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LESSONS LEARNED FROM ETHIOPIA'S PREPAREDNESS AND INITIAL RESPONSE TO THE COVID-19 PANDEMIC

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[1] Also referred as Professional Advisory Council and Scientific Advisory Council.

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Acronyms

AAU	Addis Ababa University
AC	Advisory Council
ACIPH	Addis Continental Institute of Public Health
AHRI	Armauer Hansen Research Institute
CEOs	Chief Executive Officer
COVID-19	Corona Virus Disease 2019 (COVID-19)
EFDA	Ethiopian Food and Drug Administration
EMA	Ethiopian Medical Association
EMJ	Ethiopian Medical Journal
EPFSA	Ethiopian Pharmaceutical Fund and Supply
EPHI	Ethiopian Public Health Institute
EPHA	Ethiopian Public Health Association
GoE	Government of Ethiopia
HCF	Health Care Facility
HPAC	Health Professional Advisory Council
ICU	Intensive Care Unit
IHR	International Health Regulation
IPC	Infection Prevention Control
IRB	Institutional Review Board
IV	Intra Venous
NPIs	Non-Pharmacological interventions
MHPSS	Mental Health and Psycho-social Support
MOE	Ministry of Education
MoH	Ministry of Health
MOSHE	Ministry of Science and Higher Education
PAC	Professional Advisory Council
PI	Principal Investigator
POE	Point of Entry
PPE	Personal Protection Equipment
RCCE	Risk Communication and Community Engagement
RHB	Regional Health Bureau
SAC	Scientific Advisory Council
SSA	Sub Saharan Africa
UNICEF	United Nations Children's Fund
UV	Ultra Violet
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization

Executive Summary

Introduction

Ethiopia reported the first confirmed case of coronavirus disease 2019 (COVID-19) on March 13, 2020. The novel pandemic has posed unprecedented challenges to the Ethiopian health, social and economic sectors. The socio-economic effects of the pandemic have been complex due to the presence of large, vulnerable populations, especially in urban areas. The health information system, unprepared to handle such a significant health crisis, faced additional challenges from the influx of information and misinformation, complicating response efforts. Dynamically monitoring the spread of the pandemic was, therefore, very difficult. However, the multisectoral coordination involving government and non-government stakeholders, including the diaspora, was unprecedented. In collaboration with the Ministry of Health (MoH), the Advisory Council decided to document the lessons learned during the initial phase of the pandemic to better prepare for future health crises.

Objectives

The study aimed to document the lessons learned from Ethiopia's COVID-19 pandemic preparedness and response.

Methodology

The study utilized a qualitative approach, supplemented by a desk review of various documents related to the COVID-19 response, including guidelines and publications. It was conducted at the national, regional, and facility levels. A total of 102 in-depth interviews were conducted with experts from all levels of the health system and among significant stakeholders, using semi-structured interview guides. The study period spans the initial detection of the pandemic through June 2021. A thematic framework analysis was performed based on the study's specific objectives, while a content analysis was conducted for the reviewed documents. The transcribed text was entered into *Atlas ti 7* qualitative data analysis software. Ethical clearance was obtained from the EPHA's Institutional Review Board (IRB) and informed oral consent was secured from each study participant.

Results

The findings of the study are organized under several themes below. These thematic areas reflect the diversity of the tasks implemented by various task forces to combat the pandemic. The task forces were based at either the Ministry of Health (MoH) or the Ethiopian Public Health Institute (EPHI) and included experts delegated by professional associations, non-governmental organizations, academic/research institutions, and diaspora professionals. A summary of the findings in each thematic area is presented below:

Coordination and Multisectoral Collaboration: The Prime Minister's office led the entire government in national COVID-19 pandemic preparedness and response efforts through multisectoral coordination mechanisms across various ministries. The Ministry of Health (MoH) and the Ethiopian Public Health Institute (EPHI) were given technical responsibilities. Similarly, the highest administrative offices in most regions led the response coordination at subnational levels. The MoH coordinated the technical aspects related to the pandemic.

The government took measures to protect the country and its communities by closing services and schools and implementing a state of emergency twice. The level of engagement in the multisectoral effort was unprecedented for a health-related crisis during the initial months of the pandemic. However, this engagement declined as the pandemic entered a protracted phase, influenced by other competing priorities, including elections and conflicts. The enforcement of non-pharmaceutical interventions was compromised by misinformation, the diversion of political leaders' attention, and the precarious living conditions of citizens, which were shaped by cultural, social, and economic realities.

Risk Communication: Risk communication was initiated even before the first case of COVID-19 was reported, utilizing both public and private media outlets, including social media and billboards. Call centers were established in collaboration with the Ethio Telecom. Recognized social groups and individuals, including religious leaders, elders, public figures, and investors, actively participated in risk communication activities. Nevertheless, managing the volume of information and misinformation was a significant challenge, leading to public reluctance to fully adhere to scientifically proven prevention and control interventions.

Surveillance: The surveillance system was enhanced following the World Health Organization's declaration of COVID-19 as a Public Health Emergency of International Concern (PHEIC) to support case identification and contact tracing. Virtual training was provided to expedite the deployment of thousands of surveillance personnel. Relentless efforts were made to improve data management and contact tracing. However, surveillance was inadequate due to the manual handling of data, a shortage of personnel for contact tracing, and many informal points of entry (PoE).

Testing: The nation's zero-testing capacity was quickly enhanced to more than ten thousand daily tests by re-purposing public and private university facilities and laboratories. However, testing proved expensive, and large-scale testing was not sustainable for an extended period. Private testing centers provided the much-needed relief to the heavily constrained public facilities. These private centers received considerable government support to

expedite the importation of machines and supplies necessary for COVID-19 testing. Over time, the private sector's service expansions were increasingly driven by profit, resulting in unacceptably high service costs. The testing strategy and capacity were insufficient to understand the pandemic at a granular level and to implement timely interventions.

Infection Prevention and Control (IPC): IPC was enhanced in all health facilities by revising protocols, training the health workforce, and procuring IPC materials. The COVID-19 pandemic created opportunities for innovation; locally produced items included face masks, hand sanitizers, automatic water and soap dispensers for hand hygiene, and area disinfection machines. Nevertheless, shortages of supplies and failure to adhere to IPC protocols remained severe challenges. A critical shortage of Personal Protective Equipment (PPE) was exacerbated by misuse and abuse. The scarcity of water and sanitary facilities at health institutions resulted in inconsistent IPC/WASH practices. Additionally, logistics and material shortages hindered the training and deployment of the necessary health professionals at the pandemic's start, presenting further challenges to IPC efforts.

***Case Management*:** Immediate actions were taken to free up COVID-19 treatment space in existing health facilities and temporary locations, such as the Millennium Hall, which served as treatment centers. Efforts to establish functional treatment centers were reasonably successful; the number of intensive care units (ICUs) equipped with mechanical ventilators increased, albeit grossly inadequate, due to the global shortage. In addition, the opening of private treatment centers helped manage more cases, although the cost of treatment was exorbitantly high.

The protracted pandemic also caused fatigue and burnout among healthcare workers and severely constraining the provision of essential services. Initially, mental health and psychosocial support mechanisms for frontline health workers and individuals in isolation were lacking. They were later incorporated into the guidelines with the assistance of mental health professionals and their associations. The functionality of routine health services was restored relatively quickly after the initial interruption. However, the adverse effects of COVID-19 on certain routine services, such as immunization and care of patients on long-term treatment, remain unknown.

***Supplies and Logistics*:** This was a relatively well-organized component of the health system. Nevertheless, workforce shortages, dependency on the external market, and limited capacity for local production constrained the supply chain management system shortly after the pandemic began in the country. Regulatory flexibilities regarding the importation of medical supplies and successful efforts to boost domestic production of medical materials quickly increased the availability of Personal Protective Equipment (PPE). However, the government procurement system was not conducive to handling emergency procurements, a situation compounded by the lack of emergency funds. Additionally, the tendency for countries that produce supplies and equipment and those capable of paying higher prices to hoard these resources exacerbated global shortages, creating severe consequences for low-income countries.

Conclusions and Recommendations

Despite the concurrent challenges, including political, natural, and other man-made disasters, Ethiopia's COVID-19 pandemic response was reasonable. The multi-sectoral efforts, domestic resource mobilization efforts, and innovations to overcome shortages of supplies and equipment were among the best practices. For instance, testing, isolation, and case management capacity were increased by repurposing existing lab machines, buildings, and health facilities. However, the health system was overstretched in the first few months of the pandemic, and had it not been for the relatively mild nature of the pandemic in Ethiopia, the human losses could have been tragically high.

The risk communication approaches failed to promote strict adherence to COVID-19 prevention and control efforts. The involvement of the private sector, professional associations, academic/research institutes, and non-governmental organizations was critical in strengthening the response efforts. Additionally, the Ethiopian diaspora made significant technical, logistical, and financial contributions to support these efforts.

Establishing a standing professional advisory council must be seriously considered in preparing for and responding to future pandemics. Such a body can be engaged in revising strategies for risk communication, surveillance, management of essential medical services, and providing psycho-social support. In addition, strengthening the human resource capacity, improving the health information system, and establishing an emergency procurement system along with emergency funds are critical for future pandemic preparedness.

A well-thought-out directive addressing the standards of care and pricing must guide the private sector's involvement in the pandemic response. Supporting efforts to produce essential medical supplies domestically should be given high policy priority.

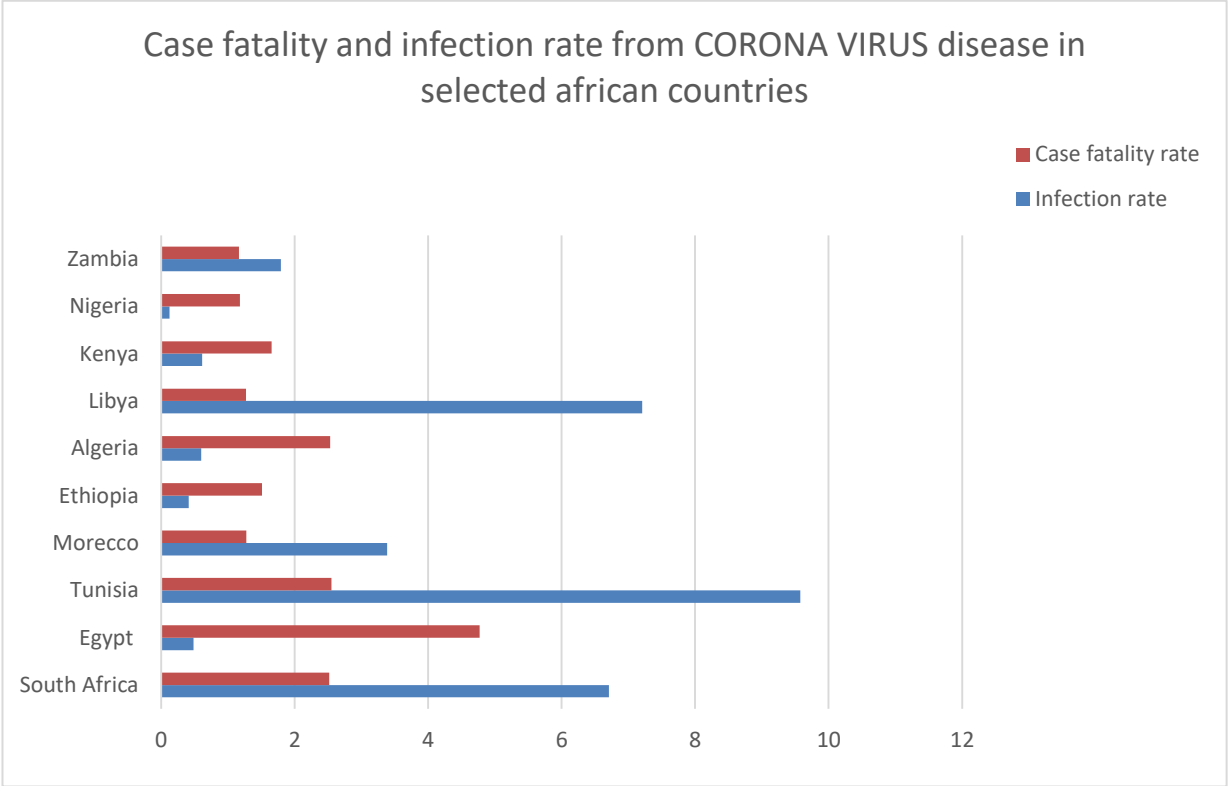
I. Background

1.1 Global, regional, and national status of COVID-19

The coronavirus disease 2019 (COVID-19) pandemic is a novel disease that emerged from Wuhan in China in December 2019 and quickly spread worldwide (1). Once COVID-19 was declared by the World Health Organization (WHO) as a public health emergency of international concern, every country started to observe its impact(2). Countries faced unprecedented health, economic, and social consequences. No government appeared fully prepared to handle the pandemic effectively and with minimal sequelae.

The WHO declared COVID-19 a global pandemic when the confirmed number of cases reached 200,000 and after 8000 deaths across 160 countries. China and Italy were the first countries affected globally(3). The pandemic is considered the most serious in the 21st century so far(4). According to the Worldometer,[2] The top five countries that were highly affected globally, in descending order, were the USA, India, Brazil, Russia, and France. The first cases of COVID-19 in Africa were identified on February 14 in Egypt and on February 27 in Nigeria) (5).

The five most affected African countries were South Africa, Morocco, Tunisia, Ethiopia, and Egypt: Figures 1 and 2 present Africa's confirmed cases and deaths by April 2021. Although the pandemic in Ethiopia initially had its epicenter in the capital, Addis Ababa, it later spread to most urban centers in all regional states. The occurrence of cases in the rural population was low (6,7), partly due to the lack of testing to confirm infections and the sparse population density in rural areas, which provided natural physical distancing. The number of daily new cases in Ethiopia, obtained from Worldometer, is depicted in Figure 3. The figure shows multiple waves of the pandemic in the country, some small and some large.



[2] https://www.worldometers.info/coronavirus/

Figure 1: **Infection and case fatality rates (in percentage) of CORONAVIRUS disease in 10 most affected African countries by the pandemic**
Source: Worldometer, accessed on February 16/2024

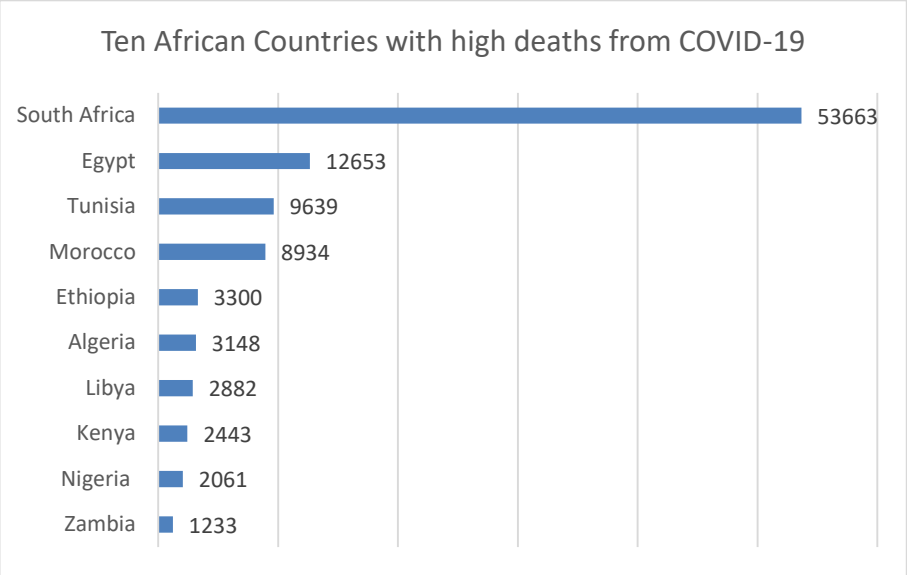


Figure 2**: Ten African countries with the highest number of deaths from Coronavirus disease as of April 16, 2021**

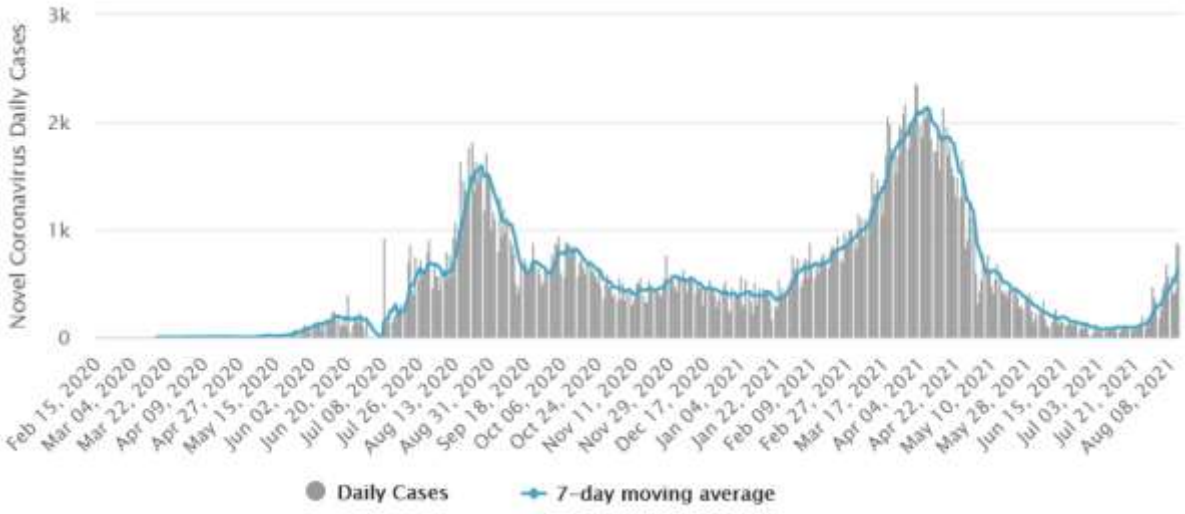


Figure 3: **Daily confirmed COVID-19 cases reported in Ethiopia**
Source: Worldometer as accessed on August 12, 2021

Despite unprecedented efforts and global collaboration to combat the pandemic, COVID-19 continued to pose an international public health threat. Countries struggled to balance safeguarding public health with saving their economies; as no proven strategy was available, they were forced to adopt a 'trial and error' approach(4,8). The COVID-19 pandemic exposed the weak societal and organizational structures insufficient to ensure global health security. The lessons learned during the pandemic highlighted the urgent need to re-think existing public health and emergency management approaches, enabling countries and the international community to better cope with future pandemics(9,10) and minimize multidimensional damages (5,11).

Weaknesses in the health system and the presence of large, economically vulnerable populations complicated the fight against the pandemic in low-income countries. The poorly developed health information systems, especially in low-income countries, along with the barrage of emerging scientific evidence and misinformation, further undermined the effectiveness of the responses by eroding public trust due to conflicting messages from multiple sources (12,13).

The interventions to contain the pandemic led to severe social and economic challenges, disrupting routine services and threatening the gains made in communicable and non-communicable disease prevention and control

efforts(13). When the pandemic emerged, the situation in Africa was characterized by financial challenges, under-maintained health infrastructure, a shortage of health workers, and scarce medical supplies(13).

In the early stages of the pandemic, African countries, including Ethiopia, drew on experiences in managing similar viral pandemics, such as Ebola on the continent (14). However, the weak public health information and communication systems hindered the implementation of lessons learned from the past (15). The lack of systems for sharing locally available data in real-time was one of the barriers to implementing appropriate interventions (16).

The response to the pandemic was complicated by the heterogeneity of the occurrence within a country, sub-regions, and even within a city, demanding calibration of responses to the magnitude of the event and socio-economic circumstances (17). African nations were chasing the pandemic from behind rather than staying ahead of it, leading to an exponential increase in the number of cases and deaths during successive waves (18). In addition, Ethiopia faced a large influx of deportees and internally displaced people, who had additional psycho-social needs (19). To address the pandemic, Ethiopia had to recruit more than 45,000 healthcare providers from different professional categories (20).

Ethiopia took various measures even before the first case was reported in the country, following the announcement of its first case on March 13, 2020 (21). Higher officials and political leaders established and led national and subnational task forces. Emergency operation centers were established and resourced to enable centers to provide critical services. Following this, a series of actions were taken based on the recommendations of the Health Professional Advisory Council (HPAC) established by MoH to support preparedness and response.

Public gatherings were limited, school closures were ordered, high-risk civil servants were directed to work from home, and borders were closed. Ethiopia suspended many international flights and restricted ground mass transport services. The country declared a five-month national state of emergency and granted pardons to thousands of prisoners pardons to reduce overcrowding in prisons (22)Ethiopia also postponed the national election. The launch of the 'PM Abiy-Jack Ma initiative' helped bolster response efforts by gaining access to COVID-19 diagnostics, infection prevention, and control commodities. Additionally, Ethiopia expanded its COVID-19 testing laboratories from zero quickly to a significant number.

According to a United Nations (UN) report (23), Ethiopia's preparedness for the pandemic was among the lowest due to an inadequate health system, low connectivity, and a limited number of hospital beds. Regardless, Ethiopia took unprecedented actions to cope with the pandemic. Table 1 summarizes the significant steps taken by the government of Ethiopia in response to the pandemic.

Table 1: **Chronology of COVID-19 response in Ethiopia**

Date	Action
13 March 2020	The first case of COVID-19 was identified in Ethiopia. The initial case involved a 48-year-old Japanese man who arrived in Ethiopia from Burkina Faso. The second report included three cases: two Japanese individuals and one Ethiopian, all of whom had contact with the first Japanese person.
16 March 2020	Recruitment and training health professionals were coordinated by the Ethiopian Medical Association (EMA).
	The establishment of Advisory Council was also initiated. The council comprised professionals delegated by various associations and experts from the diaspora worked alongside its members. .
23 March 2020	Public gatherings were suspended. The government limited public gatherings, including religious practices, sporting events, and concerts. It also ordered school closures and high-risk civil servants to work from home. Essential activities were allowed to continue under strict containment measures.
	Transport was restricted. Taxi and other mass transport services were limited to operating at half their load capacity. The nine regional states and two city administrations imposed travel restrictions.
	Flights were suspended. Ethiopia initially suspended flights to 30 countries severely affected by the pandemic, extending this to more than 80 countries on March 29, 2020.
	Land borders were closed. Ethiopia closed all land borders and deployed security forces to enforce this measure.
	Prisoner pardons were granted—over twenty thousand prisoners received pardons to prevent the spread of the disease in prisons.
5 April 2020	The election scheduled for August 29, 2020, was officially declared postponed.
	High-level engagement with religious leaders was conducted. The Ethiopian Religious Council, which includes members from various religions in the country, declared a one-month The prayer program ran from 6 April to 5 May 2020. The prayers were televised live to encourage worshipers to stay at home.
	Massive media campaigns. Different national multimedia outlets and billboards disseminated facts and educational information to create awareness and deliver up-to-date information about COVID-19. Ethio Telecom used cell phone ringtones to remind people of the importance of hygiene measures.
8 April 2020	A state of emergency was declared after compelling evidence showed that community transmission of COVID-19 had begun. The government declared a five-month national state of emergency. The Minister of Health started giving daily COVID-19-related briefings, including the number of tests performed, confirmed cases, deaths, and recoveries.
17 March 2020	International collaborations harnessed. The country took steps to leverage international collaborations to combat the pandemic. Ethiopia's Prime Minister and Chinese businessman Jack Ma launched an initiative on March 17, 2020, to support African countries with COVID-19 diagnostics and infection prevention control commodities. Ethiopian Airlines transported these supplies to African Union Member States, which included test kits, masks, and protective suits. The African Center for Disease Control and Prevention provided technical guidelines appropriate to the African context.
02 June 2020	Travel history was no longer included in the daily report.
Aug- Sept 2020	The ComBAT Campaign was launched to significantly enhance response efforts. Daily COVID-19 tests were increased to the maximum possible level, and efforts to enforce preventive measures were strengthened.

1.2 Rationale for this study

Ethiopia has experienced many epidemics and pandemics like many other African countries, including the Spanish flu, smallpox, cholera, meningitis, measles, and HIV, among others, with devastating effects and consequences (11,14,24,25). The inadequate documentation of lessons learned during these outbreaks resulted in a loss of institutional memory and inefficient handling of new outbreak occurrences. Documenting lessons learned in responding to outbreaks is essential for better preparing for future epidemics, thereby reducing human suffering/loss and severe social and economic damages.

Cognizant of the need, the Ministry of Health and the Health Professional Advisory Council, in consultation with relevant stakeholders, commissioned this study to document the lessons learned during the initial phase of the COVID-19 pandemic.

The assessment utilized the World Health Organization's evaluation framework for epidemic preparedness and response (Figure 4). The framework considers inputs and activities required to effectively manage epidemic preparedness and response. Using such a framework is helpful for systematically capturing evidence and identifying areas that need improvement in the future.

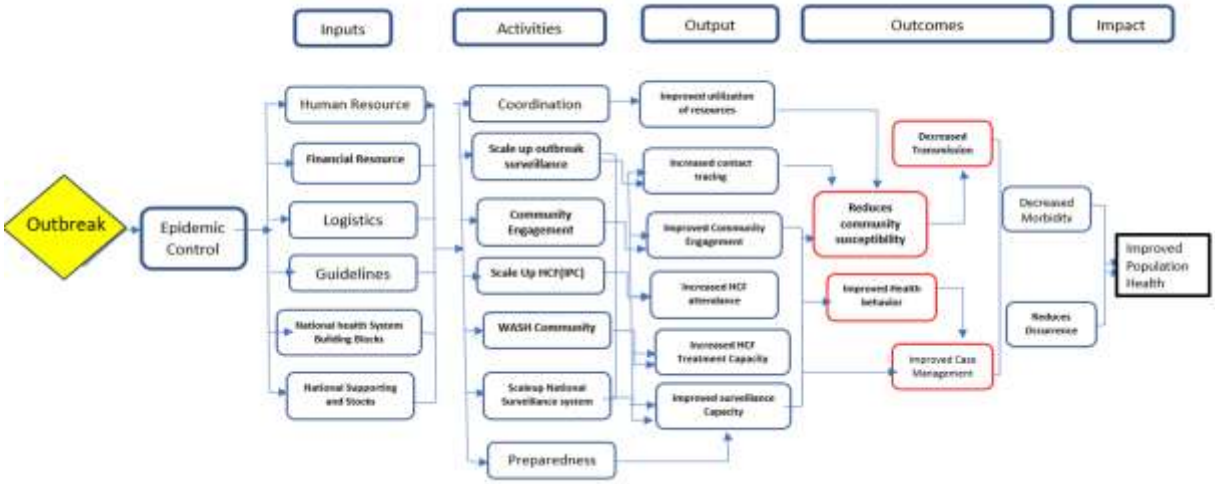


Figure 4**: Evaluation Framework for Epidemic Preparedness and Response**
Source: *Warsame A, Blanchet K, Checchi F. Towards Systematic Evaluation of Epidemic Responses During Humanitarian Crises: A Scoping Review of Existing Public Health Evaluation Frameworks. BMJ Glob Health. 2020 Jan 30;5(1):e002109.*

II. Study Objectives

This study aimed to systematically gather evidence to document lessons learned in responding to the COVID-19 pandemic in Ethiopia. The study specifically focused on lessons learned related to:

- Coordination, planning, and monitoring
- Risk communication and community engagement
- Surveillance, rapid response teams, and case investigation
- Points of entry, international travel, and transport corridors
- Laboratory capacity
- Infection prevention and control
- Case management
- Supply Chain, Logistics, and Regulatory Oversight and
- Maintaining essential health services

III. Methods

3.1 Study context

The study was conducted in seven regions, two city administrations, and federal offices in Ethiopia from December 15, 2020, to April 2021. The Health Professional Advisory Council (HPAC) for the Ministry of Health of Ethiopia was responsible for the study's conceptualization, planning, and execution. The Ethiopian Public Health Association facilitated the ethical review and management of the research project. The Ministry of Health financially supported the study. This study occurred while the COVID-19 pandemic spread in multiple waves in Ethiopia and globally.

3.2 Study Design and Participants

The study utilized a qualitative approach to obtain relevant information to address its objectives. The study subjects were selected based on their responsibility in the COVID-19 response. The study participants were drawn from federal and regional level agencies and facilities, including the Ministry of Health (MoH), Ethiopian Public Health Institute (EPHI), regional health bureaus, Ethiopian Pharmaceutical Fund and Supply Agency (EPFSA), Ethiopian Food and Drug Administration (EFDA), regional public health institutes, Advisory Council members, treatment centers, isolation and quarantine centers, law enforcement agencies, media agencies, relevant sectoral ministries such as Industry, Commerce, Construction, Education, and higher learning institutions.

A purposive sampling strategy was employed to identify eligible participants. Individuals responsible for the relevant tasks were primarily approached for interviews. Individuals recommended by the primary target participants were also invited for interviews. A total of one hundred two in-depth interviews were conducted (Table 2).

Table 2: **Samples interviewed for the study**

Organization/ agency	**# Interviewed**
MOH	4
EPHI	3
Media	3
Prime Minster Office	1
Other Ministry (MOE, MOSHE, Industry, Transport)	4
Advisory Council	1
AHRI	1
PSFA	1
EFDA	1
Law enforcement	2
NGO	10
Regional Health Bureaus	9
Regional Education Bureaus	9
Isolation/quarantine centers	9
Treatment centers	9
EOC	9
CEO and directors of health facilities	9
Health professionals and psychosocial workers	9
Community representatives	9
Total	102

3.3 Data Collection and Processing

Interviews were conducted face-to-face using interview guides while following COVID-19 prevention protocols. The interview guide was developed in English; however, the actual interviews were conducted in a language mutually convenient for both the interviewer and interviewee. Interviewers (research assistants) held at least a Master's degree and had prior qualitative research experience. The study team provided three days of training to the research assistants on the study objectives, approach, tools, and a refresher on conducting qualitative interviews.

The study investigators and designated researchers facilitated and supervised the fieldwork. All interviews were audio recorded with the participant's consent, and notes were taken to augment the interviews and capture the context. The digital audio recordings were then transcribed and translated into English (20) The person who conducted the interview performed transcription. Interviewers also prepared extended field notes using a structured framework during data collection. Daily debriefing sessions addressed and integrated emerging issues in the field.

3.4 Data Analysis

The study's specific objectives guided the thematic framework analysis used for the study. The transcribed text was transferred to Atlas.ti 7 qualitative data analysis software. Both predefined and emerging themes were incorporated within a hierarchical framework. The thematic framework was systematically applied to all of the interview transcripts. The transcribed data were coded based on the codebook, with additional codes incorporated during analysis. The desk review was conducted using a content analysis approach, focusing on identifying facilitators and barriers within each domain of inquiry. The trustworthiness of the findings was enhanced during the interpretative analysis through feedback sessions with research team members. In addition, results were presented at two major stakeholder meetings, and the feedback was incorporated into this paper.

3.5 Ethical Consideration

Informed oral consent was obtained from each study participant. The research aims, and processes were explained to all participants to secure their consent. All interviews were conducted in a convenient private space for the participants. The identities of participants and the organizations were kept confidential at all stages of the analysis. After transferring data from the digital recorders to a secure laptop, the data were deleted from the digital recorder. The transcripts contained no participant identifiers, such as names or nicknames. Transcripts were shared only with study investigators for analysis and report writing. During the interviews, the research team and study participants were provided face masks and sanitizers, and the physical distancing protocols were observed.

IV. Findings

This paper is organized around the key pillars of the public health response recommended for the COVID-19 pandemic, which includes coordination, planning, and monitoring; risk communication and community engagement; surveillance, rapid response teams, and case investigation; points of entry (including international travel and transport); laboratory services; infection prevention and control; case management; operational support and logistics (including supply chain management); and essential health services and systems. Key findings are summarized below for each thematic area.

4.1. Coordination, Planning and Monitoring

4.1.1 Coordination

The COVID-19 pandemic was considered a national challenge by all stakeholders, and all concerned bodies realized the need to act in a coordinated manner. Multisectoral collaboration was initially strong, with every sector enthusiastically engaged in the pandemic response. Multisectoral collaboration and engagement task forces were established at federal, regional, and local levels. Higher officials led these task forces, including the Prime Minister's office at the federal level and the regional president's office in the regional states. The police force, Attorney General, Ministry of Peace, Ministry of Transport, Ministry of Education, and other concerned governmental offices were engaged nationally in the pandemic response. At the sub-national level, the corresponding offices were involved.

The Health Professional Advisory Council was established through professional associations. Such an organized engagement of experts from the in-country and the diaspora was unprecedented. At all levels, the health sector coordinated the technical team. The MoH and EPHI established different technical working groups, including those focused on Logistics, IPC, Planning, Case Management, Surveillance and testing, facility readiness, and regional support.

A member of the national task force explained: *"The coordination was good as it involved key sectors, including law enforcement, transport, education, and others. However, the pace of implementation was slow, and the roles of different sectors were unclear.* Some considered the pandemic response to be the responsibility of the health sector/MoH, leading to a lag in establishing a multi-sectoral response to COVID-19. This attitude prevailed at almost all levels as the pandemic continued for an extended period. Some of the best practices and constraints regarding coordination at the national, regional, and local levels are summarized in Table 3.

Table 3: **Best practices and constraints of coordination at the national, regional and local level**

	Nationally	Regional	Local
Best practices/ Facilitators	• Active engagement of high-level government officials in coordinating the response • Active engagement of professional bodies both nationally and internationally • High level of political commitment to mobilize public and domestic resources	• Active engagement of high-level government officials in coordinating the response • Active engagement of professional bodies in the response.	• Active engagement of multisectoral implementers in the response
Constraints/ Barriers	• Blurred/unclear roles and responsibilities among different stakeholders • Waning down of active engagement by many sectors as the pandemic took a protracted course • Managing multiple interest groups was time-consuming and sometimes triggered conflicts of interest • Shortage of well-qualified professionals	• Active multi-sectoral collaboration declined rapidly • Lack of a transparent command chain	• Multisectoral coordination was almost abandoned after the initial few months. • Only the health managers and facilities became responsible for the response as the pandemic took a protracted course.

4.1.2 Planning

The MoH and EPHI coordinated the development of the COVID-19 preparedness and response planning document. Some of the best practices included the timely development of the emergency response plan, the prompt initiation of the emergency center, and subsequent adaptations of the national emergency plan at regional and local/facility levels. The emergency response plan was implemented almost immediately at all levels, although some delays were observed in some localities.

Due to the urgency of the matter and the shortage of experts at lower levels, a top-down planning process was adopted. Despite efforts to rapidly cascade training, adopting the plan at the health facility level took considerable time. A health facility head explained the issue: "Initially, only orders were given from EPHI without proper explanation…it was challenging to implement the action plan."

Additional constraints to implementing the plan on the ground included contradictory information about prevention methods, multiple pandemic projections based on uncertain assumptions, and a lack of experience that matched the predicted scale of the pandemic. Relevant guidelines were made available while the pandemic was spreading. The best practices and challenges are summarized in Table 4.

Table 4: **The Best Practices and Constraints of Planning at the National, Regional and Local Levels**

	Nationally	Regional	Local/institutions
Best practices/ Facilitators	• Timely development of the Emergency response plan • Timely initiation of the Emergency Operation Center • Continuous efforts to develop and update guidelines and manuals necessary for the response • Provision of virtual training for thousands of responders, including frontline responders	• Timely adaptation of the emergency response plan • Timely initiation of the Emergency Operation Centers • Provision of virtual training for thousands of front-line responders	• Quickly adapted the national emergency plan • Integrated the emergency plan with routine service delivery
Constraints/ Barriers	• Uncertainties about the virus and the effectiveness of the preventive measures created confusion and eroded the confidence of the pandemic workers. • Multiple projections based on many uncertain assumptions • Lack of previous experience that matches the scale of this pandemic • Learning by doing impeded efficient use of meager resources • The emergence of too much evidence, sometimes contradicting, eroded public confidence	• Delayed response to initiating an emergency plan • Evolving guidelines and plans created confusion and inappropriate use of resources. • Inadequate resources impede implementation.	• Lack of experienced and qualified persons.

4.1.3 Implementation and Monitoring of Responses

The emergency preparedness plan was developed promptly, although it required continuous adjustments. Its execution faced challenges due to inadequate human resources, medical equipment, and laboratory supplies and insufficient infrastructure (including water and waste management) at the facility level. Preparations for Mental Health and Psychosocial Support (MHPSS) services were particularly delayed due to limited prior experience, inadequate financing, and delayed engagement of trained professionals at all levels.

The execution of the emergency plan was also severely constrained by the market shortage/lack of supplies and government procurement procedures unsuitable for emergency purchases. Challenges varied from region to region, depending on the presence of stakeholder support, the local political leaders' commitment, and the strength of the regional health system and infrastructure. Most regions revised their annual plans promptly to integrate the COVID-19 response. However, in many areas, the integrated plan faced challenges in the execution due to resource limitations (with resources not proportional to needs), competing government priorities (economic and political), failure to mobilize adequate local resources (leading to dependency on federal assistance), disinformation, and poor public compliance.

As the pandemic continued, the commitments of the multisectoral stakeholders declined, and providers' demands for continued compensation/benefits went unmet, further compounding the response's efficiency. Initially, the risk compensation for health workers did not consider sustainability; though the compensation offered to providers was necessary, the amount was not sustainable. Efforts to address the human resource shortage by mobilizing volunteers and engaging high-level government officials for resource mobilization were only partially successful in the initial phase of the pandemic. The summary of best practices and constraints is presented in Table 5.

Table 5: **The best practices and constraints of national, regional, and local planning for executing COVID-19 emergency preparedness and response plan.**

	Nationally	Regional	Local/institutions
Best practices/ Facilitators	• Mobilized human and other resources – mobilized volunteers and re-purposed staff deployment • High-level officials at the forefront of resource mobilization	• Mobilized human and other resources - mobilized volunteers and re-purposed staff deployment • High-level officials at the forefront of resource mobilization	• Ability to integrate emergency plans with routine plans • Mobilized resources from local implementing partners
Constraints / Barriers	• Resource limitations – resources not proportional to the demand/needs • Other competing government priorities-economic, political…	• Resource limitations – resources not proportional to the demand • Other competing government priorities-economic, political… • Failure to mobilize adequate local resources/dependency on federal assistance	• Less compliant with the emergency response plan • Disinformation and poor public compliance, more as the pandemic progresses • Healthcare workers' commitments faded in the long pandemic course as the demand for compensation was unmet.

4.2. Risk Communication and Community Engagement

Risk communication and community engagement (RCCE) are among the most critical interventions in any public health response. RCCE involves communicating what is known, what is unknown, and what actions are being taken to all concerned parties. Effective communication and community engagement can help overcome confusion/misunderstandings and deliver complex scientific knowledge to build trust between providers and the population.

Ethiopia initially used mass media f effectively for risk communication. All public and private media outlets were utilized to create awareness. In addition, social media and billboards in public spaces, such as bus stations and marketplaces, were widely employed for communication. The risk communication materials were prepared in several languages, and efforts were made to customize them to local contexts. Call centers (free hotlines) were established with Ethio Telecom. However, in some regions, it was challenging to address all segments of the population, especially those living in remote areas. Efforts were made to use traditional communication channels: "*…our community has a traditional information exchanging culture (Dagu) that helps disseminate messages quickly to many people... Therefore, we tried to reach the community through that as well" (Respondent from Regional Health Bureau (RHB))*

Different social groups and individuals, including religious leaders, elders, public figures, and influential personalities, directly participated in creating and promoting awareness of preventive measures while providing significant logistical and financial support. However, this support was neither adequate nor sustained. Efforts were notably lacking in dealing with mental health and psycho-social support needs, which, in some instances, caused confusion, hopelessness, and frustration.

Other challenges in implementing risk communication included limited access to social media due to internet coverage, politicized and counterproductive comments, poor contextualization of messages, resistance from some groups (social, religious, political…), and a lack of resources, especially human resources. Another major challenge was the media coverage of significant events, including political rallies, where higher officials and influential leaders were aired without using face masks and maintaining physical distancing. The facilitators and barriers to risk communication are summarized in Table 6.

Table 6: **Best Practices and Constraints of Risk Management for the COVID-19 pandemic**

Strategies	Best practices/ Facilitators	**Constraints/ Barriers**
Systems	• Utilized extensively both public and private mass media, especially in the initial months and during the periods of state-of-emergency • High frequency of social media (Facebook, telegram, Twitter…) engagement • Actively engaged traditional and religious social groups and communication systems- Iddir, Dagu…	• Media coverage and frequency were not sustained simultaneously throughout the pandemic. • Airing official and influential personalities without protective measures (face mask, physical distancing and hand hygiene) • Limited social media access due to uneven and inadequate internet coverage in the country • Politicizing messages and spreading counterproductive comments
Public Communication	• Established call centers, toll-free fixed lines • Engaging high-profile persons and victims of COVID-19 • Using social diffusion to reach the community	• Politicizing messages and spreading counterproductive information • Evolving evidence created misunderstanding and confusion; subsequent evidence falsified the previous; although this is understandable to the scientific community, it made room for deceiving science • Inadequate contextualization of messages • Resistance from some groups (social, religious, political…)
Community engagement	• Involved high-profile officials and persons to engage the community • Active multisectoral and professional engagement at the beginning • Socio-economic support to the needy	• Inconsistency of messages • Inability to sustain the socio-economic support for a longer time • Multisectoral efforts declined as the pandemic protracted, and only the health sector became the sole responsible body, which eventually negatively affected the success of community engagement efforts
Managing perceptions, misinformation, and behavioral and sociocultural risk factors	• Active engagement of a variety of experts to respond to public information needs • Engagement of religious and traditional institutions and influential personalities • Engagement of victims of COVID-19 to share real-life experiences • Adjusting health care delivery modalities for patients with co-morbidity; less frequent face-to-face contact coupled with virtual consultations • Enthusiastic initiatives to provide social and economic support to promote compliance with preventive measures • Mobilizing volunteers to promote preventive measures and distribute prevention items	• Resistance to avoid big gatherings, including public celebrations, religious events, and political events. • Failure to enforce adherence to guidelines at work, market, and recreational spaces (khat houses, pool houses, bars, restaurants…) • Abundance of misinformation about the effectiveness of the prevention measures and case management options • Inability to sustain social and economic support initiatives due to the magnitude of the problem and the duration of the pandemic
Implementation of Mental Health and Psycho-Social Support	• Development of local Mental Health and Psycho-Social Support Guidelines • Provision of Mental Health and Psycho-Social Support by engaging professional associations • Mobilizing professional volunteers	• Lack of resources, especially human resource • Poor understanding of mental health and psycho-social needs • Structural deficiencies in the health system: mental health was not given due attention in the pandemic preparedness and response

4.3. Surveillance, rapid response teams, and case investigation

Surveillance and case investigation were introduced at the very early stage of the pandemic, even before the first case was reported in the country. Contact tracing was initiated, and appropriate actions were taken when the number of cases was small. However, as the number of cases increased, the country's ability to contact tracing and take appropriate action steeply declined and sharply and eventually became unattainable. A national-level respondent stated, *"At the beginning of the pandemic, the process was effective; one case was expected to have 30 contacts, and nearly all contacts were traced. As the pandemic progressed, not all contacts could be traced …"*.

Surveillance and contact tracing are highly labor- and resource-intensive activities; without innovative and technology-assisted strategies, they are unlikely to be achieved effectively in low-income countries. Many innovative technology-assisted initiatives were initiated in Ethiopia, but most were not fully developed to support the COVID-19 pandemic response. The lack of accurate surveillance data negatively impacted the initial modeling exercise, which produced unimaginable estimates of cases and deaths, as most models relied on inputs from other countries or estimated guesses. As local surveillance data accumulated, EPHI fitted the projection models with local data and produced reasonable forecasts. The MOH/EPHI regularly provided information on the number of cases and deaths throughout the pandemic.

The deceptive actions of COVID-19-positive individuals complicated contact tracing; some gave wrong addresses, and some sneaked out from the isolation/quarantine centers before completing the prescribed period- A respondent noted,*"…some people refuse to isolate without the involvement of police, and others sneaked out of the isolation/quarantine centers*".

The unfavorable conditions in some isolation/quarantine centers exacerbated the unwanted behaviors; some centers lacked basic accommodations, sanitary facilities, and running water. Isolation centers included health centers, universities, schools, meeting halls, and empty buildings that were not well prepared for human habitation. The surveillance database was initially managed manually, and as the number of cases mounted, it failed to provide real-time information for effective and timely actions.

Efforts to adapt surveillance guidelines for COVID-19, fast-track training virtually, and expedited logistical support were commendable. However, several constraints affected the response, including limited resources (financial, material, and human), challenges in managing the database and frequent changes in reporting formats, falsified residential addresses, the disappearance of positive cases, and the unwillingness of some individuals to comply with containment measures (Table 7).

Table 7**: Best practice and constraints observed in surveillance, rapid response teams, and case investigation**

Best practices/ Facilitators	Constraints/ Barriers
• Expedited adaptation of surveillance guidelines for COVID-19 • Expedited virtual training to all levels of healthcare workers • Expedited available logistical support to areas that need it most • Phone-based reporting of cases to promptly inform decision-making • Mobilized support from various stakeholders to improve surveillance, modeling, and establishing isolation/quarantine centers. • The MOH/EPHI provides uninterrupted information about the number of COVID-19 cases and deaths.	• Limited resources- financial, material, and human • Challenges in accurately managing the data due to the absence of a real-time database and frequently changing reporting formats • Weakness in surveillance strategies and failure to initiate integrated real-time information system • Lack of cooperation from people that need to isolate/quarantine- falsifying residential addresses, disappearance of positive cases, and unwillingness to be contained • Inadequate feedback to surveillance data submitted by the lower-level health system

4.4. Points of entry, international travel, and transport

The COVID-19 screening program at the points of entry, mainly temperature checks, was established by EPHI and MOH at the beginning of the pandemic. Efforts were, however, grossly inadequate due to the numerous entry points into the country. Ethiopia is a vast country with a lot of informal/illegal points of entry. In addition, the number of personnel and facilities was inadequate to conduct proper screening at all point-of-entry sites, especially in areas with a substantial flow of people crossing the border in both directions. Better screening was implemented at the main airport in Addis Ababa.

A regional EOC coordinator said, "…in this region, we estimate there are around 89 point-of-entry; only three are recognized by the federal government; thus, COVID-19 screening was mainly at those sites." In addition to the regular flow of travelers, deportations posed an additional and unexpected burden on resources, complicating COVID-19 screening and containment efforts. The eventual establishment of land border checkpoints for long-distance (cross-border) truckers is believed to have helped containment somewhat.

The lack of hygiene facilities and inadequate accommodations at points of entry were also significant challenges. A regional COVID-19 response team lead stated, *"…. there was no water and toilet at the point of entry. In fact, these facilities are not adequately available even in health facilities and some hotels".* Table 8 summarizes the facilitators and challenges at the point of entry.

Table 8: **Best practices and constraints observed at points of entry, international travel, and transport.**

Best practices/ Facilitators	Constrains/ Barriers
• Immediate introduction of border control at the main airports • Eventual establishment of land border checkpoints • Establishment of checkpoints for long-distance truckers • Developed protocol for managing entry points	• The country has too many land entry points; it was challenging to cover all of them effectively. • Deportations posed an additional and unexpected burden on resources • Resource constraints to sustain interventions at the points of entry • Inadequate water and sanitary infrastructure at the border point of entry • Human resource constraints

4.5. Isolation and Quarantine

Isolation involves separating individuals who show signs and symptoms of the suspected infection until the case is confirmed or till the maximum period of infectiousness has passed. Quarantine involves groups in a separate space until the maximum incubation period of the suspected infectious disease has elapsed. Both strategies were used in Ethiopia during the COVID-19 pandemic as necessary at entry points and for contacts of suspected or confirmed cases. Hotels and educational facilities (such as universities and schools) were used for quarantine and isolation, with the latter being more affordable for many citizens, including returnees from abroad.

As the pandemic progressed, large-scale quarantine and isolation became practically impossible, especially in locations outside the capital city. Ethiopia has a very long land border and many points of entry. A regional EOC coordinator expressed the inadequacy of isolation centers as " impossible to sustain; we did not have enough resources given the large number of entry points into the country."

At the pandemic's beginning, resources were quickly mobilized to establish quarantine and isolation centers in empty buildings, schools, and university dormitories. Citizens and local organizations enthusiastically supported these efforts by temporarily donating buildings and providing financial and material assistance. Many professionals and volunteers were trained to facilitate the rapid implementation of quarantine and isolation services.

Some challenges in implementing quarantine and isolation services included the high costs, especially for those contained in hotels; lack of essential sleeping and sanitary facilities in schools and donated buildings; and the inadequacy of available facilities, which quickly overcrowded. The overcrowding in the centers made enforcing the COVID-19 prevention protocol challenging, substantially increasing the risk of infection spreading within them.

Later on, retaining schools, universities, and donated buildings as quarantine and isolation centers became impossible for an extended period as they were set to resume their routine functions. Non-compliance with COVID-19 prevention protocols and property damages were also observed in these centers. The additional cost of maintaining and disinfecting facilities in preparation for reopening schools and universities was significant, and owners of these facilities were unprepared for such considerable cost. (Table 9).

Table 9: **Isolation and Quarantine Best practices and constraints**

Best practices/ Facilitators	Constraints/ Barriers
• Prompt acquisition of facilities to establish quarantine and isolation centers- hotels, schools, universities, empty buildings…	• Running quarantine and isolation services was very expensive for the country. Hotel accommodation was not affordable to citizens.
• Ability to arrange provisional accommodation services for health professionals who were directly involved in handling cases	• Schools and buildings lacked basic sleeping and sanitary facilities, so providing decent accommodation was a big challenge.
• Training offered to a large number of professionals and volunteers to support quarantine and isolation services	• As the pandemic expanded exponentially, the number of facilities prepared to provide quarantine and isolation services was grossly inadequate for the fast-growing needs.
• Citizens and local organizations showed high interest in donating their facilities and other resources necessary for the pandemic response.	• Challenges to enforce COVID-19 prevention protocol in crowded isolation and quarantine centers– imminent risk of increased spread of infection
	• Retaining schools, universities, and donated buildings for extended periods as the COVID-19 pandemic extended, as the facilities resumed serving their original function.
	• Some individuals' irresponsible use of facilities in quarantine and isolation centers caused severe property damage, which incurred additional maintenance costs in reopening schools and universities.
	• Non-compliance of persons in isolation and quarantine centers made implementing strict preventive measures challenging. Some also breached quarantine and isolation rules to make its effectiveness doubtful.

4.6. National laboratories

At the beginning of the COVID-19 pandemic, Ethiopia could not test samples domestically, necessitating the shipment of samples to South Africa. However, immediate actions were taken to repurpose some laboratory machines and acquire additional equipment to build capacity for performing COVID-19 tests in the country in collaboration with public universities and regional research centers. Through rapid and practical training of laboratory personnel and other health professionals, conducting tests in more than 60 centers nationwide within the first three months became possible. The testing capacity increased from a couple of hundred daily tests to 25,000 during the peak of testing in July-August 2020. Private laboratories, mainly in Addis Ababa, also began conducting COVID-19 tests.

While initiating COVID-19 testing in private laboratories was a positive development, the costs were expensive, especially considering the support offered by the government to these private testing centers. The shortage of test kits, reagents, and trained workforce posed significant challenges, leading some labs to halt testing due to resource limitations, especially in the regions. Test results were also affected by poor sampling and testing procedures. (Table 10).

Table 10: **Best practices and constraints for testing**

Best practices/ Facilitators	Constrains/ Barriers
• Re-purposing lab machines in research institutes and universities for COVID-19 testing purposes. • Testing capacity increased substantially in less than six months • Many lab personnel and other health professionals were trained quickly in COVID-19 sample collection, handling, and testing. • Mobilized resources for testing in-country and abroad in a short period • Government assistance was provided to private labs to expand their COVID-19 test capacity.	• COVID-19 test machines and kits were expensive. Thus, daily large-scale testing was not sustainable. • Delay in procuring reagents and related supplies and setting up labs in the regions • Lack of a sufficient number of qualified lab professionals, especially in the regions • Difficulty in calibrating the machines for COVID-19 • Delay in distributing test results and contact tracing • Improper COVID-19 lab waste management • High cost for testing in private centers • Testing was done in a campaign mode and was not sustained throughout the pandemic at that same high level.

4.7. Infection Prevention and Control (IPC)

Infection prevention and control (IPC) is essential for preventing the spread of diseases in healthcare facilities, and protecting patients and healthcare workers from exposure to infectious agents and materials is critical. In the context of COVID-19, maintaining a high level of IPC practices is vital to continuing to provide essential healthcare services while containing and preventing COVID-19 transmission within healthcare facilities, ensuring the safety of clients and healthcare providers. IPC was considered one of the central pillars of the response, and many parallel activities were conducted, as described below.

4.7.1 IPC Training

One of the fastest responses to COVID-19 prevention was the recruitment and training of health workers in IPC on a national scale. The Ministry of Health strategically outsourced the training to different regional partners. The Ethiopian Medical Association (EMA) and a consortium of 11 health professional associations organized under the Ethiopian Midwives Association (EMwA) played a crucial role in efficiently rolling out the training. The MoH also facilitated an online training system in collaboration with regional health bureaus.

However, the duration of the training varied, ranging from a few hours to two days. Other challenges related to the quality of training included a lack of supplies and equipment for practical training and the use of trainers who had not received Training of trainers (TOT). A lack of coordination among multiple stakeholders was also mentioned as a challenge to coordinating an efficient training program.

4.7.2 Protocols, guidelines, and innovations

The Ministry of Health, in collaboration with EPHI, the COVID-19 Advisory Council, and other national and international partners, developed various protocols and guidelines to assist health providers and other relevant organizations in preventing the spread of infection. Some of the primary documents prepared in the initial phase include:

1. COVID-19 handbook for health professionals in Ethiopia
2. COVID-19 Clinical Management Pocketbook
3. SOP for preparation of disinfectants and fumigants against Coronavirus (SARS-Cov-2) for use at the community level
4. Infection prevention and control interim protocol for COVID-19 in healthcare settings in Ethiopia
5. Ethiopian healthcare facility COVID-19 preparedness and response protocol
6. Healthcare waste management SOP for COVID-19
7. Protocol for transporting COVID-19 patients
8. Protocol for transporting dead bodies due to COVID-19 and burial

It is worth noting that almost all universities in Ethiopia were engaged in innovations and technology development to mitigate the impact of COVID-19. Some of the innovations included the production of mechanical ventilators, IV stands, venturi valves for oxygen supply, splitters that allow oxygen to be supplied to more than one patient at a time, door openers, face shields, drones, PPE and area disinfection using liquid chlorine and UV radiation, contact-free handwashing machines, sanitizers, and detergents.

4.7.3. Community Awareness

Influential personalities in the country- such as artists, activists, and political leaders, gave intensive community awareness messages using the media during the initial phases of the pandemic and the periods of lockdown; however, this effort eventually declined. An official from the Addis Ababa Health Bureau described the situation as follows: *"There was a strong media response that enhanced public awareness... all government media*

channels, the social media, and grassroots campaigners that covered more than half of the households in the city played a significant role in the response". Some respondents, both at the national and regional levels, expressed frustration with the failure to sustain such activities throughout the prolonged duration of the pandemic.

Most respondents from the regions agreed that mass mobilization and adherence to IPC measures were relatively good initially but declined over time. Public compliance/adherence with IPC measures worsened after the lockdown was lifted. One respondent remarked… "*There was a problem in our risk communication approach that initially caused panic in the community. However, the practice of preventive measures was relatively good in the early period of the pandemic, but the risk communication strategy was not appropriate for sustaining those preventive behaviours".*

4.7.4 Face Mask Use, Hand Hygiene, and Physical Distancing

Preventive efforts were intensified during the initial phase of the COVID-19 pandemic. As a result, significant changes in face mask utilization and hand hygiene were observed but not in physical distancing. Face mask usage declined as the pandemic took a protracted course. Most respondents from different regions and health facilities indicated community fatigue set in quickly despite the "*No Mask –No Service"* rules initiated by the MoH. Many respondents at national and regional levels strongly believed that the low level of face mask utilization was not due to a lack of supplies but rather to a poor behavioral change. Supplies of face masks and hand hygiene products improved substantially in the market within a short period. However, poor adherence to face mask use and hand hygiene was also observed among health professionals.

Initially, most institutions- hotels, marketplaces, schools, health institutions, supermarkets, cafes, and private and government offices prepared hand hygiene (hand washing) facilities. These facilities, which evolved into touch-free mode using locally adopted technology, quickly disappeared due to a lack of maintenance and supplies. In some big cities, insufficient water supply was challenging; most handwashing facilities did not adhere to WHO recommendations. An expert respondent from Addis Ababa said… *"After a good start, the hygienic practices degenerated to the usual trend. Water and soap were not available in most health facilities, let alone in places where people are gathered.*" The absence of IPC focal persons to follow on IPC/WASH was frequently cited as a reason for the declining practice. In addition, continuous water supply remains a challenge in almost all healthcare settings.

The most commonly cited shortages in PPE included masks (particularly N-95), gowns, and boots. A senior physician said... "*There were problems regarding PPE... they were not available in the market due to tough international competition, high-income countries monopolized access to supplies…. getting PPE from China, the largest supplier, was difficult because domestic demand in China was also high".*

The distribution of PPE was uneven across the country, with some regions experiencing severe shortages. The shortage was also exacerbated by misuse and abuse of PPE like N-95 face masks. The speed of PPE distribution was rated as '*slow and even problematic'* in most health facilities, especially those outside the capital city. It was further reported that there was no smooth flow of supplies, *and allocations were not proportional* to regional needs. The supply of PPE significantly improved after local production was intensified.

The most challenging preventive strategy to implement was physical distancing. It was difficult to enforce among daily laborers, street vendors, markets, and the transportation sector. Physical distancing was incompatible with the way of life and the way businesses are handled locally. Most people live in crowded areas and operate businesses in small spaces. The risk communication approaches also failed to consider the peculiar nature of survival struggles, especially in cities.

Most respondents also agreed that physical distancing was challenging because of Ethiopia's strong cultural and social bonds. Some noted that adherence to physical distancing was better at the beginning of the COVID-19 pandemic due to a fear factor and the lockdown that accompanied the State of Emergency declaration. However, it was abandoned entirely after the lockdown began to ease and transportation restrictions were lifted. Efforts to prohibit mass gatherings, weddings, and funerals were also short-lived and ignored mainly once the state of emergency was lifted.

Most respondents across nearly all regions indicated that social distancing had the poorest adherence of all preventive measures. The Ministry of Health and EPHI issued social distancing requirements in the interim COVID-19 management protocol and the State of Emergency declaration, but the enforcement mechanisms were weak to non-existent.

Nonetheless, studies indicated that facemask use among health workers significantly improved during the COVID-19 pandemic (33). The infection and death rates from COVID-19 were substantially higher among health professionals. One respondent from the Addis Ababa Health Bureau stated that… "*Most infections among healthcare workers happened due to poor implementation of IPC strategies. At the beginning of the pandemic … they consistently applied all the prevention measures correctly. However, gradually, they became careless, and infections increased among health workers".*

The infection rate among healthcare workers was highest in Addis Ababa, the pandemic's epicenter, while infection rates in the Amhara, Oromia, and SNNPR regions were lower. This discrepancy could be due to inadequate testing or poor documentation.

The waste management capacity of most health facilities was poor. A respondent from Addis Ababa stated… *"Waste management is performed in the usual way. No special precautions and techniques were adopted to prevent the spread of COVID-19". In some regions, for example, in Amhara, there was no waste* disposal mechanism for the treatment centers, burned their waste in the usual way. All respondents from health facilities reported having a liquid waste disposal pit. Overall, waste management was generally inadequate in facilities outside the capital city.

A health professional from the Somali region described the situation as follows: *" The Waste management capacities of the health centers are weak and not established according to the standards."* In Addis Ababa, the water shortage and poor waste management were significant challenges; about half of the health facilities in the city lacked handwashing facilities in examination rooms, and most toilets were not clean (34). Overall, the capacity of health facilities to manage waste was poor, and they did not have the appropriate personnel to deal with it. In most facilities, waste disposal methods relied on burning and burial in pits, which did not meet the standard waste management protocol for COVID-19.

Little attention was paid to managing food waste, water bottles, and environmental cleaning of high-touch surfaces. This situation made healthcare providers and their clients highly vulnerable to infections in health facilities. Table 11 summarizes the best practices and challenges in Infection Prevention and Control during the initial year of the COVID-19 pandemic.

Table 11: **Best practices and constraints for infection prevention and control during the COVID-19 pandemic. Mar 2020-Feb 2021.**

IPC Component	Best practices (Facilitators)	Challenges (Constraints)
Training	MoH employed a large number of new staff to support training and implementation.	Insufficient health staff available on the market for immediate recruitment in some medical specialty fields.
	MoH provided incentives for better implementation.	Refusal of health professionals to work in high-risk facilities (treatment, isolation, and quarantine centers) for fear of infection
	MOH adopted the WHO training guidelines with the support of volunteer local and diaspora experts	Practical training sessions were insufficient due to a shortage of materials for the demonstration.
	MOH was able to mobilize multi-sectoral resources to intensify training	Inefficient coordination led to duplication of efforts and wasted limited resources.
	All available media channels were intensively used for disseminating information.	Poor coordination of media led to information barrages, creating public confusion.
	Influential public personalities volunteered to support the public awareness strategies.	Missed the opportunities to identify best practices due to poorly coordinated and documented activities.
Community awareness and adherence to IPC measures	Intensively utilized the public media in the demonstration of COVID-19 preventive measures.	Risk communications were not targeted and segmented to any particular audience, and the effectiveness of the various risk communication interventions was largely unmonitored.
	The presence of the IPC committee and IPC guidelines even before the first case of COVID-19 was identified.	Most IPC committees became inactive quickly; they were largely ad hoc.
IPC/ WASH in health facilities	MoH set standards for the provision of WASH at health facilities	Lack of qualified professionals to maintain and repair IPC facilities and equipment.
	Engaged high-level officials and political leaders to promote WASH	Officials appear on mass media without face masks and observing physical distancing
		Shortage of water and improper handwashing techniques.
Innovations	Promoted innovations by universities and entrepreneurs to produce/manufacture and dispense sanitizers, contact-free water and soap dispensers, and UV area disinfection machines.	Innovations were unsustainable due to poor quality and lack of funding for quality improvement and scale-up. Incubation centers were established but not sustained.

4.8. Case Management and Isolation Centers

Case management was one of the pillars of the COVID-19 response, supported by other pillars, including surveillance, testing, and facility readiness. According to data from the Ministry of Health, 46,693 quarantine, 22,677 treatment centers, and 18,221 isolation centers were established in the first few months of the pandemic. This represented a massive undertaking on a scale never seen before in Ethiopia. Planning and coordinating many centers in an emergency posed substantial logistical and financial challenges.

These centers were organized with varying levels of complexity to utilize available resources effectively. A national-level respondent said…. *"Our treatment centers were organized into three categories to handle mild, moderate, and severe cases. The classification was based on the patient's oxygen and critical care requirements. At the pandemic's beginning, treatment centers admitted even mild cases; however, admission was later restricted to severe cases as the caseload increased. The admission capacity became grossly inadequate for treating severe cases at the peak of the waves".*

A health facility head also remarked… " In the early stage of the pandemic, it was possible to admit all COVID-19-positive cases at treatment centers, but now handling the surging number of severe cases has become impossible. Thus, mild cases were later managed with a home-based treatment modality".

Treatment, isolation, and quarantine center distribution varied significantly by region. The involvement of teaching hospitals affiliated with universities was instrumental in expanding treatment centers across the regions. However, there was an imbalance in the number and competencies of treatment centers nationwide. A regional health bureau respondent said: *"... the imbalance was obvious; in our region, this imbalance existed before COVID-19…our region had an insufficient number of health facilities and lack services such as blood bank, so we were obliged to use facilities at the Health Sciences College as treatment center".*

Another challenge that limited case management was the shortage of health professionals trained for this kind of emergency. Thus, efforts were intensified to train health workers to implement the case management guidelines. One of the critical partners said … *"it was possible to train many healthcare workers on COVID-19 treatment guidelines. The training enabled trainees to manage cases reasonably well, although some were challenged to develop the necessary skills in a short training".* Initially, interventions were disorganized, and many healthcare workers had no experience handling a deadly pandemic. Successive support and training helped bridge that gap. A health facility head said,*"…. most health professionals got better after being trained and receiving on-the-job orientation and support in the hospital*".

The involvement of the Ethiopian Medical Association was indispensable in organizing the Training of Trainers (TOT) and supporting the cascade of training to the regions. However, the activity varied considerably in each region. Training delivery was inconsistent from one region to another. A prominent achievement was the rapid establishment of treatment centers at the Eka-Kotebe General Hospital and Millennium Hall. These facilities were well organized and equipped with adequate human resources. However, both quickly reached total admission capacity and struggled to maintain the quality of services in the long run.

The repurposing of the Eka-Kotebe Hospital was viewed negatively by mental health professionals, as it denied services to many mental health clients. A national volunteer respondent said… "*The number of treatment centers was grossly inadequate, especially in terms of capacity to handle severe and critical cases. Fortunately, about 70 percent of our patients were mild and moderate cases".* The inadequacy of treatment centers was even more pronounced in the regions. A regional health officer stated, "… *in a zone with an estimated population of five million, there was only one treatment center, which is not enough".*

A nationally-working volunteer remarked, "*COVID-19 ICUs were insufficient in Eka-Kotebe and Millennium treatment centers. With increasing critical cases, even those ICUs struggled to meet the demands for ventilator machines and other necessary technologies".* Eventually, some private hospitals in Addis Ababa established ICUs at exorbitant costs that were unaffordable for most patients. ICUs at the regional level were scarcer and less equipped to handle COVID-19 cases. A regional health bureau explained, "…establishing a functional ICU in the regions was challenging; procurement of mechanical ventilators and the delivery of equipment and supplies, "…establishing a functional ICU in the regions was challenging; procurement of mechanical ventilators, medical equipment, medicines, and supplies was *too slow. Thus, organizing functional ICUs timely to cope with mounting cases was impossible".*

At the peak of the pandemic waves, the ICUs organized in all regions, including Addis Ababa, were fully utilized and had no further capacity, despite the government's and its partners' efforts. This situation exposed the health system's weaknesses in handling such emergencies and was a significant lesson for those responsible for emergency readiness and preparedness.

Isolation centers were established quickly in many areas without setting standards for preventing the spread of infection. A respondent from Addis Ababa stated … *"The isolation centers in Addis Ababa were relatively good."*

In contrast, a respondent from a regional health bureau described the isolation centers as… *"The isolation rooms were not designed to any standard; they lacked basic privacy to prevent the spread of the disease, and some centers were highly congested with a large number of clients."*

A respondent from a health facility described … *" Some efforts were made to make isolation centers comfortable and less prone to spreading infection, but these were insufficient to satisfy clients' needs and disease prevention goals. Some isolation centers were established in schools, making it difficult to adapt them for this purpose. In most schools chosen for isolation, water and toilet facilities were inadequate".*

In many regions, the number of functional isolation centers declined immediately after the State of Emergency declaration ended. Home isolation became the preferred option during the peak of the later pandemic waves, especially during the Omicron wave, when the caseload far exceeded the system's capacity to handle it.

The impact of the pandemic was not fully understood due to the fragmentation of information about the number of cases and their outcomes. However, the pandemic severely impacted Addis Ababa, the epicenter in Ethiopia and the Oromia region. This may be attributed to the availability of better data in these regions. A national-level respondent said … "*In general, we can say the pandemic impact was not as predicted by most modeling exercises, but the increasing number of cases in each subsequent wave demonstrates the seriousness of the pandemic. A large number of cases were admitted into ICUs, and the number of deaths was also increasing steadily".* The findings are summarized in Table 12.

Table 12**: Best practices and constraints for Case Management and Isolation**

Best practices/ Facilitators	Constrains/ Barriers
• COVID-19 case management centers were established in existing hospitals at the pandemic's beginning. • Opening new treatment centers like the Millennium Hall and other field hospitals. • Quick adoption of the WHO case management protocol • Recruited a large number of professionals for case management centers • Rapid increase in the number of mechanical ventilators • Development of waste management protocol for COVID-19 treatment centers • Engagement of the private sector in service provision	• The conversion of Eka Kotebe Hospital, which was the second-largest inpatient psychiatric facility in the country, had negative implications for mental health services. • Shortages and delays in procuring supplies, medicines, and equipment, including ventilators • Insufficient staff in treatment centers leads to burnout • Severe shortage of experienced and critical care health professionals • Interruption of routine essential services: a large number of health workers were drawn to serve in the COVID-19 response • Financial constraints for procurement and operational expenses • Minimal inpatient capacity outside Addis Ababa, especially in border and remote areas • Inadequacy of oxygen plants, essential medicines, basic infrastructure (WASH), and electricity. • Weak waste management infrastructure to handle waste in isolation and treatment centers. • High cost of COVID-19-related services in private facilities. • Failure to regularly and timely update testing, isolation, and treatment guidelines.

4.9 Supply Chain, Logistics and Regulatory Oversight

Establishing and maintaining emergency operation procedures and facilitating logistics for an effective pandemic response was critical. Efforts were intensified to encourage small-scale production, distribution, and use of alcohol-based hand rubs through the publication and dissemination of guidelines, training, and continuous mentorship and coaching in all public and some private companies. However, COVID-19 response operations and logistics were highly affected by financial constraints. The pandemic created a situation beyond comprehension due to uncertainty surrounding the scale of the crisis.

A respondent at the MoH said … *"One cannot be sure whether the amount of money allocated by the Ministry of Health will be sufficient."* Initially, Addis Ababa was the only region better off financially. In Addis Ababa,

support from partners was relatively high, as it was the pandemic's epicenter, but the financial flow was inefficient and eventually fell substantially short of demand.

Another financial-related problem was the utilization of funds due to the government procurement system, which was not tuned for emergency response. An Addis Ababa Health Bureau official said, … "At the beginning of the pandemic, the city administration supported *us reasonably well. We were able to procure items as long as they were available on the market, and finance was not a problem".* However, access to finance in many other regions was not as good as in Addis Ababa. None of the regions had financial access that matched the scale of the pandemic, and some regions, such as Oromia and Amhara, reported receiving only a tiny fraction of the requested financial support.

Pandemic readiness for logistics was generally poor. A national-level respondent said, *" There were insufficient logistics and supply resources. Very few ambulances were distributed to regions to support the response efforts. Masks and sanitizers shortage was critical in the initial phase of the pandemic, but it later improved due to increased local manufacturing capacity".*

Another senior national-level respondent noted, *"One of the main challenges was that the logistic management system was obsolete and poorly equipped to forecast needs by type and quantity."* Respondents from the Ethiopia Food and Drug Authority (EFDA) and MoH indicated that logistics and supply demands overstretched the system to the point of desperation. The number of isolation, quarantine, and treatment centers exceeded local capacity.

Mismanagement and the abuse of supplies compounded these logistical challenges. A respondent from RHB said, "Misuse of supplies such as N95 masks contributed to the current logistic problems." Dependency on the external market and "low local production capacity " further aggravated the weaknesses of the supply chain management system.

Nationally, the lack of a robust supply chain monitoring system was considered one of the bottlenecks. A logistics committee was established to coordinate and strengthen the supply chain. A national-level interviewee said, *"…there was no strong supply monitoring system with clearly established structures in all regions".*

However, some regions, including the Addis Ababa and Oromia health bureaus, claimed to have systems used in previous emergencies, but the system was inadequate for COVID-19. A respondent from the Oromia Health Bureau said …*"There were problems while monitoring supplies. The bureau has its logistics distribution structure that was used for the COVID-19 response; we did not create a new supply system. However, monitoring supplies during this pandemic was very challenging; it was a lesson learned."*

The supply monitoring system in most regions was not designed and prepared to operate in a situation like the COVID-19 pandemic, and it could not guarantee a timely flow of resources.

The supply chain for PPE and other supplies was particularly challenging; in almost all regions, COVID-19 supplies were inconsistent regarding adequacy and timeliness. A respondent from Oromia RHB said … "*Supplies were very scarce and insufficient to cover all areas in the region. Even health professionals did not get sufficient PPE on time.* Another respondent from SNNPR said, "*PPE availability was sufficient at the beginning of the pandemic, as we were prepared for the worst, but the supply was insufficient to run for long."*

In some regions, supplies received at the regional stores were not distributed on time to the lower tier of the health system. In all regions except Addis Ababa Health Bureau, financial constraints were the most critical barrier to adequately addressing the demands. Additionally, the lack of properly trained staff was a barrier in some regions, such as the Somali region. The distribution of supplies from the federal government was also criticized for not considering the scale of the problem and population size. A respondent from Oromia said,*"... the proportionality of the support from the federal offices was a significant obstacle. It created delays and constraints in the pandemic response".* A respondent from the Amhara region said, *"Only a fraction of what we requested was funded by the federal offices*.". A respondent from Gambella also said … "*We did not get what we asked for from federal offices. We got different resources in kind, but there was misalignment, un-proportional allocation, and haphazard distribution*."

In addition to the budget issues, transporting supplies through checkpoints was problematic, especially in border regions like Somali and Afar, due to a large influx of vehicles and pedestrians crossing the borders from Djibouti and Somalia. The procurement system, which was unfit for emergency purchases, added another layer of challenge in all regions. A respondent from the national level said… "… *the government procurement system was a bottleneck; it was not fit with the urgency required for COVID response*." Another respondent from Addis Ababa said, "… *procurement was challenging because they tried to use the existing finance system, which was incompatible with such a large and unexpected pandemic response. Such a pandemic needs an emergency financing system. Other challenges were the country's limited capacity to compete in the international market and*

securing adequate supplies."

Table 13 summarizes the best practices/facilitators and constraints/barriers. It is essential to note that the long-standing obstacles must be addressed systematically to increase readiness to respond adequately to future pandemics. Efforts that brought success must be maintained to build on the achievements.

Table 13: **Best practices and constraints for Operational support and logistics**

Best practices/ Facilitators	Constrains/ Barriers
• Improved coordination of sourcing, importing, clearing customs, distributing, and maintaining essential supplies and equipment. • Recruitment of additional staff on a contractual basis and engagement of volunteers. • Ability to mobilize resources from donors and development partners • Coping with the adversity by remodeling/repurposing schools, universities, and hotels as isolation, quarantine, and treatment centers • Support provided to increase local manufacturing of COVID-19-related supplies like masks and sanitizers • Regulatory waivers and fast track of supplies and procedures to procure supplies quickly • Many guidelines have been developed for emergency purchasing • Effective mobilization of domestic resources to bridge budget gaps • Soliciting and coordinating donations –test kits, ventilators, PPE, and other IPC materials from different sources • Improved cargo services by Ethiopian Airlines helped to import supplies	• Limited local manufacturing capacity of medical equipment and supplies • Insufficient collaboration among stakeholders to efficiently utilize available resources in a coordinated manner • Difficulty in obtaining information on the health system demand and unpredictability of demand • Shortage of resources (in terms of supply, people, technology, transportation capacity, and money) and high dependence on donors • Shortage of specialist health care professionals in the market • Poor supply monitoring system • Lack of stockpile both at the national, regional, and facility level • Absence of infrastructure for isolation, quarantine, and treatment centers • Lack of experience in multi-sectoral response coordination, which includes the health, security, transport, and finance • Shortage of medical supplies and equipment to cope with a large number of critical care cases • Dependency on the external market for medical supplies • Lack of emergency procurement system • Wastage and abuse of PPE • Late introduction of quality control mechanisms to local products • Failure to utilize local production capacity due to insufficient raw materials and foreign currency. • International blockade of transportation

4.10. Maintaining Essential Health Services

One of the immediate effects of the COVID-19 pandemic responses, particularly the restrictions on population movement and the redeployment of health professionals to response activities, was a massive disruption to routine essential health services, including preventive services such as antenatal care and immunization. The disruption adversely affected vulnerable populations, including mothers, children, and those with chronic illnesses requiring repeated visits to health facilities. The effects were immediately observed, and corrective actions were taken to restore essential services with some adaptations to accommodate COVID-19. One adaptation in routine care was refilling medicines to cover a more extended period than usual. However, restoring essential health services faced difficulties due to the panic caused by the pandemic, including the fear of visiting health facilities. A respondent said, *"… vaccination coverage decreased sharply during the initial response phase when most health facilities stopped giving essential services…it gradually improved after adapting the policy to restore essential health services".*

Other calamities, such as flooding, internal conflicts, and displacement, also hampered the restoration of essential services. A respondent from a health facility said, "…*healthcare seeking behavior changed remarkably due to fear of catching COVID-19 and the consequences of staying in isolation centers, which were labeled as a prison by the community"*. Some regional respondents argued that the guidelines were unclear and that adequate orientation was not given when the policies were updated.

As the pandemic was unprecedented, several revisions were necessary depending on its course. However, this process did not involve critical professionals and healthcare providers, especially those outside the capital city.

Communication gaps during this process were reported to have impeded the implementation of the guidelines to restore essential services. In addition, providing and maintaining satisfactory incentives for health professionals posed challenges in restoring essential health services. Best practices and constraints observed during the COVID-19 pandemic regarding maintenance services are listed in Table 14.

Table 14: **Best practices and constraints for maintaining essential services**

Best practices/ Facilitators	Constrains/ Barriers
• Issuing directives to continue essential services • Provision of alternative service modality for people with co-morbidity and on long-term treatment follow-up • Introduction of incentives for health professionals	• Delay in recognizing the effect of pandemic responses on essential services • Public fear of coming to health facilities • Shifting healthcare workers to COVID-19-related services • Failure to maintain incentives for health professionals • Delays in resuming preventive services such as immunization.

V. Preparedness and Response

The pandemic hit the world at a time when it was unprepared for such an unprecedented catastrophic emergency. With a weak health system and a large vulnerable population, Ethiopia confronted the pandemic aggressively but eventually adjusted its responses to socio-economic realities. After the first case was detected in March 2020, when lockdown orders were issued, the initial reaction was aggressive but unsustainable due to its resource intensiveness. A large proportion of the population in cities survived on daily income, and resources to provide financial support were exhausted shortly, within the first 3-4 months. In big-city households, residents live in crowded settlements with precarious sanitary facilities and inadequate running water.

The restricted movement negatively affected the use of essential health services. Panic reactions and a shortage of testing facilities compromised contact tracing. The process of tracing and transporting contacts to isolation centers was often dramatic and, at times, stigmatizing. The restrictions on attending social events, especially funerals and religious activities, were unprecedented and faced strong resistance from families and religious congregations. All COVID-19-positive cases were initially hospitalized, but as the caseload increased, hospitalization was restricted only to severe cases. All international travelers were held in quarantine centers, a measure that proved unsustainable.

As the pandemic transitioned to local community transmission, interventions shifted from institution-based to home-based, including isolation, quarantine, and treatment of mild and moderate cases. However, some case management strategies, adopted directly from high-income nations, were not adequately implemented due to resource constraints, including inadequate infrastructure, expertise, and institutional mechanisms. In Some instances, strong preventive guidance was given after a pandemic wave had passed, leaving no room to ease restrictions and eventually contributing to community fatigue. The country's overall preparedness and response are summarized in Tables 15 and 16, based on the UNDP vulnerability dashboard.

Table 15: **Assessment of the Country's Preparedness based on UNDP's Vulnerability Dashboard**

Pillar	Preparedness
Country-level coordination and planning	• MoH and EPHI established the COVID-19 Task Force (CTF) and Public Health Emergency Operation Centers (PHEOCs) immediately after WHO declared the pandemic, before the first case in Ethiopia. • A whole government approach was adopted to coordinate a multisectoral response, which the Deputy Prime Minister led. • State presidents led regional multi-sectoral coordination, and mayors led multi-sectoral coordination in cities. • Emergency preparedness and response plans are developed and distributed to regions and health facilities. • Although pandemic preparedness was insufficient, aggressive actions were taken initially to compensate for the shortcomings.
Risk communication	• Risk communication teams are established at national and subnational levels. • All national and regional public media were used to create public awareness. • Billboards and posters were produced and posted for information dissemination. • Call center established
Surveillance, rapid response teams, and case investigation	• Surveillance teams established under PHEOCs at all levels • Establishment of the Health Professional Advisory Council • Established contact tracing mechanisms
Points of entry, international travel, and transport	• Established surveillance at the air and land points of entries • Health screening and quarantine were implemented
National laboratories	• Mobilized laboratories in universities and research institutes for COVID-19 purposes • Training for laboratory technicians was given to all regions.
Infection Prevention and Control (IPC)	• Prepared and disseminated IPC protocols and guidelines • Trained and deployed many health workers at all health system levels.
Case management	• Substantially increased the bed capacity by repurposing existing facilities. • Established a large number of facilities for quarantine, treatment, and isolation centers • Substantially increased and equipped ICUs for COVID-19 treatment.
Logistics	• The government managed to mobilize substantial external funds from multilateral and bilateral development partners, though these were insufficient to address the unprecedented needs created by the pandemic. • The Government drew hundreds of millions of dollars from its treasury • The PM led government efforts to mobilize external donations from governments and philanthropic foundations.
Maintaining essential services	• Essential services were restored after an initial interruption due to the pandemic.

Table 16: **Assessment of Country's Response based on UNDP's Vulnerability Dashboard**

Pillar	Response
Country-level coordination and planning	• Regularly reviewed the pandemic both at the national and regional levels. • Supportive supervision was conducted to support the lower-tier health system, woredas, and health facilities.
Risk communication	• All public and private media outlets were used to create awareness. • Billboards were used for communication in some areas, such as bus stations and markets. • COVID-19 cases were daily reported through all media channels. • Risk factors like public celebrations and religious events were regulated.
Surveillance, rapid response teams, and case investigation	• A disease surveillance and contact tracing strategy was implemented, though the availability of resources constrained its full implementation. • Active surveillance and block quarantine strategy implemented • The HPAC reviewed available guidelines and assisted in developing new ones when necessary.
Points of entry, international travel, and transport	• Enforced the mandatory 14 days of quarantine efficiently
National laboratories	• The number of laboratories for COVID-19 testing has rapidly expanded.
Infection Prevention and Control (IPC)	• Engaged public figures in demonstrating IPC measures in mass media • Supported innovations in the universities and industry to manufacture equipment and supplies for the COVID-19 response • Facilitated collection of IPC materials from the private sector and NGOs
Case management	• Equipped the COVID-19 treatment facilities with specialists, equipment, and required supplies, though the centers were overstretched and had to change admission criteria occasionally. • Introduced stay-at-home orders to reduce burdens on treatment and isolation facilities
Logistics	• The Ministry of Health trained and engaged a large number of volunteers and health professionals in COVID-19 treatment and quarantine centers. • COVID-19 commodities (IPC and medical supplies) worth over one billion ETB were distributed. • Logistics for testing, quarantine, and treatment centers were made available by repurposing resources in local institutions, mainly universities.
Maintaining essential services	• Resumed essential services after some interruption • Developed various coping strategies to ensure continuity of essential health services, such as virtual consultation and reduced frequency of visits.

VI. Discussion of Key Findings

This study identified many best practices and constraints for preparing and responding to future pandemics. The findings are not unique to Ethiopia; many also apply to other low-income countries. This section discusses some key findings with reference to other settings and studies conducted within the country.

Coordination: The COVID-19 pandemic preparedness and response were coordinated at the highest level of government to facilitate effective decision-making and resource allocation. This approach was common practice in almost all countries in the region and was complimented by establishing the Health Professional Advisory Council(26,27). Such high-level coordination was crucial to ensure the engagement of all stakeholders in a coordinated manner. It also helped to tap into national resources easily and allowed for dynamic decision-making across different levels of government, which was essential due to pandemic uncertainties(28,29).

While poor coordination during a health crisis was uncommon, there were constraints that arose in the COVID-19 response due to overlapping and unclear roles and responsibilities among different stakeholders, an issue observed in many sub-Saharan African countries (30). Another constraint of the multi-sectoral coordination was the declining engagement of the non-health sector agencies as the pandemic continued (31). Coordination efforts in many countries, including Ethiopia, were further hindered by slow bureaucratic processes (32) and a shortage of qualified professionals(33).

Planning and implementation – Ethiopia organized its pandemic response according to the WHO framework for public health emergencies (34). The Emergency Operation Center (EOC) was established even before the first case was detected in the country. The urgency of responding to the pandemic necessitated a top-down planning process, which caused uneven and delayed implementation at lower levels due to resource limitations. Health professionals, COVID-19-related medical supplies, and other resources were scarce everywhere, with shortages more pronounced at lower levels of the health system (35–38). These constraints were addressed by continuously updating plans, guidelines, and manuals to clarify and simplify procedures as more lessons were learned from the local response and international experience. (39) (40). Various volunteers and collaborators across sectors supported the implementation of the response plan (41,42).

Risk Communication - COVID-19 risk communication and community engagement are extensively utilized in public and private mass media, particularly during the initial months and periods of a state of emergency. This approach aligns with the World Health Organization's risk communication and community engagement strategy, which emphasizes initiation at an early stage of a pandemic(43). Ethiopia also used social media to disseminate risk communication materials, though social media sometimes negatively influenced these efforts by spreading misinformation (44,45). The development of Mental Health and Psycho-Social Support guidelines was essential in addressing widespread fear and psychosocial problems in a culturally appropriate manner (46–48). However, the risk communication strategy faced significant constraints by media coverage and uneven distribution in Africa as the pandemic extended (48). Additionally, weak risk perceptions and the circulation of unfiltered, confusing messages undermined the effectiveness of risk communication and preventive measures (49,50).

Surveillance – A sound surveillance system is critical to the pandemic response. The expedited adaptation of surveillance guidelines specific to COVID-19 helped guide initial responses both locally and internationally(51,52). Training was cascaded to all health system levels through virtual platforms to ensure the availability of a well-prepared workforce (53) and the necessary logistical support (54). Encouraging phone-based reporting of cases facilitated informed decision-making (55). Support from various stakeholders in strengthening surveillance, modeling, and establishing isolation/quarantine centers enhanced the implementation of the surveillance system (56) and uninterrupted information dissemination by health authorities (52).

However, the pandemic surveillance efforts faced challenges due to financial and human resource limitations(57). Accurate data management is hindered by the absence of a real-time database and the frequent changes in reporting formats, contributing to delays and potential data discrepancies in low-income countries(58,59). Additionally, falsification of residential addresses and contact information posed a significant barrier to containment efforts (60)The surveillance system's effectiveness was further undermined by the inadequate feedback loop for data submitted by lower-level health systems (52).

Points of Entry - COVID-19 created unprecedented global challenges for international travel, necessitating countries to implement effective public health measures using a risk-based approach to prevent and control the spread of the virus(61). Like many other countries, Ethiopia adopted quarantine and isolation strategies immediately after WHO declared a pandemic alert (62). However, like many African countries, one of the biggest challenges in Ethiopia was the presence of many informal border crossings. Some of these crossings allowed the passage of people and goods without control. In addition, there was no infrastructure to support formal activities or meet sanitary needs.

Isolation and Quarantine - Identifying facilities for quarantine and isolation and training of many professionals and volunteers was conducted in many countries to facilitate isolation and quarantine (63). Citizens and local organizations generosity donated facilities, equipment, and supplies to support these efforts (64). Such acts were critical in coping with the pandemic pressures, helping travelers return to their countries, and enabling others to make essential travel arrangements.

However, there were many challenges in managing COVID-19 at different entry points, including the financial burden on individuals and countries. As cases increased, providing suitable accommodation with basic sanitary facilities was challenging in many low-income countries like Ethiopia(59,65,66). Overcrowded quarantine and isolation centers complicated the enforcement of COVID-19 prevention protocols, and some became venues for the virus to spread(57).

Accommodations created in schools and empty buildings lacked essential sleeping and sanitary facilities, which posed a formidable challenge in keeping individuals there for an extended period (42,67). It was also impossible to retain temporary COVID-19 quarantine and isolation centers for a long time because the repurposed facilities were required to resume their original function as the pandemic ran a protracted course(60). Moreover, like many other countries in low and middle-income countries (LMICs), Ethiopia arranged stay-in accommodation services for health professionals who were directly involved in handling cases to protect them and their families from

infection(68). These constraints may undermine the effectiveness of isolation and quarantine as a strategy to limit the spread of disease and require attention by policymakers in preparing for future pandemics (69).

National Laboratory Capacity – A strong laboratory network is a backbone of surveillance and is critical for effectively limiting the speed of the spread of a pandemic. At the onset of the pandemic, Ethiopia had a weak laboratory capacity, with no COVID-19 testing capacity and limited facilities and machines to repurpose. However, some laboratory facilities within the health system and research institutes were rapidly re-purposed for COVID-19 testing(70). The government supported the expansion of COVID-19 testing capacity in both public and private laboratories(71,72). The effort must continue until a strong laboratory network is established in the country. Additional steps are also necessary to improve procurement procedures and increase the number of qualified laboratory professionals, especially at the subnational level(66).

Infection Prevention and Control – A well-maintained Infection Prevention and Control (IPC) system is a critical component of the public health response to the pandemic(73). Ethiopia took action to ensure the availability of supplies and train health workers, which is essential to improve IPC practices (74). The adoption of World Health Organization (WHO) training guidelines, along with their implementation by volunteers both within the country and the diaspora, helped to improve practices and the availability of a dedicated pool of professionals(75,76). The participation of influential public figures also strengthened public messaging efforts (77). The initiative to improve the WASH standards at health facilities was crucial in creating a favorable work environment that protects health workers (78,79).

However, several barriers hindered the implementation and adherence to infection prevention practices. The barriers include a shortage of staff due to unavailability and, in some instances, due to refusal to work in high-risk workstations (36,80) and due to a shortage of IPC and WASH materials (81,82). Infection prevention was also hindered by misinformation and disinformation(27). Additionally, the failure to effectively counter misinformation and provide best practices hindered the successful implementation of IPC strategies(45).

Case Management – As the pandemic sets in, case management becomes critical to the COVID-19 response (83). The quick opening of case management centers was one of the best practices in Ethiopia. Both existing health facilities and temporary treatment centers were necessary to manage the escalating demand for hospital care(84). Ethiopia adopted the WHO case management protocol to ensure a standardized and evidence-based approach to patient care(85). Many health professionals, hospital equipment, and supplies, including mechanical ventilators, were mobilized to enhance critical care capabilities(84,86).

Additionally, the private sector was supported in strengthening the healthcare capacity to manage COVID-19 cases and improve patients' clinical outcomes and recovery. These efforts were not without challenges in LMICs (87). The challenges include the negative implications of repurposing health facilities on routine and specialized services(88,89), shortages, delays in getting supplies, medicines, and equipment, including ventilators, and burnout of critical care health professionals(42). The financial constraints also hindered the timely procurement of essential supplies and meeting operational expenses. The high cost of COVID-19-related services in private facilities was a formidable challenge in making alternative services affordable. The public systems were also overstretched beyond their capabilities, and monitoring a wide range of services to ensure a reasonable standard of care was practically impossible(66).

Supply Chain - Ethiopia's response to the COVID-19 pandemic hinges on effective supply chain management. Efforts to strengthen the supply chain were coordinated with several organizations with a good track record. Mobilizing domestic resources helped overcome the initial hesitance of the traditional donor countries(90). Additionally, Ethiopian Airlines improved its cargo services to transport equipment and supplies efficiently.

The COVID-19 pandemic highlighted Africa's heavy reliance on imported medical supplies(91), inefficiency of regulatory oversight (92), and inadequate local manufacturing capacity limitations(93). Additional logistical challenges were observed due to an insufficient supply monitoring system that resulted in the maldistribution of logistics(94). These challenges were related to inadequate human resources, technology and transportation, financial resources, and the absence of stockpiles (95,96). Addressing these constraints effectively demands a comprehensive, multi-sectoral strategy and establishing a robust emergency procurement system.

Maintaining Essential Services – The initial pandemic panic led to the closure of essential social services. Even in the capital city, Addis Ababa, the utilization of critical health services declined by 50% or more (33,34) despite the MoH promoting the continuity of essential services in all health facilities. While it took a while to see the implications of the closures on essential health services and act, actions were taken to reopen essential health services using context and disease-specific strategies, including reducing the frequency of visits and virtual consultations (97,98). The healthcare professionals' motivation and retention were enhanced through several incentives, including compensatory payments(99). Resuming essential health services had many challenges, including a shortage of COVID-19 preventive supplies, a shortage of health workers and medicines, and the public fear of visiting health facilities (93,99).

Additionally, in the long run, the failure to maintain incentives for health professionals poses a threat to workforce motivation and retention, potentially leading to workforce shortages and compromising the overall quality of healthcare delivery during the ongoing pandemic(106). Keeping essential services at all times, even during pandemics, is critical to ensure no life is lost due to preventable and treatable health conditions while dealing with emergencies. Particular emphasis must be given to maternal and child health programs and people on long-term treatment programs.

Preparedness and Response - The government adopted a whole-of-government, hierarchical, and dominantly top-down approach. It developed and disseminated emergency preparedness and response plans to regions and health facilities (100). The preparedness and response were reinforced through continuous risk communication and mass media campaigns (31,101,102). Although Ethiopia has encountered and managed many epidemics, none were at the scale of the COVID-19 pandemic. Preparations were inadequate, and the response was challenged by weaknesses inherent in the health system (103).

The Scientific Advisory Council played an invaluable role in seeking evidence-based yet context-appropriate strategies. Effective contact tracing mechanisms have also been implemented. These proactive measures contribute to maintaining essential health services while effectively managing the pandemic. Regular reviews of the pandemic situation at national and regional levels, facilitating a dynamic and adaptive approach to emerging challenges, were helpful in calibrating the response to the country's context (104).

The strict measures implemented at the initial stage of the pandemic were practical to limit the speed of the spread of infection but very challenging to maintain for a long time (105), like in other countries(106). So, it was necessary to scale down the level of restrictions in different geographical areas depending on the level of infection based on the WHO recommendations to maintain essential health services during the pandemic(107,108).

Innovations for testing, quarantine, and treatment facilities also supported response efforts (109)The severity of the COVID-19 pandemic in Ethiopia was not at the level seen in Western countries. Still, it exposed the weaknesses in the health system that need to be addressed systematically to be better prepared to respond to similar pandemics.

VII. Lessons Learned

The COVID-19 pandemic in Ethiopia caused significant health, socioeconomic and developmental challenges. It mobilized previously untapped resources, both domestically and from the diaspora. This section summarizes the lessons learned in the initial phase of the pandemic, before the introduction of COVID-19 vaccines in Ethiopia.

The whole government response was the central pillar of the COVID-19 response. The government established a multi-sectoral coordination for the timely response. However, its effectiveness was sometimes challenged by broken communications. Even the MoH and EPHI appeared to be competing to assert authority, and duplication of efforts was apparent in the process.

Competing priorities also affected the top leadership engagement and delayed the implementation of some recommendations by the HPAC, which likely reduced the effectiveness of some of the interventions. Delayed interventions may have caused non-adherence and refusal of some critical interventions. The lack of a dedicated secretariat for the multi-sectoral coordinating body compromised its functions and effectiveness. Although the efforts to galvanize support from external development partners and donors were commendable, coordinating their activities on the ground was challenging.

Experts in the country and the global diaspora coordinated their efforts to provide voluntary and timely technical support through the COVID-19 Health Professional Advisory Council. Despite time zone differences, members of the SAC worked relentlessly to coordinate meetings with the diaspora. Their technical inputs were invaluable in developing and adopting technical guidelines through the pandemic's various phases. However, sustaining the contribution of such a valuable body was not possible; it was a missed opportunity to nurture the professionals' engagement in building a better health system.

Professional associations in the country also played exemplary roles. They assigned their members to many of the technical task forces, mobilizing domestic resources, organized and led the training of health professionals, and raised public awareness.

Mass media organizations, both public and private, greatly support risk communication efforts. Influential leaders and public figures, including artists, religious leaders, and known experts in various fields, contributed voluntarily to strengthen risk communication efforts. However, ensuring consistent content and approaches was a challenge. The challenge was gauging the validity, amount of information, and timing. Political rallies, religious/spiritual public celebrations, and social gatherings such as funerals and wedding ceremonies undermined risk communication efforts. Additionally, risk communication did not adequately address how to preserve social institutions, such as *mahiber, ekub,* and *iddir*, which promote social cohesion and social capital.

Surveillance was the backbone of the COVID-19 response. Guidelines were developed and implemented when the first COVID-19 case was detected in Ethiopia. Many surveillance officers were mobilized and worked around the clock. Quarantine and isolation centers were established in hotels and institutions in the country.

However, the surveillance efforts were hampered by several challenges, including a shortage of experienced surveillance experts, improper sample collection methods, inadequate laboratory capacity and logistics, a lack of testing kits, and poor data management systems. Inaccurate recording of the addresses and phone numbers also hampered contact tracing efforts.

The country's large borders, lack of infrastructure, and many unmonitored land entry points posed additional challenges for border surveillance. Quarantine at many land points of entry was impractical due to a lack of infrastructure, and attempts to establish temporary centers proved to be a failure as those centers became breeding sites for COVID-19 infection. Only a small fraction of eligible individuals was handled correctly at some entry points.

Educational institutions provided their facilities for isolation and quarantine purposes. However, many of these institutions lacked basic sanitation facilities, making it difficult to accommodate people comfortably.

Non-pharmaceutical Interventions (NIPs) were adopted quickly, and local innovations such as cloth face masks and handwashing facilities helped encourage public adherence. However, the coverage was inadequate because of a shortage of supplies, including face masks, sanitizers, and water. Physical distancing was the least effective NIP.

Case management and laboratory capacities had to be literally from scratch. Health facilities, educational facilities, and buildings/meeting halls were repurposed to establish treatment centers. Equipment was pooled from stores and repurposed. The training was given to many health workers who served relentlessly around the clock despite the high risk associated with working in treatment centers. However, organizing special services, such as critical care, was challenging due to the shortage of adequately trained professionals. There was also a delay in integrating mental health and psycho-social support services in the pandemic preparedness and response. Guidelines for case management were not distributed fast to all health facilities in the country. The facilities available as case treatment centers were inadequate. The ICUs and related equipment would have been grossly inadequate had the pandemic created more cases.

As the pandemic lasted for an extended period, health professionals, especially those working in critical care units, were at risk of burnout. Incentives for health professionals were steadily drying up, and recruiting sufficient staff in treatment centers became challenging.

Maintaining essential services was critical to sustaining the gains from past investments in health programs. In the last two decades, Ethiopia substantially reduced maternal and childhood morbidity and mortality. Health programs for HIV/AIDS, tuberculosis, and malaria were on track to achieve national and global goals. The initial interventions, including travel restrictions and shifting resources from routine health services, severely restricted the utilization of essential services.

Corrective actions were later implemented in health facilities to emphasize the importance of sustaining critical health services. However, the uptake of essential services remained low for a long time due to resource constraints and the slow rebuilding of public confidence in returning to essential services. Specifically, preventive services, such as immunization, were severely affected.

Local innovations, including mechanical ventilators, disinfecting machines, and hand sanitizers, were mushrooming to mitigate challenges in procuring equipment and supplies. However, these efforts were inadequate, and the demand for medical supplies was unmet until international procurement and donations arrived in the country.

Universities and research institutions are critical in supporting evidence generation and promoting innovations. Many research undertakings were supported later during the pandemic; however, the research outputs were not readily available to inform the pandemic response. Moreover, resource limitations and other competing government priorities curtailed the long-term engagement of researchers.

Operational and logistical needs for the pandemic response were quickly mobilized from various sources, mainly by redeploying staff, diverting finance and equipment from routine services, and repurposing facilities. The timely mobilization of resources was commendable. However, nobody predicted the protracted course of the pandemic. Resources were initially used enthusiastically without considering sustainability; in addition, rampant misuse and abuse of resources compromised the sustainability of some efforts. Resources were dwindling with time and other competing priorities, leading to response fatigue at all levels.

The regions made efforts to build their response capacity within a reasonable timeframe. However, many regions started from a shallow level and had severe resource constraints to ensure a standard of care. Without the

pandemic's urban preponderance, regions would have been severely impacted by the pandemic.

This study was initiated later in the pandemic and missed the opportunity to capture some details as time passed, and some of the experts engaged in the response moved on. Due to resource limitations, the scope of the study was also limited to a segment of the pandemic course. Thus, it is likely that we have missed some voices and experiences. When the study was conducted, COVID-19 vaccines had not yet been introduced in Ethiopia. Therefore, that experience is not captured in this report.

VIII. Recommendations

The government of Ethiopia and the Ministry of Health should strengthen pandemic readiness and preparedness by systematically investing in institutions, health workforce, and health facilities. Addressing the critical shortage in some professional categories, such as epidemiology, critical care, laboratory, mental health, and IPC, must be prioritized in developing the future health workforce. Investing wisely before the pandemic hits can be cost-effective and help to build sustainable capacity.

Ethiopia must prioritize establishing a permanent multi-sectoral coordination mechanism with a clear mandate and structure supported by a permanent secretariat. Such a body can help the country better prepare for and respond to future pandemics and health emergencies.

Panic management strategies should be integral to the pandemic readiness and preparedness plan. Officials, institutions, and the public should avoid hasty decisions that waste limited resources due to panic reactions. Even during pandemics, decisions must be made based on scientific evidence and lessons learned from past experiences.

Establishing a standing Health Professionals Advisory Council for emergencies is critical to ensure scientific evidence is integral to pandemic preparedness and response. The HPAC can also help spearhead research and innovations and accumulate institutional memory to avoid repetitive mistakes.

Establishing emergency funds and procurement procedures is critical to responding appropriately to pandemics. Acquiring lifesaving resources promptly can save many lives. Exploring mechanisms to increase domestic resource mobilization for emergencies is useful.

Strengthening surveillance by integrating new technologies and state-of-the-art data management systems is essential. Surveillance must provide information in real-time to effectively guide appropriate interventions in the course of the pandemic. Maintaining a versatile laboratory network that can be repurposed as needed is essential. The GoE should strengthen the capacity to prevent and control the introduction and spread of infectious diseases at the point of entry. Building infrastructure and deploying well-trained health professionals at the entry point is essential. Establishing and strengthening land, sea, and air travel quarantine centers will help to prevent the spread of transboundary diseases.

Risk communication strategies must be updated based on the lessons learned in this pandemic. To minimize misinformation and disinformation, great attention must be paid to the trustworthiness and timeliness of communications.

Strengthening the supply chain and logistics is critical. Enhancing the planning, budgeting, and procuring systems for medical equipment and supplies at the national level is also essential. Support should be provided to incubation centers for medical device design, innovation, and local manufacturing. Additionally, the capacity to maintain and repair crucial medical devices must be strengthened.

Evaluate the regulatory processes and make the necessary revisions to ensure expedited and efficient regulatory procedures for importing essential medicines, supplies, and equipment for emergency use must be prioritized.

Universities and research institutions must be supported in further developing their innovative capacity for health interventions. Linking innovators with the industry is essential for the large-scale and sustainable production of critical equipment and supplies. Additionally, investing in basic hygiene facilities at educational institutions is essential to ensure they are prepared for future pandemics while improving their students' hygienic standards.

Professional associations must continue to play essential roles in pandemic responses. Relevant authorities should provide opportunities, a legal framework, and resources to strengthen these professional associations.

Enhancing regions' capacity to prepare for and respond to pandemics more effectively must be a priority. The development of human resources and the construction of facilities should be proportional to the needs of different regions.

Research must be an integral component of pandemic preparedness and response. Efforts should be strengthened to support research and ensure data are accessible to independent researchers throughout a pandemic.

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