



**BIOMEDICAL WASTE MANAGEMENT AT MAKESHIFT HEALTH CARE FACILITY
FOR COVID -19 PATIENTS: LESSONS LEARNT SO FAR FROM A HILL STATE IN
INDIA**

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ABSTRACT

Context: Biomedical waste management (BMW) during Covid-19 has posed many challenges to healthcare facilities. The situation becomes more difficult at makeshift health care facility where there is no regular infrastructure and staff available. **Aims and objectives:** To analyse the biomedical waste management at Dedicated Covid Care Centre in district Bilaspur, Himachal Pradesh as per BMW Rules. **Settings and Design:** Dedicated Covid Care Centre in district Bilaspur (Himachal Pradesh). **Materials and Methods:** The secondary data about biomedical waste management at Dedicated Covid Care Centre in district Bilaspur (Himachal Pradesh) from 23.05.2020 to 06.05.2021 was obtained from the register, supplemented by observations. **Statistical analysis used:** Total waste generated, category wise (yellow and red) waste generated quantity of waste generated per patient per bed and month wise analysis was done. The comparison was done between the BMW management at Dedicated Covid Care Centre in district Bilaspur and the guidelines for same. **Results:** During the study period (23 May 2020 to 06 May 2021), total of 4225 kg BMW generated comprised mostly of yellow category (58.1%). BMW management at the makeshift health care facility adhered to guidelines as per BMW Rules. **Conclusion:** The management of BMW at makeshift facility is a challenging task. Despite the hurdles, BMW found to be appropriate as per guidelines.

KEYWORDS: Biomedical waste (BMW), Dedicated covid care centre (DCCC).

Key Messages: It is the moral, social and legal responsibility of all the persons involved in generation of biomedical waste to segregate it properly as per the Biomedical waste management Rules.

INTRODUCTION

Covid-19 pandemic has disrupted many facets of health care delivery system. The use of personal protective equipment kits at every level *i.e.* sample collection, laboratory tests, patients management *etc.* has increased manifold during pandemic. The fallout of this has led to generation of biomedical waste (BMW) in large amount in various types of health care facilities.^[1] During Covid-19, India faces severe consequences due to the flawed BMW system and lack of adequate resources.^[2] BMW is a potential source of infection if it is left untreated and incorrectly managed.^[3] BMW management rules 2016 and the amendment rules 2018 are the latest guidelines to regulate the handling of BMW in the country.^[4,5] There is a stringent policy of onsite segregation of the

generated BMW and storing, transporting, and disposing of them in adherence to the BMW rules.^[6,7]

Several types of biomedical wastes are being generated due to this pandemic. Personal protective equipment (PPE) including face mask, caps, gloves, protective overalls *etc.*, items contaminated with blood, cotton swabs, lab chemicals, discarded disinfectants, floor washings, articles used for housekeeping & disinfection in health care facilities and hospitals, metallic sharps *etc.* Biomedical waste is being generated in large quantities in isolation wards, sample collections, laboratories at hospitals, centres that have been converted to serve as make-shift hospitals, community, and household level.^[8]

The health facilities were categorized to facilitate management of Covid-19 cases according to severity of disease in India. It also helped to prevent cross infection by avoiding mixing of covid-19 patients with other patients as well as severe cases with moderate and mild or very mild cases. These three types of covid dedicated

facilities are Dedicated Covid Hospital (DCH), Dedicated Covid Health Centre (DCHC), and Dedicated Covid Care Centre (DCCC).^[9]

Out of three, DCCC are makeshift facilities for management of mild or very mild cases of Covid-19. These are set up in hostels, hotels, schools, stadiums, lodges etc., both public and private. The management of biomedical waste is important to prevent the spread of Covid-19 especially in a makeshift facility where there are no proper pre-existing arrangements. With this background, the present study was done with following aim and objectives:

MATERIALS AND METHODS

Aim: To provide a clean, safe and infection free management of biomedical waste at Dedicated Covid Care Centre.

Objectives

- (i) To analyse the biomedical waste management (collection, segregation and disposal) as per BMW Rules at Dedicated Covid Care Centre in district Bilaspur, Himachal Pradesh.
- (ii) To minimize the chances of cross infection to the Covid-19 patients and the staff at DCCC.
- (iii) To improve the standard of hygiene and sanitation at DCCC.

Study area and Study period: District Bilaspur is among 12 districts in hilly state of Himachal Pradesh, India. The district had set up Dedicated Covid Care

Centre at Binaula in April 2020 following directions of the government. It had capacity of 80 beds. Recently, it has been shifted to Kothipura with capacity of 100 beds. The data about biomedical waste management was collected from 23 May 2020 to 06 May 2021.

Data collection: The secondary data was obtained from Biomedical waste management register maintained at DCCC. The data include information about variables related to BMW generation and collection in yellow and red bags, number of patients admitted at various point in time, number of beds available, consumption of sodium hypochloride solution. A check list was also prepared to obtain information about basic facilities available at DCCC.

Data analysis: The data was entered into Microsoft Office Excel 2007 and analysed. Total waste generated and category wise (yellow and red) waste generated during study period was calculated. Further, quantity of waste generated per patient per bed and month wise analysis was done. An attempt was made to compare the BMW management at DCCC in district Bilaspur according to the guidelines given by national and international agencies.

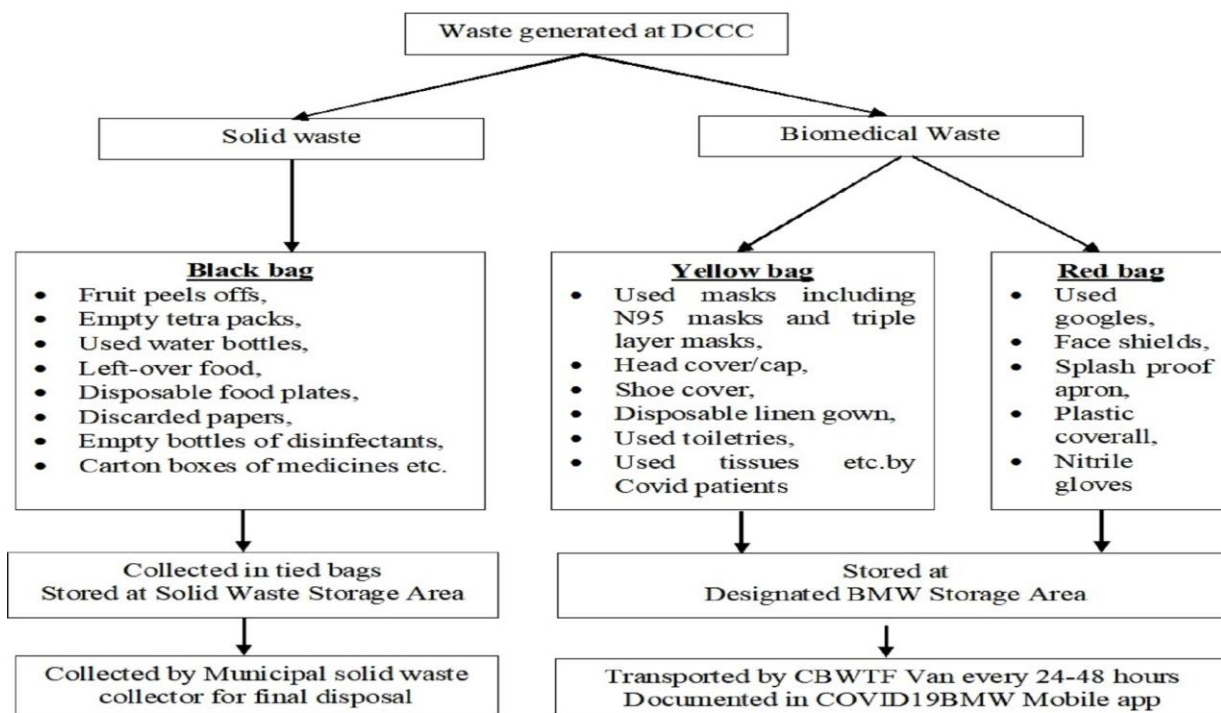
Ethics: The ethical approval to conduct the study and publish the research paper was obtained from the Special Secretary (Health) wide letter No.Health-A-B(15) 3/2021,2757dated 27-07-2021. from the Government of Himachal Pradesh.

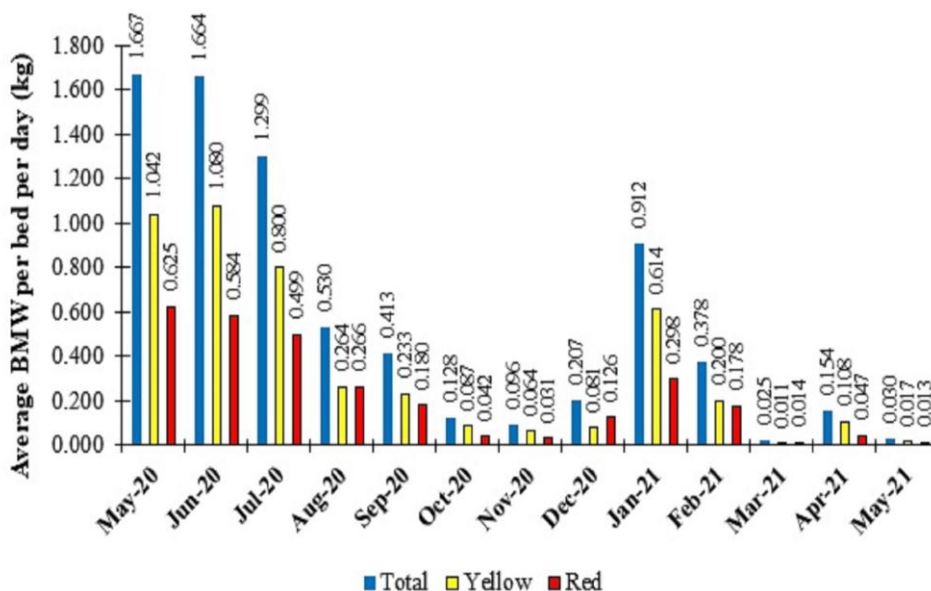
Table 1: Comparison of biomedical waste management at DCCC in relation to the guidelines.

S. No.	Guidelines for biomedical waste management	Biomedical waste management at DCCC
1.	All the centres should be adequately supplied with yellow and red bags, blue cardboard, and white puncture-proof containers for onsite segregation of waste.	DCCC was supplied with yellow and red bags, blue cardboard, and white puncture-proof containers.
2.	The use of color-coded bins for onsite segregation and the usage of double-layered bags.	There was use of color-coded bins for onsite segregation and the usage of double-layered bags.
3.	Biomedical waste and general waste should not be mixed.	There was no mixing of BMW and general waste.
4.	The biomedical waste bags and containers should be well labelled as "COVID-19".	The bags were labelled as "COVID-19".
5.	The outer and inner surfaces of the containers and trolleys should be cleaned daily by using a 1–2% sodium hypochlorite solution	The outer and inner surfaces of the bags cleaned daily by 1% sodium hypochlorite.
6.	The collected biomedical waste should be kept in the designated storage area.	The collected biomedical waste was kept in the designated storage area.
7.	BMW bags/containers are required to be provided with Bar code labels.	Bar code labels were present on all colour coded bags containing segregated BMW.
8.	BMW generated from COVID-19 related activities should be strictly disposed of within 24 hours and should not be stored for more than 24 hours after generation.	BMW generated was disposed of within 24 to 48 hours.
9.	A separate arrangement for the transportation of BMW from the centre to the common BMW disposal and treatment facility (CBMWF) should be made.	The arrangement for the transportation of BMW from the hospital to CBWTF was done by outsourcing.

10.	There should be dedicated vehicles for the transportation of BMW, and it should be sanitized after every trip.	The dedicated vehicle was provided by outsourced agency.
11.	A separate record should be maintained for BMW generated from COVID-19 related activities.	A separate record in BMW Register was maintained.
12.	The record for BMW generated should be reported to the pollution control board.	It was reported to the Pollution Control Board. An annual report was also submitted to Pollution Control Board.
13.	Upload the details on the official application of the central pollution control board (COVID19BWM).	The details uploaded on app 'COVID19BMW' daily.
14.	All the persons involved in the handling of BMW (Covid-19) should be given the required training.	All the persons were trained as per standard training modules on BMW management.
15.	All the persons involved in the handling of BMW (Covid-19) should be given the required PPE and ensure occupational safety.	There was adequate supply of PPE. Regular health check-up of staff was done after their posting.
16.	BMW Management committee should be formed.	BMW Management committee was formed. It held meetings regularly to monitor and review the BMW management.
17.	Legal compliance	Legal requirements related to BMW management were complied with as per the rules and guidelines issued by Pollution Control Board. A valid agreement was signed with authorised CBWTF for treatment and disposal of BMW generated from the DCCC.
18.	Budget allocation for BMW management	A dedicated Covid budget was allocated for BMW management which included PPE kits, BMW collection bags/containers, trolleys, Outsourcing for waste disposal, training of staff and display of IEC materials at DCCC.

Table 2: Flow chart of Biomedical waste Process in DCCC.





Graph 1: Data of BMW collection per bed per day (kg) at DCCC for the year 2020 – 21



Figure 1: Designated storage area for Biomedical waste at DCCC.

RESULTS AND DISCUSSION

During the study period, total of 4225 kg BMW was generated at DCCC. Most of the waste belonged to yellow category (58.1%). The average waste generated per bed per day was 0.546 (kg). Around 40% (1729 kg) of the BMW was generated during May to Jul 2020 (Fig. 1). Since the patients admitted were either asymptomatic or mildly symptomatic, the use of white containers and blue cardboard boxes was negligible. The comparison of the BMW management at DCCC in district Bilaspur

according to the guidelines is given in Table 1. The management of waste generated at DCCC is shown in Fig. 2.

In case of emergency, ambulance arrived on call for referral of patients to higher institution. The drinking water facility for staff and patients were present. The facility for food was arranged by outsourcing. The bathroom facility and toilet facility for staff and patients

were made available. CCTV cameras and fire safety equipment were installed at DCCC.

The pandemic has led to generation of biomedical wastes in unexpectedly large amount from the hospitals, laboratories, and temporary health facilities like dedicated covid care centres. Central Pollution Control Board revised and framed the guidelines to tackle the problem. The central and state pollution control board suggested adherence to the guidelines strictly and adopted precautionary measures.^[10] The identification and maintenance of DCCC during pandemic was a challenging task at the makeshift site. Due to hilly terrain of the State, adequate infrastructure available was limited. The logistic supply also got affected due to lockdown restrictions during pandemic. The building was identified to be converted in to DCCC as per guidelines for management of asymptomatic or mildly symptomatic Covid-19 cases. The efforts were done to manage the BMW generated at DCCC as per suggested guidelines.^[1,10-17]

Manpower and logistics

The staff was posted in rotations at this makeshift centre from the periphery health institutions. Health care workers posted at DCCC were a doctor (Medical Officer), paramedical staff (ward sister and staff nurse), and support staff (sanitation workers, peon and security guard). In addition to doctors from Allopathy system of medicine, those from alternative system of medicine *viz.* Ayurveda were also posted at DCCC for its management. The training of persons involved in the handling of BMW (Covid-19) at DCCC was done prior to their posting. But due to nature of staff posted from periphery and in rotation, it became challenging to sensitize them again and again about BMW management. The trainings were imparted on the theoretical aspects of BMW management, supplemented by practical demonstration of BMW handling methods. Training records were maintained.

Maintaining a record in BMW Register was another task at the makeshift site. Since staff was posted in rotations from the periphery, they were sensitized every time about importance of record maintenance. The record was maintained regarding quantity of category wise BMW generated, sodium hydrochloride solution used, disposal of BMW on daily basis *etc.* The weighing scale was kept at the DCCC for weighing the quantity of BMW generated. The record for BMW generated was reported to the Pollution Control Board daily. An annual report was also submitted to Pollution Control Board. During the study period, no major or minor accident occurred at DCCC.

There was adequate supply of PPE for the staff at DCCC. Regular health check-up of staff was done after their posting. They were kept in quarantine after each posting and got tested for Covid-19 as per guidelines. In India, the Covid-19 vaccination was initiated in January 2021

for health care workers, and the staff were motivated to get themselves vaccinated.

Biomedical waste generation and segregation

DCCC was supplied with yellow bags, red bags, blue cardboard and white puncture-proof containers for onsite segregation and waste collection. In the beginning, there were issues of shortage of bags due to increased patients load at the centre, inadequate supply of bags, staff posted in rotation and makeshift arrangement located at non-health facility. The staff was sensitized repeatedly about judicious use of BMW bags and proper segregation of waste. The demand for BMW bags raised accordingly to meet the requirements. Despite a greater number of patients admitted in months of August and September 2020, there was no proportional growth in quantity of BMW waste generated, mainly due to proper segregation of waste and avoid mixing general waste with BMW by the staff at DCCC.

Designated storage area for Biomedical waste

The storage area was identified and demarcated to store BMW as per guidelines, to prevent pilferage of waste or inadvertent scattering or spillage by stray animals or infestations by rats. The collected waste was transported to the designated storage area by trained sanitation staff in covered trolleys through the shortest designated routes without spillage enroute at fixed time schedule to prevent cross infection. BMW was kept under lock & key in storage room. Only authorised personnel allowed to enter storage area with sign of BMW Hazard at entrance (Fig. 3). There was no partition between storage areas for colour coded bags, but signage was paste on the wall to keep the bags separately (Fig. 4). All colour coded bags containing segregated BMW had bar code on them (Fig. 5). The cleaning of the storage area was done routinely. Fire extinguisher was installed to prevent any mishap/accidents. No general waste was stored in BMW storage area and kept at another designated area as per Solid waste management.

Biomedical waste disposal

BMW generated was disposed of within 24 hours in routine. There was no onsite arrangement for waste disposal at this makeshift centre. The arrangement for the transportation of BMW from the hospital to Common Biomedical Waste Treatment and Disposal Facility (CBWTF) was done by outsourcing to an authorized agency. There were only two CBWTFs in the state of Himachal Pradesh. It was practiced that when small quantity of BMW was generated at this makeshift site, then the transportation vehicle came on call basis, but not later than 48 hours. This was done for judicious use of limited budget available.

Role of Designated Nodal Officer

Designated Nodal Officer had various tasks to perform for smooth functioning of the DCCC. He carried out supervision of staff posted at DCCC regularly, follow-up by feedback from them and its documentation. He kept

them updated with information education and communication related to Covid-19. The arrangement of all required logistics at the DCCC was herculean task during pandemic. Nodal officer ensured that diet was provided to the admitted patients as per nutritious menu which was delivered by an outsourcing agency. He also ensured the solid waste was segregated and collected separately from BMW. He uploaded details about quantity of BMW generated at DCCC on biomedical waste tracking app 'COVID19BMW' daily.

Evaluation of quality indicators for Biomedical waste

BMW Management committee was formed, and it held meetings regularly to monitor and review the BMW management. Legal requirements related to BMW management were compiled as per the rules and guidelines issued by Pollution Control Board. A valid agreement was signed with authorised CBWTF for treatment and disposal of BMW generated from the DCCC.

Grievance redressal box was installed at DCCC for the welfare of Covid-19 patients. No complaints from patients regarding unhygienic conditions or foul smell was received. No incidence of needle stick injury, Hospital acquired infection, major or minor accident were reported. Standard Operating Procedure/ "DO's" and "DON'T's" were followed to segregate biomedical waste at point of generation as per guidelines. Minor irregularities observed were addressed during DCCC rounds by BMW Management committee.

Legends

1. Table 1: Comparison of biomedical waste management at DCCC in relation to the guidelines
2. Table 2: Flow chart of Biomedical waste Process in DCCC
3. Graph 1: Data of BMW collection per bed per day (kg) at DCCC for the year 2020 - 21
4. Picture 1: Designated storage area for Biomedical waste at DCCC

LIMITATIONS

The study had few limitations. Only one DCCC was covered for evaluation of BMW management by authors. The study was done on Covid-19 patients admitted at different time intervals at one place. The waste generated at health care facilities/hospitals varies in nature than DCCC due to the more severe Covid-19 cases were managed in the former.

CONCLUSION

The Covid-19 pandemic has challenged all the health care system (including makeshift hospital) to manage biomedical waste. The sudden outbreak of Covid-19 has led to exponential rise of biomedical waste. Proper implementation of standard operating procedures, continuous and regular training of all the staff about correct handling and disposal of BMW are most important to prevent any health and environmental

hazard posed by Covid-19. It is the social, moral and legal responsibility of all the persons involved in generation of biomedical waste to segregate it properly as per the BMW management (Amendment) rules 2018, 2019, and Guidelines for Covid-19 patients.^[11] The practice of Covid appropriate behaviour (hand hygiene, use of face mask, social distance) at DCCC and immediate reporting of any accidental injury occurred during BMW management to Nodal Officer will help to combat Covid-19 pandemic.

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