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Review Article

Strengthening Preparedness for Infectious Disease Outbreaks in Sub-Saharan Africa: Lessons from Recent Outbreaks

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Abstract:

One of the major public health emergencies that has affected lives globally is infectious disease outbreaks. These issues are of great concern due to their potential to transcend borders. The control and management of such outbreaks even with the attention channelled towards it globally has been a difficult task in many developing and underdeveloped countries of the world of which the majority of sub-saharan african countries fall under. However, with this review, we aim to contribute to the body of knowledge dedicated towards control of infectious diseases by analyzing the preparedness of Sub-Saharan African (SSA) countries in managing infectious disease outbreaks based on lessons from recent outbreaks (with focus on COVID-19, Lassa fever and Ebola outbreaks). In carrying out this narrative review, we make use of PubMed and African Journals Online (AJOL) as the primary literature sources. To ensure we capture publications from reputable organizations that are solely involved in control of infectious diseases in the region, we carried out a grey literature search.

However in this review, we synthesized challenges such as weak healthcare systems, inadequate healthcare infrastructure, inefficient surveillance systems, poor data management and reporting practices, limited laboratory capacity and reliance on external donors for supplies during emergencies.

The review proposes potential interventional measures aimed at addressing these challenges aimed at enhancing the preparedness

The findings from this review provide critical insights into the preparedness gaps and potential interventions, informing policy and practice to enhance the region's resilience future outbreaks.

Keywords: Infectious Disease Outbreaks; Sub-Saharan Africa; Public Health, Healthcare Systems; Laboratory Capacity; Community Engagement; Surveillance Systems; Data Management; Supply Chain Management

Introduction

The world has been challenged by several unforeseen events that are life threatening of which health emergencies such as infectious illness outbreaks are one of them. Infectious disease outbreaks are a major and ongoing global health problem, and especially a great challenge to many developing and underdeveloped countries due to their unsophisticated healthcare systems [1]. Many infectious diseases outbreaks have been witnessed in Sub-Saharan African (SSA) countries and these have a great impact on lives and economy [2]. Notable among these infectious disease outbreaks witnessed in this part of the world were the Ebola outbreak crisis, the ongoing issues of Lassa fever, and the COVID-19 pandemic. However, the control and management of these outbreaks in many SSA nations is challenged by a lack of healthcare infrastructure, poor public health preparedness, and limited budget which often led to delay in response, thereby worsening the impact of these outbreaks [3].

These epidemics had a big throw on both the economy and have led to loss of lives. The Ebola outbreak in West Africa from 2014 to 2016, resulted in over 28,600 cases and more than 11,000 deaths [4]. On the other hand, the Lassa fever outbreaks have been reoccurring and there are between 100,000 and 300,000 reported new cases per year, and about 5,000 people die from the disease yearly with the average case fatality rate of hospitalized being 15% [5, 6]. Moreover, the economic impact of the Ebola outbreak is between $30 billion and $50 billion, which was a big problem for the affected countries, like Guinea, Liberia, and Sierra Leone [7].

The COVID-19 pandemic made the deficiencies of healthcare systems in this region more evident as countries in SSA faced challenges of limited medical supplies, ventilators, and personal protective equipment (PPE) during the pandemic, thereby making it difficult for them to handle the crisis efficiently [8, 9, 10]. One of the main reasons these problems exist is that many SSA countries' healthcare systems are underfunded The World Bank (2022) pointed out that healthcare expenditure in SSA was only 5% of GDP on average, which is far lower than the African Union's (AU) estimated 15% recommended to ensure healthcare system improvement [11, 12, 13].

Nevertheless, in addressing infectious diseases outbreak it is very important that healthcare systems at all levels be ready at all times as these outbreaks do not give prior notice before occurring. There is also a need for continuous assessment of preparedness level of healthcare systems. Prior studies have discussed the need for frameworks or measures to examine whether health system investments have made countries more prepared for natural disasters or health emergencies. Researchers and health organizations have defined and quantified the complicated concepts of preparedness, vulnerability, and resilience to infectious disease outbreaks and other emergencies to aid policy design and decision-making [14].

The ongoing process of predicting disaster situations, preventing or mitigating bad outcomes, and creating capacities and resources to respond to and recover from them is called preparedness [15]. Public health systems, healthcare organizations, employers or corporations, academic institutions, communities, and individuals are key players required to demonstrate these capacities or acquire resources for certain forms of readiness [16]. Preparation may include improving disease detection and investigation systems, creating outbreak response plans, and distributing human, material, and financial resources to support public health infrastructure and ensure adequate response [17].

Objective

The aim of this review is to synthesize findings from publications on previous infectious diseases outbreaks (COVID-19, lassa fever, and Ebola) preparedness in Sub-Saharan African countries.

Methodology

Narrative synthesis approach was adopted in this review to assess the preparedness of Sub-Saharan African nations towards infectious disease outbreak. PubMed and African Journals Online (AJOL) were the primary databases consulted for this review. To ensure more comprehensive search, grey literature search was conducted in reputable sources like the African Union (AU), the World Health Organization (WHO), and the Centers for Disease Control and Prevention (CDC) that feature publications on infectious disease outbreaks in SSA countries. The search focused on Ebola, Lassa fever, and COVID-19 outbreaks and preparedness articles from 2010 to search date (June 20, 2025). The search terms employed were "Ebola outbreak", "COVID-19

outbreak", "Lassa fever outbreak", "infectious disease outbreaks","Sub-Saharan Africa", "readiness", and "preparedness". The goal was to synthesize findings from publication on infectious disease readiness in Sub-Saharan Africa, concentrating on healthcare systems, surveillance systems, laboratory capacities, data management, and community involvement. Publications published in English-language were included. However, only peer-reviewed academic papers from reputable organizations mentioned above were included. Papers not published between 2010 and the search date were excluded.

Narrative Synthesis

This section is structured around key themes identified in the literature on infectious disease preparedness in Sub-Saharan Africa, categorized under the following headings.

Recent Outbreaks Epidemiology

Sub-Saharan African countries have witnessed several infectious disease outbreaks including Zika, Cholera, monkey pox Rift valley fever, COVID-19, Lassa fever, Ebola virus etc. The scope of this review focuses on recent outbreaks such as Ebola virus, COVID-19 and Lassa fever. Although there was a relatively low number of reported cases of COVID-19 in Sub-Saharan Africa at the very onset of the pandemic but as it spread globally the number of cases rapidly intensified, resulting in 7,926,999 reported cases (representing 3.6% of worldwide cases) and 200,045 fatalities (4.4% of overall global fatalities recorded) by September 7, 2021 [18]. However, among the Sub-Saharan African countries, South Africa was the most affected, followed by Ethiopia, Kenya, and Nigeria. During the COVID-19 pandemic Sub-Saharan African countries encountered significant obstacles, especially regarding testing, contact tracing, and case management [19]. Several studies have discussed some of these obstacles as evident in Epée et al. (2022) study in which Cameroon's strategy for epidemic control was examined and emphasized the importance of proactive measures to address some of the obstacles encountered such as mass testing, border control, and early quarantine. However, the effectiveness of these measures is dependent on the country's capacity to swiftly mobilize resources and execute coordinated policies [20].

On the other hand, the Ebola virus disease (EVD) which is the most significant outbreak that occurred between 2014 and 2016, led to over 28,600 reported cases and more than 11,000 deaths with a case fatality ratio of 28% to 75% [21]. Among the Sub-saharan African countries, the Democratic Republic of Congo (DRC), Sierra Leone, Liberia, and Guinea were the countries that were mostly affected. However, of all EVD infections recorded from 2001 to 2025, the DRC accounted for 46% of all EVD infections. There are many species of Ebora virus, however, the Zaire virus happened to be the most predominant during these outbreaks followed by the Sudan virus [22]. The outbreak rapidly spread as a result of delayed response which is linked to lack of cooperation among governments and international institutions and inefficient surveillance systems. However, countries like Nigeria demonstrated a more effective control of the outbreak through prompt response measures and significant community involvement [23].

Nevertheless, Lassa Fever which is a viral hemorrhagic fever prevalent in West African countries including Nigeria, Liberia, Sierra Leone, and Guinea still exists in some of these West countries [5, 6], with estimated annual incidence ranging from 100,000 to 300,000 cases, and approximately 5,000 deaths recorded each year [24]. For hospitalized patients with severe cases of the disease, the case fatality rate is 15% [24]. Recent outbreaks, notably in Nigeria, have been significant, with major outbreaks witnessed in 2016 and 2018. Lassa fever epidemics may not have gotten as much attention around the world as Ebola or COVID-19, but they have a big impact on local populations and healthcare systems that should not be ignored. These outbreaks keep happening, and they are getting worse because of poor surveillance and limited healthcare resources. This puts a lot of stress on health systems in the affected regions [24].

Preparedness of Healthcare Systems

The recent outbreaks have exerted considerable strain on healthcare systems across Sub-Saharan Africa, highlighting the essential need for ongoing investments in health infrastructure and workforce development. As noted by Asamani et al. (2024), Sub-Saharan Africa is experiencing a significant shortfall in healthcare personnel, projected to reach a deficit of 6.1 million health workers by the year 2030 [25]. The current shortage presents a considerable obstacle to effective outbreak response, given that healthcare facilities frequently operate with insufficient staffing and limited resources [25]. According to Ahmat et al. (2022), countries such as Sey-

chelles, Namibia, Mauritius, and South Africa made notable advancements in fortifying healthcare systems in 2019, particularly regarding the increase in healthcare professionals and the improvement of service delivery, as illustrated in Figure 1. Nonetheless, numerous other nations continue to have insufficient health infrastructure [26]. Conversely, the latest evaluation (2021-2024) revealed that merely 7 countries in Africa (Libya, Eswatini, Tunisia, Mauritius, Seychelles, Algeria, and Cape Verde) achieved the doctors-patient ratio of 10 doctors per 10,000 citizens. The primary factors contributing to progress in these nations include heightened investments in healthcare, the integration of emerging technologies, and international collaborations [27].

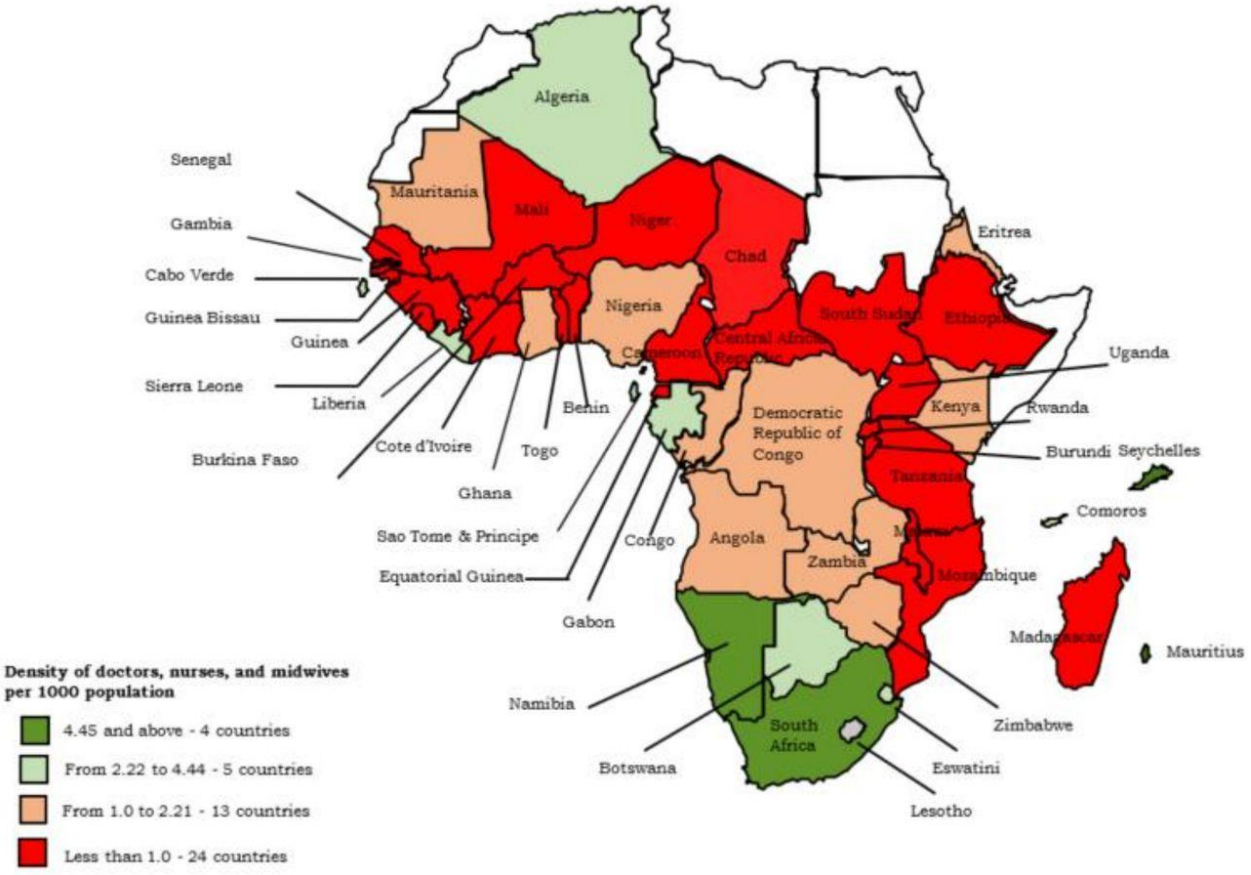

Figure 1: The density of Available Healthcare Professionals per 1,000 Population in Africa as at 2019. (Source: Ahmat et al., 2022 [26])

In terms of preparedness assessment, Salami et al. (2022) highlighted that healthcare systems in nations such as Nigeria and Sierra Leone were not adequately prepared for large-scale outbreaks, largely attributable to insufficient infrastructure and inadequately equipped health facilities [28]. Moreover, the African Health Security Index (AHSI) assessment stipulated that no African country is fully ready to deal with potential pandemic or epidemic risks as African countries face different problems relating to building strong healthcare systems, keeping up investments and adequate competences, as well as improving health security governance [29]. Therefore, several countries in SSA had low scores on preparation measures, such as access to healthcare, the capability of health systems, and how quickly they could respond to emergencies.

However, several factors have been highlighted in the literature that are linked to challenges of achieving optimal preparedness such as insufficient use of the existing healthcare workforce, attributed to inadequate training and a lack of continuous professional development [30]. Additionally, the challenges of ineffective governance and political turmoil were found to significantly hinder response to infectious disease outbreaks in Sub-Saharan Africa, thereby leading to delay in response and in some cases fragmented efforts [31]. Moreover, the majority of countries in the region have unsophisticated surveillance systems, which hinder early detection and swift response, thereby leading to rapid spread of outbreaks and at the longrun loss of lives and a strain on the economy [32].

In the same vein, the events during the COVID-19 pandemic shed light on the preparedness of healthcare systems SSA countries. For example, the region found

it difficult accessing vaccines at first, as less than 20% of the population were vaccinated by early 2023 [33]. However, according to the Africa-Europe Foundation (2022), Africa has only 3% of the world's healthcare workers, even though it has a disproportionately high number of diseases [34]. This was also evident during the COVID-19 pandemic. Another issue encountered during the pandemic was inefficient data management and reporting systems, this makes it difficult to track, and respond to disease outbreaks [35]. Despite these notable efforts and contributions of bodies such as the African Union and the World Health Organization (WHO) at both national and international levels during the pandemic and beyond were evident through their several initiatives to make healthcare systems more resilient [36, 37].

countries continued to have difficulty with diagnosis [43].

Laboratory and Technological Readiness

The availability and the number of efficient laboratories plays a crucial role during infectious diseases outbreaks and it is one of the metrics of preparedness [38]. However, establishing enduring and dependable laboratory networks throughout the region is quite challenging, particularly in rural areas where access to healthcare services and diagnostic technology is limited [39]. The WHO EVD Togo Report (2014) emphasizes the critical need for enhancing laboratory infrastructure in Sub-Saharan Africa to facilitate prompt disease diagnosis and effective treatment [40]. However, in terms of technology, Asiri et al. (2023) examined the application of modern technologies such as artificial intelligence (AI) driven diagnosis and automations in improving laboratory efficiency and found out that the application these technologies varies significantly throughout SSA region, often due to financial constraints and insufficient local technical expertise [41].

Findings from several studies have highlighted the laboratory and technological aspect of preparedness. Golin et al. (2020) demonstrated that the absence of diagnostic facilities during the Ebola and COVID-19 outbreaks significantly impeded the ability of the affected countries to respond promptly [42]. Iyare et al. (2023) conducted a study demonstrating how technological advancements, such as the Internet of Medical Things (IoMT), could enhance the preparedness of laboratories in Sub-Saharan Africa and facilitate monitoring of outbreaks [23]. However, in a study by Erike et al. (2024) who examined the IoMT-enabled monitoring systems implementation, it was concluded that integrating these technologies into health systems will significantly enhance the ability to monitor and respond to future epidemics [21].

On the other hand, a survey of African Union Member States by Ashenafi et al. (2024) revealed significant variability in the testing capacity in SSA regions. According to the survey results, some of the most significant issues were the lack of sufficient or relevant testing reagents, not having enough qualified staff, and lack of sufficient infrastructure [43]. During the COVID-19 pandemic, these problems were clear because many

Community Involvement and Public Health Infrastructural Development

Public health infrastructural development and community engagement are integral parts of control, management and interventional measures of infectious disease, both of which are crucial for preparedness. However, in the healthcare systems of SSA there have been reports of poor infrastructural development and limited public health communication networks due to drawbacks in familiarity of modern technology and computer literacy [44]. In a study by Niyigena et al. (2023) in which the impact of community health workers in Rwanda's response to COVID-19 were discussed, it was found that they play a crucial role in disseminating accurate information and advocating for preventive measures [45].

Moreover, the findings of Owoyemi et al. (2021) shows that engaging the community in health education, monitoring, and service provision has played a crucial role in mitigating the impacts of past epidemics such as Ebola and COVID-19 [46]. Additionally, community-based surveillance systems approach, enable local communities to be solely involved in interventional plans as they take an active role in the monitoring and reporting of diseases, thereby enhancing prompt response [46].

However, in terms of preparedness, the lack of sufficient community involvement during the Ebola outbreak in Sierra Leone resulted in opposition to public health measures, such as quarantine and safe burial practices according to Gebremeskel et al. (2021) [20]. Moreover, in many SSA nations, inadequate public health infrastructure and insufficient coordination among government agencies and international organizations persistently hinder the region's ability to effectively manage and control diseases [47].

Surveillance and Data Management

In identification and prevention of infectious disease outbreaks, there is a need for monitoring and data management systems that are efficient. According to WHO (2019) countries with robust surveillance systems were more capable of timely response to COVID-19 which helps in mitigating spread of the outbreak [48]. Nonetheless, the management of data in SSA countries is challenged by a lot of factors such as inadequate data quality, poor technology, and insufficient training for health professionals in data collection and analysis [24]. These are evident based on the findings from the review by Mremi et al. (2021), which stipulated that despite advancements in surveillance systems, numerous countries continue to face challenges in obtaining comprehensive data as Health management information systems (HMIS) usually serve as the primary data source [32].

However, in many SSA countries, the effectiveness of the HMIS is often compromised due to poor data quality as well as omission of data [32]. In order to address such data issues, mobile technologies, event-focused surveillance that supports real-time data correction and community-driven monitoring can be collectively employed to improve traditional data management methods [50]. Moreover, big data analytics and artificial intelligence (AI) can be employed to help enhance predictive models for infectious disease outbreaks [32].

Despite significant advancements, the persistent challenge lies in achieving collaboration among data gathering initiatives across various sectors, such as health, agriculture, and weather, to establish a cohesive and integrated surveillance system. Enhancing data integration and coordinating responses across various diseases and sectors necessitates the establishment of comprehensive surveillance systems that encompass a broad spectrum of sectors and indicators [32].

Furthermore, effective data generation is crucial for enhancing surveillance and reaction to infectious disease outbreaks. By leveraging digital health technologies, mobile apps, and other data collection methods, healthcare systems can gather timely and accurate data on disease trends, transmission patterns, and outbreak dynamics. Integration of data from various sectors, such as health, agriculture, and weather, can facilitate a more comprehensive understanding of outbreak risks and enable evidence-based decision-making. For instance, climate data can inform predictive models for vector-borne diseases, while agricultural data can help identify potential animal-human transmission interfaces. Strengthening data generation and integration capabilities can ultimately enable more effective preparedness and response strategies in Sub-Saharan Africa.

Supply Chain Management

Management of the supply chains for medical products in Sub-Saharan Africa presents significant challenges. The WHO (2019) and World Bank (2025) emphasized the critical role of regional supply chains in the rapid distribution of essential medical supplies, such as vaccinations, PPE, and pharmaceuticals, to areas in need during outbreaks [48, 49]. Salami et al. (2022) indicated that the disruptions caused by the COVID-19 pandemic highlighted the deficiencies in Africa's supply chains. A coordinated plan that incorporates both international and local partners is essential for enhancing their strength [28].

The Africa CDC (2025) demonstrates that a robust supply chain requires the ability to forecast demand, establish procurement agreements, and manage logistics effectively. It is essential to conduct regular simulation exercises to ensure preparedness [49]. To ensure rapid responses during emergencies, maintaining the integrity of cold chain infrastructure and strategically stockpiling at key locations is essential. The pandemic highlighted the deficiencies in delivery systems, underscoring the critical need for robust regional frameworks capable of managing various outbreaks effectively. The Africa CDC's framework emphasizes the importance of having pre-existing agreements to enhance the speed of responses during health emergencies [50].

Summary of Lessons from Recent Outbreaks

Events of the recent infectious disease outbreaks in Sub-Saharan Africa such as the COVID-19 pandemic, the Ebola outbreak, and the Lassa fever outbreak sheds light on some of the obstacles associated with public health interventions execution during health emergencies. Notable among these obstacles was weak healthcare systems, as there were lack of medical supplies as well as lack of healthcare workers and laboratory inefficiencies reported. On the other hand, a number of nations, particularly those experiencing conflict or political instability, encountered challenges related to delayed responses, attributed to inadequate management and coordination efforts.

Nonetheless, there remains a continuous necessity for enhancement in aspects such as improved data management, more effective monitoring systems, and increased professional training for healthcare workers.

Countries such as South Africa that invested in robust surveillance systems demonstrated greater effectiveness in managing outbreaks. Mremi et al. (2021) indicate that the application of digital technologies for real-time data collection and predictive modelling has the potential to enhance the management of outbreaks [32].

Figure 2 below highlights the critical factors to consider when preparing for and responding to an outbreak of an infectious disease.

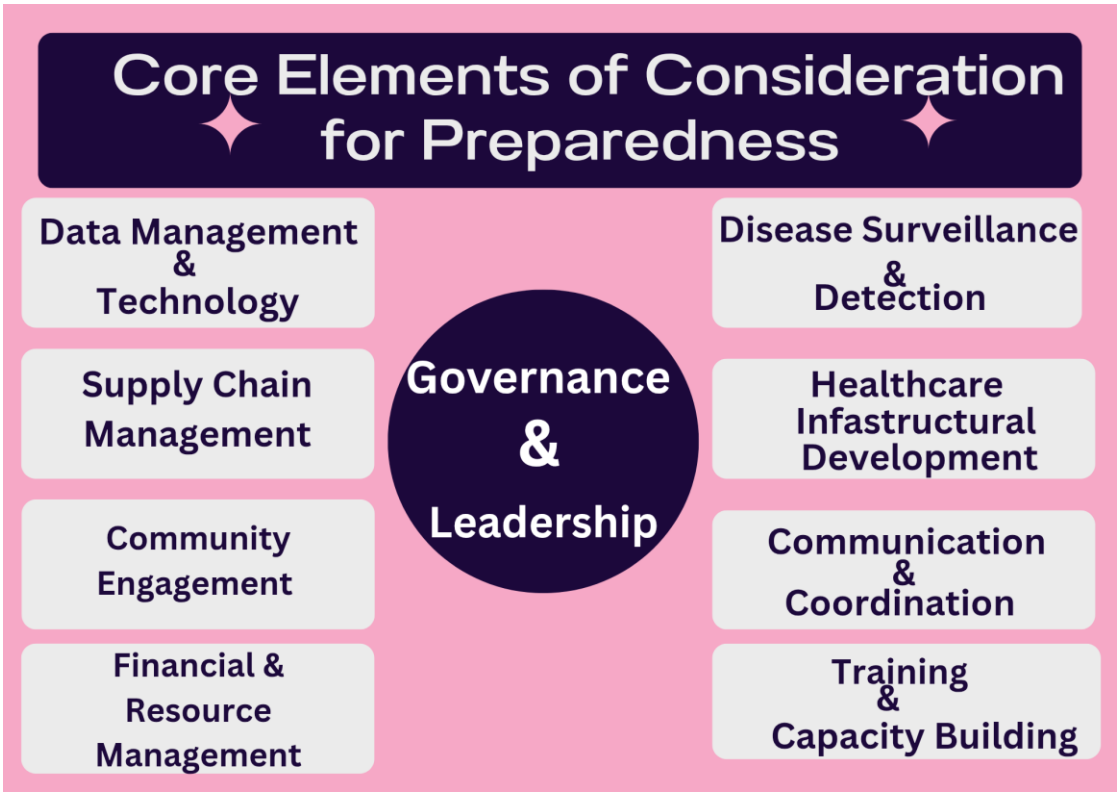

Figure 2: The Core Elements of Consideration for Infectious Disease Outbreak Response and Preparedness

Conclusion

The findings of this study shows there are still some aspects of preparedness metrics that many SSA countries need to pay attention to, such as strengthening healthcare systems, investing in infrastructural development and healthcare workforce, as well as digital health technologies, improving laboratory capacity, and optimizing surveillance mechanisms in Sub-Saharan Africa. Furthermore, it is essential for governments to enhance collaboration with international partners to secure sustainable funding and allocate resources effectively for preparedness initiatives.

Specifically, nations should prioritize ongoing professional development for healthcare professionals dedicated to infectious disease outbreaks to ensure they are ready and capable of handling such emergencies. Moreover, it should be ensured that reliable diagnostic systems, and supply chains are efficient in order to increase local capacity for controlling epidemics. National response strategies must also incorporate community engagement and public participation at all levels of healthcare (primary, secondary and tertiary levels), as these are vital in adhering to public health protocols during outbreaks.

Based on this review, the summary of the major challenges and possible interventional measures that will help improve infectious disease preparedness in Sub-Saharan Africa are contained in Table 1.

Table 1: Sub-Saharan Africa Infectious Disease Preparedness Challenges and Interventions

Preparedness Challenge	Suggested Intervention
Weak Healthcare Systems	Strengthen healthcare infrastructure by increasing investments in healthcare facilities, workforce training, and resources.
Limited Laboratory Capacity	Enhance laboratory systems by improving diagnostic capabilities, integrating mobile diagnostic tools, and building regional laboratory networks.
Inadequate Public Health Infrastructure	Improve public health infrastructure by expanding facilities, ensuring access to medical supplies, and enhancing emergency management systems.
Poor Surveillance and Data Systems	Develop robust surveillance systems by integrating digital health technologies for real-time data collection, reporting, and sharing.
Reliance on External Support	Build local capacity for self-sufficiency by investing in local production of medical supplies and creating sustainable funding mechanisms for healthcare.
Inadequate Community Engagement	Foster community involvement by developing public health education campaigns and empowering local leaders to facilitate health interventions.
Insufficient Supply Chain Management	Improve local supply chain management by strengthening logistics systems, creating regional supply hubs, and ensuring timely distribution of critical medical resources.

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