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Health Emergencies in sub-Saharan Africa: Response, Challenges, and Strategies for the Future

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ABSTRACT

Health emergencies pose significant threats to countries all over the world. They arise from various hazards, such as infectious disease outbreaks, natural disasters, food contamination, humanitarian crises, and threats associated with climate change and deforestation. Risk factors for these emergencies include poverty, social determinants, weak health system infrastructure, and poor health financing. Sub-Saharan Africa has experienced numerous health emergencies over the last few decades. Events like the Ebola outbreaks and the COVID-19 pandemic resulted in large-scale health emergencies, suffering, significant social, economic, and political disruption. These events also tested the resilience, preparedness, and capabilities of sub-Saharan Africa countries to respond to health emergencies. To better handle future health emergencies, countries in sub-Saharan Africa need to be prepared, learn from previous emergencies they have experienced, and put in place strategies to respond rapidly and effectively to risks, in order to preserve life and their economies. This paper discusses two health emergencies that have occurred in sub-Saharan Africa, their risk factors, strategies employed to address them, challenges experienced, lessons learned, and strategies to handle future health emergencies in the region.

Keywords: Health emergencies, sub-Saharan Africa, Ebola, COVID-19, emergency response.

Introduction

Health emergencies are situations that pose a significant threat to public and global health. They can affect many countries simultaneously and may be caused by an increasing range of hazards including infectious disease outbreaks, natural disasters, chemical and radio nuclear incidents, food contamination, humanitarian crises, and threats associated with climate change including extreme weather events and deforestation. Risk factors for these emergencies include poverty, social determinants, weak health system infrastructure, and poor health financing.

Since 2011, 188 countries have experienced over 1200 disease outbreaks[1] including Ebola Virus Disease (EVD), cholera, human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS), and most recently, the corona virus disease of 2019 (COVID-19). These outbreaks resulted in large-scale health emergencies, suffering, and death among disproportionately poor and vulnerable populations. They also caused significant social, economic, and political disruption[1]. While most of the health emergencies that have occurred in the twenty-first century have wreaked havoc, the COVID-19 pandemic has been the worst to date[2].

The emergence of the COVID-19 pandemic tested the resilience, preparedness, and response capabilities of nations worldwide including those in sub-Saharan Africa (SSA). As countries grappled with rapidly escalating cases, diverse strategies to manage the pandemic were developed and utilized, some more successfully than others. With their robust health infrastructure and substantial financial resources, developed countries were projected to have low disease incidence and to be able to manage the pandemic more effectively than developing countries[3]. However, contrary to popular predictions, COVID-19 cases and mortality rates were lower in SSA than in Asia, Europe, and the Americas[4]. Various reasons proffered to explain lower cases and mortality rates include the fact that SSA countries have a relatively younger population (70% under the age of 30), contributing to lower disease incidence[4], have smaller populations, and the fact that the numbers of COVID-19 reported cases and mortalities may not have been accurate, due to weak surveillance systems in the region[4]. Regardless of the reasons, it must be noted that COVID-19 claimed many lives in SSA. In addition to COVID-19, the several outbreaks of EVD in certain parts of SSA also caused health emergencies that in some instances, were even more deadly than COVID-19. While EVD was later contained and COVID-19 cases were lower in SSA compared to certain parts of the world, it does not mean that countries in this region are ready to handle future health emergencies. Risk factors including the environment, climate change, social determinants, poor health system infrastructure and governance, as well as limited health financing, increase vulnerability and exposure of populations in SSA to health emergency threats. To better handle future health emergencies, countries in SSA need to be prepared, learn from previous emergencies they have experienced, and put in place strategies to respond rapidly and effectively to risks, in order to preserve life and their economies. This paper discusses two health emergencies that have occurred in SSA, their risk factors, strategies employed to address them, challenges experienced, lessons learned, and strategies to handle future health emergencies in the region.

Global Health Emergencies in sub-Saharan Africa

EBOLA VIRUS DISEASE (EVD)

Ebola Virus Disease is one of the severe and most deadly re-emerging infectious diseases in SSA. It is a zoonotic disease transmitted to humans from animal reservoirs or through direct human contact with contaminated body fluids. First emerging in the Democratic Republic of Congo (DRC) in 1976, EVD is now prevalent in 20 SSA countries including Gabon, Guinea, Liberia, Nigeria, the Ivory Coast, Senegal, Uganda, Zaire, and Sudan.[5] Since 2000, Central Africa has suffered 28 large outbreaks, with Uganda experiencing seven, including the most

recently declared one in September 2022[6]. Between 2014 and 2016, three western SSA countries, Guinea, Liberia and Sierra Leone, experienced one of the most notable EVD epidemics, which created a public health emergency of international concern. By the time the epidemic was brought under control, it had claimed the lives of about 11, 300 people[5].

COVID-19

In December 2019, a cluster of pneumonia-like infections identified by Chinese authorities in Wuhan Province in China were reported to the WHO[7]. In January 2020, after virus isolation and analysis, the pneumonia-like infection was identified as SARS-CoV-2 and subsequently named COVID-19 by the WHO[7,8]. The COVID-19 pandemic posed a new and formidable challenge to health and economic activity in SSA[7]. Although SSA was initially reported to have lower cases and deaths compared to other parts of the world, the region faced scarring effects from the pandemic. As of November 2022, there were about 12.7 million confirmed COVID-19 cases in SSA, representing about 2% of the global infection[9]. During that period, South Africa was the most affected country in SSA with over 4 million cases, followed by Ethiopia (494,270 cases), Kenya (340, 784 cases), Zambia (333, 685 cases), Botswana (326, 344 cases), and Nigeria (266,242 cases)[9]. By May 2, 2023, COVID-19 had spread to almost every country in the world and claimed the lives of over 6.86 million people. Countries like Liberia, Sierra Leone, and Guinea, which were still recovering from the Ebola crisis, found their nascent health systems under immense pressure during the pandemic[10].

Health Emergency Risk Factors in SSA

Countries in SSA have experienced health emergencies including EVD and most recently, the COVID-19 pandemic. Risk factors for these emergencies include climate, environmental and social factors, poor health systems infrastructure (characterized by health workforce shortages, inadequate health care facilities equipped with limited intensive care units, essential medicines, and technology), as well as limited financing capacity[11].

ENVIRONMENTAL FACTORS AND CLIMATE CHANGE

Sub-Saharan Africa has been described as a "climate-vulnerable" region with rainfall variability, hydrological extremes, and anthropogenic climate change that causes great harm to its population[12,6]. In addition to creating breeding grounds for animals and pathogens that transmit disease[13], climate variability in SSA has also been linked to an increase in the animal reservoir population[14]. Per existing literature, EVD transmission in SSA is more likely to occur at the end of the wet season when animals such as bats and primates, the natural reservoirs of the virus, gather to access limited water sources and food[15,6]. This convergence increases the chances of animals transmitting the Ebola virus among themselves and to humans they encounter[15,6].

SOCIAL DETERMINANTS

Social determinants of health are the conditions in which people are born, live, grow, work, play, and age. They include income and social protection, socio-economic status, environmental factors, and culture[1]. A substantial proportion of people in SSA live below the poverty line and as a result, are economically and socially disadvantaged, and bear a disproportionate burden of disease than their better-off-counterparts in developed countries. According to the WHO,[1] because millions of people in SSA live in extreme poverty, deprivation, and degraded environments, they are easily exposed to significant health threats. The poor economic status of people in Guinea, Liberia, and Sierra Leone, contributed to their vulnerability to EVD.

Culture as a social determinant of health influences health behavior and health outcomes. According to medical anthropologists, funeral and burial practices amplified the 2014-2016 EDV outbreak in Guinea, Liberia, and Sierra Leone[16]. Data collected by the Guinea Ministry of Health and the government of Sierra Leone showed that 60% and 80% of new EVD cases respectively, were due to traditional burial and funeral practices.[16] In Liberia and Sierra

Leone, some mourners are said to have bathed in water used to wash corpses, aiding with the transmission of the virus. Apprentices to socially prominent members of secret societies are also reported to have slept in close quarters with infectious corpses for several nights, believing that doing so would ensure the transfer of powers to them from their "masters"[16]. The belief in helping one another also contributed to the spread of EVD in SSA. Some doctors and health care providers became infected with EVD when out of compassion and a communal spirit, they rushed, unprotected to aid patients who had collapsed in waiting rooms or in places outside a hospital[16].

HEALTH SYSTEM INFRASTRUCTURE

The goal of health systems everywhere is to promote, restore, and maintain the health of the populations they serve[17]. However, due to subpar health systems, about 400 million people globally lack access to healthcare[18]. Effective health systems are characterized by a well-trained and motivated health workforce, properly maintained infrastructure, reliable supply of medicines and technologies, adequate funding, strong health plans, evidence-based policies, and the capacity to control and address global and public health threats such as epidemics and pandemics. Unfortunately, this is not the situation in the majority of SSA countries. Health systems in SSA generally suffer from neglect and underfunding[19]. While the rapid detection and response to health threats through the utilization of real-time surveillance systems and well-equipped laboratories are crucial to saving lives and reducing negative health outcomes during health emergencies[1], many countries in SSA still rely on paper-based surveillance reporting and utilize laboratory information management system software that are obsolete[20]. Although a robust health workforce is necessary to protect communities and to help populations stay healthy physically and mentally, the health workforce in SSA is far from adequate, with numbers reflecting 60% below the United Nation's recommended minimum threshold. Available intensive care unit (ICU) beds per capita in SSA is very low (1%-5%) compared to what exists in Europe and East Asia.[21] Chronic financial barriers, and ineffective national health insurance systems have left most patients in SSA with high out-of-pocket expenditures, leading to inequitable access to medical technologies, medication, and quality health care[21].

A common denominator of the 2014 EVD epidemic in Guinea, Liberia, and Sierra Leone was the fact that the three countries had weak health systems[5], which contributed to the uncontrolled transmission of the virus[22], and the slow detection and response to cases. According to the US Centers for Disease Control and Prevention (CDC), the health system at Port Loko in Sierra Leone lacked sufficient health care workers across all levels[23]. In Liberia, about 57% of the country's health facilities lacked personal protective equipment (PPE) and protocols for the isolation of persons suspected to have EVD, and about 24% of the facilities also lacked access to running water[24]. In the DRC, the country's health system was "on life support" as it lacked medical supplies, equipment, funds, clean water, and adequate sanitation facilities to handle EVD outbreaks[25].

HEALTH FINANCING

The ability of governments to finance health systems is essential to the delivery of health services in times of normalcy and during health emergencies.[26] While some countries have made it a point to routinely set aside funds from their national budget for the financing of health systems in the event of a health emergency, most countries in SSA do not do this, either because of lack of fiscal capital or foresight. Where emergency funds are available in SSA, there usually are issues with how they should be allocated, and managed.[27] Sierra Leone, Liberia, and the DRC are among countries in SSA with the lowest investments in health care infrastructure. With under resourced and understaffed hospitals and health centers, these countries were unable to rapidly detect, respond to, and halt EVD outbreaks[24].

Health Emergency Response

EBOLA

Collaboration and assistance from the US CDC and other partners helped Guinea respond to the 2014 Ebola outbreak. When the epidemic first occurred, the ability to test for EVD in Guinea was limited and took up to seven days to confirm a diagnosis. With CDC assistance, Guinea was able to improve upon its testing capability, train laboratory staff, and temporarily boost its health workforce capacity[28]. Guinea was also able to activate a make-shift emergency operations center (EOC) network (Table 1).

With support from the US CDC, the WHO, and other partners, the Liberia MOSW was able to set up an ad hoc Ebola incident management system for case management, engage in contact tracing, promote safe burials, and educate communities about the outbreak (Table 1)[24]. The Liberia MOSW was also able to improve upon case reporting in the 15 counties using WHO case definitions, case investigation forms, mobile phones, texting, and email messaging[24]. With support from the US National Institutes of Health and the US Army Medical Research Institute of Infectious Diseases, a laboratory at the Liberia Institute for Biomedical Research was able to conduct Ebola testing[29] (Table 1). With only two Ebola treatment Units (ETU) in Liberia with a total capacity of 40 beds which allowed only a few patients to be admitted at a time, Médecins Sans Frontières (MSF) stepped in and provided a 400 bed ETU (Table 1)[24]. Irrespective of the collaborations and financial and physical assistance received, maintaining an adequate health workforce, case data entry, obtaining accurate surveillance data, and the rapid transportation of specimens from remote to urban areas remained a challenge[24].

During the 2014 Ebola outbreak, the government of Sierra Leone engaged in social mobilization, and used radio as a medium to communicate with the public about the outbreak[30]. Social mobilization efforts evolved from one-way communication[31] to multi-pronged communication that included over 6000 religious leaders that assisted in the promotion of safe burials and about 2500 community mobilizers who facilitated the implementation of community-led action plans (Table 1)[32]. When vaccines became available, the government of Sierra Leone distributed them to frontline health workers and to people living in border communities (Table 1)[33].

Table 1 Sub-Saharan African Country Response to Ebola (2014-2016)

Country	Response
Guinea	• Activated national and district emergency management committees, deployed multidisciplinary teams for case management, and contact tracing • Improved surveillance systems to enable rapid detection and response • Deployed vaccines to at risk populations • Made efforts to create awareness about Ebola • Improved laboratory capacity to confirm cases quickly (from 7 days to one day) • Introduced screening measures at airports and borders • Isolated and treated confirmed cases • Promoted safe burials
Liberia	• Set up an incident management system • Established emergency operations centers • Promoted community engagement • Educated communities • Enhanced epidemic-prone disease surveillance • Developed laboratory diagnosis and reporting • Promoted patient isolation • Trained health workforce in infection prevention and control (IPC) • Promoted safe burials
Sierra Leone	• Conducted isolation of identified cases • Developed measures to prevent health facility disease transmission • Mobilized and provided community education on Ebola • Rolled out preventive vaccine • Implemented community engagement to modify care practices and hygiene to reduce transmission

COVID-19

Coordination, planning, financing and monitoring, risk communication and community engagement (RCCE), surveillance and outbreak investigation, infection prevention and control (IPC), operational support, coordination and supply chains, and the strengthening of essential health services and systems were central to the management of the COVID-19 pandemic in SSA (Table 2). Most countries activated a joint national COVID-19 task force comprising high-level multi-agency and ministerial officials to coordinate response[34]. This was the case in Botswana, Eritrea, Ghana, Guinea-Bissau, Kenya, Liberia, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sierra Leone, South Sudan, Uganda, Tanzania, Zambia, and Zimbabwe[34]. In each of these countries, a public health emergency operations center (PHEOC) was activated to coordinate daily COVID-19 response activities, and to develop a costed National COVID-19 Response Plan with technical support from WHO (Table 2)[34].

Table 2 Sub-Saharan African Country Response to COVID-19 (2020-2022)

Country	Country Response
	Coordination, Planning, Financing and Monitoring
Ghana	• Created package for vulnerable persons affected by COVID-19 in the Ashanti and Greater Accra regions
Kenya	• Provided 10% tax relief for individuals and corporates entities
Lesotho & Nigeria	• Established national and regional Public Health Emergency Operations Centers (PHEOCs)
Botswana	• Public health specialists were deployed to the sub-national units to coordinate response activities
Kenya	• Trained sub-national teams and supported the formation of the sub-national PHEOCs
Mauritius	• Launched online platform to order supplies and home delivery
South Africa	• Allocated about 400 million Rands for the Social Relief of Distress (SRD) grant to vulnerable households
Sierra Leone	• Implemented Quick Action Economic Response Program (QAERP) to moderate shocks associated with COVID-19
	Risk Communication and Community Engagement (RCCE)
Benin	• Implemented awareness campaigns in high-traffic areas using health brigades • Developed communication and social mobilization strategy for the introduction of COVID-19 vaccine
Chad	• Deployed community relays to promote community messaging
Central African Republic	• Trained 600 social protection agents to conduct door-to-door COVID-19 sensitization
Ghana	• Utilized gatekeepers, such as Queen mothers (women leaders selected from the royal family of each town/village with socio-political influence) and businessmen, to promote prevention and control mechanisms • Ghana Health Services utilized Ghana Premier and Division One Soccer Leagues to share risk communication messaging on COVID-19 during matches
Rwanda	• National Police used drones to spread awareness messages to remote and densely populated neighborhoods
South Sudan	• COVID-19 recorded messages were disseminated by Blue Bicycle Messengers each mounted with a megaphone, amplifier, battery, and USB drive
	Surveillance and Outbreak Investigation
Burundi, Congo, Malawi, & Nigeria	• Trained regional rapid response teams (RRTs)
Kenya	• Nairobi Metropolitan Services conducted contact tracing
Central African Republic	• Implemented community-based testing in hotspots
Gambia	• Utilized Tourism Security Unit patrol teams to enforce COVID-19 restrictions
Ghana & Malawi	• Conducted regional Training of Trainers (ToT) on integrated disease surveillance and response (IDSR 3) technical guidelines
Burundi, Togo, & Zambia	• Trained Districts health teams and health care workers on IDSR
Botswana	• Recruited surveillance officers and trained them in IDSR to support district response
	Infection Prevention and Control (IPC)
Nigeria &Tanzania	• Developed guidelines for personal protective equipment (PPE)
Seychelles	• Prioritized health work force safety through infection prevention and control • Developed 2021-2025 IPC Strategic Framework
	Operational Support, Logistics, and Supply Chains
Seychelles	• Developed tools to project required PPE
Liberia	• Equipped and reinforced national stock of drugs, medical equipment and PPE
Benin	• Activated Logistics Sub-Committee, which identified COVId-19 stock status and quantified COVID-19 needs for 6 months (June-Nov 2020)

Country	Country Response
Burundi	• Instituted emergency purchasing platform in 2020
South Sudan	• Finalized procurement plan of over 14 million PPE
	Strengthening Essential Health Services and Systems
Burundi	• Identified and adopted activities critical to ensure service continuity, and authorized a service continuity budget of USD 9,142,162
Eswatini	• Decentralized the provision of non-communicable disease services to primary health care facilities
Gabon	• Assessed impact of COVID-19 on the continuity of essential health services • Reviewed performance of the National Tuberculosis Control Program • Developed Tuberculosis National Strategic Plan 2021-2025
South Africa	• Launched National Action Plan for Health Security to strengthen national capacity to prevent, detect and respond to public health emergencies

WHO. Africa's response to the COVID-19 pandemic: A summary of country reports January 2020 to December 2021[34]

Some SSA countries reallocated their development budgets to the health sector to fund their COVID-19 prevention and control strategy. To supplement their budgets, close financial gaps in their COVID-19 response plan, purchase vaccines, and to economically support citizens due to lockdowns and the loss of income,[34] many SSA countries obtained financial support from the World Bank and other donors.

Health Emergency Response Challenges

EBOLA

During the 2014 Ebola epidemic, the lack of information technology (IT) resources made it difficult to establish effective surveillance systems and to coordinate assisting organization support to impacted country response[35]. Internet and cell phone services were inadequate, especially in rural areas. Power outages occurred frequently, and in-country IT expertise was limited[35]. Difficulties linking laboratory results with epidemiologic data exacerbated reporting delays and in some instances, caused sample testing and reporting to be delayed for a week or longer, hindering the use of test results for patient management[35]. The reluctance of some communities to report cases and to work with health workers, made it a challenge to track and contain the outbreak[35]. Owing to inadequate training, and limited access to PPE, many health workers contracted EVD, putting additional strain on an already limited health workforce[36]. The poor management of cross border movement facilitated disease transmission and complicated containment efforts. It was assistance from international organizations such as the CDC, WHO, and Médecins Sans Frontières that helped to contain the outbreak in Guinea, Liberia and Sierra Leone[35].

COVID-19

During the pandemic, there were challenges with adherence to COVID-19 prevention guidelines and protocols in many SSA countries. In Sierra Leone for example, there was inconsistent adherence to the wearing of face masks and social distancing[34]. In Kenya, social distancing was not observed during political events and in public transport and marketplaces, and in Uganda, there was complacency in observing COVID-19 protocols[34]. In Gambia, community testing was not sustained owing to inadequate funding to purchase testing reagents[34].

Due to lack of emergency funds, WHO and other united nations agencies such as the World Food Program (WFP), United Nations Development Program (UNDP) and UNICEF had to provide critical support to SSA countries[34]. They provided Guinea-Bissau and Zimbabwe with telephone and internet connectivity, transportation and fuel during the second quarter of 2020[34]. In Burkina Faso, Benin, DRC, Gabon, Lesotho, Madagascar, Nigeria, Tanzania, Togo, South Sudan, and Uganda, they provided sanitizers, face masks, and gloves. In addition to PPEs, Senegal was given 30 ventilators from the WHO office. Private organizations in SSA also contributed in diverse ways to the COVID-19 response[34]. The WHO AFRO office provided catalytic funding to several African countries including Ethiopia, Ghana, Liberia, and

Uganda to ensure the continued provision of essential health services during the pandemic[34].

Lessons Learned and Future Strategies

All countries are at risk for health emergency threats, however, their ability to detect and effectively respond to the threats is important and has implications for population health outcomes. Over the years, SSA has experienced health emergencies. The measures employed that worked, in addition to the challenges experienced, need to be considered, assessed, and used to inform strategies to handle future health emergencies.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

At the beginning of the COVID-19 pandemic, SSA countries experienced PPE shortages and consequently depended on UN agencies for assistance. As this was not a sustainable option[37], some SSA countries (The Central African Republic, Eswatini, Gambia, Ghana, Kenya, Nigeria, Rwanda and Uganda) that required the wearing of face masks in public places, began to manufacture their own face masks using locally available materials in the second and third quarters of 2020[34]. Ghana, for example, produced face masks at highly subsidized prices and made them available to 11th-grade students and teachers across the country. Other SSA countries also produced local alcohol-based hand sanitizers. By the first quarter of 2021, most SSA countries had created some type of PPEs, which they made readily available to the public at affordable prices[34]. This is an important lesson for the future. Since there is no rhyme to when a health emergency will occur, it is important for SSA governments to rely on themselves and to use the local resources they have, to produce and stockpile PPEs, so they will not have to rely on external parties in the event of an emergency.

HEALTH SYSTEMS INFRASTRUCTURE

At the heart of health emergency preparedness, detection, and response is a strong health system with an adequate and well-trained health work force[38]. However, this is a challenge in many SSA countries[39]. While some SSA countries were able to strengthen their health systems during the EVD outbreak and the COVID-19 pandemic, it was mostly on an ad hoc basis as they mostly relied on external assistance and support. It is important for the governments of SSA countries to prioritize and build effective and well-functioning health systems even in times of normalcy when there is no health threat. Casting their minds back to lessons learned from their handling of the 2014 EVD and COVID-19, they need to establish emergency operation centers, set up real-time surveillance systems, increase the number of beds in hospitals to guarantee the provision of necessary healthcare in both times of normalcy or health emergencies, and invest in human capital by recruiting, training, and empowering more healthcare workers[40]. SSA governments also need to ensure the equitable distribution of health care workers at all levels of care geographically (rural and urban) and to identify alternative means of health system financing besides depending on developed nations and UN agencies for assistance[40].

Preparing the health workforce in SSA for future health emergencies will require a paradigm shift including the utilization of a continuous multidimensional approach that engages the health workforce, policymakers, and planners in the conduct of health workforce workload analysis, and the estimation of health workforce staff strength.

PARTNERSHIPS

To be ready for future health emergencies, SSA countries need to form partnerships locally and with other countries in the region. They need to invest in and empower multi-sector stakeholders like government officials, technocrats, healthcare and public health workers, and expert advisers, to coordinate, implement and monitor the multiple facets of health emergency management. At the regional level, institutions such as the Africa CDC should be used to help coordinate disease surveillance, support local production of vaccines, therapeutics and diagnostics, and to provide rapid response during public health emergencies in SSA[40].

In July 2022, the World Bank approved a $100 million support program for the Africa CDC to help strengthen the institution's technical capacity and institutional framework to support African countries in preparing for, detecting, and responding to disease outbreaks and health emergencies.

EMERGENCY FINANCING

Setting aside funds for health emergencies will help to make funds more immediately available to finance unanticipated issues in times of need. Prior to the pandemic, many developed countries including the US already had policies in place that allowed their leaders to set aside and access emergency funds[27]. In South Africa, an existing Provincial Disaster Relief Grant (PDRG) which was activated in March 2020, allowed R466 million (about US$ 29 million to be channeled to provincial health departments to fund immediate health needs[41]. If South Africa was able to do this successfully, then leaders of other SSA countries need to learn from this example and put mechanisms in place so they too will have access to funds should a health emergency occur.

In addition to setting up emergency funds, SSA countries need to develop clear protocols on how to make disbursements less cumbersome while ensuring transparency. Their leaders also need to be allowed to use executive decrees to quickly re-prioritize budgets to respond to health emergencies. In the Philippines, Congress granted the President authority to implement temporary budgetary measures that allowed him to access and re-direct public funding from various sources including the National Disaster Risk Reduction and Management Funds and other contingency funds to respond to the COVID-19 pandemic[42].

Prior to the COVID-19 pandemic, some SSA countries had initiated budget reforms that moved towards a more agile and flexible budgeting approach, with the health sector often being the focus. These reforms have been beneficial in some SSA countries. However, a scaling-up of this approach is necessary to ensure budgets are better structured to respond to future health emergencies[27].

DECENTRALIZATION

Countries that decentralized COVID-19 emergency response to the subnational, district or grass roots levels were able to rapidly slow community transmission. For example, utilizing provincial incident management teams in South Africa, and existing district surveillance teams and district task forces in Uganda, enabled the central government of these countries to focus on strategy development and resource mobilization[43]. To handle health emergencies in the future, SSA countries will need to decentralize their response. For decentralized strategies to work, SSA countries will need to have strong political will and commitment from their governments to provide required health resources and facilities, as well as well-coordinated information flow from the center to the periphery.

PRIOR EXPERIENCE AND INNOVATION

Building on the health infrastructure created during the 2014-2016 EVD outbreak, Guinea, Liberia, and Sierra Leone were able to activate and respond to the COVID-19 pandemic. In addition to utilizing past strategies, SSA countries need to develop and adapt innovative technologies. For example, during the pandemic, Rwanda used drones to share public information. In Ghana, robots were used for screening and inpatient care. In Liberia, a communication platform called mHero was used to connect the Ministry of Health and health workers. Niger used an app called Alerte COVID-19. These technologies can be further developed for broader use in the future during health emergencies in SSA[4].

EMERGENCY PREPAREDNESS

Although SSA experiences over 100 health emergencies annually[44], the COVID-19 pandemic revealed significant gaps in the region's preparedness and emergency response plans. To be prepared for future health emergencies, SSA countries need to take steps to improve upon their emergency preparedness and response capabilities. Initiatives such as the Africa CDC's Joint Emergency Preparedness and Response Action Plan (JEAP) could help SSA countries strengthen their health security against future health emergencies[45]. The

World Health Organization Regional Office for Africa (WHO AFRO) has developed three flagship programs Promoting Resilience of Systems for Emergencies (PROSE), Transforming African Surveillance Systems (TASS), and Strengthening and Utilizing Response Groups for Emergencies (SURGE)) to support Member States in the African region to prepare for, detect and respond to public health emergencies[46]. To execute the activities outlined in the flagship program's workplans in SSA, key inputs such as complementary partnerships, buy in from multi-sectoral stakeholders at the national, central, and sub-national levels, as well as human and financial resources will be needed[46].

HEALTH PROMOTION

There are significant challenges to health promotion in SSA. Low levels of health literacy, and obsolete cultural beliefs and practices serve as barriers to behavior change[45]. To enhance health promotion efforts, the governments of SSA countries need to engage community members in the development of culturally appropriate health promotion activities and content and train health care workers and community leaders in effective health message delivery. The governments of SSA countries also need to implement health promotion policies and utilize technologies most available to populations to disseminate health information and messages in both urban and hard to reach rural areas[47]. The utilization of appropriate health promotion strategies will present a great opportunity for SSA countries to manage emerging and re-emerging disease outbreaks, most of which may have no known cure.

CLIMATE CHANGE

Sub-Saharan African countries need to develop climate warning systems and tools to facilitate the timely and accurate detection of climate change occurrences[48]. They need to develop weather monitoring systems to collect data to help predict severe weather events and to inform the development of risk mitigation strategies. Information on El Niño, for example, can stimulate early warning on hydrological extremes[49]. Building climate resilience will help to protect lives and livelihoods in SSA.

Conclusion

Sub-Saharan African countries' previous experience with health emergencies has provided valuable insights into the dynamics of managing health threats. The 2014 EVD outbreak and the COVID-19 pandemic revealed the strengths and vulnerabilities of health systems worldwide, particularly those in SSA. As SSA continues to face ongoing health emergencies, the region must begin to adopt a more proactive and integrated approach to preparedness and response. By addressing the systemic weaknesses of its current health system, investing in health system resilience, fostering innovation, as well as local and international collaboration, SSA countries can better protect the health of their citizens and mitigate the impact of future health emergencies.

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