

Waste Workers and Pickers: Neglected High-risk Groups in Developing Countries During the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic has induced some negative environmental issues, especially in the waste management sector. In developing countries, handling waste is carried out by two groups: waste workers and waste pickers who are exposed to possible hazards of infected waste. In the present narrative review, we searched for high-quality English publications in PubMed, Scopus, and Embase databases. The COVID-19 pandemic led to several problems in waste management systems, especially in developing countries. Due to poor management systems, waste workers and pickers are likely exposed to health risks related to unhealthy waste handling. The support of governments is urgently required to properly inform ordinary people about the correct ways of disposing of PPE and also train sanitation workers and waste pickers to reduce the hazardous possibilities. Additionally, financial support can also act as a suppressive agent to reduce the number of waste pickers.

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Background

In early 2020, the COVID-19 pandemic rapidly spread worldwide in about 215 countries.¹ According to world meter, by December 1, 2021, 263,096,46 individuals had been infected, and 5,234,130 people had lost their lives.² Many countries have imposed strict travel restrictions, and even intercity travel was banned around the world.³⁻⁵ In addition, using personal protective equipment (PPE), such as masks, became mandatory in public, and media outlets began to promote using masks as well as the mandated social distancing measures to prevent the spread of the virus.² However, mismanagement of PPE during the global COVID-19 pandemic resulted in the use and disposal of an estimated 129 billion face masks and 65 billion gloves per month, causing widespread environmental contamination and posing risks to public health.

The situation developed so rapidly at the beginning of the pandemic that supplying PPE was a global concern, and providing enough masks for healthcare

workers and ventilators for patients became a global crisis.⁶ However, international cooperation and the support of the World Health Organization (WHO) and non-governmental organizations (NGOs) reduced the supply chain problems.^{7, 8}

Despite these health problems, the COVID-19 pandemic initially brought some environmental benefits. For example, due to the widespread lockdown curfews, global CO₂ emissions reached their lowest levels since World War II.^{9, 10} In addition, air pollution in cities decreased sharply due to the reduced commuter traffic,¹¹ and the tourism industry experienced a severe recession, which reduced pollution in beaches and aquatic ecosystems.¹² The closure of many polluting industries also brought many environmental benefits. For example, in Asia, Europe, and other continents, energy and industrial sectors produced lower pollutants during the countries' quarantine.¹³⁻¹⁶

Conversely, the COVID-19 pandemic also resulted in widespread negative environmental

issues related to waste management systems.¹⁷ One of the greatest challenges was managing discarded face masks and gloves. Almost all over the world, people are either recommended or forced to wear face masks for outdoor activities, as it is the most effective non-pharmaceutical intervention against COVID-19 spread. Therefore, to reduce the risk of person-to-person transmission of coronavirus,¹⁸ a huge amount of PPE is being produced, used, and eventually discarded.^{18, 19} In other words, billions of face masks are being disposed throughout the world every day. It has made a serious concern for researchers and policymakers, and several studies have addressed the health problems resulting from the mass production and use of masks. Used masks or gloves might be contaminated by infectious droplets and aerosols carrying coronavirus.²⁰ In addition, face masks are a potential source of microplastic fibers in the environment and waste workers. The study by Nzediegwu and Chang (2020) found that the daily demand for masks in Africa is 700 million. All of the masks were subsequently disposed of in landfills, which can pose a very high risk not only from the waste itself but also from the leaked leachate in landfills for workers exposed to these items through poor and unsustainable waste management systems like those of underdeveloped countries.²¹

In addition to waste staff, another at-risk group is waste pickers. Because of the economic crisis which originated from COVID-19 spread, about 200 million employees are predicted to get fired and lose their job. Especially in developing countries, owing to weak financial stability and infrastructure, the rate of unemployment and the risk of poverty have sharply increased, and it is anticipated that about 140 million people will be faced with food insecurity and extreme poverty.²² As a result, the number of waste pickers has dramatically soared and many former jobholders have started picking up useful waste items. They are looking for Plastic bottles or PETs, aluminum cans, cardboard in waste containers, and curbside plastic garbage bags as well as place of landfills.²³ The presence of potentially contaminated PPE in waste composition and containers can expose waste pickers to the secondary transmission of coronavirus. Meanwhile, the health of waste workers and pickers have not been given much attention, especially in developing countries addressed in this study.

Methods

In this narrative review, we comprehensively searched the main databases, including PubMed, Scopus, and Embase databases, to collect information related to the health risk of COVID-19 for waste workers and pickers. As the papers published concerning waste workers and pickers during the COVID-19 outbreak were limited, wider keywords, including waste management system,

practice, challenges, waste staff, waste workers, and waste pickers, were used. The qualitative findings of the selected papers were reported as figures. We only included English-language articles that have been published regarding waste management issues during pandemics and health emergencies. Besides, papers presented in conferences, seminars, or webinars were excluded. We used the estimates and statistics reported by the world meters website and the study of Sangkham to calculate medical waste and weight of disposed facemasks during the COVID-19 pandemic.^{24, 25}

Results

The medical waste production and the weight of face masks produced in developed and developing countries were estimated and presented in Table 1. Accordingly, there is no remarkable difference between developed and developing countries concerning medical waste production related to COVID-19 patients. Also, the main determining factor for wasted face masks is the urban population rate in different countries.

Figure 1 presents the challenges, reasons, and consequences of COVID-19 on waste management systems. However, the COVID-19 outbreak had several disturbing environmental effects, and waste management systems were significantly affected by the pandemic. Recycling and reusing facilities became closed, and landfilling activities increased greatly. In several developed countries, due to poor waste management systems, many facemasks were left in the environment.³³⁻³⁶

Additionally, at the peak of the COVID-19 outbreak, many positive COVID-19 patients were recommended to stay home.^{36, 37} These patients produced infected waste, which were collected as municipal waste. It could make the potential risk of virus transmission for those in contact with the waste.^{20, 38}

Risk to Waste Staff

During and after the quarantine, the amount of produced waste increased in different countries as people tended to buy their food in single-use plastic containers, and many restaurants were banned from serving food.² In addition, an inevitable part was added to the waste (i.e., PPE such as face masks, gloves, protective clothing, shields, and eye protectors). As a result, the production of PPE has increased significantly; for instance, in china, the generation of medical waste and protective equipment has surged about sixfold, from 40 tons per day to 240 tons/d.²

Regarding the huge amount of used PPE, there are some challenges. First, during the disposing process, these items can release microplastics that can contaminate different parts of the environment, such as bodies of water.³⁹ On the other hand, cross-contamination might occur if they are not disposed

Table 1: The estimates of medical waste and the waste produced due to face mask usage in developed and developing countries

Continent	Country	Developing areas				Developed areas				
		Population	Urban population (%)	Daily weight of mask production (tons/day)	Medical waste production (tons/day)	Country	Population	Urban population (%)	Daily weight of mask production (tons/day)	Medical waste production (tons/day)
Asia	Afghanistan	39835428	25%	55.76	432.65	China	1,444,216,107	61%	4933.4	466.2
	Bahrain	1,748,296	89%	8.7	1044.4	Japan	126,050,804	92%	649.4	3124.7
	Bangladesh	166,303,498	39%	363.2	3448	Singapore	5,896,686	100%	33	33
	India	1,393,409,038	35%	2731.1	118827	South Korea	51,305,186	82%	235.6	42.7
	Iran	85,028,759	76%	361.8	12403.5					
	Iraq	41,179,350	73%	168.3	5178.8					
	Jordan	10,269,021	91%	52.3	2957.3					
	Oman	5,223,375	87%	25.4	1013.34					
Europe	Albania	2872933	63%	10.13	523.36	Austria	9,043,070	57%	28.8	2550.8
	Armenia	2968127	63%	10.4	886.9	Belgium	11,632,326	98%	63.8	4270.2
	Bulgaria	6,896,663	76%	29.3	1664.3	Denmark	5,813,298	88%	28.6	1154.1
	Czech Republic	10,724,555	74%	44.4	8422.9	Finland	5,548,360	86%	26.7	373.6
	Greece	10,370,744	85%	49.4	1656.8	France	65,426,179	82%	300.4	22331.6
	Turkey	85,042,738	76%	361.9	21280.8	Germany	83,900,473	76%	357.1	14712.9
Africa	Algeria	44616624	73%	182.39	541.3					
	Cameroon	27,224,265	56%	85.3	317.9					
	Egypt	104,258,327	43%	251	1102.7					
	Morocco	37,344,795	64%	133.8	2086.3					
North America	Nigeria	211,400,708	52%	615.6	661					
	Mexico	130,262,216	84%	612.7	9826.6	Canada	38,067,903	81%	172.7	5573.2
South America						United States	332,915,073	83%	1547.3	131311.9
	Argentina	45605826	93%	237.5	17088					
	Bolivia	11,832,940	69%	45.7	1685.6					
	Brazil	213,993,437	88%	1054.5	71771.03					
	Colombia	51,265,844	80%	229.7	15906.7					
Oceania	New Zealand	4,860,643	87%	23.7	9.4	Australia	25788215	86%	124.1	120.1

of safely. PPE used by the public should be sealed in one or two plastic bags before being thrown away; however, in poorer countries where people were not trained to dispose of PPE, masks, and gloves safely, were discarded in the trash -bins without being sealed. Therefore, other items in the bins could be contaminated.²⁰ As a result, the presence of masks and gloves in the waste container has increased the likelihood of cross-contamination among waste workers in various sectors such as collection, separation, recycling, and even incineration.^{28, 40} To tackle this issue, it is recommended that segregation and recycling facilities be suspended in some areas for the short term; furthermore, it is emphasized that the waste must be sealed in a plastic bag and then disposed.⁴¹ However, due to the lack of adequate training for the public, garbage is often dumped inside the streets and sidewalks, which can lead to a high risk of infection for the workers clearing the streets and pavements (i.e., sanitation workers).²⁸

Leachate of waste and the waste itself can pose a risk of transmitting the virus to municipal service personnel and even ordinary people - especially in areas where waste collection is not well done.²⁸ Moreover, in developing countries, the facilities and technologies used in waste management systems are very old. Thus they might leak leachate highly infected by different viruses, and it might make sense for coronavirus because SARS-CoV-2 is roughly persistent compared to other similar virus types.^{24, 42-44}

Another vital point is that during and post-COVID-19 pandemic, untreated waste has been increasing. For instance, in Tehran, the amount of landfilled waste has rocketed to 7500 tons per day during the COVID-19 pandemic, which is equal to all the waste generated in Tehran.²⁸ Additionally, the production and demand for face masks and gloves have increased during the COVID-19 pandemic throughout the world. This increase has overloaded the waste staff and increased work shifts. For example,

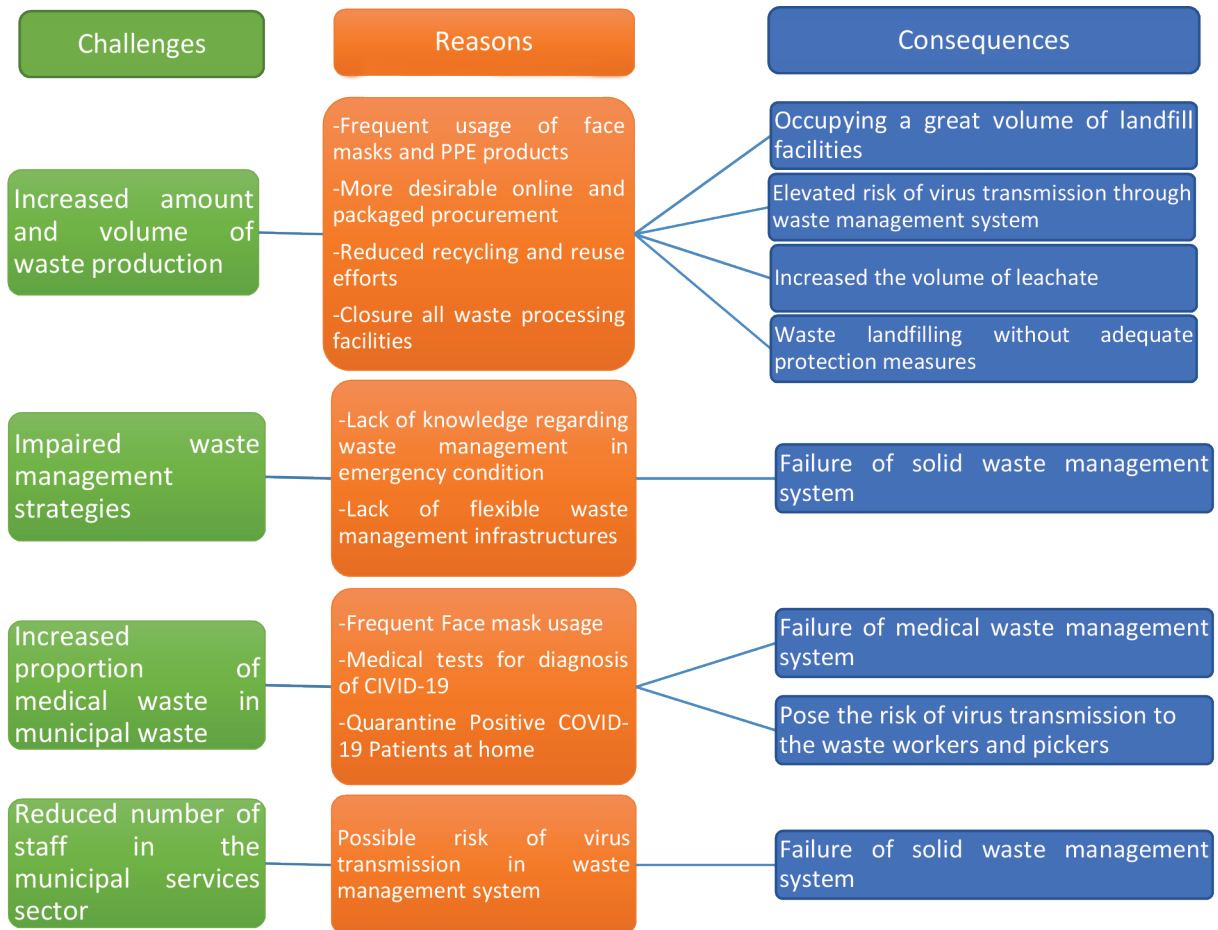


Figure 1: Challenges, reasons, and consequences of waste management systems due to COVID-19 outbreak.²⁶⁻³²

sweepers have been working as waste collectors in Austria in recent months. In these conditions, it is recommended that older staff should not be hired as a waste collector since they are more vulnerable due to their poorer immune system.^{45, 46}

Risk to Waste Pickers

The issue of waste pickers is very serious. In different countries, especially those that do not have a good economic infrastructure, many people lost their jobs due to the recession of industries, and this has caused a large number of people to be added to the garbage collector population in different cities.^{22, 47} In addition to the economic and social consequences, this issue will have many health ramifications. These people quickly collect bottles and items from garbage bags all over the city before being collected by the waste collectors. They often tear up the garbage bags to get a bottle and scatter the garbage.²³ Therefore, they are at risk of being exposed to toxic and chemical components of the waste²³ In addition, masks and PPEs are often mixed directly with other contents in garbage bags, so when the waste pickers search through the bag and come in contact with them, they can be potentially contaminated. A smooth wind can spread the contaminated masks and gloves due to their low weight.⁴⁸ SARS-CoV-2 persists on some surfaces

for some days. Among different waste components, there are several reusable items, including cardboard, plastics, and aluminum cans on which the virus can persist for one, two, and three days, respectively (Figure 2).

Because most waste pickers lack health education, they do not have enough information about the hazardous content of waste bags and the disease transmission methods.²³ For example, their knowledge about how to prevent COVID-19 is limited to using a reusable mask without proper gloves and protective equipment; they go to the garbage can to find a few plastic bottles.⁵¹ Moreover, due to the severe recession during COVID-19, the number of these people has increased, and their chances of finding plastic bottles and other items have decreased; therefore, they have to spend more time to find useful items.²²

Unfortunately, these individuals do not receive proper financial support the ,from local or central government and must continue their efforts to find used plastics, aluminum, cardboard, and metals. In addition, due to incorrect information and financial problems, they wear a single mask for several days, which could lead to the ingestion of microplastic fibers. Extended use of a plastic mask or using it several times is also not recommended due to the

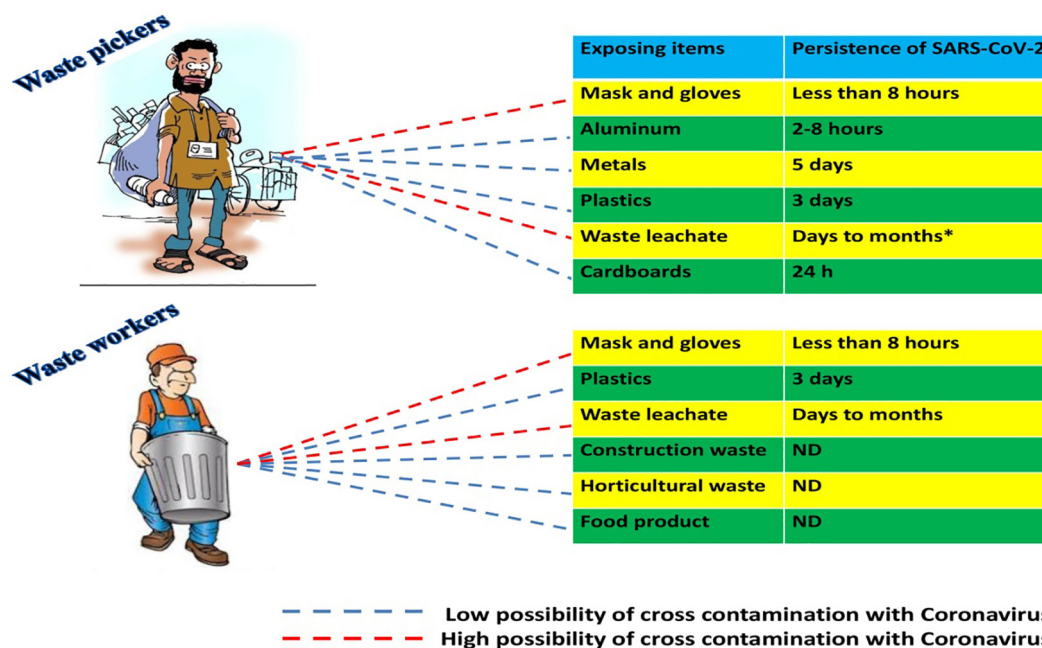


Figure 2: Persistence time of viable SARS-Cov-2 virus and contamination potential of different COVID-19 disposal items by which waste workers and pickers are exposed.^{28, 44, 49, 50} The exact remaining time of coronavirus in leachate is not reported, and the persistence time of other viruses is considered for waste leachate. ND: there is no available data.

false security it brings.⁵² On the other hand, picking up garbage is not limited to the city, and many waste pickers illegally collect garbage at landfills.⁵¹ This activity can also greatly increase the infection risk and transmit disease in other people.

Discussion

It has been mentioned that the risk of coronavirus transmission from surfaces is negligible. Nevertheless, there are several concerns about the transmission of the virus in municipal waste management.^{20, 53} For example, many patients spent their recovery period at home. The waste produced by these people has the characteristics of medical waste, but it is disposed of as municipal waste and poses both waste pickers and workers on the verge of health risks.⁵⁴⁻⁵⁷ On the other hand, waste leachate can contain high concentrations of the virus, which can be dangerous. The risk and dangerous conditions are more prevalent in poor or unsustainable waste management systems.^{35, 45, 58-60}

Many measures can be taken to reduce the risk of infection, especially in people who are in contact with waste potentially contaminated with COVID-19. For example, as much as possible, sufficient information should be given about the methods of collecting masks and gloves at the city level, and special bins should be placed to collect these items; so that, the waste pickers would not enter the bins.⁶¹⁻⁶³ Moreover, an accurate assessment of the potential of virus transmission in different parts of the waste management chain must be carried out.⁴¹ In the case

of waste pickers, governments can play a key role, first, by providing financial support to these people to address the post-corona virus vulnerabilities, and second, by restricting garbage collection, especially around landfills.^{23, 51}

Conclusion

Many alterations happened in the nature and composition of waste, which has resulted from the presence of several types of contaminating materials entering the waste cycle during the COVID-19 pandemic. Hence, both sanitation workers and waste pickers are probably at risk, especially in developing countries. This risk may be originated from exposure to potentially contaminated waste components or coronavirus-infected leachate. In-home quarantine of COVID-19-positive patients and mixing infectious waste of these people with municipal waste could increase the chance of virus transmission to people working with the waste. Older waste workers are more vulnerable to coronavirus infection; therefore, it is recommended that they should not be hired for high-risk jobs in waste management systems in which workers have more contact with the waste.

Moreover, sanitary workers should be trained and equipped with proper PPE. In addition, the use of mechanized devices with less human intervention can help reduce the risk of disease spread among municipal service employees. As for the waste pickers, the role of government is very important. Governments should increase their support for underprivileged people. In addition, NGOs could step forward to

support low-income residents. The economically vulnerable residents should also be trained about the possible hazards of picking up waste for themselves and the public. Unfortunately, the correct method of discarding used masks and gloves was not publicized or advertised. For the time being, health policymakers just encourage or force people to wear masks and other protective equipment; however, the public should be notified how to dispose of masks and gloves correctly. Disinfecting the waste before disposing of it has also been recommended.

Conflict of interest: None declared.

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