

RESEARCH

"We Are Already Sick": Infectious Waste Management and Inequality in the Time of Covid-19, a Reflection from Blantyre, Malawi

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The efficient and sanitary management of infectious waste is an essential part of the humanitarian response to any disaster, including the ongoing Covid-19 pandemic. Unfortunately, in many contexts within the Global South, waste management systems are poorly equipped to handle these waste streams during periods of normalcy, let alone during times of crisis. The purpose of this article is draw attention to a number of existing inequalities that define infectious waste management practices globally, with a critical eye to how they constrain poorer nations' ability to respond and manage their own Covid-19 outbreaks. In particular, the work draws on the authors' extensive research, experience, and activism at Queen Elizabeth Central Hospital in Blantyre, Malawi, to understand how waste management practices will inform and react to mitigation efforts and to propose a number of practical steps that can be achieved in the short-term, as well as towards long-term structural transformation. Ultimately, this conversation is meant to contribute to a more inclusive and critical waste management studies discourse.

Keywords: Waste Management; Disasters; Climate Change; Infectious Waste; Africa

1. Introduction

In addition to its human impacts, the Covid-19/Coronavirus pandemic will lead to the creation of a vast amount of solid waste that will require sanitary and sustainable management. From disposable disinfectant wipes to polystyrene takeaway containers, this influx of waste, generated by society's efforts to slow the transmission of Covid-19, will strain waste management systems, which are already being operated under difficult circumstances. Compounding this challenge is the possible infectious nature of much of this waste, from the ubiquitous masks, to hospital waste, or even a contaminated grocery bag. How should waste management systems react within a pandemic, when the waste itself is a possible source of infection? Moreover, what are the potential implications for poor nations within the Global South, where waste management systems, including for infectious waste, may be incomplete or non-existent? The quote in the title of this article was spoken by a caregiver at a public hospital in Malawi, who was voicing their apprehension over

the potential health impacts of breathing polluted air for already ill or immune-compromised patients. However, in the time of Covid-19, their concern can be interpreted further. If the Covid-19 pandemic has put such a strain on the healthcare and waste management services of some of the wealthiest and most technologically advanced nations in the world, how will less-resourced nations like Malawi fare—those nations who struggle, and frequently fail, to maintain best practices even during periods of normalcy?

Some early, and widely circulated narratives have referred to Covid-19 as the great equaliser, as it can infect anyone, regardless of wealth or race (see, for instance, a March 31st tweet by New York Governor Andrew Cuomo [2020]). However, in regards to waste management, it has instead emphasised the persistent and structural inequality that existed before the pandemic and will characterise each nations' attempts to manage and contain it.¹ For instance, while China was able to mobilize resources to construct medical waste facility in Wuhan in near-record time (Nan 2020), and despite the fact that companies in the US are now struggling to not only manage the amount of waste generated but to ensure the safety of their workers (Minter 2020), the possibility of such precautions in many Global South contexts is slight. The late onset of Covid-19 in most of sub-Saharan Africa has allowed some much-needed time to prepare, yet in the rush to coordinate an emergency response, hospitals must now plan for the infectious detritus that will quickly accumulate; waste that could barely be managed in periods of normalcy

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must be now prioritised as never before in order to prevent further spread, with little help or guidance from the international community or from richer nations that are struggling to manage their own domestic response. Moreover, although the current Covid-19 pandemic makes this topic feel timely, its urgency is more broadly rooted in climate change. As global temperatures continue to rise, the number of catastrophic climactic events are expected to increase. Additionally, there is a strong correlation between population density and the risk of pandemic, and with current population growth trends, the risk of man-made disaster (both climactic and disease), especially within the Global South, is expected to increase exponentially (Gholipour 2013). As such, the waste impact of these disasters is likely to significantly increase, as well as the waste footprint of our efforts to contain the damage. Finally, once the pandemic recedes, the inequalities will remain if not become more extreme: the fragile solid waste systems that already struggle to provide the barest level of public services and standards of environmental health will be left overburdened and underfunded with dire consequences for the dense urban centres that rely on them. As such, there should be no plan to return to a status quo, which for much of the Global South was fundamentally broken to begin with.

The purpose of this article is to highlight the absolutely essential role that the management of infectious waste must play in a humanitarian response, towards Covid-19 now and to other future disasters, as well as to shine a light on the inequalities that characterise these practices within the Global South. The article highlights the gap in waste management literature over the management of infectious waste during times of disaster, particularly within Global South contexts, as well as a lack of technical guidance from international organisations such as the World Health Organization (WHO). The context of waste management across the Global South is heterogeneous, and certainly, some countries are much better positioned to respond to new challenges than others. Nonetheless, we have chosen to specifically focus on one case study as a broadly illustrative example: Queen Elizabeth Central Hospital (QECH or Queen's), in Blantyre, Malawi, the largest public hospital in the country and a space in which the authors have nearly five years' experience of research and activism. Methodologically, we draw on substantial personal observation, dozens of hours of interviews with hospital staff, caregivers, and patients, as well as significant periods of action research, facilitating between various stakeholders at the hospital, patients, caregivers, and representatives of the state, to address shortcomings in institutional waste management practices and secure the necessary resources to allow sustainable improvements in practice.² By recounting the experiences of QECH we hope to highlight the persistent and structural inequalities that frame waste management practices within the Global South, identify gaps between best practice and quotidian reality, and comment on the lack of basic information and data which should inform how waste management best practices could be realistically achieved in low-resource settings.

2. Infectious Waste and the Global South

Classifying hospital or medical waste takes in a broad range of waste typologies to account for the diverse range of materials that needs to be accounted for and sanitarily managed within these contexts, including: infectious waste, pathological waste, sharps, chemical and pharmaceutical waste, genotoxic waste, and even radioactive waste, among others (Padmanabhan & Barik 2019). Nonetheless, the significant majority of healthcare waste produced (85% according to the WHO [2018]), is non-hazardous. However, the remaining 15%—the bodily tissues, used gloves, or syringes—is considered hazardous material that may be infectious, necessitating sound management and sanitary disposal in order to minimise risk to healthcare workers, patients, the environment, and the general public. Yet, targeted infectious waste management presumes that the diverse waste streams remain separate and distinct. All waste has the potential to become infectious waste, and when general hospital waste mixes with hazardous waste streams, either before or during disposal, it all becomes hazardous and a possible source of infection. Moreover, during a pandemic, as broadly shared guidelines for washing grocery store items suggest (see Young 2020, for instance), any innocuous object can carry infection, further underscoring the need for sound waste management in healthcare settings, where Covid-19 in particular has shown a propensity to proliferate amongst patients and staff (for example, Banton [2020], Erasmus [2020], and Petersen [2020] describe three such outbreaks at South African hospitals).

However, within most healthcare facilities across the Global South, even during times of normalcy, the basic provision of healthcare services is a daily struggle in the face of chronic shortages in human resources, water, energy, and medical supplies (WHO 2015; WHO/UNICEF 2019). As such, the separation and proper disposal of medical waste is rarely a priority. This struggle is reflected in our scholarly understandings of waste management practices in such contexts, as there is a dearth of information about the volumes of waste generated and the extent of separation and safe treatment during non-pandemic conditions. For instance, a WHO study revealed that from a survey of 66,101 healthcare facilities from 54 countries, data on solid waste management were only available from 24 countries, and of those, only 58% had adequate systems in place (WHO 2015). While the WHO/UNICEF Joint Monitoring Program (JMP) has been responsible for the collection and analysis of global water and sanitation statistics since the initiation of the Millennium Development Goals in the year 2000, the results of healthcare waste tracking were not presented until 2019 (WHO/UNICEF 2019). Though useful in understanding the extent of healthcare waste (HCW) management, data are presented broadly,³ as the JMP does not yet track quantities or the breakdown between infectious and noninfectious waste: essential data for planning logistics and treatment. Likewise, Minoglou et al. (2017), who survey healthcare waste generation rates (HCWGR) globally, lament the limited and disaggregated (i.e. infectious, etc.) nature of available data. Despite limitations, however, their results indicate a relationship between

GDP, CO₂ emissions, and the production of medical waste, with less industrialised nations producing less waste. For instance, Tanzania, a neighbour of Malawi, which faces similar developmental challenges, produces about 0.75 kg of medical waste per bed, per day (Minoglou et al. 2017). However, without nationally generated and desegregated data, planning for a variation, such as might occur during a pandemic, becomes even more challenging.

Though unique in its scale and spread, the Covid-19 pandemic shares some similarities with other humanitarian disasters such as the outbreak of Ebola, the 2015 earthquake in Nepal, or the ongoing conflicts in Yemen and Syria: massive, quickly escalating needs for medical intervention that result in an unprecedented quantities of medical waste in difficult-to-manage conditions. Nonetheless, literature at the intersection of waste management and disasters has predominantly focused on strategies for managing disaster waste (i.e. building rubble, plant material, etc.) (Amato et al. 2020; de Magalhães et al. 2018; Domingo & Luo 2017; Dugar et al. 2020; Gabrielli et al. 2018; Karunasena & Amaratunga 2016; Karunasena et al. 2009) including possible options for reuse or recycling (Brown & Milke 2016; Regattieri et al. 2018; Tabata et al. 2019), the modelling of potential impacts and systems reliability (Cheng et al. 2018; Trivedi et al. 2015), and the restoration of waste management systems post-disaster (Petersen 2004; Ulasan & Ergun 2018). Moreover, the literature on emergency medical disaster relief pays, at best, tokenistic lip service to waste management issues.⁴ Regardless, scholarly evidence related to the quantification and characterisation, safe management, and potential health and environmental impacts of infectious and non-infectious HCW during and following a pandemic such as Covid-19 seems to be largely absent within waste management academic literature.

Still, given the pace, uncertainty, and glaring priorities that are not necessarily aligned with the production of scholarly literature during periods of crisis, this gap is not necessarily surprising. It is usually the international, bilateral, and donor agencies that are responsible for producing the practical grey literature and construction manuals upon which many institutions and first responders rely. The gold standard in disaster response for water, sanitation, and hygiene (WASH) is the Sphere Handbook, which has been field-tested for over twenty years and is regularly updated (Sphere 2018). However, though excellent for water and sanitation, its guidance for solid waste management, and the management of medical waste in particular, is lacking.⁵ Though not designed for emergencies, both the International Committee of the Red Cross (ICRC) (2011) and the Ethiopian Ministries of Health, Water, and Energy (2012) have produced excellent practical manuals for use in difficult contexts generally; the inclusion of design values and schematics make these particularly useful, but they have not been written to specifically respond to humanitarian situations. The short technical note *Solid waste management in emergencies* by the WHO/WEDC (2013) appears to be the only dedicated guidance document that would provide any practical relevance in a humanitarian situation, though it lacks

specificity for the current context. Finally, in response to the Covid-19 outbreak, the WHO issued an interim guidance document specifying that, 'all health care waste produced during the care of COVID-19 patients should be collected safely in designated containers and bags, treated, and then safely disposed of or treated, or both, preferably on-site' (WHO 2020: 4). While technically correct, the lack of specificity, work-around solutions, or second-best practices render the advice vague and of dubious value in many Global South contexts. A clear gap exists in our understandings of best practices for HCW managements under normal circumstances, rendered more dire by the situation we find ourselves in now. Given the current and on-going pandemic, these issues will not be solved today, but must be addressed to minimise casualties in future crises, improve waste management during periods of normalcy, and contribute to a more inclusive waste management studies discourse

3. Waste Management at QECH

Blantyre's Queen Elizabeth Hospital (QECH) or Queen's, is Malawi's largest public hospital. Built in 1964, Malawi's year of independence, Queen's, in many ways, resembles a university campus more than a hospital. Built in a tropical, open-plan style, the hospital sprawls across a broad swath of central Blantyre, with dozens of wards connected by a warren of covered corridors. Crowded with hospital staff, patients, caregivers, and visitors at all hours of the day and night, the space can be difficult to navigate and is often bewildering for new arrivals, who are struck by its size and scale. Yet, to a casual observer the hospital maintains another, more distinct, feature: a thick, oppressive cloud of acrid-smelling white smoke that hangs over the space, contributing to ambient air pollution levels well beyond those considered hazardous⁶ by the United States Environmental Protection Agency (EPA) (2012), and stinging the eyes and throats of all who navigate the space.

Queen's has a waste management problem. The hospital houses a number of specialist wards and receives referrals from across the country. Nonetheless, despite its academic and treatment prominence, broad sections of the hospital, managed by the Ministry of Health, are plagued by constant shortages of human and material resources: staff are paid far below neighbouring countries, routinely miss paycheques, and struggle to provide treatment with failing infrastructure and scarce supplies (Muula & Maseko 2006). In such conditions, it is not unexpected that solid waste management is neither diligent nor a priority, with best practices often being unobtainable with the human and material resources available. Owing to a lack of storage containers,⁷ time, and waste management staff, there is minimal segregation of waste, which means that highly infectious waste (syringes, bandages, examination gloves) is disposed along with more benign items (waste food, newspapers, packaging). As a result, all waste becomes highly contaminated in the process, yet is not handled or treated as such. However, because each ward is managed differently, resources and practices can vary wildly across different points of the hospital, and individual wards with

slightly better resources and a more dedicated nursing staff may manage a better separation regimen.

Regardless, separation ends at the point of collection, because most hospital waste (infectious and non-infectious) is gathered by cleaning staff and burnt at the hospital's incinerator, located at a central point on the hospital grounds (sharps are handled separately). The waste is not incinerated, however, as the incinerator has been in disrepair for years, and the new incinerator provided by the Ministry of Health in late 2019 has taken nearly a year to commission. Rather, the waste is openly burned, in a constantly smouldering pile around the foot of the incinerator building (see **Figure 1**), sending up the aforementioned smoke, which blankets the grounds.⁸ Other, scattered fires contribute their part, as grounds staff consistently burn leaves and other garden refuse, and caregivers,⁹ who reside separately on hospital grounds, burn their own domestic waste. As a result, air quality at the hospital is often hazardous, and patients, staff, and caregivers alike report frequent respiratory-related illness, as well as a belief that the pollution could be contributing to other, more potentially life-threatening diseases such as asthma, cancer, and tuberculosis. Further investigation of these impacts and understandings is currently ongoing.

Finally, arranging municipal waste collection for the hospital has been a hard fought issue for a number of years. The city has limited vehicles and funding (petrol) to manage the regular collection of non-hazardous waste with sufficient frequency to prevent it overflowing the provisioned dumpster. Furthermore, ongoing source separation training and infrastructure provision (color-coded buckets) has not made a significant impact on the heterogeneity of waste that is still incinerated (i.e. it is not purely infectious). As a result, far more waste is burnt

than is strictly necessary. Furthermore, although municipal collection of some, non-infectious hospital waste may be desirable to reduce the burden of incineration and improve the local ambient air quality, it is not necessarily a more sanitary solution, as collected waste gets dumped at Mzedi Dump Site, an open dumpsite that is intensively cultivated by local subsistence farmers and is inhabited by more than one hundred informal waste pickers. Although the city bans the dumping of medical waste at the site, as Kalina et al. (2019) describe, sightings of potentially infectious medical waste, including needles, blood bags, and even body parts at Mzedi are common and are one of the most problematised and feared hazards at the site for those who navigate it on a daily basis.

Malawi, by most developmental metrics, is one of the poorest nations on the planet. In such a context, its commitment to universal free healthcare for its citizens is something to applaud, and although care conditions remain far below best practices achieved in other Global South healthcare 'success stories', such as Cuba, Malawi's healthcare system far outperforms what may be predicted by its level of income. Yet, as this article has shown, Malawi has a healthcare waste problem. At QECH waste management is severely deficient, and given that it is the flagship hospital of the country, with the resources and attention that that entails, it's likely that conditions at other facilities within Malawi and within other similar low-income settings are likely the same if not worse. However, as we have articulated, that claim in itself is difficult to verify, due to glaring gaps in our professional and academic understandings around the state of healthcare waste management across the Global South. Without sufficient data it is impossible to understand and predict how waste, such an underfunded, unprioritised aspect of hospital



Figure 1: Burning waste outside the defunct incinerator at QECH (Kalina, 2019).

safety, can or should respond to the new demands that the Covid-19 pandemic is expected to present.

4. Coping with Covid-19

In Malawi, modelled results released on 31 March, 2020, before any cases of Covid-19 were reported within the country, projected that over 85% of the population (16 million people) could be infected, with more than 400,000 requiring hospitalisation (Kuunika 2020). If these projections are met it would be an unthinkable disaster for the nation. Aside from the unimaginable human loss, Malawi is woefully unequipped to hospitalise 400,000 individuals while providing a sufficient level of care. For example, the availability of medical equipment, and ventilators in particular, has been a significant metric for care capacity in impacted countries, and as such, the drive to source ventilators has dominated coverage within western nations, with the United States alone spending \$2.5 billion on tens of thousands of new machines¹⁰ (Loftus 2020). However, in Malawi, there are 17 ventilators available nationally, an amount which is woefully inadequate even during normal periods, with little prospect of sourcing the quantities needed if infections skyrocket (Kuunika 2020). Domestic institutions have stepped in to fill some of these gaps, and a number of Malawian universities and innovators have rapidly set to work to develop low-cost production methods of PPE, such as visors, masks, and even ventilators. However, from a waste perspective, there has been less enthusiasm towards developing the facilities and technologies needed to manage the disposable gloves, masks, and testing swabs that will be needed to contain an outbreak. Given the immediate need to protect frontline workers, the prioritisation of PPE is essential, but when will the end-of-life management of these items become as an important a consideration as their design and creation?

At Queen's, business has largely carried on as usual, with little to suggest to the casual observer that the rest of the world is struggling with a global pandemic. In early April, the Malawian government called a nationwide lockdown; however, immediate and widespread protest action, as well as legal challenges led to it being quickly suspended by the national High Court. As a result, Malawi is now one of the few nations on the planet without broad-based nationally mandated social distancing regulations or a clear plan of action should an outbreak occur. How does a public hospital prepare for a pandemic within such a context? New regulations limiting one resident caregiver per patient has limited the density of the wards slightly; however, it has been difficult to enforce, and the hospital lacks the staff and resources to take on caregiver duties internally. PPE is scarce, and funds to buy additional PPE are mostly being supplied by charities and churches. Moreover, the hospital grounds themselves are porous, bisected by numerous roads and footpaths, with the broad layout of the facilities and the tropical design rendering strict access control impossible. As the incinerator is not functioning, some infectious waste is being transported to another, nearby incineration facility, which was recently renovated after being damaged through community intervention. Yet, although this is the safest option, it

is financially unsustainable for the institution, which has irregular access to money and petrol, while access to the facility itself is determinate on the goodwill of the local community, and a recent effort to impose a nationwide lockdown to combat Covid-19 has sparked protest and unrest.¹¹ As a result, transporting infectious waste may no longer be an option, and local treatment and disposal will have to be realised as a necessity.¹² Requiring PPE without adequate provisions to supply or dispose of it sanitarily presents poorer alternatives, as pictures of women in Mozambique cleaning collected masks with the intention to clean and resell them show (see **Figure 2**) (Abanobi 2020). Although the provenance and legitimacy of the images are questionable, they were widely circulated on social media within Malawi, where scepticism and misinformation regarding Covid-19 is already rife. Furthermore, when citizens who cannot afford masks are told that they should or must wear one, despite not being able to afford one, the recycled mask market suddenly becomes appealing (or at least the lesser of two evils). However, given the diversity and uncertainty of their prior uses, it is essential that no reused masks be exposed to the general population through inadequate disposal.

Meanwhile, a substantial amount of QECH's waste, both infectious and non-infectious, continues to be openly burned at the hospital. As we previously noted, this open burning contributes to poor local air quality, including dangerously high levels of particulate matter (PM), particularly in the centre of the hospital, where a number of the most medically sensitive wards, such as those for HIV and tuberculosis (TB) patients, are located. Early research on Covid-19 has suggested that those with pre-existing respiratory conditions may be at risk for worse treatment and recovery outcomes (Bansal 2020). A demonstrable link between Covid-19 and air pollution is also emerging, for instance, in Northern Italy, which is not only a hot spot for infections, but is also one of the most polluted regions within Europe (Conticini et al. 2020). In the United States, researchers have presented evidence that suggests an increase of just $1 \mu\text{g}/\text{m}^3$ in $\text{PM}_{2.5}$ is associated with an 8% increase in the Covid-19 death rate (Wu et al. 2020). These findings, when viewed in the context of the levels of air quality we have measured at QECH, seriously compromise the integrity of the hospital as a space of care. This is particularly true for the most vulnerable who may be recovering from Covid-19, as well as for the less compromised patients, staff, and caregivers who are daily exposed to the persistent cloud of smoke that smothers the facility.

Although it is difficult to refer to dead bodies as infectious waste, during the Covid-19 pandemic, they are, and corpses of infected patients will need to be managed quickly and safely in order to limit the risk of further infection. Religion and ceremony are deeply important aspects of Malawian cultural tradition. Funerals in Malawi are large affairs. Usually spanning several days, and hundreds of mourners, they often involve travel to and burial in an ancestral village, which can be days of travel away. If or when this pandemic truly grips Malawi,¹³ these traditions will unfortunately, be untenable. Malawi does not have the capacity or the infrastructure to cremate on a large



Figure 2: A picture that appears to depict women in Mozambique washing used masks for resale (Abanobi, 2020).

scale, and even if it did, to the majority of the population this would be unacceptable. Mass graves could be the safest, most affordable, and dignified solution for many, but Malawian urban centres lack space, and the state possess little capacity to mobilise resources on a significant scale. Given such a context and the high stakes for unpreparedness, these are scenarios that strongly warrant further investigation and planning. Guidelines for body disposal developed during the Ebola outbreak may be helpful in this instance, but the compatibility of their recommendations for Covid-19 infected patients is unclear. Finally, although the WHO released guidance on April 23, 2020 that suggests that the risk of transmission from handling corpses of the deceased is low (WHO 2020), that risk is likely correlated to the quality and preparedness of

the systems in place, and as we have repeatedly shown, that leaves Malawi, and countries like it, in a vulnerable position.

5. Looking Forward

Covid-19 may represent the most serious threat to the global capitalist economic order to emerge so far this century. As national economies across the Global North have frozen, and broad swaths of the population in Europe, the United States, and other industrialised nations, have had to turn in anger and desperation to overwhelmed public assistance programmes, the deep-seated and structural inequalities that have always underpinned these systems have been laid bare. Yet, in the Global South, this inequality is not a revelation; it has always been a lived reality, and

in the context of Covid-19, it will inevitably shape each nation's ability to manage and respond to the human impacts of the virus. Likewise, this inequality in capacity and means extends to the management of the significant quantities infectious waste that will inevitably be created. Masks, bandages, and even bodies, will all need to be handled and disposed of safely in order to minimise the risk of further infection, and will represent an additional burden to waste management systems which were already fundamentally unequal and broken. These systems will not be transformed overnight, and addressing these imbalances will take decades of serious investigation and radical socio-economic transformation. Waste management is not, and should not be considered as an afterthought—a bonus after all other precautions have been put into place—but rather, a core component of the fight against Covid-19. It is an essential part our response at multiple locations (homes, hospitals, cities), at all points along the service chain (collection, transport, disposal), for a diversity of waste (infectious, non-infectious, pathogenic, etc.) if the spread of the virus is to be mitigated. This is particularly true in low-income nations such as Malawi, where existing waste management systems are weak, and the material resources to rapidly scale up any response are likely to be inadequate or non-existent. Nevertheless, now, in the midst of a global pandemic, Malawi stands poised, with many other countries across the globe, at a precipice: how can we, as academics, best focus our efforts to enact meaningful change?

We recognise that not all practices can be best practices, particularly in times of crisis; however, the current dearth of information on waste and waste practices within Global South contexts only serves to mask the extent of the problem. As academics, we must better quantify and characterise the real and potential waste impacts of Covid-19, both in terms of the quality and quantity of waste generated and how, if at all, it has been and will be managed. We call on editors and agencies to encourage the publication of non-perfect practices, anonymized if necessary, so that the full extent of the generation and disposal practices during emergencies can be better understood; clear, achievable guidelines, templates, and manuals must be made available for local governments, NGOs, institutions, and emergency workers alike. Low-cost designs for sharps containment at hospitals, household guidance for disposal and safety guidelines for when open burning is the only option, and specific playbooks for municipalities overwhelmed with trash, are some of the materials that must be developed and disseminated immediately and updated once improved evidence becomes available. Unfortunately, it has taken a global pandemic to draw attention to the difficulties of safe solid waste management in the Global South, despite the fact that for decades, small corners of the sector were highlighting the quotidian challenges and shortages that shape daily practices. When the pandemic recedes, we cannot allow a return to a status quo that tolerated such inequality within our field of study. As a caregiver at Queen's described, 'we are already sick'. We will not cure

these structural illnesses overnight, but we can no longer pretend they do not exist as we work towards a more equitable and sustainable future.

Notes

- ¹ The label also collapses when you consider infection and mortality rates for the disease, which, at least in the United States, is disproportionately impacting poor and minority communities (Noppert 2020; Ro 2020; Wadhera et al. 2020).
- ² Our application for ethical approval by the National Committee on Research in the Social Sciences and Humanities (PROTOCOL NO. P.03/19/356) was approved on 19 May 2019. In addition to formally approved research that both authors have conducted, Dr. Tilley has served on various committees related to waste management at QECH, has provided expert input during the Covid-19 crisis, and is an active member of the ChiraFund, which helps to provide water, sanitation, and hygiene services to the most vulnerable patients and guardians.
- ³ For instance, according to their three-level ranking, the results for Malawi indicate that 43% of healthcare waste (HCW) is classified as 'Basic Waste Management Services' (waste segregated and treated and disposed of safely—the highest level) and 56% is classified as 'Limited Waste Management Services' (waste not segregated or treated and disposed safely—middle level) (WHO/UNICEF, 2019). Helpful, but not particularly revealing.
- ⁴ One notable exception is Zhang et al. (2016) who offer guidelines for characterisation of medical waste at disaster relief sites.
- ⁵ For instance, in the case of an outbreak, their sole advice is to "increase waste-handling precautions, using full PPE based on disease type", which though undoubtedly correct, is not particularly useful (Sphere, 2018, p. 134).
- ⁶ According to the EPA (2012), the 'good' range for PM_{2.5} (µg/m³, 24-hour average) is 0–12, while the hazardous range is up to 500. Our own (unpublished) data collected from points around the hospital frequently hit or exceeded 1000 µg/m³.
- ⁷ One of the public maternity wards, for instance, had a weekly allowance of three rubbish bags. There were no specialised bags provided for infectious waste, which was mixed with general solid waste, and they used a cardboard box to separate sharps.
- ⁸ The inequality at Queen's is again manifest in this arrangement, as the Mercy James Center, which was originally donated by Madonna but it is in the process of transitioning to Ministry management, has their own incinerators, not available for use by other departments.
- ⁹ Each patient is required to bring a caregiver, i.e. a person to assist with feeding, bathing, and all other non-medical services that are not within the responsibilities of the limited nursing staff.
- ¹⁰ As of April 14, 2020.

¹¹ The lockdown is currently suspended by the national High Court.

¹² The main incinerator at QECH, to which we have previously referred, is currently under repair; however, timelines for its activation are unclear.

¹³ At the time of writing, known cases were in the low double digits.

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Competing Interests

The authors have no competing interests to declare.

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