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HEEDED AND UNHEEDED ATTENTIONS ABOUT COVID-19 VIRAL TRANSMISSION WITH SPECIAL REFERENCE TO BIOMEDICAL WASTES

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ABSTRACT

The whole world is struggling with the problem of COVID-19 disaster which not only affected the human being but also collapsed the global economic condition and therefore, the survival of human beings. COVID-19 transmission in the society increased the usage of masks and gloves by the public as preventive measures. This is associated with the huge amount of biomedical waste, generation which is coming out with household waste. Biomedical waste generated from healthcare centre, quarantine and isolation centres, laboratory diagnosis facilities have received international attention for disposal. However, household wastes mixed with biomedical wastes have not received proper attention. The aim of this review is to draw the attention of different stakeholders towards this problem in order to get coordinated support to get rid of these wastes. As the detailed information is not available on the transmission of COVID-19 through discarded gloves and masks, it is necessary to develop awareness, modify waste transportation vehicles by introducing a covered section, produce gloves and masks from eco-friendly material, uniform implementation of rules in all states of India in order to control fomite and biomedical waste-based transmission. As the clock is ticking, the right decision for strict implementation of policies and their monitoring must be taken to control the spread of COVID-19.

Keywords: COVID-19, Gloves, Masks, PPE kit, environmental impact, incinerators, hospital waste

A. INTRODUCTION

The whole world is facing the health and economic consequences of the COVID-19 disaster which spread in the whole world in two months through community transmission and became the cause of significant morbidity and mortality. Globally, 15th March 2020, there have been 120 million confirmed cases of COVID-19, 67.9 M recovered cases 2.65 M deaths, reported to World Health Organization **[1]**. In India, on 15th August 2020, there have been 11.4 million confirmed cases of COVID-19, including 159 K deaths and 11 Million recovered cases are reported to WHO[1]. As it was a new strain of virus and detailed knowledge about its aetiology, transmission was not known, it spread in the whole world in the blink of an eye. This highlighted the high transmissibility of the COVID-19 virus **[2, 3]**.

Scientific race has begun to develop vaccines, drugs **[4, 5]**, herbal or chemical sanitizers however, prevention is better than cure till the development of new medical cure, treatment, or vaccine. Therefore, there is drastic change in the lifestyle of the persons which increased the use of masks, gloves, and respirator as protective measures against COVID-19 infection. However, improperly disposed protective coverings (personal protective equipment i.e., PPE, gloves, and masks) act as biomedical waste and may spread COVID-19 in community **[6]**. Many sites, journals, blogs are flooded with the articles on etiology, diagnosis, its prevention and treatment **[7]**. However, there is scarcity of reports on the transmission of virus through discarded protective coverings. There are concrete guidelines for the disposal of biomedical wastes as these are considered as toxic and hazardous waste. The standards, norms and policies; methods for the disposal of biomedical wastes vary in different countries for the safety of health-care workers, patients, public and environment. Biomedical wastes generated at biomedical, or health care centers are getting appropriate attention and discarded properly. Contrastingly, biomedical waste discarded with household waste by the public in non- segregated form, is a matter of concern during COVID-19 disaster as it creates the problem of effective disposal.

This paper is based on the publicly available information, scientific researches, and data available at governmental bodies to recapitulate the transmission and preventive measures to control the epidemics of COVID-19 through managing biomedical waste. This review identifies and outlines the gap between the rules for biomedical waste management and the problems related to their implementation and hurdles in their run through along with the details of heeded and unheeded

attention related to the spread and transmission of COVID-19 through biomedical wastes.

B. Transmission of COVID-19

In India, biomedical waste management disposal practices are up to the standards in the healthcare centres or hospitals however, the mixing of waste with household waste creates the problem of effective disposal which increases the risk of infection among public **(Figure 1)**. Auxiliary research is required about the stability of virus in environment to reduce the chances of transmission from contaminated sources **[8]**. The disease is spread by discarded masks and gloves, duration of virus shedding in environment must be fully elucidated because discarded protective coverings shed viruses in the surrounding and pose negative impacts on the environment and human health **[9]**. The negligence and lack of training and awareness among the people about the waste disposal spoils the health and pollutes environment **[10]**.

B.1: Transmission through discarded wastes by asymptomatic cases

In a preliminary study, Gao *et al*. **[11]** reported that asymptomatic cases cannot spread virus due to lower viral load as compared to symptomatic cases. In contrast to this, detailed cluster study based on contact transmission reported that asymptomatic person can also transmit infection **[12]**. As virus harbored in the body for 9-10 days in both symptomatic and asymptomatic cases before its clearance from the body and therefore, both can spread the infection. The analysis of large number of asymptomatic cases will give the clear idea about the infectivity of asymptomatic cases. Also, information must be gathered on the viral transmission through discarded biomedical wastes by asymptomatic cases as this will be useful in controlling the infection.

B.2 Biomedical waste as a possible cause of transmission

The biomedical waste increased during this pandemic in many countries **(Figure 1)**. The comparison of generation of biomedical waste pre-COVID-19 and post-COVID-19 era for India is presented in **Table 1**. The collected data showed the significant increase in biomedical waste generation in post-COVID era. Mumbai is on high risk as the collection of biomedical waste is 37 tonnes daily from containment zones comprising both residential and institutional quarantine facilities. There are several risks because many containment zones do not segregate medical waste **[13]**. Although Common Bio-medical Waste Treatment and Disposal Facilities (CBWTF) have taken many measures to solve the problem of biomedical waste accumulation, dumping place and incinerators are required to discard all the waste properly without harming any

climatic and human living conditions. This rapidly increasing biomedical waste will affect various aspects of environmental conditions in future, if not managed at right time.

Table 1: Status of biomedical waste in Indian pre-COVID-19 and post-COVID-19 period

S. No.	States of India	Pre-COVID-19 waste (in Kg)	Post-COVID-19 waste (in Kg)	References
1	Maharashtra	25,000	35,000	14
2	Delhi	27,000	63,000	15
3	Karnataka	700-800	3000	16
4	Uttar Pradesh	1,100	12312.2	17
5	Gujarat	385	11,051	18

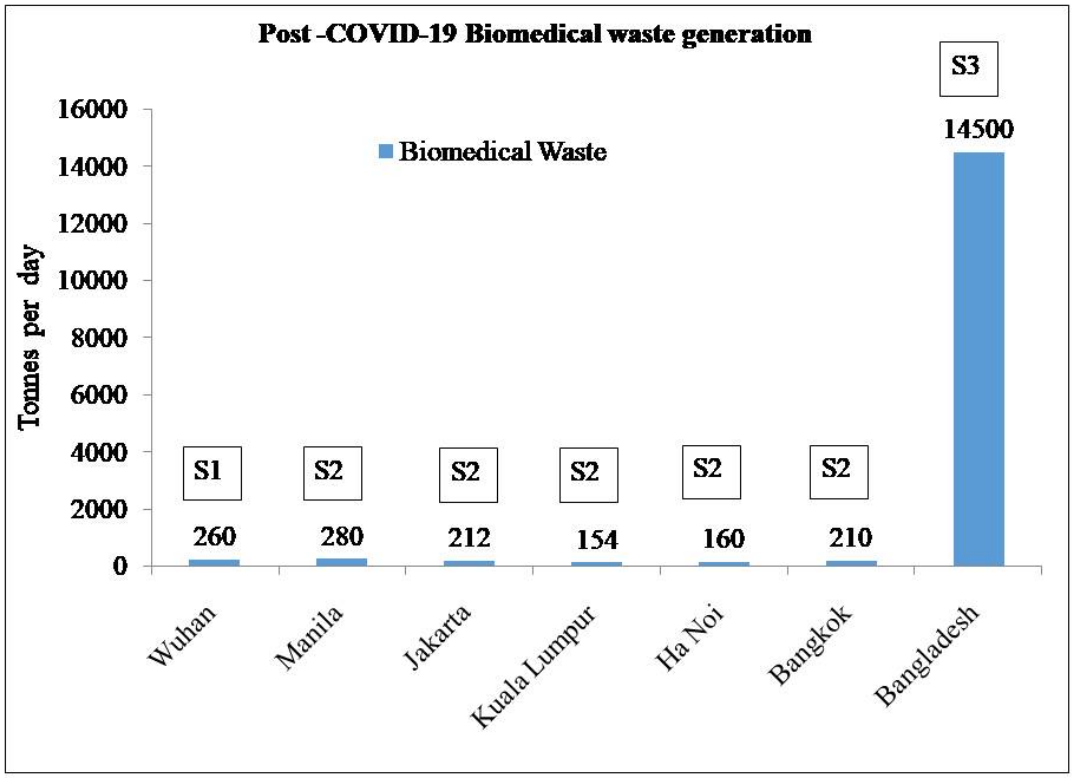

Figure 1: Post-COVID-19 biomedical waste generation in Tonnes per day (TPD) in different countries. Source 1 (S1): South China morning post [19]; Source 2 (S2): adb.org [20]; Source 3 (S3): Rahman *et al.* [21]

In India, 775.5 tons of biomedical wastes of personal protective equipment (PPE), masks, gloves are generated daily. It is assumed biomedical waste will be increased by 550.9 tons daily by 2022 **[22]** according to the current condition of viral spread. It is expected that biomedical waste will grow at an annual growth rate of about 7 percent. In India, approximately 609 tonnes of daily biomedical waste generation in 2018, India now generates 710 tonnes daily, including 101 tonnes of COVID-

related waste **[23]**. This waste is collected from hospitals, quarantine and isolation centers, home quarantine centers and testing laboratories by 195 combined biomedical waste treatment facilities and then disposed by incinerator facilities, captive facilities and deep burial facilities **[24] (Figure 2)**.

Non-segregation of biomedical waste from household waste increases the amount of waste generated beyond the disposal capacity of incinerators. The data of biomedical waste generation in tonnes per day (TPD) is mentioned for different cities of India along with the disposal facility of incinerators, captive facilities and landfill in India are mentioned in **Figure 2**. The adequacy of incinerators is also mentioned **(Figure 1 and Figure 2**) which reflects the inadequate facility in some states like Bihar, Uttarakhand, and Arunachal Pradesh **[24]**. Moreover, incinerators are not designed for the disposal of household waste. This creates unnecessary burden on incinerators and therefore, waste is disposed in landfills **[24] (Figure 2)**. Land-filling of biomedical waste can spread the infection through rag pickers, sanitary workers, and several illiterate and unaware workers who are involved in the screening of waste. They deal with the household garbage mixed with biomedical waste with bare hands and without any protective coverings which can cause transmission of disease from waste to human beings **(Figure 1)**. This waste can also transmit infection through animals. However, there is scarcity of reports on this problem.

Covid-19 can be transmitted through fomite **[25]** and therefore, transmission of COVID-19 due to discarded medical waste cannot be ignored. Inappropriate disposal of protective coverings by general public can increase the amount of solid biomedical waste which may be source of infection and matter of concern. These protective coverings discarded as waste after single use which reach the dumping or landfill area through waste transportation vehicles.

The only way to solve this problem is to sort out the biomedical waste at its source and to prevent its mixing with the household waste. The reduce, reuse, recycle depend on the segregation, transportation and method of disposal at the source site and require active and collective action of different associated teams, private companies and governmental bodies. The implementation of these depends upon the regulatory authorities or bodies, and strict legislative actions **[26]**.

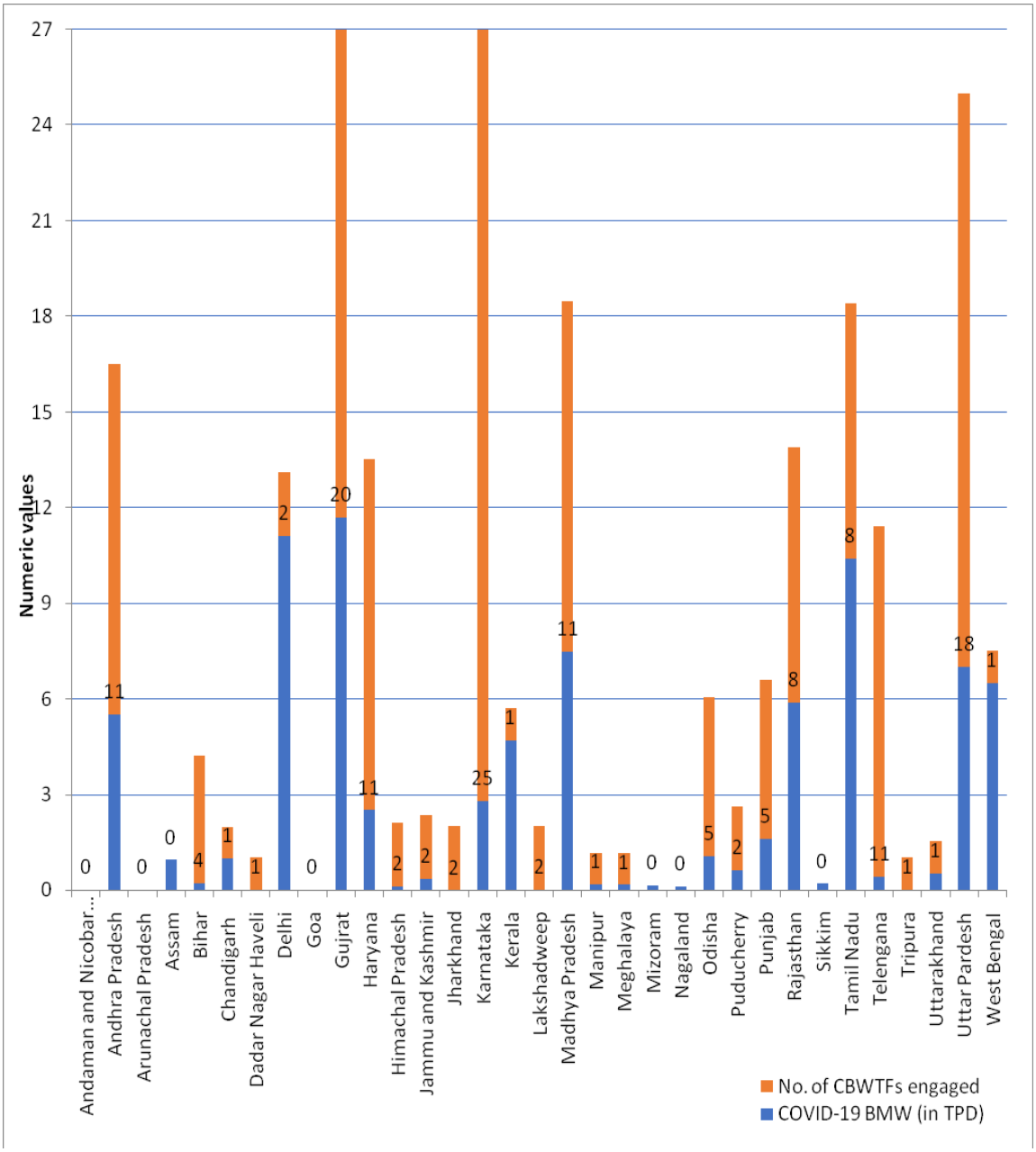

Figure 2: Biomedical waste generation (BMW) in tonnes per day (TPD) during Covid-19 disaster and number of combined biomedical waste treatment facilities (CBWTFs) in different states of India (Data Source: CPCB) [24]

The problem is also associated with the implementation of biomedical waste related rules in different states of India. Although Biomedical Waste Management Rules-2019 are same for all, yet there are differences in their implementation in different states. In Vijayavada, Health department has instructed to collect the waste from the houses of isolated person can be collected and segregated in different containers and then, handed over to the organizations authorized to dispose biomedical waste. In

Chennai, guidelines are issued for the proper disposal of discarded gloves and masks. These can be disposed in yellow bags only after proper disinfection **[27]**. Datta *et al*. **[26]** recommended that the non-governmental organization can play an important role in the waste disposal. There is a need of issuing a common guideline by central government for the disposal of biomedical wastes.

The safe disposal of biomedical waste from health-care activities is mentioned in "The Blue Book" of WHO, first published in 1999. Biomedical Waste Management Rules were implemented in India on 20th July 1998. These were amended in 2003, 2011, 2016 and 2018. There is no rule for the disposal of medical devices and kits **[28]**, personal protective coverings by public even after many amendments. There is need of rule amendment to prevent the COVID-19 disease transmission through biomedical waste mixed with household waste. A lot of training messages and programs are communicated through media, newspaper, social media channels on the use of protective coverings. However, the general public is not trained about the right method of disposal or segregation of waste at source. The lack of knowledge and segregation of waste i.e. infectious and non-infectious waste from the municipal waste is the main challenge in maintaining the biomedical waste **[29]**.

At medical facility centre, erroneous use of PPE by patients and their attendants due to inappropriate training; and improper disposal causes the viral transmission **[11]** as it can harbor virus. The U.S. Centers for Disease Control and Prevention (CDC) issued a guideline to health care professionals regarding the case definition, infection prevention and control measures **[30]** and for removal of gloves and masks after use. However, there is no guideline for proper disposal of personal protective coverings. The use of PPE by the attendants of the patients must be made mandatory and appropriate publicity and training must be provided to the individuals regarding its use and disposal.

There are several environmental implications like, contamination of the soil and water. Another problem is associated with the use of plastic disposable gloves. Plastic gloves usage during the COVID-19 era increased, which further increased the amount of plastic waste and difficulty in getting rid of it, even after banning single time-usable plastic. Therefore, there is a room of research for the development of biodegradable personal protective coverings. Further, there is need of equipment which disposes masks and gloves without producing toxic gases in order to reduce the impact of biomedical waste on the people **[26]**. According to Capoor and Bhowmik **[28]** polyvinyl

chloride free devices are required to minimize the release of toxic gases and carbon during waste incineration.

The on-site incinerators for disposing masks and gloves by public can be established however, poses the financial burdens but also gives rise to environmental and health related issues. There is also a need of training to all health care workers and general public regarding the disposal of biomedical waste such as protective coverings. Different stakeholders like pollution control board, state government, Municipal Corporation, people must work in harmony to dispose biomedical waste safely. During the waste disposal from collection to incinerator or common biomedical waste facility, especial care must be taken to prevent any type of spillage by animals and human beings **[26]**.

C. Proposed suggestions to control the spread of COVID-19 through Biomedical waste

The following suggestions can be followed to get rid of biomedical wastes and prevent the spread of COVID-19:

1. Awareness among the people must be developed to stop the biomedical discharges at site of origin. Gloves, masks and PPE must not be discarded with household waste should be widely publicized through social media, newspaper and television, radio, posters etc.
2. One separate bin or covered section must be introduced in the waste transportation vehicle for the transportation of such type of infectious wastes.
3. Prior to dispose, the biomedical waste must be disinfected properly by using 1% sodium hypochlorite solution or phenolic disinfectants.
4. Waste disposal guidelines must be strictly followed irrespective of the symptoms of the person.
5. Whether person is asymptomatic or sick, these must be strictly implemented in all states of India uniformly without exception.
6. Onsite incinerators can be established.
7. Biodegradable or photodegradable material can be used for manufacturing gloves and masks.
8. The monitoring committee must be constituted to monitor the proper disposal of biomedical wastes.

D. CONCLUSION

Improperly disposed biomedical waste by general public and asymptomatic cases is the major cause of transmission of COVID-19. As there is not complete information about the transmission of virus though discarded gloves, masks and PPE, it is necessary to take precautions in terms of waste disposal. Biomedical waste must be disposed after disinfection in separate bins. Besides, there is need of amendment in

biomedical waste disposal rules, their monitoring and uniform implementation.

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