

## Editorial

### Recommendations for the Management of COVID-19 in Low- and Middle-Income Countries

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At the conclusion of its first year, the dynamics of the COVID-19 pandemic are still fluid. Today's global and regional numbers on incidence and mortality are outdated just a few weeks later. Effective SARS-CoV-2 vaccines are becoming available, but the exact timeline of their availability, in particular in low- and middle-income countries (LMICs), is still unclear. What has become clear, albeit not completely understood, is that many poorer countries have been hit less by the pandemic than high-income countries (HICs), even when accounting for underreporting related to more limited testing capacity (Figure 1). Many LMICs need to be commended for their generally faster public health responses at much earlier stages in their epidemics than their HIC counterparts. Also, likely because of the relatively younger population in LMICs than HICs, the estimated COVID-19 infection/fatality ratio is typically around two to three deaths per 1,000 infections in LMICs, contrasted to six to 10 deaths per 1,000 infections observed in HICs with older populations.<sup>1</sup>

Nevertheless, patients hospitalized with COVID-19 pose an enormous burden on healthcare systems and individual clinicians in many LMICs. Dealing with the pandemic has proven a huge challenge to all healthcare systems, but there are many setting-specific challenges in LMICs. Although the availability of intensive care units (ICUs) with access to mechanical ventilation has increased over the last decade in upper-middle-income countries, ICUs are still very limited in LMICs. For example, the number of ICU beds in Bangladesh, a low-income country, is 0.3/100,000 population and that in Sri Lanka, a LMIC, is 2.5/100,000, compared with around 20/100,000 in the United States and 30/100,000 in Germany. In addition, ICUs in poorer countries are often only accessible to those who can afford private hospitals. Maybe more importantly, around one-quarter of hospitals in LMICs lack sufficient oxygen supply, even for care independent of the COVID-19 pandemic.<sup>2</sup> Also, availability of basic equipment for respiratory and hemodynamic monitoring can be limited, and proper maintenance of equipment is often lacking. Supplies of laboratory consumables or essential medication can be unpredictable, and sometimes, even the continued availability of basic commodities such as electric power and running water is not guaranteed. Although highly variable between LMICs, the number of skilled doctors, nurses, and other health personnel is often very limited.<sup>3</sup>

Within the constraints of the limited resources in LMICs, what is the best way to cope with a high burden of severe COVID-19 patients, and how can we ensure the best possible patient outcomes? Developing a comprehensive, setting-

specific evidence base will be important to answer these questions, but most COVID-19 intervention trials are performed in HICs, with a few important exceptions, such as the WHO-coordinated Solidarity trial,<sup>4</sup> which studies repurposed antiviral drugs for COVID-19 and will expand into novel therapeutics, and the Randomized Embedded Multifactorial Adaptive Platform for Community-acquired Pneumonia study,<sup>5</sup> a global adaptive clinical trial platform now including COVID-19, with study sites in LMICs evaluating anticoagulant strategies and other interventions. COVID-19-specific treatments currently tested, such as antiviral or immunomodulatory drugs, are only a small part of the management of patients with severe COVID-19. Management of patients with respiratory failure in a very basic ICU environment, or in the absence of a mechanical ventilator, requires setting-adapted recommendations on modalities for optimal oxygen delivery and respiratory support but also on lung imaging techniques and laboratory tests suitable for LMICs. Although respiratory failure is the main feature of severe COVID-19, other organ systems can be affected, and organ support feasible in a resource-limited setting needs to be defined. Coping with the large excess burden of severely ill patients, while ensuring the safety of healthcare staff caring for patients with this highly contagious disease, is crucial. These issues require pragmatic guidance on the organization of care and efficient triage of hospitalized patients with COVID-19.

To address the need for guidance on severe COVID-19 management in resource-limited settings, a COVID-LMIC Task Force was formed, comprising doctors and nurses with experience in critical care in LMICs. These members are either based in LMICs or have worked there extensively out of their home institutions in HICs. The group reviewed the current literature on a wide range of aspects of the management of severe COVID-19, focusing on evidence generated in the target countries. From this review, and supplemented with local expert experience, the group formulated an evidence-informed set of pragmatic recommendations targeting the LMIC bedside practitioner. This led to a set of 10 articles presented as a supplement to the AJTMH. It is recognized that these recommendations are time-sensitive. Every month, more than 10,000 journal articles on COVID-19 are published, and new evidence can be expected to necessitate modification in the provided guidance. There are also additional sources of information on this topic. The WHO actively engages with doctors globally to discuss severe COVID-19 case management through their "COVID-19 Clinical Management and Characterization Working Group" (<https://www.who.int/teams/health-care-readiness-clinical-unit/covid-19>). Other professional groups, such as the Surviving Sepsis Campaign,<sup>6</sup> have issued adapted guidelines. The new supplement offers a more comprehensive approach, discussing a wide

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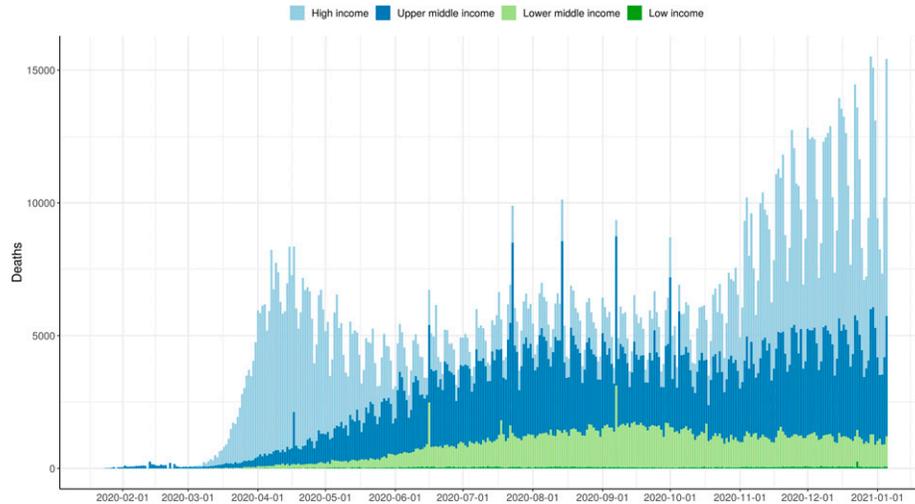


FIGURE 1. Reported COVID-19-attributed mortality according to the country's income category. Source: <https://mrc-ide.github.io/global-lmic-reports/> (accessed December 14, 2020).

variety of relevant topics. We hope that the articles will provide important practical guidance for the many doctors, nurses, and other frontline healthcare workers caring for patients with severe COVID-19 in LMICs. They are heroes.

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