



Implementation of COVID-19 emergency response strategies in South Sudan

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Abstract

The COVID-19 pandemic posed unprecedented challenges worldwide, exacerbating pre-existing vulnerabilities in healthcare systems. As the world's newest country, South Sudan faced many healthcare barriers that led to distinct challenges in managing the pandemic. After gaining independence in 2011, South Sudan experienced further conflict driven largely by ethnic divisions and competition over resources. The nation was pressed to navigate the pandemic with a healthcare system that has been battered by conflict and inadequate funding.

This manuscript assesses emergency management strategies implemented in South Sudan during the COVID-19 pandemic, using publicly available government, private sector, and academic sources. A structured analysis of key components of emergency response—human resources, health service delivery, and logistics—was conducted. Interventions by the Ministry of Health (MOH) included community-based surveillance, updated care guidelines, increased risk communication and community engagement. Despite these, a lack of trust in the government and healthcare system, security challenges, limited resources, and dependence on international aid were identified as notable barriers to the country's pandemic response. The vaccination campaign in South Sudan was particularly challenging, with only a small percentage of the nation being vaccinated by 2023 despite efforts to increase coverage. While the impact of the strategies implemented cannot be fully appreciated due to limited data, their study can still inform approaches to future public health emergencies.

Keywords: COVID-19 response, South Sudan healthcare, emergency management, vaccination campaign, humanitarian aid

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1 Background

In 2011, South Sudan gained independence from Sudan after decades of conflict stemming from power struggle, scarce resources, and ethnic divisions, much of which was shaped by British colonial rule and control over oil wealth (Aufiero and Tut Pur, 2021). As the nation worked to establish itself, unrest and bloodshed continued in the years that followed. Even during periods of relative peacetime, healthcare delivery was limited. Ministry of Health (MOH) facilities were poorly staffed, lacked essential resources, and were mostly concentrated in urban areas (where healthcare professionals sought better pay and safer working conditions). Rural and conflict-prone areas were markedly underserved,

and the 2012 halt of community health worker training programs further exacerbated healthcare access and workforce shortages (Jones et al., 2015). Patients often traveled long distances under harsh conditions, only to find facilities understaffed or closed. Civil conflicts reignited in 2013, with intense violence further destabilizing the nation and destroying its fragile healthcare system (Jones et al., 2015).

The country relied heavily on humanitarian aid, as its decentralized healthcare system left service delivery to state and county-level ministries (Jones et al., 2015). This structure made coordination difficult, with challenges in procurement and supply chains adding to the obstacles faced by aid organizations. Ethnic discrimination also affected

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healthcare access, with some regions restricting both who could provide or receive care based on ethnicity. Despite the introduction of the District Health Information System II (DHIS) which improved coordination between healthcare system actors by standardizing data collection and aligning efforts between the government and NGOs, long-term external/foreign investments were hampered by mistrust between the government and international donors (Jones et al., 2015). International organizations such as the International Committee of Red Cross (ICRC) and Médecins San Frontières (MSF) and local NGOs have played a crucial role in supporting the provision of healthcare in South Sudan, providing and funding up to 70% of healthcare services in South Sudan by 2015 (Gianaris et al., 2021). By 2016, two-thirds of South Sudan's population depended on humanitarian aid (Schots et al., 2022) and, in 2023 alone, the US contributed over \$600 million in aid (USAID, 2024).

With over 1.4 million internally displaced persons (IDPs) by 2015, the healthcare system struggled to meet the needs of displaced communities and refugee camps (Jones et al., 2015). As of 2020, there were about 2.2 million refugees and 1.5 million internally displaced persons (Gianaris et al., 2021). In South Sudan, as of 2011, there was one physician per 65,000 individuals and one midwife per 40,000 individuals (Gianaris et al., 2021). Moreover, care delivery is often hampered by natural disasters. As an example, the Sudd wetland floods extensively during the rainy season rendering roads inaccessible and forcing some patients to travel days on foot for services (Gianaris et al., 2021).

In 2020, local government leadership was dissolved to unify leadership (Kirk et al., 2021). The advent of COVID-19 in the same year further strained this fragile system. Despite efforts by the MOH and WHO to carry out public health campaigns in South Sudan early on, government-imposed curfews and restrictions severely limited humanitarian operations, forcing many organizations to withdraw staff (Kirk et al., 2021). When the COVID-19 pandemic occurred, there was already a notable lack of trust between South Sudan's government and the international community; international organizations/donors were often hesitant to support more long-term investments in South Sudan's healthcare due to uncertainty related to armed conflicts (Jones et al., 2015). As with other nations, the pandemic compounded the challenges faced by South Sudan— in this case, a fractured healthcare system, ongoing conflict, and a heavy reliance on external aid.

2 Methods

2.1 Determinants of Readiness

As of March 10, 2023, there were 18,368 reported cases of COVID-19 and 138 associated deaths in South Sudan (JHU, 2023). This case study focuses on how South Sudan responded to the pandemic, using the World Health Organization (WHO) Health Emergency and Disaster Risk Management (H-EDRM) Framework. Of the ten components, three that relate specifically to healthcare delivery aspects of the COVID-19 response were examined: (iii) human resources; (vii) health infrastructure and logistics; and (viii) health and related services (WHO, 2019).

2.2 Research Questions

To refine the inquiry/search process, the following questions were developed and researched: (1) What difficulties and challenges did South Sudan experience during COVID-19 concerning human resources, health service delivery, and logistics? (2) How did South Sudan respond to these challenges? (3) What did South Sudan learn from the COVID-19 pandemic to prepare for future responses in terms of human resources, health service delivery, and logistics? (4) What influence have these challenges and responses had on the present system and post-coronavirus H-EDRM system concerning human resources, health service delivery, and logistics? These questions were intended to explore the real-world challenges faced at the national level in addressing COVID-19. Crucial aspects of healthcare delivery are emphasized, aiming to gain insights and identify necessary adaptations for future crisis/ pandemic response (Chen et al., 2022).

2.3 Search Strategy

Information was gathered from publicly available data encompassing the period from March 2020, when WHO declared COVID-19 a pandemic, to March 2023. Official sources included reports, press releases, and policy briefs from the South Sudan Ministry of Health (MOH), WHO, and the US Centers for Disease Control and Prevention (CDC). Search terms included “COVID-19”, “South Sudan”, and “response”. Documents publicly released by the South Sudan MOH on their response guidelines and standard operating procedures (SOPs) were reviewed. These SOPs addressed key areas such as case management, point of entry, risk communication and community engagement, epidemiology and surveillance, logistics, and infection prevention and control/wash. The COVID-19 infection and vaccination data were obtained from the Johns Hopkins University Coronavirus Resource Center and Google COVID-19 Open Data.

An informal literature review of peer-reviewed journal articles was conducted using PubMed and Google Scholar. Search terms included “challenges” and “response” in combination with “South Sudan”, “COVID-19”, “human resources”, “health service delivery”, and “logistics”. Inclusion criteria focused on peer-reviewed articles in English on COVID-19 with relevance to South Sudan published between 2019 and 2024. For insights into the effectiveness of South Sudan MOH response, additional information was drawn from reports by non-governmental organizations (NGOs), communications from a correspondent in South Sudan, and news articles from reputable media outlets. These sources provided timely perspectives on the impact of COVID-19 on South Sudan health systems and emergency response efforts.

The compiled data was used to address questions related to health emergency and disaster risk management in South Sudan. Identified challenges and associated responses or management strategies were synthesized and categorized into three major groups: “health service delivery”, “community rapport”, and “logistics”.

3 Results

3.1 Health Service Delivery

Shortage of Workers

Before the COVID-19 pandemic, South Sudan had already faced limited healthcare access and a severe shortage of healthcare professionals due to civil conflict/unrest, lack of incentive (pension, pay), geographic preferences (i.e. urban over rural), and a lack of educational and training opportunities for healthcare workers (Jones et al., 2015). Various external organizations have worked to remedy some of these gaps, yet in 2019, the MSF reported that still less than half of South Sudan's population had access to adequate medical services (MSF, 2019). COVID-19 further strained a healthcare system already tested by conflict, crises, and other infectious disease outbreaks. Shortages of not just healthcare providers but also laboratory technicians (Kunjok and Zingbondo, 2020) and other essential medical staff were felt almost immediately.

To navigate the pandemic with a limited workforce, the South Sudan MOH developed a Case Management Strategy that aimed to distribute burden and optimize how COVID-19 was managed. In brief, the Strategy emphasized home-based isolation for most COVID-19 cases—which were predicted to be only 'mild or moderate' in severity—such that the limited capacity of hospitals and other facilities was not overwhelmed (MOH, 2020b, 2020c). The MOH also offered recommendations on: (i) redistribution of healthcare workers; (ii) using trained community healthcare workers to check on patients isolating at home and (iii) designating COVID-19 wards for proper management of patients in healthcare facilities (MOH, 2020b). In addition to distributing loads on HCWs, these aimed to ensure that internally displaced population camps (IDCs) had healthcare workers available to them (Wamala et al., 2022).

Home-based isolation for mild illnesses in the absence of comorbidities relieved the exhaustion of space, human resources, and medical resources (MOH, 2020b, 2020d) and training community healthcare workers to manage home-based isolations would significantly reduce the workload of hospitals and clinics during future outbreaks. Developing trained cadres to provide targeted assistance during an outbreak and investing in medical laboratory equipment, healthcare facilities, and staff across the country are urgently needed. Implementation of improved laboratory logistics for quick and efficient testing while enabling management of any concurrent outbreaks is needed for future public health emergencies.

Disparities in healthcare access in isolated areas and those prone to civil unrest also need to be addressed, together with implementation of strategies that ensure continued healthcare provision to IDC camps during times of crisis. While greater assurances of safety and benefits or incentives to individuals who work in such locations would offer a step in the right direction, access to care is without a doubt an infinitely more complicated issue. In 2017, only 28.6% of the population were found to be within 5 km of a public health curative service (Macharia et al., 2017), and remedying this

requires substantial investment in infrastructure and resources.

Overall, no matter whether the context is civil war or a global pandemic, one of the most pressing matters is augmenting the HCW workforce. To do so, there must be appropriate incentives, greater assurances of safety and support, robust educational and training opportunities and more effective distribution of HCWs across the country. Each of these steps requires greater investment at an administrative/government level to ramp up community healthcare worker (CHW) training such that remote communities are served. Increasing the regular HCW workforce would also avail more individuals to be assigned to facilities that require trained staff, serving in critical roles when more technology or specialized care efforts are required. Finally, any lasting, durable recovery or reconstruction of the healthcare system in South Sudan will only be achieved in the context of peace and stability.

New Care Guidelines

In addition to an already reduced capacity, flooding and other infectious disease outbreaks occurring during the pandemic further complicated management of COVID-19 (Wamala et al., 2022). The country's concentration of resources in urban areas compounded these problems, resulting in limited access to COVID and non-COVID care for vulnerable populations and internally displaced populations (IDP) (Wamala et al., 2022), as well as rural/non-urban populations in general.

Prior to COVID-19, guidelines such as the MOH Basic Package of Health Services (BPHS, that detailed interventions that should be available for primary healthcare) was seen as valuable in providing a workable framework and objective for HCWs (Jones et al., 2015). To address the wide array of challenges plaguing the country's healthcare system, the South Sudan MOH created a variety of additional Standard Operating Procedures (SOPs), such as for Triage and Infection Prevention Control (IPC), to standardize/streamline all care efforts across the country. The new SOPs outlined numerous healthcare guidelines that focused on infectious disease practices, but also called for provision of more well-rounded care auxiliary items such as nutritional support in support of primary care efforts (MOH, 2020f, 2020g). New IPC committees were established in each county and focal IPC personnel in each healthcare facility, and specific guidelines were created for community and camp-like settings (MOH, 2020g), as well.

Being heavily dependent on external funding, South Sudan had to make various adaptations. One change shifted testing all contacts of a positive case to testing only symptomatic contacts and those with increased risk factors. When borders opened, there was also a move from testing suspected domestic cases to increasing travel screening tests for asymptomatic individuals without known exposure which likely resulted in underestimation of the actual number of positive cases (Majer et al., 2022; Shragai et al., 2021) and fewer resources for local testing.

Resource constraints aside, the MOH also released numerous guidelines and training that instructed healthcare

workers to teach the community about disease transmission and prevention measures such as proper hand washing, social distancing, etc. (MOH, 2020f, 2020g), to increase efficiency/decrease burden on healthcare resources, and overall aimed to reduce transmission of COVID-19. Regular assessment of healthcare facilities for disaster and public health preparedness effectiveness is needed. The COVID-19 Triage, Screen-Isolate-Notify, and IPC SOPs could all be employed for efficient management of ill patients in future outbreaks (MOH, 2020f).

Limit of International Aid

As previously highlighted, a major component of health service delivery in South Sudan is international aid. However, despite the challenges posed by the pandemic and need for capacity building, donors are often inclined to support temporary humanitarian efforts in lieu of long-term investment and programs due to instability within the nation (Jones et al., 2015). In the face of frequently renewed conflict and deliberate targeting of healthcare facilities, donors are not incentivized to focus on long-term problems or invest in South Sudan's healthcare system. On the healthcare front, reliance on international aid in South Sudan is likely to continue for the foreseeable future.

3.2 Community Rapport

Trust and Community Engagement

With respect to COVID-19 testing, South Sudan encountered significant challenges. General mistrust of authority and a perception of low risk were persistent across communities with or without adequate access to healthcare, affecting the testing and vaccination rates (Kirk et al., 2021; Majer et al., 2022; Udoh, 2022). This, compounded with limited testing capacity in South Sudan due to a shortage of trained laboratory technicians and resources, stymied effective testing.

Stigmatization of COVID-19 also played a large role in discouraging people from reporting illness and/or getting tested (Majer et al., 2022). The South Sudan MOH responded by implementing surveillance measures to improve the accuracy of COVID-19 transmission data and infection control. New community-based surveillance training on infectious diseases such as COVID-19 and Ebola virus disease (EVD) was provided for public health workers and volunteers (MOH, 2020e), and the MOH also created a "Training of Trainers (ToT) Guide on Community-Based Disease Surveillance" to use in the five-day training of staff and volunteers to carry out more widespread surveillance. Together, these guides instructed trainees on how to detect and report diseases in a larger, integrated nationwide disease surveillance context (MOH, 2020e), and enabled the training of new members in remote areas.

In addition, the South Sudan MOH also created a Risk Communication and Community Engagement (RCCE) program as part of its Infection Prevention and Control (IPC) SOP (MOH, 2020h). The goal of RCCE was to combat misinformation about COVID-19 and vaccines, improve vaccination rates, promote adherence to preventive measures,

and foster awareness and reporting of signs and symptoms (via surveillance and contact tracing) (MOH, 2020i, 2021). RCCE also ensured that appropriate and accurate information was made available in different languages—including languages spoken by refugees—and engaged with vulnerable populations (MOH, 2020i).

To further promote adherence to MOH guidance, it was often necessary to also involve community figures. For example, in Jonglei, healthcare actors tasked local chiefs with communicating knowledge about the virus and promoting health literacy (Kirk et al., 2021). Their presence was essential in these efforts, as COVID-19 quickly became associated with foreigners and UN workers. It was referred to as the 'Kawajas [white people] virus' or 'town people virus' (Kirk et al., 2021), engendering significant mistrust of HCWs. Efforts to regain trust through more formal or thorough training of HCWs alone seemed insufficient. In situations where vaccine hesitancy was widespread, the prompt return of unused vaccines before expiration appeared necessary to prevent vaccine waste.

As with any public health efforts, the role of the community is crucial. As evidenced across the world and particularly here in communities across South Sudan, education is an essential element for preventing or reducing stigmatization of ill individuals. Good communication strategies and modes of communication and outreach are key to gaining the trust of people. In this regard, the novel RCCE was beneficial, reaching over 3 million people by May 2020 (MOH, 2022) and appears promising for future health crises.

Vaccination Efforts

Despite such extensive efforts in community outreach, South Sudan did not meet its COVID-19 vaccination goals. As of March 10, 2023 only 27.9% of the population had received at least one dose of the COVID-19 vaccine (JHU, 2023), falling short of the MOH's target of 40% (Malak, 2021). This was also quite low relative to other countries in Africa such as South Africa and Nigeria, and the United States. When compared with the Democratic Republic of the Congo (DRC), which has a similarly conflict-affected healthcare system, South Sudan did have a modestly higher vaccination rate.

Free COVID-19 vaccines were supplied to South Sudan, the Democratic Republic of Congo, and Nigeria by the COVID-19 Vaccine Global Access (COVAX) program, but low vaccination rates often resulted in vaccines being returned because they would not have been administered before the expiration date (Udoh, 2022). For similar reasons as South Sudan, the DRC also had to ship COVID-19 vaccines to other African countries ahead of their expiration.

In South Sudan, in contrast to the DRC, Nigeria, South Africa and the United States, there were no major differences among those who received at least one dose of the vaccine and those who were fully vaccinated. This suggests that, despite low overall vaccination rates, those who received at least one COVID-19 vaccine dose in South Sudan were more likely to return for the complete vaccination. Of note, South Sudan faces ongoing challenges in improving

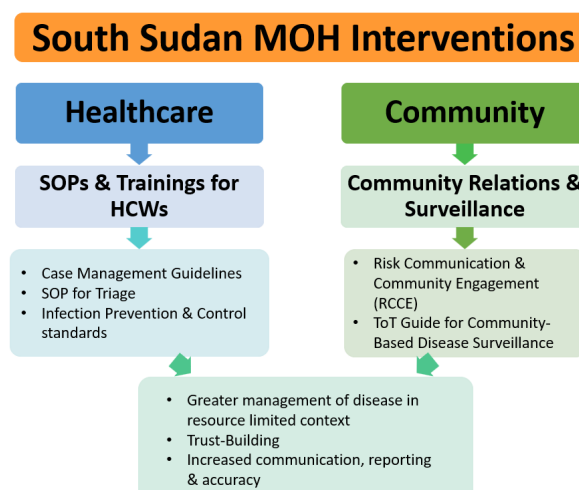


Fig. 1. Summary of MOH interventions.

vaccination rates for other diseases such as cholera (Udoh, 2022), with the low vaccination rate likely explained by similar trends: stigma, low risk perception, mistrust, and barriers to access.

3.3 Logistics

Transportation and Security Challenges

Given the complex travel and safety conditions in South Sudan that were characterized by armed conflict, crime, and adverse weather, another important area to be addressed during the pandemic was logistics. The South Sudan MOH partnered with the WHO's Operational Support and Logistics program and WFP's Logistics Cluster to create a comprehensive SOP for Logistics (MOH, 2020a). This outlined a vast array of WFP-led arrangements made to enhance logistics efforts during the COVID response, detailing satellite phones, websites (such as the Logistics Cluster with maps and other resources), convoy services, emergency air transportation, formation of task forces, and fast-tracking of COVID-19 supplies (Fig. 1).

Still, the regions most affected by armed conflict, flooding, and food shortages continued to suffer from poor healthcare provision. In these areas, it proved both difficult and dangerous for HCWs to deliver services, so they often resorted to mobile outreaches and 'hit-and-run' modalities (Atwongyeire et al., 2024). The 'hit-and-run' approach involved rapid deployments of vaccination teams to mobilize communities before retreating to safer areas. This was especially important in the states of Unity, Lakes, Upper Nile, and Jonglei due to frequent occurrences of civil conflict, cattle rustling, 'revenge killing,' and inaccessibility due to flooding (Atwongyeire et al., 2024).

The importance of efforts in logistics and transportation cannot be understated in South Sudan; efficient transport of PPE, laboratory samples and resources, and vaccines are essential to combating health emergencies. When ground transportation is unavailable, air transport increases the costs of healthcare delivery. The management of COVID-19 in South Sudan showed the promise of interdisciplinary efforts, calling on international organizations (e.g. WHO,

WFP) to fill in gaps. Without such partnerships, delays, or inability to deliver medical and laboratory resources can drastically impact patient outcomes.

Other infrastructure such as roads and security play critical roles in healthcare logistics. Plans to deal with numerous transportation barriers (such as outlined in the logistics SOP) are important considerations that also shape outcomes. Nationwide roadbuilding, peacekeeping efforts, and greater investment in infrastructure to support healthcare would be welcomed.

Facility Capacity Efforts

To reduce burden on limited healthcare resources at the facility level, the Case Management Discharge Criteria Guideline was updated to address prolonged isolation in healthcare facilities due to limited space/beds/resources and laboratory testing capability (MOH, 2020d). In centers facing laboratory backlogs, patients were discharged (home-based isolation) from isolation centers after 10-13 days depending on the severity of their symptoms, rather than relying on a negative PCR result (although a negative PCR test result was recommended in isolation centers where testing was available) (MOH, 2020d). Efforts such as this went hand in hand with the assortment of other SOPs and guidelines, freeing up capacity for patients with more emergent illness and/or groups that required urgent testing. Additionally, a patient follow-up system and greater education to prevent reinfection was installed (Fig. 2).

3.4 Limitations

Several limitations may have influenced the comprehensiveness of these findings. Sources were restricted to English language peer-reviewed articles and official reports. Limited research data and statistics specific to South Sudan were available compared to higher income countries. Inclusion of non-English language sources may have potentially provided a broader cultural and global context, highlighting shared challenges across the region.

Additionally, there was limited objective evaluation of the proposed solutions and management strategies imple-

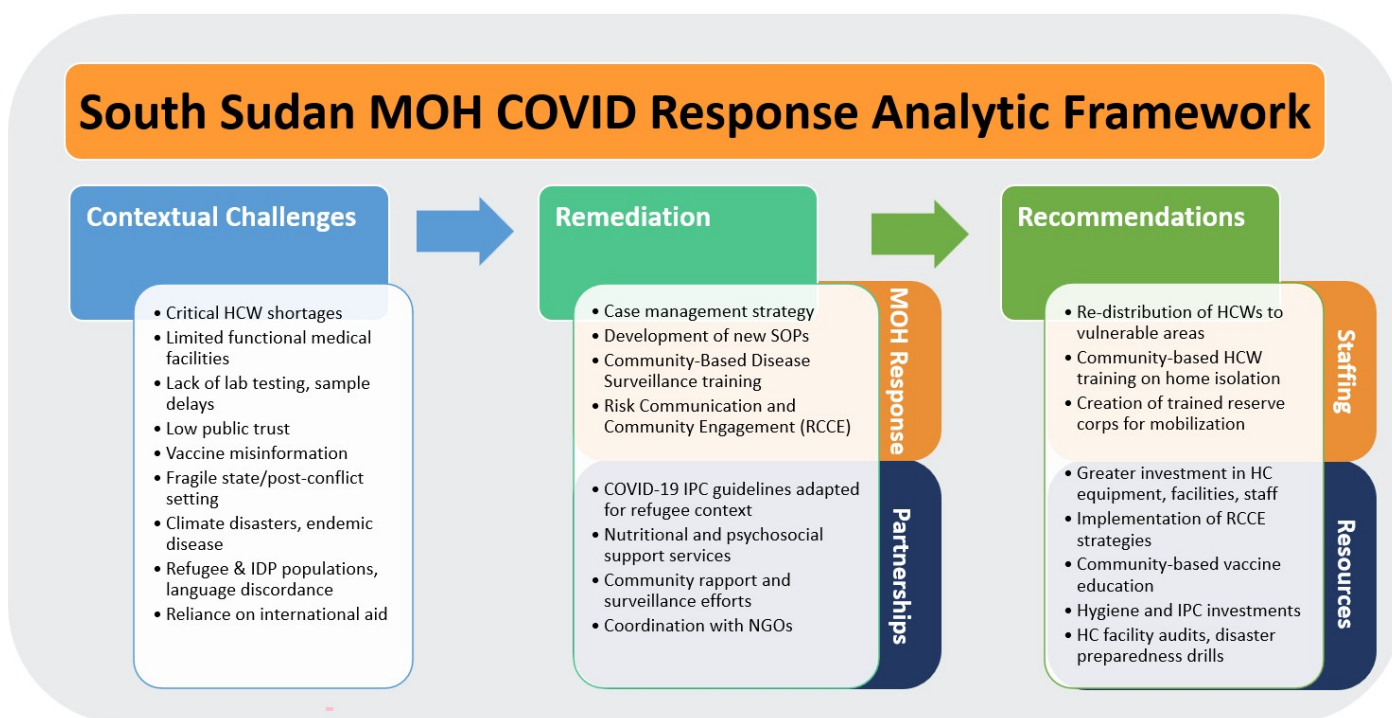


Fig. 2. Analytic framework describing South Sudan's COVID-19 response.

mented during the pandemic. While extensive interviews with local sources were beyond the scope of this study, important insights from those working during the pandemic in South Sudan on response and vaccine distribution were obtained. Firsthand accounts added to contextual understanding of policies implemented by the MOH.

4 Conclusions

Although the COVID-19 pandemic presented many challenges for countries like South Sudan, the response prompted the development of important frameworks and tools that could be used to manage future crises more efficiently. Though South Sudan faced disadvantages in comparison to more developed countries and those without conflict, its MOH was still able to quickly implement novel strategies to manage COVID-19.

Nevertheless, healthcare in South Sudan warrants greater attention and investment. The current degree of influence and dependence on international humanitarian resources cannot be overstated and must move toward greater self-reliance. A particular area of urgent need is expanding the number of healthcare workers and critical medical/ laboratory resources. Furthermore, targeted interventions in the broader domains of education, communication, and healthcare delivery are needed. Lasting impact of the changes implemented, and programs established during the COVID-19 pandemic should be thoroughly assessed. Such assessments will help provide valuable insights into the sustainability and effectiveness of these interventions in addressing ongoing healthcare challenges in South Sudan. These findings highlight the importance of constructing adaptive and resilient healthcare systems in South Sudan that can navigate today's ever-changing global health environment.

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Conflict of Interest

The authors declare no conflict of interest.

CRedit statement

FO: Study design, data collection, analysis and interpretation of data and drafting the manuscript. **ASH:** Analysis and interpretation of data and drafting the manuscript. **KG:** Interpretation of data and critical revision of the manuscript. **JA:** Interpretation of data and critical revision of the manuscript. **RS:** Critical revision of the manuscript. **EBH:** Interpretation of data and critical revision of the manuscript.

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