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# Healthcare Facilities in Low- and Middle-Income Countries affected by COVID-19: Time to Upgrade Basic Infection Control and Prevention Practices

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## Abstract

COVID-19 as a pandemic has spanned across all continents. With the increasing numbers in cases worldwide, even the countries with the best of healthcare facilities are reeling under the burden of the disease. Therefore, in countries with limited access to resources and poor healthcare infrastructure, the low and middle-income countries (LMICs), limiting spread becomes even more challenging. Low- and middle-income countries (LMICs) are severely hit by any outbreak and pandemics and face the lack of infrastructure and problem of overcrowding. Health facilities are compromised and almost exhausted at the time of emergency. There is disruption of normal supply chain, and consumables are not in sufficient quantity. In the current situation, rationalized use of available supplies is important. This paper presents the perspective on the basis of current literature on gaps in various infection prevention and control (IPC) strategies that are being followed currently in LMICs and suggestions for bridging these gaps.

**Keywords:** COVID-19, hand hygiene, low and middle income, personal protective equipment

## INTRODUCTION

In the last decade, the world has already faced two epidemics with members of the Coronaviridae family, i.e., Middle East respiratory syndrome coronavirus (MERS) and severe acute respiratory syndrome coronavirus (SARS), which have led to a significant economic loss. The newest member of this Coronaviridae family emerged in Wuhan, China, on 31 December 2019. On 30 January 2020, the World Health Organization (WHO) announced coronavirus disease 19 (COVID-19) as a Public Health Emergency of International Concern and a pandemic on 11 March 2020.<sup>[1-3]</sup> The major route of transmission is through respiratory droplets, although aerosols have also been implicated in a study.<sup>[4,5]</sup> COVID-19 has shown an exponential growth of cases with a  $R^0$  ranging from 1.45 to 3.58 in various studies and predictive models. The estimated average incubation period in 97.5% of individuals is 5.2 days.<sup>[6,7]</sup> Thus, human-to-human transmission is more efficient and rapid. As updated on 20 June 2020, the WHO website reports 8,799,323 confirmed cases, with 463,312 deaths spanning across 213 countries and territories.<sup>[8]</sup> The

above figures support the fact that this virus has a more efficient transmission than MERS and SARS since the latter was mostly transmitted by symptomatic cases and is, therefore, more of a challenge to contain.

Low- and middle-income countries (LMICs) are severely hit by any outbreak and pandemics and face the lack of infrastructure and problem of overcrowding. Health facilities are compromised and almost exhausted at the time of emergency. The capacity of hospitals to contain all cases is less. There is a lack of basic necessities such as personal protective equipment (PPE), hand sanitizers, gloves and masks. Epidemiological data of the COVID-19 and the disease

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are still in evolving stage. This uncertainty and infodemics has led to a situation of chaos and anxiety amongst people, especially in LMICs. Kandel *et al.* have utilised data from the International Health Regulations State Party Annual Reporting in foreseeing the ability of countries to fight against any public health emergency. Not to much surprise, only 43% of countries had response capacities at levels 4 or 5, indicating that these countries are operationally ready to face any pandemic. Most of these were developed countries.<sup>[9]</sup> There is a limited capacity in hospitals of the LMICs to handle epidemics due to a multitude of reasons: a lack of basic resources and workforce. In the present situation, nothing new can be done, but the strengthening of the existing facilities can and should be attempted. The following study is a review of literature on existing data of infection prevention and control (IPC) practices in LMICs, to gauge the quantum of work required to achieve recommended levels of the same.

## HOSPITAL INFRASTRUCTURE, WORKFORCE AND RESOURCES

The mode of spread of COVID-19 is through the respiratory route.<sup>[5]</sup> Ideally, designated isolation wards, emergency departments (ED) and intensive care units (ICUs) with negative pressure should be used to house these patients. In developed countries, intelligent hospitals with these facilities integrated during inception itself are incorporated to handle such exigencies.<sup>[10]</sup> Dedicated air handling units (AHUs) can convert positive or neutral pressure rooms to negative pressure rooms depending as the circumstances demand. In LMICs, very few hospitals have stand-alone buildings or even wards with negative pressure ventilation settings to house infectious patients such as COVID-19.<sup>[11]</sup> Installing separate AHUs to support negative pressure rooms might be an expensive and not a very feasible option. Hence, enhancing natural ventilation with the help of exhausts and quickly converting buildings with ordinary ventilation to negative pressure settings may be the only alternative for EDs.<sup>[12]</sup> Planning should be done in ICUs for the upcoming surge in cases. The ICU facility should be expanded at least 20% from the baseline capacity.<sup>[13]</sup> The alternative method could be utilisation of the normal pressure ICU beds or existing monitored beds (e.g., operation theatres and high-dependency units). In addition, simple measures such as cohorting beds with physical barriers (e.g., curtains) in between patients and timely step-down of stable patients with deisolation protocol can be done.<sup>[13]</sup>

The workforce per category is grossly inadequate in healthcare facilities of the LMICs. The doctor or nurse-patient ratio is also poor. When hospitals are likely to get overburdened, this will add to more shortage.<sup>[14]</sup> The workforce capacity should be increased by changing work structure (e.g., extra shifts or work hours) and restricting leaves. Elective procedure and non-essential services can be suspended, and staff from these areas can be redeployed to the COVID-19 areas.

Currently, the resources in LMICs are limited. Even in developed countries like the United States, the supply of

ventilators and PPE is inadequate.<sup>[15]</sup> There is disruption of normal supply chain, and consumables are not in sufficient quantity. In the current situation, rationalised use of supplies is important. Extended or limited use of N95 respirators can be done. Alternative methods such as decontamination and reuse of masks can be done. Alternative sources of mechanical ventilation or other forms of respiratory support like non-invasive ventilation should be obtained. Furthermore, stratification of resources and their use should be done in COVID-19-designated areas.<sup>[13]</sup> Thus, the infrastructure should be strengthened. Furthermore, the workforce and resources need to be increased according to the rising demand.

## NATIONAL ACTION PLANS FOR INFECTION PREVENTION AND CONTROL, INFECTION PREVENTION AND CONTROL PERSONNEL AND WRITTEN INFECTION PREVENTION AND CONTROL PROTOCOLS

A policy at the national level will set a uniform standard to be followed at all the levels of healthcare in a country. The existence of these requirements constitutes the initial starting point for building additional components according to a stepwise approach based on assessments of the local situation. The importance of IPC has been well recognised by governments of many developing countries and has led to the establishment of national programmes for reduction of hospital-acquired infections (HAIs).<sup>[16]</sup> This is the most important factor as it determines the commitment of stakeholders at the highest levels.<sup>[17]</sup> An example of this is the building of national teams in the African continent which tremendously benefitted 40 of the African countries to tackle the pandemic of COVID-19.<sup>[18]</sup>

It has been estimated that one full-time or equivalent infection control (IC) nurse per 250 beds in acute care centres is a minimum requirement for IC.<sup>[17,19]</sup> However, dedicated cadres of IC personnel are not a common feature in LMIC healthcare set-ups, as they are in developed countries. The IC personnel who are there do not receive a formal training or a certification course in IPC. In addition to trained personnel, there is a need for written IPC protocols, regular training and monitoring of these trained staff.<sup>[20]</sup> Akter *et al.* reported an urgent need to improve handling and disposal methods for hospital waste in almost all medical facilities in Bangladesh.<sup>[21]</sup> Therefore, organised IC structure and training should be the focus in LMICs at this time to prevent the spread of COVID.

In LMICs, although there is a lack of IPCs, general measures of IC such as droplet and aerosol standard precautions should be adopted by all healthcare workers (HCWs). Strict hand hygiene (HH) and social distancing should be maintained. Appropriate handling of COVID-19-generated waste should be done. Meticulous training and adherence to standard protocol in the absence of written protocols can suffice the need of the current pandemic.

## TRAINING AND INITIATING BEHAVIOUR CHANGE

Studies have shown that the implementation of an IC training programme led to containment of outbreaks and prevented their further spread.<sup>[22]</sup> The WHO and Centers for Disease Control and Prevention have published interim guidelines regarding COVID-19 prevention. The need of the hour is to conduct training and initiate behaviour changes amongst HCWs.

Furthermore, according to the WHO case definition, prompt identification and isolation of all suspected cases should be done. The number of visitors to all the areas of a healthcare facility also needs to be restricted. The first point of contact for most COVID-19 patients will be the emergency or outpatient settings of hospitals. It is of paramount importance that IPC practices be adequate in these settings to prevent transmission to HCWs and other patients in this scenario. It is known that nothing changes overnight, especially behaviour in relation to IPC. Most studies have shown a gradual change in IPC practices after education-feedback interventions.<sup>[23,24]</sup> Most likely, COVID-19 is here to stay. Enhanced IPC interventions should be sustained over prolonged periods to handle any pandemic.

## USE OF PERSONAL PROTECTIVE EQUIPMENT

Many countries have reported HCWs contracting COVID-19 infections even when provided with PPE.<sup>[25]</sup> These HCWs do not know the correct order of donning and doffing. Many HCWs do not know the correct usage of PPE and have less than recommended compliance with recommendations. *In situ*, just-in-time N95 fit testing and simulation training with before-and-after multidisciplinary peer-review processes is required. Thus, meticulous training should be provided before deputing these individuals to high-risk areas.

There are not many studies on this aspect, however, policies and practices on PPE use are reported to be inconsistent.<sup>[26]</sup> In LMICs, basic PPE such as medical masks, gloves, goggles, face shields, respirators, gowns and aprons are not readily available in many facilities. The usage of PPE is being rationed for use only in high-risk scenarios. As a consequence, the shortage in supplies is making doctors, nurses and other HCWs dangerously ill-equipped to care for COVID-19 patients. In view of this, the WHO has recently called upon industries and government agencies to increase the manufacturing of PPE by 40%.<sup>[27]</sup>

## ENVIRONMENT CLEANING AND DISINFECTION

COVID-19 spreads through droplets and can contaminate fomites on hospital surfaces. These viruses are enveloped, and they can be easily inactivated by disinfectants. In an environmental sampling study from Hong Kong, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was detected in 1 (7.7%) of 13 environmental samples.<sup>[28]</sup> Previous studies on SARS-CoV and Middle East respiratory syndrome-CoV have shown that these survive from 2 h to 9 days on different surfaces in the environment at average room

temperature (20°C).<sup>[29,30]</sup> Therefore, environmental cleaning and disinfection are of utmost importance.

Meticulous environmental cleaning of frequent touch surfaces such as doorknobs, telephone surfaces, computer keyboards, desks and chairs is the need of the hour. However, surface cleaning needs to be regular with adequate contact time according to manufacturers' recommendations, which is frequently not the case.<sup>[31]</sup> In LMICs, hospital surfaces and equipment are frequently found to be contaminated pointing to inadequate housekeeping practices. Fomites carried by HCWs, for example, stethoscopes, are also reported to be contaminated very frequently unless decontaminated in between patients.<sup>[32]</sup>

Coronavirus being an enveloped virus is easily disinfected. In a review by Kampf *et al.*, the routine disinfectants such as ethanol (78%–95%), 2-propanol (70%–100%), the combination of 45% 2-propanol with 30% 1-propanol, formaldehyde (0.7%–1%), glutaraldehyde (0.5%–2.5%) and povidone-iodine (0.23%–7.5%) readily inactivated coronavirus infectivity by approximately 4 log<sub>10</sub> or more in suspension test. On the other hand, sodium hypochlorite and hydrogen peroxide require a minimum concentration of 0.21% and 0.5%, respectively, to be effective.<sup>[33]</sup>

The WHO recommends that 'Environmental cleaning and disinfection procedures should be followed consistently and correctly. Thoroughly cleaning environmental surfaces with water and detergent and applying commonly used hospital-level disinfectants (such as 0.5% sodium hypochlorite) are effective and sufficient procedures.'<sup>[34]</sup> A concentration of 70% ethanol is also recommended by the WHO for disinfecting small surfaces.<sup>[35]</sup> On 3 March 2020, the United States Environmental Protection Agency released a list of disinfectants to use against COVID-19. They were mostly alcohol-based disinfectants.<sup>[36]</sup> Thus, frequent cleaning by dedicated staff is important to prevent droplet spread of COVID-19 within hospital setting.

## HAND HYGIENE INFRASTRUCTURE AND PRACTICE

Although many LMICs have successfully implemented HH programmes, they continue to face unique challenges such as the unavailability of basic infrastructure, inadequate procurement of soaps and alcohol-based hand rubs (ABHR), lack of awareness and compliance. Cronk *et al.* estimated that 50% of healthcare facilities (HCFs) lacked basic necessities such as piped water supply and electricity. Nearly one-third of them lacked toilet facilities and soaps for handwashing. Only a dismal 2% of HCFs in LMICs were competent enough to provide these basic infrastructures.<sup>[37]</sup> Currently, there are no *in vitro* data available on the efficacy of handwashing against coronavirus contamination. However, in a study from Taiwan, the mere installation of handwash stations in the ED led to significant protection from SARS-CoV amongst HCWs.<sup>[38]</sup>

Apart from this, overcrowding of the patients and paucity of dedicated nursing staff are the other factors influencing HH compliance.<sup>[39,40]</sup> In a study involving 875 Bangladeshi hospitals in 2013, it was observed that even if the basic HH tools were

made available, still HCWs performed recommended HH in only 9% of the opportunities.<sup>[41]</sup> Awareness amongst HCWs towards HH practices is also low. In one study, approximately 57% of medical students had received no formal training in HH throughout their undergraduate medical training. Due to the above and many other reasons, HH compliance remains low in these countries, 5%–50%.<sup>[42-45]</sup> Various categories of HCWs exhibit poor compliance (physicians: 32.6% and nursing staff: 43.4%).<sup>[46]</sup> Studies in many of these LMICs reveal that dedicated interventions, training and supervision have shown marked improvement in the compliance level.<sup>[47-49]</sup> These data emphasise that apart from the basic requirements, there is not only a need for increasing awareness about the importance of HH but also a need for a change in the overall behaviour amongst HCWs.

In such overburdened HCFs, the role of family members becomes important as they are directly involved in patient care. However, patients in LMICs are not empowered towards HH. In a study from India, only 28.7% of patients asked their HCW to wash their hands before performing an examination.<sup>[50]</sup> In a study by Biswal *et al.*, dedicated training of family members led to very good compliance in HH towards their patients. It is, therefore, worthwhile empowering and educating patient attendants, as it is recommended as an integral part of the WHO HH multimodal strategy.<sup>[51,52]</sup> HH is the most cheapest and effective measure. Transmission in healthcare settings can be successfully prevented when appropriate measures are consistently performed.

## CONCLUSION

LMICs face certain challenges in many aspects of IPC. These challenges will be amplified during COVID-19 times. COVID-19 is likely to stay for a long time. Hence, along with increase in compliance of HH, these countries also need to sustain the practice for prolonged period. Therefore, a sustained habit of HH would be a very good armamentarium in the fight against impending epidemics in the long run. This would help HCWs prevent the spread and indirectly the risk of infecting themselves.

This is the right time to augment our resources and revisit the challenges while managing outbreaks. Thus, high and effective baseline IPC practices amongst HCWs and infrastructure in LMICs need to be in place during the non-outbreak settings. Only then can we be competent enough to contain such an outbreak of immense proportion like the one which the world is facing now. In response to the ongoing pandemic, if the IC practices are strengthened and sustained across developing nations, it will prevent many HAIs and deaths apart from COVID-19.

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