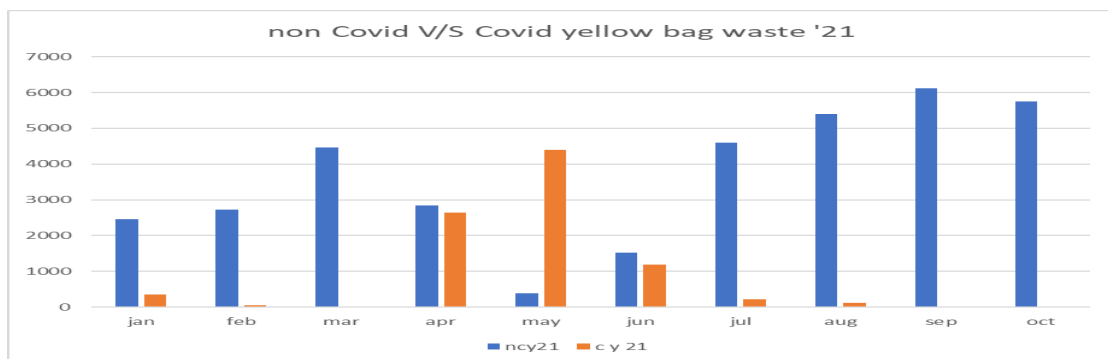
Inclusion Criteria: All HCW who underwent both the training sessions and were available for the review audits. HCW, both male and female 20 years to 60 years were included in the review.

Exclusion criteria: Members of Infection Control Team, & BMW Team. Members about to retire, or those transferred outside the HCF.

**RESULTS**

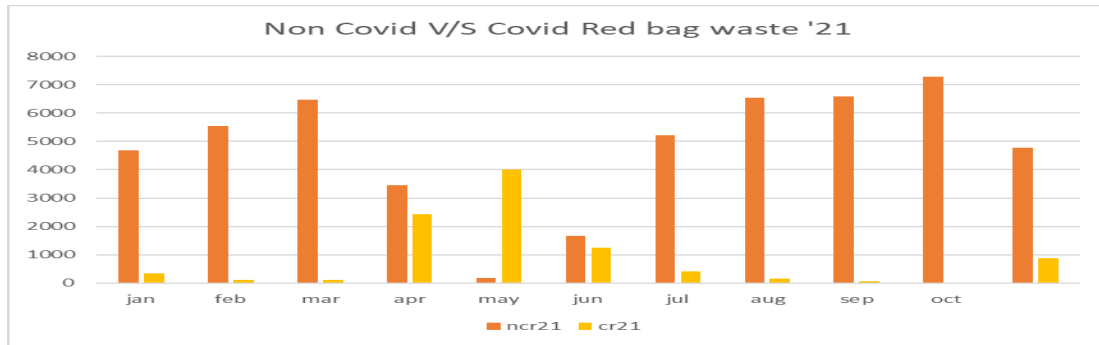
The two types of BMW generated, Non Covid BMW (NBMW), & Covid BMW (CBMW) were compared with respect to the amount generated in both yellow bag category and red bag category, from January 2020 to October 2021, retrospectively. These formed the bulk of the BMW generated in the current study. CBMW was nil in January, February, and major part of March 2020, as CBMW rules came into force from 22<sup>nd</sup> March 2020. The amount of CBMW was very less compared to NBMW, as the hospital reserved few Covid beds, which increased slightly in phases as per Government directives. Being a mixed Covid & Non Covid bedded hospital throughout the year 2020 and a major part of the year 2021, both CBMW & NBMW coexisted.

Comparison of the 02 types of yellow bag waste NBMW and CBMW showed an average of 3155.60 Kg and 599.80 Kg respectively in the year 2020, & Red bag Average of 5620.00 & 493.80 Kg. respectively.



**Figure 2:** Comparison of Covid and Non-Covid Yellow bag waste

Comparison of the 02 types of yellow bag waste, ie NBMW and CBMW showed an average of 3625.90 Kg and 899.90 Kg respectively in the year 2021. January, February, March depict mainly non Covid waste, whereas in April almost equal NBMW, CBMW had to be handled in the hospital. The month of May saw a major spike in the Covid BMW which rapidly decreased by July end, as the 2<sup>nd</sup> wave of Covid in Delhi burned itself out. Similar situation was seen with Covid Red bag BMW, with NBMW & CBMW avg. at 4766.70 & 886.10 Kg from January through October 2021.



**Figure 3:** Comparison of Covid and Non-Covid Red bag waste

## Discussion

A comparison of BMW generated in Health Care Facilities in the whole of Delhi and DDUH shows the load of DDUH in tons per month to be 0.03% of entire Delhi, but the focal, local challenges faced in BMW management were many and probably similar in nature to those faced in other parts of India. Mixing of waste due to improper handling, safety measures from BMW generation to handing over to CBWTF transporter, increasing share of plastic wastes, risk of disease transmission at every step involved in BMW, and vulnerability of waste handling workers were issues discussed by other reviewers.<sup>3</sup>

An average number of patients admitted per month were 5068 in 2019 and 3270 in the year 2020. From 23rd March 2020, a small no. of Covid suspect and confirmed patients were also admitted, for which separate areas of isolation had to be created. These isolation areas were cordoned off from other units. Separate corridors for BMW movement had to be devised. All HCWs, including BMW & sanitation staff were trained extensively in 1. Hand Hygiene, 2. Personal Protective Equipment (PPE) donning and doffing, 3. Needle Stick injury 4. Blood spill management, 5. Immunization for Hepatitis B 6. Proper use of disinfectants. The trainings were reinforced. In the year 2021 during a second wave of Covid, the number of beds reserved for Covid patients increased in phases. In May, June 2021 the entire hospital was catering to Covid patients. This led to increased CBMW. But a stream of NBMW continued from the Blood Bank, the Labour room, Paediatric nursery & Emergency. NBMW increased in phases from other areas like Dialysis Unit, Immunization Room, Thalassemia Unit etc.

The challenges presented were many: 1. Training the staff in safe usage of personal protection equipment. 2. Segregating Covid suspect, confirmed, and Covid negative patients. 3. Managing the two types of Covid & Non Covid BMW separately 4. The HCWs reported feeling intense heat and dehydration in the PPE .5. Tears in BMW bags, though an infrequent incident, would lead to increased workload and more time in PPE for the HCW. 6. Risk assessment had to be done for torn PPE & counselling of the HCWs was needed.

During the training audits the knowledge, attitude & practices of HCW was studied. A total of 428 participants were included in the study, and their demographic profile was as follows.

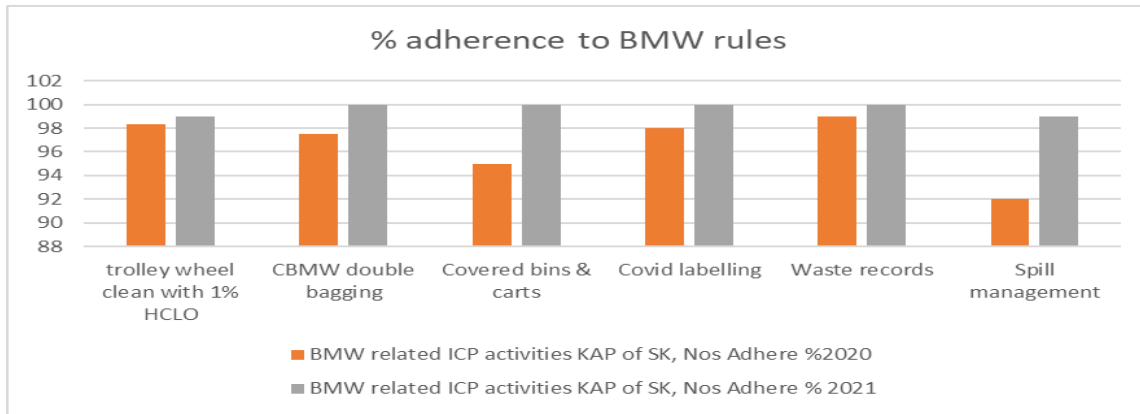
**Table 2:** Demographic profile of HCW for ICP & BMW

Demographic profile of HCW for ICP & BMW		
<b>Sl. No.</b>	<b>Occupation</b>	<b>n= 428</b>
1	Senior physicians	25
2	Nurses	172
3	Lab Technicians	25
4	Interns	25
5	Residents	60
6	SK	100
7	D & NO	21
<b>Age in years</b>		
		<b>n= 428</b>
1	21-30	184
2	31-40	147
3	41-50	58
4	51-60	39
<b>Sex</b>		
		<b>n=428</b>
1	Male	155
2	Female	273
<b>Educational Qualifications</b>		
		<b>n= 428</b>
1	10 +2	121
2	Bachelors	244
3	Masters	63

**Table 3:** Hepatitis B vaccine & Covid vaccination status

Sl. no.		n	vHBV	nvHBV	C+	C-
1	Senior Physicians	25	20	5	20	0
2	Nurses	172	161	11	172	0
3	Lab technicians	25	24	1	24	1
4	Interns	25	4	21	22	3
5	Residents	60	38	22	55	5
6	SK	100	56	44	67	33
7	D & NO	21	8	13	17	4

The above table shows Hepatitis B vaccine & Covid vaccination status of HCW, enrolled. All senior staff was receptive to vaccination for personal protection. Junior staff had to be motivated & audits and re trainings helped to improve the vaccination score.



**Figure 8:** Percentage Adherence to BMW Rules

The above chart shows the knowledge, attitude and practices of the nursing orderlies and safai karmcharis with respect to adherence to covid BMW rules. In the first assessment during August 2020, the adherence to rules was less than 97%. With repeated trainings, and increased legal measures the score improved by August 2021 to nearly 100%

Laboratory safety norms were researched and improved with the help of guidelines from WHO, and govt of India. Separate sample receiving areas were created for receiving covid samples and they were received in triple packaging. Before opening, the packs were sprayed with 70% alcohol. Sample requisition forms were kept in UV ray chambers before handling. Full PPE was worn by the technical staff posted in the labs. Covered centrifuges were used, and all lab waste was discarded as per COVID BMW rules. Glass slides for fungal specimens were put into blue puncture proof covered containers. All lab waste was pre-treated for disinfection by autoclaving or microwaving.

## Conclusion

The rapidly spreading Covid pandemic increased the receptivity of HCWs to better ICP & BMW management. The increased micro plastic and other biomedical waste led to more frequent removal of waste from the site and motivated HCW to improve techniques for balling up PPE during doffing to reduce the volume of waste. The Labs also devised safety norms for handling Covid & later fungal suspect/ confirmed samples and appropriate BMW disposal of such samples.

## References

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