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Strategic response to COVID-19 in Ethiopia

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COVID-19, the novel coronavirus, has posed a major threat to low- and middle-income countries (LMICs) due to inadequate health infrastructure and human resources. Ethiopia, a low-income country with the second largest population in Africa, has coordinated a strategic response, leveraging existing infrastructure and health systems and mobilizing public health professionals and specialist expert physicians for a multifaceted, unified government approach and adaptive response. Resource limitations, particularly in critical care, have still posed challenges, but the public health and clinical interventions thus far have prevented the catastrophic toll that many predicted. As the pandemic continues, Ethiopia expects to use a triple care model integrated at all levels, consisting of COVID-19 care, isolation care for suspected cases, and essential health services, and urges intensified non-pharmaceutical interventions alongside equitable global vaccine distribution as the ultimate answers to pandemic control. This paper draws on existing data, national planning and guidelines, and expertise from health leadership to describe this response in hopes of providing an example of how future large-scale health challenges might be faced in LMICs, using Ethiopia's successes and challenges in facing the pandemic.

COVID-19, a novel viral disease caused by SARS-CoV-2, has infected over 160 million globally, with over 3.3 million deaths as of mid-May 2021.[1] At the beginning of the COVID-19 pandemic, the number of cases and fatalities in China, Europe, and the United States revealed how ill-prepared the health system was to address respiratory pandemics despite advances in the field.[2–4] The impact was expected to devastate low- and middle-income countries (LMICs), due to dire limitations in health care infrastructure and expertise.

In Ethiopia, a low-income country with limited healthcare delivery, the COVID-19 pandemic posed a monumental challenge. The population of roughly 117 million is the second largest in Africa; as of mid-May 2021, the country accounted for 5.6% of total COVID-19 cases and 3.1% of COVID-19-related deaths on the continent. The case fatality rate is 1.7%, although only 2% of the population has been tested.[5] Since the first SARS CoV-2 case reported on March 13, 2020, the country has tackled the pandemic using a multi-pronged approach that we believe can be an example for other LMICs facing large-scale health challenges.[6,7] This paper describes Ethiopia's successes and challenges addressing the pandemic, using existing data, referencing national planning and guidelines, and drawing on expertise from leaders in the COVID response.

NATIONAL IMPLEMENTATION AND ACHIEVEMENTS OF COVID-19 CONTROL STRATEGY

Leadership and governance

First, an Emergency Operation Center was activated, the Ministry of Health (MOH) established Clinical Advisory and Multi-Sectorial Teams, a national COVID-19 task force was established, and a state of emergency was declared. Health facility readiness, human resources for health, and financial constraints posed major challenges during early pandemic containment and later mitigation measures.[8]

The state of emergency lasted 5 months. Travelers were quarantined, social gatherings were discouraged, religious congregations were closed, and universal masking was required. Schools and universities closed 3 days after the first case, with restriction of long-distance travel to and from Addis Ababa, the epicenter of the pandemic in the country.[7] These interventions likely accounted for slow case increases with few severe and critically ill patients, which allowed time to prepare facilities, train and deploy healthcare workers, and educate the public.[9]

Health service delivery

Next, Ethiopia had to meet needs for testing, hospitalizations, oxygen therapy, and intensive care. To improve access, testing was decentralized from the capital to the regions. Facilities were designated for COVID-19 management in three models: 1) health facilities dedicated to COVID-19 care, 2) non-health facilities repurposed for COVID-19 care, and 3) health facilities devoted to essential non-COVID health services.[8,10,11]

Health facilities exclusively for COVID-19

Eka Kotebe Hospital (Addis Ababa, Ethiopia) exemplifies the first model, a health facility dedicated to COVID care. Pre- pandemic, the hospital provided primarily psychiatric services. After the pandemic began, the MOH designated it as the first COVID Care Center in Addis Ababa, then made it a stand-alone Federal Hospital. Initially, it was an isolation and quarantine center, with nearly 600 beds for suspected and confirmed COVID patients. As the surge progressed, national admission criteria recommended admission only for severe disease, those with comorbidities, and

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those unable to isolate at home. The hospital structure ultimately reflected these categories, with a severe ward, intensive care unit (ICU), high-dependency unit (HDU), and recovery ward. A dialysis center was established to manage patients with multi-organ failure. Health professionals included pre-existing staff, contract workers hired by the MOH, volunteers, and resident and consultant physicians from Addis Ababa University College of Health Sciences, Addis Ababa, Ethiopia.

Non-health facilities re-purposed for COVID-19 care

Millennium COVID Care Center, a prototype for model 2, is a public recreational hall repurposed for COVID care, with about 1,000 beds. It was led by consultant clinicians, public health professionals, and administrative staff of Saint Paul's Hospital Millennium Medical College (SPHMMC; Addis Ababa, Ethiopia).[12] The healthcare providers were SPHMMC staff, contract workers hired by the MOH, and other volunteers. The center was initially structured with regular wards for asymptomatic patients; the capacity eventually included ICUs and HDUs. In addition, a facility-based oxygen plant was installed, and the clinicians organized data collection to conduct studies on clinical interventions and mortality predictors within the Ethiopian context.[13,14]

Health facilities for essential health services

Tikur Anbessa Specialized Hospital (TASH; Addis Ababa, Ethiopia), the largest tertiary hospital in the country, represents the third model, providing ongoing essential healthcare for the sickest non-COVID patients. As the pandemic progressed with widespread community transmission, the rate of COVID-19 acquisition among complex medical patients also increased. The initial goal was to transfer complex patients from non-COVID centers to designated COVID-19 centers; however, COVID-19 centers were not always prepared to manage complex multidisciplinary care, so these patients remained at TASH.

As a result, the Pulmonary and Critical Care Division organized COVID isolation wards and ICUs to run alongside non-COVID clinical services. The hospital created its own Emergency Operating Committee (EOC), which oversaw the hospital's development of COVID-19 testing capacity sufficient to test every admitted patient and isolate cases. A core case management team from Emergency, Anesthesia, Infectious Disease, and Pediatrics managed every aspect of patient flow through this new parallel system, as well as patient care.

Likewise, regions and city administration followed the models we describe here, repurposing colleges and university campuses as isolation centers and hospitals. Most hospitals continued to provide essential healthcare services.[8]

Use of health information systems for data and research

Throughout the pandemic, clinical teams collected data to adapt planning and patient care to the local context and to conduct relevant research, such as the use of awake proning in LMIC settings. Broader data were used in WHO and Ethiopia Public Health Institute (EPHI) studies.

Ethics

Because our manuscript does not report on or involve the use of any animal or human data or tissue, the need for ethics approval and consent to participate is not applicable.

CHALLENGES FACED AND FEASIBLE SOLUTIONS IN THE COVID-19 CONTROL STRATEGY

Despite these efforts, many hospitals and health centers developed stringent admission criteria to avoid becoming COVID-19 epicenters themselves, given the meager in-country resources for healthcare delivery, limited experience handling a large-scale epidemic, and poor infection prevention and control (IPC) practices, including critical deficiencies in personal protective equipment (PPE) and hand sanitizers. Moreover, patient fears of contracting COVID-19 in healthcare facilities reduced health-seeking behavior. Ultimately, urban referral hospitals bore much of the burden, both reflecting and exacerbating the disparity in urban–rural resource and case distribution.[8]

Addressing limitations in health systems

Fortunately, as the pandemic progressed in Ethiopia, most cases were mild, though moderate and severe cases gradually saturated the treatment centers. However, according to internal data from EPHI, over half of COVID-19-related deaths occurred in the community, underscoring the need for further education, prevention, and improved strategies to manage these cases. Moreover, despite unrelenting efforts by federal and regional governments to increase national ICU capacity, the current pandemic has strained critical care service delivery. Although most ICU capacity is in Addis Ababa, which has the majority of the nation's ICU beds and critical care physicians, the city faced challenges as the epicenter of the pandemic.

The national pandemic registry data shows that up to 1.5% of COVID-19 cases required ICU admission, mainly for hypoxemic respiratory failure, and most patients requiring mechanical ventilation had poor outcomes. A dearth of both critical care capacity (ICU beds, advanced monitoring, ventilators) and trained critical care professionals posed a major limitation as 15% of COVID-19 cases progress to severe illness.[15] Moreover, ICU medications have been in critical shortage in Ethiopia due to global supply chain interruptions, which may contribute to increased mortality in critically ill patients.[16]

Health workforce as a major defense against COVID-19

During the COVID-19 pandemic, a cadre of pulmonary, emergency, anesthesiology, and critical care physicians proved key to an effective response. Their roles included development of protocols, treatment guide-

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lines, and training manuals; and mentoring and coaching healthcare providers throughout the country. These specialized physicians provided hands-on, in-hospital training and mentoring focused on IPC, PPE, and self-care. They also partnered with public health experts and media to disseminate prevention messages, using community engagement and interpersonal communication in hard-to-reach and vulnerable populations.

Because of gaps in ICU capacity, employing treatment strategies to delay ICU admission and/or mechanical ventilation became crucial. Practitioners throughout the health system, guided by these specialists, adopted anticoagulation and steroids before studies like the RECOVERY Trial were reported, and employed prone positioning in both intubated and non-intubated patients. In addition, critical care specialists sought to disseminate their expertise using lung-safe modes of ventilation in severe COVID-19 cases.

In addition, these physicians filled major leadership roles, heading the National COVID-19 Clinical Advisory Team and spearheading efforts to improve the COVID-19 response throughout the country. Moreover, the major treatment centers in Addis Ababa—Eka Kotebe, Millennium Treatment Center, St Paul's Millennium Medical Centers, and St Peter Hospital (Addis Ababa, Ethiopia) with its affiliated field hospitals—drew on these professionals as their core teams in clinical service and leadership.

These specialist physicians also leveraged their professional societies—the Ethiopian Thoracic Society (ETS; Addis Ababa), the Ethiopian Medical Association (EMA; Addis Ababa), the Ethiopian Pediatrics Society (Addis Ababa), the Ethiopian Public Health Association (Addis Ababa), Ethiopian Anesthesiologists Society (Addis Ababa), and the Ethiopian Society of Emergency Professionals (ESEP; Addis Ababa, Ethiopia)—to meet needs outlined by the MOH early in the pandemic. These societies cooperated to establish task forces and consultative workshops, provided feedback to the MOH on COVID-19 control efforts, and consulted on regional strategies. As part of the Coronavirus Task Force, they analyzed and monitored the virus nationally using the best available science to track, predict, and mitigate the curve of the outbreak. They continually worked to determine the source of new outbreaks and inform policy makers.

These clinical and leadership responses were largely possible because Ethiopia had already established emergency medicine and critical care capacity through collaborative, long-standing programs. These included the Emergency Medicine Task Force (EMTF), the East African Training Initiative (EATI), the Toronto–Addis Ababa University Collaboration (AAU-TAAAC; Toronto, ON, Canada), and the University of Wisconsin (Madison, WI, USA) and People to People (p2p; Spokane, WA, USA) team.[17–20] Moreover, the existing public health system played a major role in mitigating the pandemic, as its development over the last three decades extends from national leadership to grass roots-level involvement.

DISCUSSION: LESSONS AND POLICY IMPLICATIONS

Ethiopia's challenges to mounting an effective COVID-19 response included low socioeconomic status, under-developed health infrastructure, a weak health delivery system, and a large population. Conversely, a young population with low risk of severe disease, a delayed pandemic surge, global experience sharing, public awareness creation, and domestic and international resource mobilization, particularly of their human resources, provided opportunities for optimism. Effective vaccines and novel therapeutics also give us hope. The uncertainties come from the pandemic's persistence with multiple variants that may shift the prevalence of severe illness in young people, the effect of altitude on oxygenation at baseline, and ongoing social and economic disruption.[15] Moreover, access to vaccines and vaccine hesitancy due to disinformation and misinformation may pose additional challenges.

COVID-19 will remain a global threat to health for the foreseeable future, and pursuing an integrated approach has proven highly effective. Cognizant of this fact, facilities such as St Paul's Hospital Millennium Medical College and Hospital now include COVID care in the existing health system, combining COVID-19 care with essential health services. This standard will be the new normal for health facilities in the coming months.[8]

If the surge recurs or if we face other large-scale health challenges, we must learn from our vulnerabilities to mitigate the possible damage. Although mortality has been low, likely due to young demographics and early NPI interventions, the mortality in the elderly has remained high, and ICU mortality was elevated nation-wide.[21,22] These gaps—common across Africa—highlight that LMICs must strengthen critical care capacity and infection control practices to face many of our health challenges.

Our experience has provided critical answers to managing the pandemic in a populous low-income country. First, we constructed a unified national response, informed by clinical and public health experts with local expertise, and supported by professional societies. Next, we leveraged existing resources to expand continuing medical education and COVID infrastructure for hospitalized patients. Our response in referral hospitals included flexible planning and early adoption of new standards of care, including anticoagulation, steroid use, and awake proning. Our current case fatality rate gives us hope that these measures were effective, despite many uncertainties. Furthermore, as effective vaccines are the light at the end of the tunnel, we urge equitable vaccine distribution across developing countries like Ethiopia, and strong community engagement to create trust and to ensure global health security.

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COVID-19, le nouveau coronavirus, a représenté une menace majeure pour les pays à revenu faible et intermédiaire (LMIC) en raison de l'insuffisance des infrastructures de santé et des ressources humaines. L'Éthiopie, un pays à faible revenu dont la population est la deuxième plus importante d'Afrique, a coordonné une réponse stratégique, en tirant parti des infrastructures et des systèmes de santé existants et en mobilisant des professionnels de la santé publique et des médecins experts spécialisés pour une approche gouvernementale unifiée à multiples facettes et une réponse adaptative. Les ressources limitées, notamment en matière de soins intensifs, ont encore posé des problèmes, mais les interventions cliniques et de santé publique menées jusqu'à présent ont permis d'éviter le bilan catastrophique que beaucoup prédisaient. Alors que la pandémie se poursuit, l'Éthiopie prévoit d'utiliser un modèle de soins triple intégré à tous les niveaux, composé de soins COVID-19, de soins d'isolement pour les cas suspects et de services de santé essentiels, et préconise l'intensification des interventions non pharmaceutiques parallèlement à une distribution équitable des vaccins à l'échelle mondiale comme réponses ultimes au contrôle de la pandémie. Cet article s'appuie sur les données existantes, la planification et les directives nationales, et l'expertise des responsables de la santé pour décrire cette réponse dans l'espoir de fournir un exemple de la manière dont les futurs défis sanitaires à grande échelle pourraient être relevés dans les LMIC, en utilisant les succès et les défis de l'Éthiopie face à la pandémie.

Public Health Action (PHA) welcomes the submission of articles on all aspects of operational research, including quality improvements, cost-benefit analysis, ethics, equity, access to services and capacity building, with a focus on relevant areas of public health (e.g. infection control, nutrition, TB, HIV, vaccines, smoking, COVID-19, microbial resistance, outbreaks etc).