

Impact of Healthcare Related Plastic Waste Towards Sustainable Environment During Covid 19 Outbreak: Prospect of Bangladesh

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Abstract - As a lower-middle-income economy with one of the world's densest populations, Bangladesh was already suffering from underprivileged biomedical waste management. It is now knocked out hardly due to sudden burdening from the huge plastic wastes of covid-19 used both by health caregivers and by general people. Consequently, another alarming long-term secondary medical hazard may add newer problems to this pandemic through inadequate biomedical plastic waste management. To address this threat, this paper aims to investigate the real scenario of usage of healthcare-related plastic wastes and assess the impact of plastic products on erratic waste management infrastructure and inadequate facilities in Bangladesh as a middle-income country. Based on the comprehensive study of the recent COVID scenario and the corresponding response of the authority in waste disposal and management, this paper recommends on-site treatment of biomedical waste, recycling and reusing of single-use plastics, teaming up of hospitals, waste management programs, and city corporations to effectively manage wastes and raise awareness among people. If properly executed, the paper's findings would lead to a sustainable roadmap for COVID-19 related to plastic waste management in Bangladesh.

Keywords: Bangladesh, COVID-19, Healthcare, Plastic Waste, Sustainable Environment, COVID-19

I. INTRODUCTION

The coronavirus COVID-19 pandemic emerges as one of the most pronounced challenges of 2020 since World War II due to its breathtaking fast-track outspread. The ongoing pandemic of coronavirus disease 2019 (COVID-19) is now considered a syndemic in recent studies due to its long-lasting vulnerabilities [1]. The UN's Framework for the Immediate Socio-Economic Response to the COVID 19 Crisis already raised the alarming effect of the COVID-19 outbreak on health, social, and economic [2]

The COVID-19 is triggered by severe acute respiratory syndrome beta-corona virus 2 named SARS-CoV-2, having a genomic sequence analogous to that of the severe acute respiratory syndrome (SARS) coronavirus 2003, [3]. Initially, in Wuhan, China. Quite a lot of cases with symptoms of pneumonia having unknown etiology were reported on around December 31, 2019, with an outbreak in early December or November [4] and quickly transmuted from a zonal outbreak of China into a severe global pandemic. The World Health Organization acknowledged the outbreak as a Public Health Emergency of International Concern in January 2020 and a pandemic in March 2020 as a consequence of the large-scale outbreak being shaken out to over more than 216 countries throughout the world, (WHO, 2020b). As of October 30, 2020, in the tenth month of the pandemic, more than 43,372,617 people were infected, with death cases close to 1,159,425 throughout the world, while more than 4,00,250 people tested as Covid-19 positive with death cases of 5,818 in Bangladesh [5]. Many countries like the United States of America, Italy, the United Kingdom, China, Spain, Iran, France, Belgium, the Russian Federation, Germany, India, Turkey, Brazil, and Canada were badly shattered with more than 30,000 confirmed cases. The number of cases is increasing throughout the whole world [6].

The current COVID-19 pandemic imparted a gross use of single-use plastics like personal protective equipment (PPE) usually used in medical sectors like masks, face shields, goggles, gloves gowns to protect the individuals from exposure to COVID-19 affected persons, pathogens, and contaminants. Since the COVID-19 outbreak, increased production and random uses of plastic-based PPE equipment, polyethylene, single-use plastics like one-time-use plastic glasses, cups, plates for isolated patients and health caregivers have been increased predominantly, which have resulted in a rapid accumulation of potentially infectious domestic solid waste streams. Recent studies showed the



global market for PPE raised from approximately \$40 Billion to \$58 Billion from 2016 to 2020 with a compound rate of increase of 6.5% per year; in contrast, the World Health Organization projected that PPE supplies must increase by 40% monthly to deal the COVID-19 pandemic effectively. PPE's demand is not expected to decline substantially during the post-pandemic period either, with an estimated compound annual growth of 20% in facial and surgical masks supply from 2020 to 2025 [7].

As a lower-middle-income economy with one of the world's densest populations, Bangladesh was already suffering from poor management of biomedical waste management. Now, it is hit hard due to sudden burdening from the huge plastic wastes of covid-19 used both by health caregivers and also by general people. So, another alarming medical hazard may add newer problems to this pandemic through this inadequate management of biomedical plastic wastes since some research findings showed before the outbreak that the waste disposal facilities from health-care establishments of Bangladesh were not enough to their demands, which is now suffering harshly due to current pandemic situation [8]

So, the key purposes of this study are a) to investigate the real scenario of usage of health-care-related plastic products, particularly single-use plastics, mostly surgical masks, via collection and organizing major data circulated scattered by the media, concerning governing authorities, and academic groups, attributed to COVID-19 pandemic from the prospect of Bangladesh. b) to assess the impact of an upsurge of plastic products wastes management on erratic waste management infrastructure and inadequate facilities in Bangladesh as a middle-income country, c) and to recommend some alternative solutions towards a sustainable roadmap for COVID-19 related plastic waste management, indispensable to diminish the threats of environmental pollution from different contamination routes.

II. COVID SCENARIO IN BD

The COVID-19 pandemic was first confirmed to spread in Bangladesh in March 2020. The country's epidemiology institute IEDCR reported the first three known cases on March 7, 2020. The general holiday was declared on March 26, 2020. Infections were low till March ending but spiked in April and peaked in July 2020. For a long time, testing was centralized to only the Institute of Epidemiology, Disease Control and Research (IEDCR) in the capital Dhaka. On July 2, 2020, the highest number of confirmed cases were recorded to be 4,019. A total number of deaths till October 24 had been 6,448. These statistics are imperative for assessing the COVID response of Bangladesh in mitigating fatality along with corresponding waste management. A summary of covid scenario in Bangladesh is given below:

Bangladesh government tried to provide ample logistics and safety support to doctors and health workers during the pandemic; which unfortunately was a major contributor in producing a large amount of biomedical waste posing a great threat to the environment. However, a summary of safety logistics support provided by the government to health workers and their potential after-use conversion into different types of plastic waste is presented in the table below:

Table 1: COVID Scenario in BD

Incidents	Date/Number	References
The first case detected	March 7, 2020	[9]
General Holiday Declared	26 th March, 2020	[10]
Confirmed Cases peaked	July 2, 2020	[11]
The highest number of cases a day	4,019 on July 2, 2020	[12]
Total confirmed cases (till 24 th October, 2020)	451, 990	[13]
Total Recovered cases (till 24 th October, 2020)	366, 877	[14]
Total Death (till 24 th October, 2020)	6,448	[15]

Table 2: Logistics Supply in BD (Source: DGHS covid-19-dashboard, Bangladesh [16])

Logistics	Quantity (pcs)
Masks	4,296,452
No. of surgical gloves	951, 412
No. of gloves for examination	866, 865
Apron/Gown	74,648
PPE Kit	968, 935
Shoe Protector	48, 751
Sanitizer	218, 958

III. COVID SCENARIO IN WORLD

The coronavirus, which surfaced in a Chinese seafood and poultry market in December 2019, has spread to at least 177 countries, killing more than 957,000 and infecting more than 30.8 million according to data compiled by Johns Hopkins University. More than 21 million people have recovered. Below is a timeline from January to September of the pandemic year 2020 indicating milestones of the global pandemic [17, 18]:

service sector in most of the countries, especially in poor and lower-income countries. And as an obvious consequence, the Covid-19 pandemic seriously disrupted the usual waste management practices all over the world, mostly reported with the viral infection spreading from the waste collectors and improper decontamination of recycled plastic wastes, like- PPE, which thus further impose precarious secondary impact upon public health and sustainable environment [20]

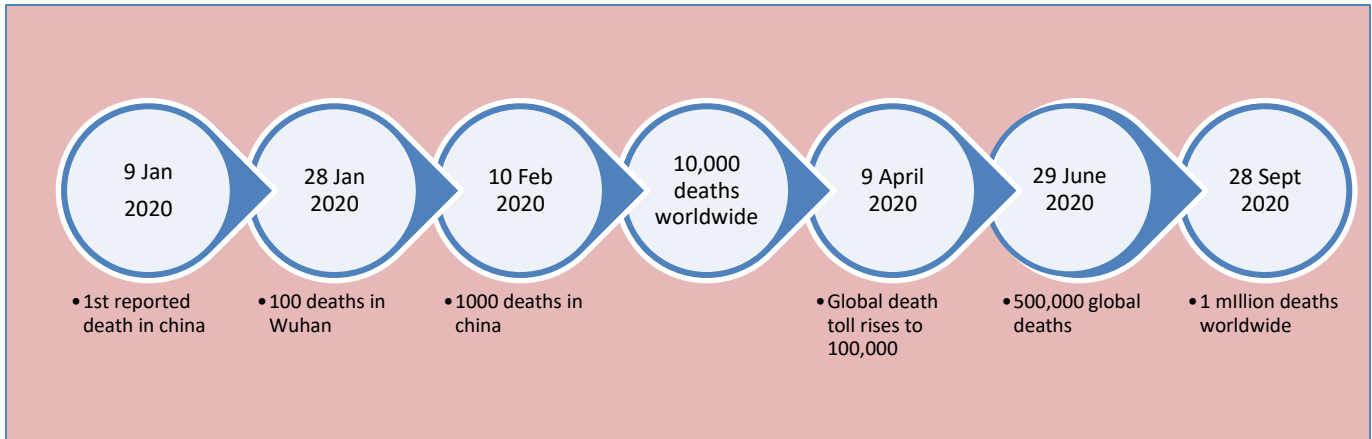


Fig 1: Timeline of COVID-19 pandemic globally

As November 2020 is upcoming, and the weather has turned cold, many countries are experiencing second and third waves of coronavirus disease 2019 (COVID-19), bringing a fresh wave of lockdowns in countries like France and the United Kingdom or restrictions to daily life. Still, in some regions, hospitals systems are again being pushed to the brink. As of November 25, the global death toll had reached 1,412,223, with 18% (259,976) from the United States alone. The number of confirmed global cases reached 59,905,468, and the United States accounted for 21% (12,598,660) of the total global number.

In Bangladesh, the medical waste generation rate is estimated as 1.63–1.99 kg per bed per day in Dhaka, the capital of Bangladesh [21]. About 14,500 tons of waste was produced from the health care sector in Bangladesh due to COVID-19 pandemic, as reported in April 2020. In Dhaka alone, on average, 206 tons of medical waste per day are generated because of COVID-19 [22]. Severe risk of spreading SARS-CoV-2 is predominant if used personal protective equipment, masks, and gloves are not disposed of and managed properly keeping direct involvement of waste management workers with increased risk of infection.

Over the summer, some parts of the world had a bit of a respite from SARS-CoV-2, but as the summer months turned into fall, cases began picking back up. However, there is now some hope in the not-too-distant future with 3 vaccine candidates reporting strong efficacy data [19].

Enforcement of national chemical policy and law, management dedicated to medical wastes is patchy in Bangladesh. Though the Medical Waste Management and Processing Rules were passed back in 2008, still there is hugely lacking in establishing safety management system of the daily health-care wastes discarded by hospitals, diagnostics centres, clinics, and households. Hospital waste is largely handled by city corporations, third-party organizations, and nongovernmental organizations. A non-government organization, PRISM Bangladesh Foundation actively treating the medical wastes since 2006 at Matuail Landfilling plant, Dhaka, containing incinerator following an agreement signed with Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC). PRISM Bangladesh Foundation also runs Well-equipped medical waste management plants in Rangpur, Sylhet, Rajshahi using incinerator and in Jashore using an autoclave.

IV. COVID WASTE MANAGEMENT IN BANGLADESH

Medical plastic-based waste materials most often contain highly toxic metals, toxic chemicals, pathogenic viruses, and bacteria. Improper disposal or handling of these contaminated waste can transmit viral pathogens to health-care and recycling workers. So, appropriate medical waste management is very crucial to be started at the point of the generation with proper treatment, and safe disposal to avoid further health hazard. But the medical waste management sectors were not given enough attention as a significant

Still, their capacity is not comparable to the demand for medical waste management throughout Bangladesh. About 6 tons of wastes used to be collected for high-temperature incineration treatment each day from more than 950 health centres in Dhaka by PRISM which turned into 10-11 tons per day at the time of pre-Covid-19 period [23]. It is precise to mention that uncontrolled burning of these medical waste may generate acidic gases, heavy metals, furans, and dioxins and induce pollution in the air.

Another the alarming issue is that a large amount of COVID related wastes like PPE, face-masks, gloves, head covers, sanitizer containers are being generated outside health-care establishments which are not treated by PRISM and are usually discarded for sanitary landfilling. These domestic health-care wastes are being mixed with other household wastes during collection (shown in fig 2) by unprotected, inefficient and unconscious cleaners, and disposed of randomly in unauthorized waste collection and treatment. Nearly 40,000 informal waste collectors are at high risk of being infected by SARS-CoV-2 and also by being carriers of the virus to transmit the virus among their family members and neighbours in Bangladesh [24]. Thus, these single used contaminated plastic medical wastes may pose a prolonged re-emerging health hazard by being mixed with water bodies or scattered randomly during or after landfilling in Bangladesh along with intensifying environmental hazards by disrupting the riverine ecosystems and burdening the sanitary landfilling.



Fig 2: Randomly dumped medical wastes during Covid-19 outbreak in Dhaka, Bangladesh [25, 26]

V. RECOMMENDATION

After analyzing previous studies [27, 28], we consider the following recommendations should be taken into account by the policymakers in dealing with the environmental and health catastrophe related to Covid-19 plastic-based waste management in Bangladesh:

A. Separate Collection of COVID Waste

The Covid-19 wastes including hospital wastes and municipal wastes from households of confirmed/suspected COVID-19 cases must be collected in enclosed residual bin separately, where municipal waste generated in households having no COVID cases are to be collected by as usual collection schemes properly.

B. Extensive Awareness Raising Programs

Strong communication of waste management authorities with the general public is to be established during the COVID-19 pandemic, for comprehensive waste management practices of suspected infectious wastes. Both rural and urban residential PPE users are to be made conscious about following proper safety protocols for safe disposal of their used PPE, masks, sanitizer containers in a labelled bag. Repeated awareness-raising program might be planned for by media or online programs for making people aware of these issues.

C. Proper Health Safety Training for Waste workers

Waste workers must be trained enough about occupational health safety protocols and safe waste collection management, provide facilities for PPE equipment and access to disinfectants whenever required. Concerned authorities must take the initiative to stop the unhealthy practice of informal waste collectors and rag-pickers of accumulating used wastes, mostly masks, gloves, single used PPE for reselling at lower prices and monitor the local markets strictly with the help of law-enforcing authorities.

D. Introducing On-site Treatment Facilities for Biomedical Waste

COVID-19 pandemic depicts that medical waste management treatment by both burning and landfilling is a critical environmental concern around the world considering safe transportation, handling and environmental pollutant generation issues. So, a cost-effective and less time-consuming way can be on-site treatment facilities (hospitals) instead of collection, transportation and incineration. But this option demands developed medical waste management plant along with efficient human resources.

E. Recycling and Reuse of Single-Use Plastics

Recycling and Reuse of Single-used PPE can be a sustainable practice, with proper decontamination practices by infusion of UV or γ -irradiation, hydrogen peroxide vapour, ethylene oxide gasification, disinfectants spray, and infusion of base materials with antimicrobial nanoparticles as revealed by recent studies which also requires expert hands. The safe and sustainable recovery and reuse of PPEs will largely reduce the secondary health and environmental menaces, which demands new policy development for PPE management during and after the current pandemic.

Some other alternative options those can be initiated in Bangladesh: (i) chemical treatment using sodium hypochlorite, peracetic acid or inorganic chemicals, (ii)

Irradiation-based technologies using ultraviolet rays or cobalt-60 rays, (iii) low-temperature thermal treatment at 105 °C–177 °C using hot air inactivation and drying process, (iv) biological processes of using enzymes to break down the organic matters.

VI. CONCLUSION

In short, Bangladesh can no more be unaware of effective plastic-based medical waste management and developing state of the art technology facilities for the management of hazardous hospital wastes as well as must start working promptly to implement and update Bangladesh Medical Waste Management and Processing Rules 2008. Ministry of Health and Family Welfare, Department of Environment, health care centre authorities, waste management authority and City corporations should team up collectively to upsurge the capability of hazardous PPE waste management. Several medical waste management plants must be established throughout the country after strategic study of comprehensive health and waste-related statistics, the feasibility of treatment processes, and volume of waste management to tackle the current health care waste hazard of COVID-19 pandemic and to cope up with further outbreaks.

DECLARATION OF COMPETING INTEREST

The authors declare no known competing financial or personal interests that could have appeared to influence the report in this paper.

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