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Lessons for Epidemic Emergency Policy: A Scoping Review of Ebola and COVID-19 Pandemics in Africa

Sam Agatre Okuonzi

Arua Regional Referral Hospital, Ministry of Health, Arua, Uganda
Email: sokuonzi@gmail.com

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Abstract

Ebola Virus Disease (EVD) outbreaks in Central and West Africa 2013-2020 were the deadliest, most intense and most widely spread. On top of this, the novel Corona Virus Disease 2019 (COVID-19) has given us all a new experience. It is imperative to draw lessons to prepare for future disease outbreaks. This was a scoping review, a method that allows the assessment of emerging evidence. The objectives of the review were to 1) describe the manifestation of the epidemics; 2) elaborate on the social and economic effects; 3) characterize the responses; and 4) draw lessons. The findings show that Ebola risk is permanent and even increasing. The next COVID-19 epidemic is around the corner. For Africa, the situation has been made worse by poverty and fragility of institutions. Africa's incapacity to manufacture its own vaccines, medicines, diagnostics and protective wear has been detrimental in the management of epidemics. The need for personal and home hygiene has been emphatically brought to attention. The trust in the government and other agencies is the cornerstone in the management of emergencies. The use of armed soldiers should be discouraged, for they scare people from seeking help. It is much better to use trusted local leaders instead of strangers during pandemic emergencies. Understanding the local politics without getting involved in them is essential. It is critical to understand community and individual perception of the risk of the disease in question. Often neglected is the psycho-social aspect, which should be planned early. The science of response measures ought to be explained simply and transparently, as part of risk communication. Emergency funds should be raised, and made easy and quick to disburse. Mechanisms of sharing health technologies and knowledge need to be devised under the UN. People centeredness ought to guide the conduct of trans-border movements and all transactions during pandemics.

Keywords

COVID-19, Ebola, Emergency Response Policy, Health Security, Global Cooperation

1. Introduction

Ebola Virus Disease (EVD) outbreaks in West Africa and Democratic Republic of Congo (DRC) 2013-2020 were the deadliest, the most intense and the most widely spread [1]. The risk of another Ebola outbreak or another epidemic is high in the region. The circumstances, the exact location, the timing and the scale of the next epidemic are unpredictable [1]. On the backdrop of the current global pandemic of novel Corona Virus Disease 2019 (COVID-19) and similar previous outbreaks such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), it is imperative to draw lessons so as to prepare and do better in the current or future outbreaks of epidemics or emergencies. This review covers the period 2013 to 2022, with focus on COVID-19 from 2020-2022, and a heavy focus on the 2013-2015 Ebola outbreaks in Guinea, Sierra Leone, and Liberia, and its ramifications throughout West Africa. It also has a focus on Democratic Republic of the Congo (DRC) with regard to the persistence of Ebola epidemics and an ongoing armed conflict.

The purpose of the review was to draw lessons that can be applied in managing the coming epidemics and emergencies better in Africa and across the world. The specific objectives are to 1) describe the manifestation of the disease, epidemic and emergency; 2) elaborate on the social and economic effects; 3) characterize the responses; and 4) draw lessons that can be used improve the management epidemics and emergencies.

2. Methodology

2.1. Scoping Review

This was a scoping review, a method that allows the assessment of emerging evidence as a first step in research development [2]. It provides more flexibility than traditional systematic reviews and meta-analyses. It is able to accommodate a diversity of literature and studies using different methodologies. The end product is usually a narrative without much statistical information.

Both grey literature and peer-reviewed scientific publications were reviewed. Data bases used were of PubMed and Web of Science. Key words were derived from the systematic scoping review approach called PICO-ST, which stands for Population, Interventions, Comparisons, Outbreaks/Situations and Types. **Table 1** shows the key words used.

2.2. Analytic Framework

A framework was used for analyzing the data and information. The analysis

Table 1. PICO/ST generated key words.

	Information category	Key words
1	Population	Guinea, Liberia, Sierra Leone, DRC, West Africa, Africa
2	Interventions	Response, International response, Technical assistance, emergency response, community engagement, social mobilization, vaccines, therapeutics
3	Comparisons	West Africa and DRC, West Africa and Uganda, Africa, Global, Ebola and COVID-19
4	Outcomes	Clinical, social and economic
5	Situation	Poverty, Fragility, Conflict and Global spread, Mistrust, Inequality
6	Types	Ebola strains; SARS-COV-2 variants; Regional variations

consisted of the five components: manifestation of the disease and epidemic, the responses, the outcomes of the response, and lessons. The framework is in Table 2 below.

3. Findings

3.1. Manifestation of Disease and Epidemic

EBOLA

Causative agent

Ebola Virus Disease (EVD), formerly called Viral Hemorrhagic Fever (VHF), is a deadly disease with occasional outbreaks that occur primarily in the African continent [3]. It mostly affects people and other primates (such as monkeys, chimpanzees and gorillas). It is caused by an infection of a virus in the genus (broad group) called Ebola viruses [4]. There are six virus types: Zaire, Sudan, Tai Forest, Bundibugyo, Reston, and Bombali virsuses. Of these, four (Zaire, Sudan, Tai Forest and Bundibugyo) are known to cause disease in people. Reston causes disease in non-human primates and pigs. It is not known whether Bombali causes disease at all in any animal. It is still not known precisely which animal is the reservoir of the Ebola virus.

Origin

EVD first appeared in 1976 simultaneously in two outbreaks in Nzora, Sudan and Yambuku in Zaire, now DRC. In Yambuku, the outbreak of Ebola was in a village near Ebola river, from which the disease has taken its name. Fruit bats of the family of *Pteropodidae* are thought to be the natural hosts. Human-to-human transmission of Ebola is through the broken skin or mucous membranes coming in contact with blood, secretions or organs of an infected person or animal. The body fluids which can transmit Ebola virus include saliva, feces, sweat, and semen. Contaminated or soiled objectives are a common route of transmission. They include soiled clothing, beddings, medical waste and supplies. Burial ceremonies are a major way of transmitting the disease. This is particularly so

Table 2. Analytical framework.

	Broad aspect	Components	Sources (References)
1	Manifestation of disease and epidemic	Causative organisms Transmission Health effects Health system effects Economic effects Social effects	[3] [4] [7] [8] [11] [22] [24] [35] [37]
2	Response	Emergency response Health system support Technical support Social interventions Community Engagement Global Security International response Vaccines	[6] [9] [13] [14] [16] [17] [18] [19] [20] [22] [27] [29] [31] [32] [34] [38] [39] [41] [43] [44] [45] [47]
3	Outcomes	Immediate Long-term impact Persisting risks Unintended consequences	[1] [14] [16] [17] [21] [22] [27] [36] [49]
4	Lessons learned	Local knowledge Social and community engagement Global health governance Research and science	[1] [10] [15] [22] [26] [33] [36] [39] [43] [44] [48] [50] [53] [54] [55] [56]

where people touch, wash and kiss dead bodies during or before burials. Men can also transmit the Ebola virus through their semen to their sexual partners.

Clinical manifestation

The incubation period is 2 - 21 days, before the disease begins to manifest. EVD is characterized by sudden fever, profound weakness, muscle pain, headache, sore-throat, vomiting and diarrhea. Infected people may have a papulo-macular rash. Bleeding is experienced in half of Ebola patients. That is why its name was changed from VHF to EVD, to reflect the fact that bleeding is no longer a dominant clinical feature of the disease. People are infectious to others as long as they have the disease. The mortality rate of Ebola is up to about 90%, ranging from 40% depending on the type of the virus. The confirmed diagnosis of EVD is essential before its management can be instituted. The clinical symptoms are confirmed by a laboratory diagnosis [5]. The patients' blood will show increased transaminases, lymphopenia and thrombocytopenia (reduced white blood cells and platelets). The confirmatory test is positive polymerase chain reaction (PCR) test. An antigen test may be done in parallel. Antibody test for IgM and IgG is secondary usually for surveillance.

Clinical, social and economic consequences

The disease is devastating if not quickly and effectively controlled. It is controlled by both preventive and protective measures in clinics, hospitals, com-

munities and homes. The treatment of EDV is supportive, mainly through oral or intravenous fluids. New experimental drugs and vaccines are now available. It has a devastating social effect on an affected community. There is usually collective panic, civil resistance to any collective action. There are spontaneous acts of denial, mistrust and misinformation.

Africa's fragile health systems are often quickly overwhelmed and disrupted [6]. Often health workers are reluctant to provide care to EDV patients. With poor infection control among health workers, many health workers often get infected and die. It has consequences on health, life, the economy, travel and exports. The context of fragility of the affected countries made the Ebola outbreak situation particularly explosive. Ebola outbreak response measures impose strong restriction on people's movement and interaction. Farming, trade and access to food and other essentials are drastically curtailed. The heaviest toll of Ebola is on women, who were 4 - 5 times more affected than men.

COVID-19

The causative agent and origin

COVID-19 is caused by Severe Acute Respiratory Syndrome Coronavirus type 2 (SARS-COV-2). The virus outbreak possibly occurred in a wet (live animal) market in Wuhan, China. DNA studies have indicated that the virus could have "jumped" from a bat to humans through an intermediate host, thought to be a pangolin, although this now seems unlikely [7]. The disease is characterized by fever, a dry cough, sneezing and some non-specific symptoms. This virus is remarkably simple, made of four proteins and one strand of RNA. One type of proteins constitutes the characteristic spikes or crowns, from which the name corona is derived. Two types of proteins are membranes binding the entire virus into shape, and the last protein surrounds the RNA.

Clinical manifestation

The virus enters the body through mucous membranes of the nose, mouth and eyes [7]. It attaches itself to a protein on the cell surface called Angiotensin-Converting Enzyme 2 (ACE2), which acts as a receptor or doorway into the cells of the lungs, heart, blood vessels, kidneys, liver, stomach and intestines. The exchange of oxygen and carbon-dioxide between blood and lungs takes place through special cells called pneumocytes, which line small air sacs (alveoli) in the lungs. When pneumocytes are attacked by the virus, they rapidly multiply inside causing the cells to burst and die off. The air sacs then begin to collapse and get filled with fluid from inflammation. This hardens the lungs, which lose their elasticity to expand and contract, as should be in normal breathing.

This hardening of the lungs is pneumonia. When pneumonia sets in, the flow of oxygen from the lungs into the blood, and of carbon dioxide from the blood into the lungs drastically reduces. This is when the patient urgently needs assisted ventilation (breathing). This breathing crisis is what is described as severe acute respiratory syndrome. Post mortem results have shown extensive micro-clots of blood in multiple organs, including blood vessels. This means that there is multiple organ failure due to micro-clots that block blood supply to and

causing the death of organs, and ultimately of the individual.

COVID-19 tends to affect the elderly 3 to 4 times more than the young [8]. It affects men twice more than women. What is not yet clear is at what stage an asymptomatic carrier of the virus can infect others. The virus escapes from the lungs by droplets through coughing or sneezing or just normal breathing, which leads to the contagion of others who get in contact.

Socio-economic effects

It is now generally expected that a major global recession is coming, majorly sparked off by COVID-19 pandemic [7] [9]. The Russia-Ukraine war has accelerated the global economic gloom. Initially there was a dramatic decline in the stock-markets, airline industry, tourism, hospitality, and oil and gas markets. The value of gold plummeted. Life opportunities have become even more unequal. Unemployment has shot up everywhere.

Those who cannot work at home stand a risk of being exposed to the virus. Universities and businesses are fast turning into remote working and operation [7]. Home schooling and internet education are increasing by the day. There was a disruption of the global supply chain. Labour supply, vital for domestic work and agriculture, plummeted. Small businesses that depend on cash flow closed. Mortgages and rents remained in arrears.

There was an escalation of social misinformation and propaganda as result of COVID-19 [10] [11] [12]. Much of the propaganda was clearly selected public information designed to achieve political or social objectives, rather than to manage the pandemic and its consequences. Through mass media, COVID-19 pandemic has helped bring home a shocking realization to most Africans of how grossly unjust the global economic system is. Many Africans appear to have become suddenly and sharply aware and angry about the current shameful global narrative about the continent and its people. Africa is depicted as a continent of conflict, corruption, diseases and dependency. The economic and social inequalities are stark against Africa. However, youth unemployment in Africa is the single most explosive contemporary issue on the back of COVID-19 pandemic [10]. This has made the youth even more restless, and a potent source of violence and insecurity.

3.2. Response to Epidemic Emergency

EBOLA

[*1*] *Emergency support*

WHO led the emergency Ebola response, which had been preceded by the UN Security Council Resolution 2177. This resolution urged countries to raise resources urgently for the Ebola crisis in Guinea, Liberia and Sierra Leone. The first task was to strengthen field response by enhancing local response in each hotspot [13]. This included the provision of logistics and care to patients. The critical action was to break transmission through surveillance, case investigation, contact tracing and follow-up. Public information and relations, social mobiliza-

tion and risk communication were part of the response. This entailed effective management of Ebola Operations Coordination Center [14]. It included strengthening the leadership of WHO, cross-border coordination, logistics management, disease-related expertise, managing external relations, clinical support, and the development of a new treatment protocol [15] [16] [17] [18] [19]. It also entailed ensuring the preparedness of countries high at risk of Ebola [14] [15]. This was done through planning, surveillance, laboratory diagnosis, public information, and social mobilization [16] [17].

[*II*] *Health system support*

Strengthening national and regional health systems was paramount in the Ebola outbreak response. This included capacity building in human resource numbers, skills and knowledge base [20] [21] [22]. It included recruitment of skilled personnel plus training local staff, and infrastructure development, especially setting up treatment centers and providing equipment. It involved supporting national and regional institutions such as ministries of health, WAHO and Africa CDC [14] [23]-[28]. Waste management of contaminated materials was crucial in Ebola control. A system was set up to manage liquid and solid bio-waste, which included incineration. Also provided were information technology (IT) and telecommunication equipment such as computers, TV and projectors, and vehicles for transportation. Systems of coordination were set up at ministries of health leadership called Incident Management System and Emergency Operations Centers. Capacities were enhanced for contact tracing and community-based surveillance [29]. An integrated disease surveillance and response system (IDSR) was set for all partners and remains a key feature of enhanced national health systems. Mental health and psycho-social services were established or strengthened.

IDSR included community engagement in disease surveillance [20] [30] [31]. This triggered alerts and responses. Manuals were made and CHWs were trained and facilitated. Electronic IDSR through mobile phones was set up and used. Closed user phone group phones were used for alerts, reports and quick communication. Support supervision was integrated. HMIS was strengthened with data quality assessment set up for accuracy, reliability, integrity, precision, completeness and timeliness. A laboratory information system (LIS) was set up to enhance HMIS.

A tool for assessing risks was developed and set-up for use for epidemic preparedness and response. This tool is called STAR (Strategic Tool for Assessing Risks). This tool was used together with All Hazard Incident Preparedness and Response manual [20]. The MoH staff was trained in monitoring and evaluation, data entry, analysis, visualization and use. At the regional level lab kits, PPEs, IT software, m-health, and FIMS were provided, and additional staff hired. Isolation centers were provided. Support was given to regional bodies (WAHO, Africa CDC, Regional Laboratory Network and ECOWAS Bio-Bank) in the framework of one health.

[*III*] *Technical assistance*

At the onset of the Ebola outbreak, the affected countries were overwhelmed as they were unprepared and had no capacity to handle the crisis. A technical assistance (TA) was led by WHO and funded by AfDB [18]. An epidemiology team was dispatched to the affected countries to investigate and quarantine the suspected cases of Ebola, and monitor and evaluate the situation. The team did contact tracing, mentoring and training of local tracers, and surveillance. They revised the case definition of Ebola Virus Disease in order to improve case investigation and contact tracing. This team laid the foundation for IDSR and infection prevention and control (IPC). They were critical in guiding the establishment of Ebola Response Centers, and in training of staff on IPC. They also laid the foundation for social mobilization and community engagement, psycho-social first aid and cultural understanding. They provided technical support in developing Health Sector Recovery Plans and mental health strategies. They planned the transfer of Ebola response institutions into permanent institutions of MOH and DHMT.

[*IV*] *Social mobilization*

The critical factors for social mobilization were transparency, communication and community engagement [24]. There was an initial community resistance in the fight against Ebola. Social mobilization had to be tailored to the geography and size of the outbreak, and the behavior of the population [25]. This required an early consideration of community behavior and prevention strategies. It then became important to formulate messaging in the context the community, so as not to drive away the community members, but to facilitate them towards the response effort.

In Liberia, for example, there were six social mobilization groups: 1) media and documentation group, dealing with gathering, monitoring and analyzing information; 2) messages and materials development group responsible for audience specific message development, using the right communication channels, and responding to rumors; 3) interpersonal communication and training group ensuring frontline workers are trained, and that messages are targeted and focused; 4) field mobilization and support partners, to ensure safety of mobilizers, to facilitate reporting back, to network with other teams, and to inter-face with survivors and community-based networks; and 5) research, monitoring and evaluation group to coordinate, implement an M&E strategy, carry out research and ethical reviews.

The key factors for the need to do social mobilization included denial and disbelief in Ebola, fear, traditional practices of burial rites, refusing official response procedures, to reassure those who had given up themselves to die, and many people who had just migrated from the city. The strategy of social mobilization was called RED (reach every district), ring inter-personal communication, net-strategy (keeping an eye on all border entry points).Radio and TV played jingles, talk-show survivor interviews, and sensitization and advocacy messages

[32].

Social mobilization required community engagement and ownership [33]. The use of Ebola survivors was effective. It required deliberate building of community structures and systems, and providing an enabling environment. The approaches used were to be systematic, sustainable and targeted. The different social mobilization efforts required coordinated and constant adaptation. There was need to for two-way communication with the community, and to work in collaboration with local media. It was always important to deliver consistent messages, not to oversimplify, and to be clear.

[*V*] *Community Engagement*

It was difficult to engage communities [33]. It required careful assessment and strategy. Communities do not share the same values and local interlocutors do not represent communities. Linking interlocutors to external agencies created resentment and compromised the effectiveness of their work. When strangers take away Ebola patients to distant treatment centers, people become resentful and will not cooperate. Instead, as it happened in Sierra Leone, people found alternative treatment approach. They took their loved ones deep into the forest, hydrated them and gave them any support they knew, both modern and traditional. Those who died were buried in hidden places. They made their own protective wear. Burial was done by members of secret societies across the region. They evaded the institution of the Chief, whom they saw as conniving with foreigners. Some of the Ebola affected people they treated survived. So, they were convinced that that what they were doing was right.

People live in complicated social spaces. Engaging them necessitates a politically nuanced understanding of specific circumstances [20] [33]. Interlocutors are unlikely to represent views of everyone. Treatment of Ebola patients is easier in communities where people feel for each other, and they will shun the dictates of co-opted leaders. Accountability is beyond the family unit. In engaging communities it is useful to be aware of such parallel groups and efforts. Avoiding or ignoring such groups and efforts is counter-productive.

An example of ignoring communities' views is the ban of bush meat in West Africa 2013-2016 [34]. This had serious unintended consequences. The official message condemned wild meat as very dangerous. But the target population ate bush meat routinely without incident. This dissonance undercut the effectiveness of the ban. The ban of bush meat merely served to proliferate informal networks of wild-meat trade. Instead the ban and criminalization of bush meat entrenched distrust and tension against front line workers. It cultivated silence and jeopardized surveillance and other preventive measures.

The solution is a double strategy of bottom-up and top-down approach [35]. Ebola has shown that communities are important in the management of health care. In particular, understanding community perceptions, human behavior, willingness to report and complying with established procedures is critical [36]. Communities need to be empowered through education, assurance of good

health, economic and social support, and health knowledge. Each community needs a unique and different way of engagement [37] [38]. Communities want local and familiar people who speak the local dialect to be emergency workers in the outbreak. Emergency workers include vaccinators, disinfectors, support staff and drivers. Therefore community engagement should be designed, validated and refined to incorporate the concerns, values and practices of local people.

[*VI*] *Ensuring health security*

Health security is the protection from threats to health. It is the most important non-traditional security [39] [40]. Ebola infected people, facilitated by modern air travel, can travel far and wide, and put everyone on their way at risk. The standard paradigm is rapid detection and quick response. But West Africans have also learned that individual health security is important. And Ebola outbreak has also taught them that health care is not always safe, accessible or effective.

WHO declared Ebola outbreak as a public health emergency of international concern (PHEIC) in August 2014 [41]. The WHO Director General declared "As a result of this concern of further spread, the committee recommended that I declared the outbreak of public health emergency of international concern, and I have accepted that advice". This declaration had three concerns: 1)the spread of Ebola, 2) the large number of violent attacks on health facilities and health workers, and 3) the need for coordinated international response and for fund-raising.

PHEIC is defined as an event that poses public risk to other countries through international travel and requires a coordinated international response [41]. The need for fund-raising has never before been a component of a PHEIC declaration, but with Ebola it was a key feature. This has now set a new precedence. This PHEIC was described as "light" because it had many caveats. The Ebola risk was assessed as HIGH in West Africa and DRC, and LOW elsewhere. PHEIC signaled the severity of the situation, brought focus and instruments to bear, and obligated NGOs and UN partners to take greater responsibility for areas in which they had expertise and comparative advantage [42].

The Ebola outbreak in West Africa spread to Nigeria, Senegal, Mali, Spain and USA [1] [15] [42] [43] [44]. The national responses of countries outside the Ebola affected region (West Africa and DRC) were varied. Visa was withheld for persons from the Ebola affected region. Flights and ships sails were canceled to and from the region. The countries that canceled flights or ship sails were Kenya, Sri Lanka, Chad, Nigeria, South Africa, Seychelles, Mauritania, Guinea Bissau, Belize and Australia. Precautionary measure of isolation, bio-containment and screening all incoming travelers were enforced in Malta, Germany, Philippines, Mauritania, USA, Canada, Rwanda, France and UK. All countries bordering the Ebola affected region closed borders.

The risk and chances of epidemic outbreaks are high in today's world due to large and dense populations, rapid transnational movements and growing inequalities. Ultimately, for a stable global environment with minimal health security risks, there are three pre-requisites: global equity, solidarity and social jus-

tice [45]. Over the past 20 years, global health problems led to the institution of International Health Regulations (IHRs). In 2005, WHO revised IHRs but not more than 20% of countries have complied. On February 13, 2014, WHO partners and 28 countries formed the Global Health Security Agenda (GHSA).

[*VII*] *Ebola Vaccination*

When Merck's Ebola vaccine rVSU-ZEBOV became available in 2019, the company donated over 195 doses for front line workers in DRC. The plan was to procure 900,000 more doses in 18 months. A ring vaccination strategy was adopted, initially developed in Guinea. The effectiveness of the vaccination was limited by the small number of vaccine supply. Experts recommended that the wider population where cases came from be targeted and the dosage be calibrated on the basis of the Ebola risk. By July 21, 2019, a total of 169,767 community members, 34,000 front line workers and 52,000 children had been vaccinated [43] [44]. Merck was still seeking clearance from Food and Medicine Administration (FDA) of USA and the European Medicine Agency. There were several issues with the vaccines. Vaccination was time consuming in a situation of conflict. There were challenges of insecurity in gathering people for vaccination. The number of people vaccinated was ultimately too small to effectively control the epidemic. Transportation of the vaccine was problematic, at a temperature of negative 60 degrees Celsius all the way from Kinshasa to Eastern DRC.

There were problems with another vaccine for Ebola vaccine [25] [32] [44]. This was the experimental vaccine from Johnson & Johnson. The DRC health minister Oly Ilunga Kalenga resigned in relation to this experimental vaccine on July 22, 2019. In his resignation letter he wrote: "…actors have demonstrated manifest lack of ethics, hiding information from health authorities…". This may have caused confusion among the population.

The Ebola vaccination program was running on the sidelines of the main response. It started with clinical trials. This was to be done according to scientifically sound research methods and ethical standards. The WHO Strategic Advisory Group recommended the use of Ebola vaccine made by Johnson & Johnson [44] [45]. But soon many questions were asked and uncertainties expressed about this vaccine. However, better results were got from Merck's vaccine, both in DRC and Uganda.

[*VIII*] *Ebola Therapeutics*

DRC and Uganda imported three experimental drugs for clinical trials [44] [45]. These were: ZMapp, MAb114 (monoclonal antibodies) Remdesivir (GS-5434) antiviral drug, and REGN-EB3, a monoclonal antibody cocktail. According to WHO, so far more than 500 Ebola patients have recovered after taking these drugs.

[*IX*] *Psycho-social response*

Socio-cultural, psychological and higher order (spiritual) disease dynamics played an important role in the spread of the Ebola epidemic [46]. Yet the dynamics were not included in the strategies for Ebola containment. A study done during the outbreak [46] revealed serious psychological effects of the epidemic

for the health system for which the Ebola response had no capacity or readiness to handle. The psychological effects of Ebola included fear, trauma, shame, guilt, stigma, loss of trust, and breakdown of community interaction.

Therefore, the management of psycho-social effects of Ebola outbreak should always be part of an outbreak response. It should focus of rebuilding trust and limiting stigma. There is need to integrate local knowledge and understanding of the illness into the bio-medical interventions. Communities affected by an outbreak should not be marginalized or stigmatized. There is need for mental health training of all health workers deployed for an outbreak response. These lessons should be incorporated into outbreak responses and health systems development.

[*X*] *Post-Ebola interventions*

The post Ebola crisis recovery interventions are illustrated by the post-Ebola Social Investment Program funded by AfDB. The program was for Guinea and Sierra Leone [32] [47]. The aim was to enhance the resilience of communities that had been affected by Ebola. The specific objectives were to restore basic social services and revive economic activities for women. The target groups were survivors, orphans, organized groups, cross-border traders, social workers and micro-small enterprises. After some difficulties, the program was re-adjusted to increase local participation and ownership, to carry out political dialogue and coordination, and to allow countries to approve sub-projects.

After the end of the Ebola crisis, the risk of Ebola in the region remains high, persistent, widespread and unpredictable. The focus should be on preparedness of countries. The response can be evaluated from the lessons so far learned. There is need for increased research on Ebola vaccines and drugs [48]. Community engagement strategies should adopt local health and cultural practices. The support of survivors is critical to mitigate further outbreaks [37].

Data collection post-Ebola should be standardized and the reporting should be included into the national health information system. The national governments should begin to provide dependable financial support with a view to establishing PHC systems and aiming to achieve UHC [47]. A standby emergency team should be available to respond rapidly to any new Ebola cases. No small outbreaks should be allowed to become big.

[*XI*] *International support*

WHO convened an emergency meeting in July 2014 attended by eleven health ministers from the West Africa region. WHO announced a collaborative strategy to coordinate the technical support for the response. In August 2014, WHO declared Ebola outbreak in West Africa as an international PHEIC [41]. And in September 2014, the UN Security Council declared Ebola outbreak in West Africa as a "threat to international peace and security". AFDB responded swiftly and then ECOWAS and the World Bank followed. The Word Bank had an existing Ebola facility called the Ebola Emergency Response Project which was established way back in 1993 [27]. This facility was reactivated with the short term objective of controlling the EVD outbreak, of providing selected essential services, and of mitigating the socio-economic impact of the outbreak. Over the period

since 2014 to September 30, 2020, the World Bank disbursed funds to Guinea, Liberia and Sierra Leone over USD 400 million. Other contributors were USA, UK, AfDB, France and China.

WFP mobilized food, and NGOs (especially MSF) mobilized technical support and expertise. Samaritan Purse, an NGO, started to mobilize humanitarian assistance [27]. UN called for a massive international response under UN Mission for Ebola Emergency Response (UNMEER). The idea behind UNMEER was to plan and coordinate all efforts and actors in the Ebola outbreak response [41]. The UN Security Council 2177 urged countries, organizations and individuals to raise funds and material resources for Ebola response effort.

COVID-19

Emergency measures

Social distancing measures were the mainstay of mitigating the spread of the disease. Most countries instituted various versions of social distancing measures or lockdowns. While lockdown measures have some effect on curtailing the spread of COVID-19, the nature, duration and intensity of the lockdown that will be most effective and proportionately beneficial for the level of sacrifice required is yet to be fully understood.

On 23 January 2020, the central government of China imposed a lockdown in Wuhan and other cities in Hubei in an effort to limit the spread of the outbreak [7]. This action was described as unprecedented in the history of public health. This "Wuhan lockdown" has been emulated in different forms globally. But one distinguishing feature of the Wuhan lockdown was that it was announced without giving a window period for people to leave the city, and within hours travel restrictions were also imposed on the nearby cities thereby limiting the chances of panic travel out.

Lock downs instituted by African countries lacked the ingredients of suddenness and intercity travel restrictions. Although the evidence of success or failure of the various lockdown types is still far-fetched, if the inspiration is from the Wuhan experience in China, we in Africa have not yet done enough. Perhaps we will have do more as the outbreak in our countries evolve.

Washing hands combined with social distancing was the first approach used to reduce the spread of the virus. The mainstay of treatment is symptomatic, in form of assisted respiration. No approved drug has been found for the treatment of COVID-19 [7]. Hyroxychloroquine and related drugs have been tried, but without replicable or consistent benefits. Experimental Remdesiver and other medicines have also been tried with disappointing results. The mainstay of COVID-19 control has been to limit people's movement and interaction, in addition to hand hygiene, coughing and sneezing etiquette, social distancing, and for individuals to avoid touching their face. Governments have instituted quarantine and isolation of those who are suspected or already infected. Borders were closed. So were schools, places of worship, and markets. In most countries public transport was suspended. It was hoped that people would get herd im-

munity naturally (for those who got infected and survived) or through a vaccine.

Public health measures

The thrust of COVID-19 public health policy has been to flatten the curve by slowing the spread of the virus, as countries await a vaccine [49] [50]. Containment policy was preferred by some countries where people who fell sick were managed but no lockdown measures were instituted as in Sweden. Suppression policy was through lock downs to prevent or minimize contagion. The idea was to suppress the epidemic until a vaccine became available. But prolonged economic shut down could lead to social unrest and is not sustainable.

Preventive policies included 1) case isolation at home, 2) voluntary home quarantine, 3) isolation of entire neighborhoods 4) social distancing for those over 65 years, 5) social distancing for all, 6) closure of all public institutions, 7) suspension of public and private vehicles, and 8) night curfew. The testing policies include a) all those with pneumonia or flu-like symptoms, b) representative samples of the population, c) high risk populations, (e.g. in Uganda), d) asymptomatic populations, (e.g. in South Korea), and e) testing the entire population, (e.g. in New Zealand) [16].

Vaccination

The COVID-19 pandemic has raised a range of issues related to clinical trials of COVID-19 therapeutics and vaccines [49] [50]. Trust in clinical research is directly related to vaccine deployment, as trials pave the way for how vaccines and therapeutics are perceived and taken up. While vaccine trials adhere to international and local bio-ethical standards, local concerns about medical research are contingent on local cultural norms and values, reflect previous experiences of research and are influenced by existing health systems. For example, understanding local power dynamics, ideas of fairness and the nature of trust has been important for the recruitment of participants into Ebola vaccine trials. Conducting clinical research in an epidemic, when people are understandably fearful, also requires an appreciation of what motivates people to take part in trials. Fears and mistrust can be expressed through rumors, gossip and conspiracy theories. Building good relations between researchers and communities requires engaging with these concerns.

To build vaccine confidence, it is important to take these voices seriously and address misinformation. Vaccine confidence is also influenced by historical, cultural and political dynamics [51]. Social relations, trust and legitimacy are particularly important. Social science inquiry has revealed that governments and COVID-19 country coordinating bodies can improve public trust, acceptability, effectiveness and uptake of COVID-19 vaccines and therapeutics. Ebola research has demonstrated that the roots of mistrust extend beyond the epidemic, making acceptability contingent on past relations between communities, healthcare providers and international agencies. Ebola vaccine trials have taught us the importance of altruism, sacrifice, curiosity and hope, in participants' decision-making, despite their fear and the disinformation, which affect vaccine uptake. Effective

community engagement should be systematized for COVID-19 clinical trials and vaccine deployment. In particular social justice in access to COVID-19 vaccines in resource poor contexts became a major issue [51] [52] [53] [54]. Yet COVAX has not secured sufficient vaccine supplies and it is clear that a charity model for vaccine equity does not work. A key concern is the pricing of vaccines that is determined by intellectual trade-related property rights agreements, which means that novel, patent-protected products tend to be over the price range that low-income countries can afford.

3.3. Outcomes and Future Outlook

EBOLA:

The outcomes and impact of the Ebola outbreak response can be categorized into three: immediate, long-term and continuing risk.

Immediate

All Ebola outbreaks in West Africa and DRC were finally brought to the end. But only temporarily because the risk of another Ebola outbreak is always present [17] [18] [19]. Overall, the Ebola response brought in considerable amounts of resources to boost health infrastructure, staff skills and knowledge, as well as health institutions. Many lessons were learned, some were put to use. Other lessons will inform future emergency actions. Capacity has improved on many fronts in the Ebola affected areas. The countries now have emergency preparedness plans and plans for strengthening health systems resilience. The countries are certainly more prepared than before. But it is still hard to say whether the level of preparedness is adequate for the challenges of epidemics and emergencies.

Long-term

The lessons learned during the recent Ebola outbreak are likely to be long-lasting. These lessons will inform general changes in lifestyle and development strategies. In particular, the lessons should trigger an acceleration of health system development. Fragility and poverty are strongly associated with outbreaks such as Ebola. In the long run, a consistent focus on fragility and poverty elimination will improve the countries' health system preparedness and resilience to deal with disease outbreaks. Ultimately, health knowledge and practices of hygiene will foster good public health among the population.

Lingering risk

The situation remains unpredictable as to when the next outbreak will be. It is prudent to be ready for an outbreak or other kind of emergency. Some experiences have been negative. The examples of the burial of Ebola outbreak victims done by strangers in an undignified way, and the banning of bush meat, which people have eaten from time immemorial without incident, tell us to do better next time. Careful community engagement as part of preparedness planning will be necessary to address negative experiences.

The future outlook

Health risks are high and increasing. Individuals and communities must be made aware and change behavior [53]. There is need for community structures for constant vigilance, surveillance and reporting. Governments should have standby health emergency response teams and easily available emergency funds. Above all, governments should build resilient health systems. Governments should enhance community structures and PHC systems. Research is the heart of innovation to overcome and mitigate the impact of epidemics. There is need for a fast acting funding mechanism for epidemics and emergencies. Where feasible, emergency management should be decentralized and managed by or through local agents and workers. Respect for patients, including the dead and their burial, and other affected individuals and communities, is crucial.

Emergency operations should be broad based right from the start, which should include food, nutrition, water, sanitation and medical supplies. Always be prepared for multiple emergencies at the same time when an epidemic outbreak occurs. It is always crucial to empower communities as primary partners in an emergency, and to use survivors for public education and awareness building. Using a two-way communication with communities works well. Partner with local media and give consistent, clear and simple messages. Be open to learn from front-line workers who have incredible amounts of knowledge and ideas about epidemic/emergency management. During conflict avoid the use of armed guards. Use neutral international peace brokers to bring warring parties to agree on ceasefire and to create safe corridors for emergency work to proceed.

In dealing with policies of border relations, the economy and diplomatic relations, it is prudent to adhere to the principle of the centrality of people [54]. Global security requires continuous awareness creation among the public on individual and community health security. This needs the use of mass media. Post-Ebola interventions should not be overlooked. These include clinical and material support of survivors for at least two years. There is need to integrate Ebola surveillance into the national health management information systems.

COVID-19

Effects of measures

While current the current measures appear to have had a significant impact on decreasing COVID-19-related morbidity and mortality burdens, some policies such as mandatory vaccination are likely to cause more societal harm than good [53]. Restricting people's access to work, education, public transport and social life based on COVID-19 vaccination status impinges on human rights, promotes stigma and social polarization, and adversely affects health and well-being. Current policies may lead to a widening of health and economic inequalities, detrimental long-term impacts on trust in government and scientific institutions, and reduce the uptake of future public health measures, including COVID-19 vaccines as well as routine immunization.

For example, mandatory vaccination is one of the most powerful interventions in public health and should be used sparingly and carefully to uphold ethi-

cal norms and trust in institutions. COVID-19 vaccine policies should be re-evaluated in light of the negative consequences that we outline. Leveraging empowering strategies based on trust and public consultation, and improving healthcare services and infrastructure, represent a more sustainable approach to optimizing COVID-19 vaccination programs and the well-being of the public.

Perspectives for the future

COVID-19 response continues to be driven by epidemiological priorities, and yet, the epidemic and responses are situated within specific political and health system contexts [48]. An understanding needs to be made of the context and politics, power and social difference. There are four critical priorities for COVID-19 research and policy in the long term [49] [50] [51].

First, political-economy needs to support the design of public health measures and elucidate how public health responses are produced by political systems. Second, a better understanding of the political and social structures that relate to vaccine confidence will improve public trust, acceptability, effectiveness and uptake of COVID-19 vaccines and therapeutics.

Third, development of a social perspective on health and governance is vital to inform and untangle the complicated ways in which nationalism interacts with public health measures. Finally, how individuals and communities perceive, understand and construct COVID-19 risk and severity and seek help.

These insights support building trust and good relations between local and international research and program teams and between communities and researchers that will enhance confidence in the development, research and deployment of vaccines and other COVID-19 control measures.

3.4. Lessons

Table 3 summarizes the key lessons drawn from the experience of the two epidemics.

Table 3. Lessons drawn from the two epidemics.

Aspects where lessons are drawn from	EBOLA	COVID-19
1 The individual	Personal, home and food hygiene Stop risky habits such as hunting and eating bush meat	Hand and face hygiene Cough and sneeze etiquette Spacing out in crowds
2 Household	Household hygiene Immediate isolation and reporting of suspected cases	Ventilation of rooms Minimize number of people sleeping per room Spacing at home
3 Community	Community workers deployed for epidemic vigilance Surveillance and reporting Engage local leaders Train and use local agents for public health campaigns Use local people and radios to educate the public Avoid any acts that create suspicion; be transparent	Refrain from using armed soldiers, shooting or jailing people during epidemics and emergency Enabling local people, leaders, health workers and survivors to educate the public

Continued

4	Health system	Permanent emergency preparedness The need to sustain the capacity to deliver the core services, and aim to achieve universal coverage Making research an essential element of the health system Expansion of health care infrastructure nationally Securing a standby quick-to-be disbursed emergency fund Building and sustaining a national capacity for collaboration and coordination of emergency activities Establish an elaborate and continuous communication system The national readiness to legislate and enforce supporting laws and regulations Making emergency management structures flexible Ensuring effective infection prevention control measures Ensuring continuous quality improvement	Capacity to manufacture medicines, protective wear and other medical supply in countries or region Understand how politics and social dynamics can be used to improve public health measures, especially vaccine confidence Understand community and individual perceptions and behavior with regard to the disease
5	Psycho-social aspects	Stop bush meat hunting and consumption Stop eating raw meat Demystify stigma of patients and survivors Build a strategy to address fear, trauma, shame, guilt, stigma, loss of trust, and breakdown of community Rebuild trust in government and foreign emergency workers	Distancing in public Masks when in public Working at home when you can Stop embraces, hugs and greeting by kissing
6	Science and public health	The introduction of an experimental Ebola vaccine was not transparent	COVID-19 vaccination was riddled with coercion
7	Economic system	Grant support small businesses, women traders and farmers Food and nutrition support during and after the outbreak Provide water supply as part of emergency support	Grant support to businesses Food support during the emergency
8	Politics	Need to address polarization triggered or exacerbated by the outbreak Use neutral groups or actors Work on restoring trust in the government	Address misinformation and divisive issues Restore trust in governments and international organizations
9	International support	International donors need to establish emergency funds for quick disbursement WHO Emergency Response Team needs to be formalized as a permanent full time structure with readily available funds to scramble into action	A mechanism needs to be set up for equitable sharing of health technologies and knowledge Governments and international donors need to create permanent and readily available emergency fund
10	Global Health Security and Governance	Establish people centered policy for handling diplomatic and trans-border matters Governments' willingness, IHR and trust in WHO all broke down	Resolve the supply chain issues Build medical supplies manufacturing capacity within Africa

4. Discussion

Ebola has taught us that the risk of an epidemic is permanent and even increasing [55]. COVID-19 has shown that the next epidemic is just around the corner. For much of Africa, these scenarios are made worse by poverty, fragility of institutions and of governance [18]. In addition, Africa's incapacity to manufacture its own vaccines, medicines, diagnostics and protective wear has been de-

trimental in the management of epidemics, particularly COVID-19 [55]. The need to build this capacity has been made clear.

The post-epidemic socioeconomic outlook is generally gloomy [7] [9]. It is expected that a major global recession is coming. The Russia-Ukraine conflict has accelerated the global economic melt-down. Initially there was a dramatic decline in the stock-markets, airline industry, tourism, hospitality, and oil and gas markets. The value of gold plummeted. Life opportunities have become even more unequal. Unemployment has shot up everywhere. There was a disruption of the global supply chain, affecting vital industries everywhere. The cost of labor, vital for domestic work and agriculture, plummeted. Small businesses that depend on cash flow closed. Mortgages and rents have remained in arrears.

Through mass media, the epidemics have brought home a shocking realization to Africans of how grossly unjust the global economic system is [10] [11] [12]. Many Africans have become suddenly aware and angry about the current shameful global narrative about the continent and its people. Africa is depicted as a continent of conflict, corruption, diseases and dependency. The economic and social inequalities are stark against Africa. Youth unemployment in Africa is the single most explosive contemporary issue on the back of COVID-19 pandemic. This has made the youth even more restless, and a potent source of violence and insecurity.

The need for enhanced personal and home hygiene has been emphatically brought to attention [54]. The trust of the government and all other agencies doing humanitarian work has become the cornerstone of epidemic and emergency management. The use of armed soldiers and operations, including mounting road checks, increase mistrust and drive away people from seeking help and care during emergencies.

The use of trusted local leaders and epidemic survivors has been effective in mobilizing people during emergencies [38]. These leaders include teachers, religious leaders, chiefs, and community health workers [42] [43]. Communities want local leaders and familiar people who speak the local dialect to be responders in the outbreak. Responders include vaccinators, disinfectors, support staff and drivers. Therefore community engagement should be designed, validated and refined to incorporate the concerns, values and practices of local people.

Epidemic survivors have in some cases done more mobilization than all the public education done. However, understanding the local politics of a community and the social dynamics is essential in planning emergency public health measures. Emergency workers must avoid getting into polarized politics and stick to neutral ground. They need to confine themselves to technical management of the epidemic based on science and evidence [38] [44] [53]. They need to confine themselves to technical management of the epidemic based on science and clear evidence. Otherwise, they can very easily be distrusted [54].

It is critical to understand community and individual perception of the risk of getting the disease [31]. Accordingly, a response strategy can be designed. Often

neglected or put last is the aspect of addressing psycho-social reactions to epidemics and emergencies. These include fear, trauma, shame, guilt, stigma, loss of trust, and breakdown of community. The epidemic response must be designed to address these aspects in advance. The science behind the response measures should be explained simply and trustfully. Any shortfalls of the measures and what is not known should be explained honestly. Misinformation must be avoided and quickly countered.

The spread of public knowledge should be a double strategy of bottom-up and top-down approach. Communities are important in the management of health care. In particular, understanding community perceptions, human behavior, willingness to report and complying with established procedures is critical. Communities need to be empowered through education, assurance of good health, economic and social support, and health knowledge. Each community needs a unique and different way of engagement.

It is important to address misinformation. Vaccine confidence, for example, is influenced by historical, cultural and political dynamics. Social relations, trust and legitimacy are particularly important. Social science inquiry can reveal how governments and country coordinating bodies can improve public trust, acceptability, effectiveness and uptake of vaccines and therapeutics. The root of mistrust often extends beyond the epidemic, making acceptability contingent on past relations between communities, healthcare providers and international agencies. Altruism, sacrifice, curiosity and hope in participants' decision-making, even despite their fear, are important.

Emergency funds should be easy and quick to be disbursed, whether from donors or within the country. This means that that the relevant UN agency, WHO, should have authorized and mandated by convention to have an emergency fund at all times [55]. Countries should be encouraged to create and operate a sizable and quick to disburse emergency fund. Mechanisms to globally and equitably share health technologies and knowledge (on items such as vaccines, medicines and diagnostics) should be devised under the auspices of the UN [55]. And people centeredness ought to guide the conduct of trans-border movements and transactions during pandemics [56].

The UN emergency response system should therefore transform into an international, formalized and full time institution, not an ad hoc and periodic effort or institution. There has to be full time engagement and coordination with other big players such as the World Bank. International donors need to establish joint emergency funds for quick disbursement. The WHO Emergency Response Team needs to be formalized as a permanent full time structure with readily available funds to quickly scramble into action. A mechanism needs to be set up for equitable sharing of health technologies and knowledge, with focus on how to help out poor countries.

5. Conclusion

This review points to much work that needs to be done to upgrade the current

response to pandemics. Innovative approaches are needed at individual, community, national and global levels. Public education and counseling, response capacity building, and cooperation among nations must all be improved. Above all, there is need to foster and sustain political will to build a global health security.

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Conflicts of Interest

The author declares no conflict of interest regarding the publication of this paper.

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