

# The impact of cyclones and COVID-19 on HIV and the health system in Mozambique

A mixed methods study



 COLUMBIA CLIMATE SCHOOL  
THE EARTH INSTITUTE

## EXECUTIVE SUMMARY

Climate change has a profound and escalating impact on the health of people around the world. Acute events such as cyclones, tornadoes, fires, and flooding are predicted to become more common and severe, as are slower-moving changes such as drought, aridification, extinction of pollinators, and temperature extremes. In addition to augmenting economic stress, migration, and forced displacement, these changes also hinder access to and engagement in health services. Treatment interruption is of particular importance to people living with HIV (PLWH), where missing medication doses can lead to drug resistance and poor outcomes. The Solutions 4 Sustainability (S4S) project was designed to evaluate the response of the health system in Mozambique to the catastrophic cyclones (Idai and Kenneth) which occurred in the Spring of 2019. The study integrated data from key informant interviews (KIIs), focus group discussions (FGDs), and survey data collected via an electronic questionnaire. Data were collected between February and May 2021 via interviews with health care providers and policy makers (n=53) at the central, provincial and facility level, and from an electronic questionnaire shared with national and international stakeholders involved in the cyclone 2019 response (n=23). Nine focus group discussions were also held with groups of health care clients living with HIV or other conditions (n=72). Furthermore, questions regarding the COVID-19 response were also incorporated in the study, in order to assess whether policy makers and clients recognized any similarities between the calamities and the health system response.

Overall, although there was extensive damage to infrastructure, as well as to supply chains for equipment, medications and consumables, most clients, providers and policymakers noted being relatively satisfied with the government response to the cyclones. Adaptations including mobile clinics and tents were supported by international partners, which provided the resources for a quick response to acute emergencies. Almost universally, participants noted the heroism of health care providers and first responders, who were able to maintain services despite often suffering personal loss and trauma. There was also much positive feedback for the management of acute infectious illnesses occurring due to flooding, such as malaria, and a cholera outbreak. Mozambique had also adopted differentiated service delivery (DSD) prior to the cyclones for PLWH; this is a new model of service provision which includes multi-month dispensing (MMD) of antiretrovirals to stable clients, improving convenience for them, and clinical efficiency. Many PLWH noted that there was minimal disruption to their treatments because of MMD, whereas people with other chronic diseases did not benefit from these models. In terms of challenges, participants commonly noted that the early warning system was inadequate, with disruption of communications due to power loss and destruction of infrastructure, and many underestimating the seriousness of the cyclones and subsequent flooding.

Few felt that the COVID-19 pandemic was analogous to the cyclones, as the timeframe was so much longer, and the economic impact so much more diffuse. Many felt that the government had limited resources to mitigate the impact on households due to lost labor from the economic devastation also felt by international partners. However, MMD and alternative means of psychosocial support for PLWH, such as community health workers visiting clients at home, were also cited by PLWH as integral to diminishing any potential disruption in care. Some clients cited apprehension at losing the direct contact with their health care providers. Providers and policy-makers worried about the downstream effect of the pandemic on other health services, and many recommended more training on surveillance and emerging pathogens.

# Recommendations

Community consultations should be prioritized as part of national planning around climate change resilience in Mozambique



## KEY COMPONENTS OF infrastructure resilience

- 1 Use validated methodology to assess vulnerability of communities and health facilities to climate change
- 2 Map health infrastructure according to the type of risk by weather phenomenon
- 3 On the basis of this mapping and vulnerability index, allocate health resources to design cyclone-resilient health structures, incorporating resilient materials and articulation designed to withstand high-force winds, or flooding or other extreme weather event
- 4 Identify and allocate resources for these adaptations, with adequate monitoring and enforcement of building codes
- 5 Prioritize community engagement to assist with mobilizing households out of flood plains and other areas of high risk
- 6 Plan a communication strategy to optimize acceptability of any strategies to heterogeneous communities.
- 7 Financing: identify international resources for the most urgent adaptations, develop public-private methods for future funding
- 8 Planning for mitigation of events of greater magnitude, such as the salinization of the Incomati river, will require additional study and innovative solutions



## KEY COMPONENTS OF health system resilience



1 Develop a health sector contingency plan for disaster response using the vulnerability index

2 The electronic health record system is both a liability and an opportunity, as it is currently unreliable and resource-intensive. However, with improved maintenance and a system of backup for situations of power loss, these records could allow improved record keeping across facilities.



3 Integrate epidemiological surveillance of diarrhea, dengue and other emerging diseases into the routine activities of the national health system

4 Provide adequate psycho-social support for first responders and health care providers during disasters, including mental health evaluation and care.

5 Expand DSD to other chronic disease conditions but ensure that clients have adequate counseling and support during periods of forced reduction in health care access.



6 Employ alternative methods for contacting clients with chronic diseases, such as mHealth, to optimize engagement and reduce attrition.

7 Provide enhanced training of health care workers and public health specialists in disaster care, emerging diseases and pandemic management, with sourcing of adequate resources. Ensure that this training is integrated into different syllabi such as those for health technicians, postgraduate courses and sector-specific short courses. Strengthen targeted ongoing training and supervision activities prioritizing areas most at risk.



8 Include a disaster response unit within the MOH, and ensure care for chronic diseases is incorporated into Preparedness planning.

9 Promote partnerships and coordination between different actors (government, United Nations agencies, NGOs) working on climate change mitigation in Mozambique.

## KEY COMPONENTS OF communicating future calamities

- 1 Allow the MOH a larger leadership role in the health care response
- 2 Encourage early and regular community engagement as it is critical to the response, particularly in ensuring that people understand the potential severity of these events, and have the necessary support to prepare.
- 3 Ensure redundancy of communication modes to allow adaptation to different circumstances.
- 4 Use weather forecast information for the rainy season to prioritize areas at risk, in coordination with INAM, and ensure any risks are adequately conveyed to partners and communities as early as possible.
- 5 Community health workers and other leaders should disseminate information during an emergency on sanitation, resources for food and shelter, and emergency medical care



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## ACRONYMS

<b>AIS</b>	AIDS Indicator Survey
<b>ART</b>	Antiretroviral
<b>CDC</b>	U.S. Centers for Disease Control and Prevention
<b>CHW</b>	Community health worker
<b>CIBS-INS</b>	Instituto Nacional de Saúde Comitê Institucional de Bioética para Saúde
<b>DNGRH</b>	National Directorate of Water Resources Management
<b>DSD</b>	Differentiated service delivery
<b>FGD</b>	Focus group discussion
<b>HCW</b>	Health care worker
<b>INAM</b>	National Institute of Meteorology
<b>INGC</b>	National Institute of Disaster Management
<b>INGD</b>	National Institute for Disaster Management and Risk Reduction
<b>INS</b>	Instituto Nacional de Saude
<b>KII</b>	Key informant interview
<b>MMD</b>	Multi-month dispensing
<b>MOH</b>	Ministry of Health
<b>NCD</b>	Non-communicable disease
<b>NGO</b>	Non-governmental organization
<b>NHO</b>	National Observatory of Health
<b>PLWH</b>	People living with HIV
<b>PLWNCD</b>	People living with non-communicable chronic diseases
<b>PLOTH</b>	People attending other out-client clinics
<b>PPE</b>	Personal protective equipment
<b>TCDM</b>	Technical Committee for Disaster Management

## INTRODUCTION

KENNETH

Pemba

Beira

IDAI

Maputo

### Cyclones

-  120 km/h
-  60 km/h
-  90 km/h
-  Uncertainty Cones

### HIV prevalence (%) value



**FIGURE 1.** HIV prevalence among adults aged 15-59 in Mozambique, 2015 and the 2019 Cyclones Idai and Kenneth

Climate change has a profound and escalating impact on the health of people around the world. Acute events such as cyclones, tornadoes, fires, and flooding are predicted to become more common and severe, as are slower-moving changes such as drought, aridification, extinction of pollinators, and temperature extremes. In addition to augmenting economic stress, migration, and forced displacement, these changes also hinder access to and engagement in health services. Acute weather events can hinder access to health facilities, damage infrastructure, interrupt supply chains, and displace health care workers (HCW), threatening health outcomes and magnifying health disparities. Efforts to mitigate the impact of climate change on health have predominantly focused on forecasting potential outbreaks and tracking the changing patterns of malaria and other vector-borne diseases.<sup>1,2</sup> As health ministries around the world prepare for future

emergencies, there is also a need to focus on anticipating, preparing, preventing, responding to and recovering from climate-related disruption of health systems and health service delivery.

Since 2016, the Government of Mozambique has worked to enhance strategic planning activities related to climate and health by establishing the Platform of Climate, Environment and Health within the National Observatory of Health (NHO). The NHO and its partners prioritize understanding the effects of extreme climate events on health, including vulnerability and adaptation assessments of the health system and the development of risk maps of climate sensitive diseases (malaria and diarrheal diseases) based on forecasts for the next rainy season. These activities are intended to optimize an early warning system for malaria and cholera. The National Institute of Disaster Management (INGC) is responsible for coordinating the response to these warnings and works with the Technical Committee for Disaster Management (TCDM) to mobilize other government organizations' responses, including the health sector.

In 2019, Mozambique suffered from two catastrophic cyclones, Idai and Kenneth, the worst natural disasters to hit southern Africa in 20 years.<sup>3</sup> The cyclones affected more than 1.85 million people, displacing over 400,000 residents into shelters with poor access to running water and other basic services.<sup>4</sup> They also severely damaged infrastructure, causing the destruction of 77 health facilities,<sup>5</sup> disruption of roads and transportation, and profound interruptions in health services.<sup>6</sup> The forecasting and early warning systems in place during the 2019 cyclones were evaluated later that year, with a focus on the work of the National Institute of Meteorology (INAM) and the National Directorate of Water Resources Management (DNGRH).<sup>7,8</sup> These evaluations noted the limited capacity in 2019 to provide accurate forecasts of flooding hazards.<sup>8</sup>

Adult HIV prevalence in communities impacted by Idai and Kenneth was 13.5-16.3% and 5.7-13.8% respectively (Figure 1),<sup>9</sup> and an estimated 350,000 (people living with HIV) PLWH lived in the cyclone-affected regions.<sup>10</sup> As is common in post-disaster settings, the primary response focused on emergencies such as injuries, loss of shelter, and mitigation of water-borne illnesses including cholera.<sup>11</sup> The Government of Mozambique launched an international appeal for assistance after the cyclones, which enabled some organizations to expand community-based services

for PLWH, including home-based antiretroviral therapy (ART) distribution.<sup>12</sup> These efforts leveraged Mozambique's early leadership as one of the first countries to scale up differentiated service delivery (DSD) for HIV, starting in 2017. DSD allows clients doing well on ART to access more convenient models of care; these include multi-month dispensing (MMD) of medications, community delivery of ART, and peer-led counseling and adherence support.

Since March, 2020, Mozambique has also had to contend with the COVID-19 pandemic, with a total of over 150,000 confirmed cases and 1900 deaths by September, 2021.<sup>13</sup> The government has imposed recurrent lockdowns when cases surged. In a largely informal economy, these lockdowns have created difficult economic conditions for much of the public. Furthermore, the health system needed to restrict access to routine services as part of their mitigation strategy for control of COVID-19, with a demonstrably negative effect on utilization of HIV testing and treatment services.<sup>14</sup> The pandemic also exacerbated the problems caused by terrorist activity in the northern province of Cabo Delgado, which has displaced tens of thousands of people.<sup>15</sup>

In order to better understand how health systems and communities might best prepare for climate emergencies, particularly in settings of high HIV prevalence, we designed a study using key informant interviews (KII), focus group discussions (FGD) and a semi-structured electronic questionnaire to identify strengths and gaps in the health system response to the 2019 cyclones; we also focused on continuity of care for chronic diseases such as HIV. Furthermore, we explored the effects of the COVID-19 pandemic on the health system, to elicit opinions on similarities to the cyclones and the response, and whether lessons had been learnt from the cyclones on how to manage chronic diseases during emergencies. Study findings could inform the development of a comprehensive preparedness and response plan for resilient health systems. The recommendations provided by the stakeholders interviewed could also serve as a model to inform other countries facing similar threats

Figure 1 shows weighted HIV prevalence (%) in adults aged 15-59 in 2015 with spatial interpolation by inverse density weighting to calculate prevalence. Labels in black indicate city locations for KIIs and FGDs. Cyclone Idai struck land March 14, and Kenneth on April 25, 2019. Sources: HIV prevalence - AIS 2015<sup>16</sup>; cyclones- Global Disaster Alert and Coordination System.<sup>17,18</sup>

# Study design and sampling

This study integrated data from key informant interviews (KIIs), focus group discussions (FGDs), and survey data collected via an electronic questionnaire. Data were collected between February and May 2021 by interviewers trained in quantitative and qualitative data collection, interview techniques, human subjects protection and biosafety measures.

## KEY INFORMANT INTERVIEWS (KIIS)

KIIs were conducted in person or via telephone with policy makers and health providers. KII guides were designed to elicit perspectives on the strengths and challenges of the health system response to the cyclones in 2019, and to the ongoing COVID-19 pandemic, including the role of government leadership, the quality of communications in terms of the early warning system and guidance on the response, and successes and challenges faced by the health system and communities (Table 1). The KII guides were developed in English and translated into Portuguese (Appendix A).

Purposive followed by snowball sampling was used to recruit policymakers and health care providers who had been directly engaged in the cyclone response. The Mozambique INS (Instituto Nacional de Saude) staff provided an initial list of key informants at the central level in Maputo City, the capital of the country, from the districts of Beira and Dondo in Sofala, and from Pemba in Cabo Delgado. Snowball sampling was then used to recruit provincial- and district-level health care providers, managers and policymakers based on feedback from the central-level informants.

A telephone or in-person interview was scheduled at a convenient time for KII participants, who were sent an information sheet and a consent form prior to the interview. Following verbal informed consent, interviews were conducted in English or Portuguese by trained study staff and took approximately 60 minutes. When participants agreed, interviews were audio-recorded and transcribed verbatim,

and then reviewed for accuracy and completeness by a second investigator. In the case of three interviews where the informant declined recording, study staff took notes during the interview. DeepL Pro software was used to translate the Portuguese transcripts into English; translations were reviewed and verified by study staff fluent in both English and Portuguese.

## FOCUS GROUP DISCUSSIONS (FGDS)

FGDs were conducted in Maputo City, Pemba and Beira with three mixed-gender groups of adult health care users: PLWH, people living with non-communicable chronic diseases (PLWNCD), and people attending other out-client clinics (PLOT). The FGD guide explored participants' perspectives and experiences within the health system before and after the cyclone, and during the COVID-19 pandemic (Table 1). FGD guides were developed in English and translated into Portuguese (Appendix B).

Participants were recruited from facilities located in cities impacted by the cyclones, and in Maputo, via informational flyers and by healthcare providers using a standardized recruitment script. Healthcare providers obtained permission from interested clients to be contacted by the study team and documented this permission in the client's medical record. Following written informed consent, FGDs were conducted at health facilities by two trained study staff over approximately 1.5-2 hours. They were audio-recorded, and transcribed verbatim, with a second investigator checking the transcription for accuracy and completeness. DeepL Pro software was used to translate the Portuguese transcripts into English; translations were reviewed and verified by native speakers.

## QUESTIONNAIRE

The electronic questionnaire was adapted from the KII guide to explore the same themes to allow contributions from those no longer in Mozambique, or unavailable for KII due to COVID-19 precautions or other reasons. The questionnaire was translated from English into Portuguese, and programmed into Qualtrics (Appendix C).

A list of roughly 75 possible stakeholders involved in the cyclone response was created by members of the study team at ICAP-Mozambique and INS. Potential participants included in-country staff of the World Health Organization, the U.S. Centers for Disease Control and Prevention (CDC) and other donors. This list was then emailed with a link to the survey, and two reminders were sent.

**TABLE 1.** Data collection and domains

Data collection method	Illustrative Domains	Examples of questions
<p>Key informant interviews (in-person or by phone) with health care providers, and policy makers who were involved in the cyclone response (e.g. district-level MOH staff, INAM field coordinator)</p>	<p>Successes of the health system response to the cyclones</p> <p>Impact of challenges on chronic disease programs, including HIV</p> <p>Success or challenges of the cyclone early warning system</p> <p>Comparison between the response to the cyclones and to COVID-19</p> <p>Suggestions for community resilience to natural disasters</p>	<p>What feelings did the community have towards your role in the response [to the cyclones]?</p> <p>What was the impact of these challenges on HIV and chronic disease programs specifically?</p> <p>Where did most communication you received about the 2019 cyclones come BEFORE the cyclones hit Mozambique?</p> <p>What were some weaknesses/challenges in the health systems' response to the cyclones? How do these weaknesses compare to the COVID-19 response?</p> <p>What can local communities do to better prepare for and respond to natural disasters or unexpected events (like COVID-19)?</p>
<p>Electronic survey for policy makers and disaster responders, local and international</p>	<p>Health system response to cyclones</p> <p>Challenges encountered due to the cyclones</p> <p>Quality of the communications around the early warning system</p> <p>Comparison between the response to the cyclones and to COVID-19</p>	<p>On a scale from 1 to 10, with 1 being not at all positive, 5 being somewhat positive, and 10 being very positive - Community opinion of healthcare worker response?</p> <p>Thinking of the 2019 cyclones, which of the following were challenges your community experienced? (Select all that apply)?</p> <p>Where did most communication you received about the 2019 cyclones come BEFORE the cyclones hit Mozambique?</p> <p>How has the Mozambican leadership response to the 2019 cyclones compared to the leadership response to COVID-19?</p>
<p>Focus group discussion (in person) with health system clients with HIV, NCD or other health needs, who were resident in Sofala or Cabo Delgado when impacted by the cyclones</p>	<p>Experience with the health system before the 2019 cyclones</p> <p>Health system response to the cyclones</p> <p>Challenges encountered trying to access health services after the cyclones</p> <p>Impact of COVID-19 on individual and community</p>	<p>Suppose I was a community member going to the health facility you attended before the cyclones in 2019. Tell me what that experience would have been like?</p> <p>Thinking back to the months following the cyclones, what actions by the health system during the cyclone were effective in your community?</p> <p>Thinking back to the months following the cyclones, please tell us about challenges you faced in staying on treatment for your chronic condition?</p> <p>of the challenges [caused by the COVID-19 pandemic], which were the most significant and why?</p>

## DATA MANAGEMENT

Digital recordings of KIIs and transcripts were password-protected and located on encrypted end-user devices. Transcripts utilized randomly generated identifiers to maintain participant confidentiality. Any potential identifiers in the transcripts were erased prior to data analysis. Results from the electronic questionnaire were downloaded from Qualtrics as a .csv file, with potential identifiers also removed.

## ETHICAL REVIEWS

The study protocol and data collection tools were approved by the Ethics Committee of the Instituto Nacional de Saúde Comitê Institucional de Bioética para Saúde (CIBS-INS), and the Institutional Review Board at Columbia University Irving Medical Center (protocol #AAAT4102). KII participants provided verbal consent, whereas those responding to the electronic questionnaire provided virtual written consent. FGD participants also provided written consent.

## DATA ANALYSIS

A codebook was developed using deductive coding derived from modules in the questionnaire and inductive coding derived from review of the transcripts. This codebook was based on an analytic matrix distinguishing key informant responses by respondent organization, types of barriers and successes, and nature of the disaster. FGD Investigators independently reviewed the same transcript and compared identified themes to allow the finalization of the initial codebook. Each transcript was independently coded by at least two investigators, and additional themes or categories were incorporated into revisions to the codebook. Investigators met regularly to review emergent themes and achieve consensus. Data management and analysis was conducted using Dedoose, a platform application for analysis of qualitative and mixed methods research. Open-ended responses from the electronic questionnaire were extracted and added to DeDoose, to be analyzed using the same codebook as for the KIIs.

Focus group discussion in Sofala



# Demographic characteristics of sample

We conducted a total of 53 key informant interviews: 36% were women (n=19), 34% clinicians (n=18), and 45% (n=24) employees of the Ministry of Health; 43% (n=23) were from Beira or Dondo, which was afflicted by Cyclone Idai, 25% (n=13) from Pemba, impacted by Cyclone Kenneth, and 32% (n=17) were from organizations in Maputo (Table 2). Aside from the MOH, staff from several government agencies were interviewed, including INAM, INGD (National Institute for Disaster Management and Risk Reduction), whose mandate is to build climate resilient infrastructure, District Service Planning and Infrastructure, Public Works and Water Resources, the National Directorate of Water Resources Management (DNGRH), members of District Emergency Operating Committees, National Operational Center for Emergencies, the National Directorate of Housing, and Planning and Infrastructure Services. Leaders and technical experts from the Ministry of Gender and Social Action, Provincial Service of Social Affairs, the Operational Research Center, and the Ministry of Education were interviewed.

The data were extracted from 23 electronic surveys: the majority were employees of non-governmental organizations (NGOs) (74%, n=17), including international organizations. A total of nine FGDs each with eight persons per group (n=72), evenly distributed across location, and clinic type (HIV, other chronic conditions and general health service users).

**TABLE 2.** Participants numbers by tool and location

Tool & target group	# of Participants
<b>Key informant interviews</b>	53
<b>Sofala (Beira &amp; Dondo)</b>	23
MOH	9
Other government agency	14
<b>Cabo Delgado (Pemba)</b>	13
MOH	8
Other government agency	1
NGO	4
<b>Maputo</b>	17
MOH	7
Other government agency	8
NGO	2
<b>Electronic Survey</b>	23
MOH	2
Other government agency	1
NGO	17
<b>Focus group discussions with clients at health facilities</b>	
Beira	24 (3 FGDs)
Pemba	24 (3 FGDs)
Maputo	24 (3 FGDs)

# Clients’ perspectives on the health system overall

## PERCEIVED STRENGTHS

Participants across the FGDs widely agreed on the characteristics of the health system that they valued, including reliable, rapid attendance by clinicians, community outreach programs for clients who could not go to health facilities or tracking of those who defaulted on their treatments. Participants also noted the value of professionalism in the staff, including a dedication towards maintaining confidentiality and providing non-stigmatizing care. This issue of privacy did not vary by the type of health care user. Finally, the availability of prescribed medications at the hospital pharmacy was often cited as an example of quality. These qualities were cited across location and FGD group, as evidenced by a quote from the Maputo FGD of PLOTH. **[QUOTE 1]**

**[QUOTE 1]**

*“When the service is good is when we arrive at the hospital at a certain time and we are attended to in a short time ... and.. when we arrive at the pharmacy,... we get all medicines.”*

**MAPUTO FGD (PLOTH)**

PLWH also reported that DSD models provided many advantages in the months preceding the cyclones. These included multi-month dispensing of medications (MMD), which reduces inconvenience of medicine collection during routine visits, here described in Beira. **[QUOTE 2]**

FGD patients also really valued health care workers who would attend to them at home if necessary, as well as teen clubs for young people living with HIV, as discussed by a young adult in Pemba **[QUOTE 3]**. PLWH emphasized the compassionate nature of the staff, including counselors even occasionally bringing food and juice with their medications during home visits, for those with food insecurity. **[QUOTE 4]**

The value of community organizations who would provide similar advocacy and services to those for PLWH was also noted by people with other chronic disease conditions, including for those with diabetes mellitus, described by a participant in the Beira PLWND FGD. **[QUOTE 5]**

## PERCEIVED CHALLENGES

A consistent challenge raised by discussants was poorly planned health services, leading to delayed appointments and disordered queuing, and medication and testing shortages. This was most frequently reported in the Maputo FGDs, who also reported long transit times to get to the facility, regardless of which service they were attending. Clients also noted difficulties with uncompromising staff who were not understanding of possible barriers to care, particularly in cases of missed visits or if arriving late.

**[QUOTE 2]**

*“they are giving three months, in three months you already have time to rest at home ... three months to six months, they give it when your analyses are all good.”*

**BEIRA FGD (PLWH)**



Displacement due to flooding in Beira, 2019  
Source: DFID-UK Department for International Development

[QUOTE 3]

*“We as youth ..they attended well, ... you have a girlfriend.. and want anything to be clarified, they explained..... and if a week passed without you coming, they would call you to ask you why ..., they didn't criticize.”*

PEMBA FGD (PLWH)

[QUOTE 4]

*“They came to your house and visited you, ...they gave you juice, water, cookies, advice, ... they gave me ointment ... out of their own pockets”*

PEMBA FGD (PLWH)

[QUOTE 5]

*“We have created some associations among the clients as well,...there was association of diabetics...like HIV and AIDS. it helped a lot of people”*

BEIRA FGD (PLWNCDD)

# Clients’ perspectives on the health system response to the cyclones

## PERCEIVED STRENGTHS

FGD participants in Beira and Pemba reported considerable infrastructure damage causing problems with transportation to facilities as well as damage to the structures themselves. However, most of the FGD participants felt that they received good care for acute issues after the cyclones, despite the scale of the destruction. They reported fast and good service, particularly for injuries or other acute emergencies. They also consistently reported being impressed with the work of the health care staff in the face of personal loss and extremely difficult physical conditions. In Beira, many in the FGD spoke to the heroism of health workers working through their own trauma, and noted the great lengths nurses went to in order to ensure a pregnant woman’s safe delivery. **[QUOTE 6]**

Clients in both Beira and Pemba felt that the response to the cholera and diarrheal outbreaks post cyclones, as well as increased risk of malaria as a consequence of the flooding, was well managed. Many positively discussed the role of international organizations and the generosity of neighboring countries in the response, including these quotes from FGDs for PLWH and PLOTH. **[QUOTES 7 & 8]**

Despite the destruction of many people’s homes and their own medical cards, and their subsequent displacement to government shelters, most PLWH did not report missing any of their doses of antiretrovirals. Even in the case where supply had been impacted, clients noted that the government adapted quickly. Many also highlighted that facilities adapted to the loss of client’s medical cards through other means of determining their current treatment regimen.



## PERCEIVED CHALLENGES

Some participants felt that the acute issues, including the cholera outbreak, diverted resources from the provision of treatments for more chronic conditions, such as HIV. Clients noted that not everyone was able to access care, either due to loss of their medical information, or due to reduction in some of the community services. In the Pemba FGDs, food shortages were also noted as driving nonadherence with antiretrovirals, and making it impossible to adhere to special diets such as for diabetics. A PLWH in Pemba spoke of his sister's difficulties in accessing medication due to displacement and loss of resources. [QUOTE 9]

A participant with diabetes in Beira also spoke of how difficult it was to adhere to his recommended diet due to poverty and food shortages. [QUOTE 10]

In Maputo, which was not directly impacted by the cyclones, clients reported that frequent flooding meant that it was physically impossible to get to facilities. This was also exacerbated in the context of medical emergencies, where the lack of ambulances can hamper accessing urgent necessary care. These barriers to care were reported to lead them to use whatever medicine was locally available, despite fears of lack of efficacy.

### Damaged roads and buildings in Beira after cyclone Idai, 2019

Source: World Bank Photo Collection



#### [QUOTE 6]

*“the health workers themselves also suffered the cyclone and they had to do everything possible to attend..., but they were also with the pain ..... The people that are working here in the hospital as service agents, nurses, doctors are also suffered, they all suffered.” “They attended me well, I went to the hospital and there was no power and we used candles to light to try to see if the lady could [give birth], the nurses did what they could do.”*

BEIRA FGD (PLOTH)

#### [QUOTE 7]

*“What was working well at that time that you think was the strong point is that it? Treatment of diarrhea.”*

PEMBA FGD (PLWH)

#### [QUOTE 8]

*“After the IDAI cyclone we had a lot of support. From the neighboring countries that supported us. It was food, clothing.”  
“ they donated medicine and ..gave me mosquito nets and it was very important.”*

PEMBA FGD (PLOTH)

#### [QUOTE 9]

*“my sister ... when it started raining her house fell down and she is on HIV treatment, all the medicines were gone, and she had to be evacuated ... she didn't even have money, and neither did she have food or medicine ..she stayed like that for... three weeks.”*

PEMBA FGD (PLWH)

#### [QUOTE 10]

*“ I had a lot of difficulties in following the diet .....I used to eat dried fish, chicken, but there wasn't even dried fish, I had to buy a lot of vegetables but I didn't have a lot of vegetables anymore.”*

BEIRA FGD (PLWNCB)

[QUOTE 11]

*“I think that they [first responders and clinicians] were true soldiers, they never spared their lives, their time to be able to save people’s lives”*

**BEIRA KII (MOH)**

[QUOTE 12]

*“no health unit was closed even in those conditions with no roof, we were able to improvise a tent to provide this assistance to the community”*

**BEIRA KII (MOH)**

[QUOTE 13]

*“The activities of the mobile clinics were well coordinated and minimized the suffering of the population.”*

**ELECTRONIC SURVEY (MOH)**

[QUOTE 14]

*“It was an experience of total solidarity and everything was achieved by inviting people, institutions to participate, there was a great movement of solidarity, people who brought all kinds of clothing materials, food to distribute to the most affected families. So it was a great solidarity movement that lasted for months”*

**BEIRA KII (GOVT EMPLOYEE)**

[QUOTE 15]

*“in less than 30 days we were able to have both for Sofala as well as for Cabo Delgado the vaccine for cholera prevention and in less than two weeks after the outbreak ..., we immediately started the vaccination process which allowed us to quickly contain the outbreak..”*

**BEIRA KII (MOH)**

## Key informant perspectives on the health system response to the cyclones

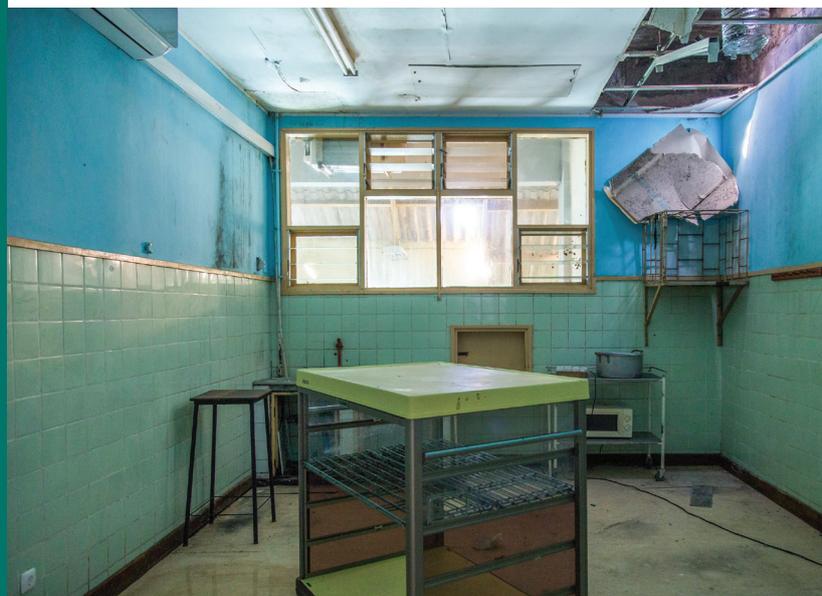


Overall, most key informants had a favorable response in terms of overall leadership from the government during the cyclones.

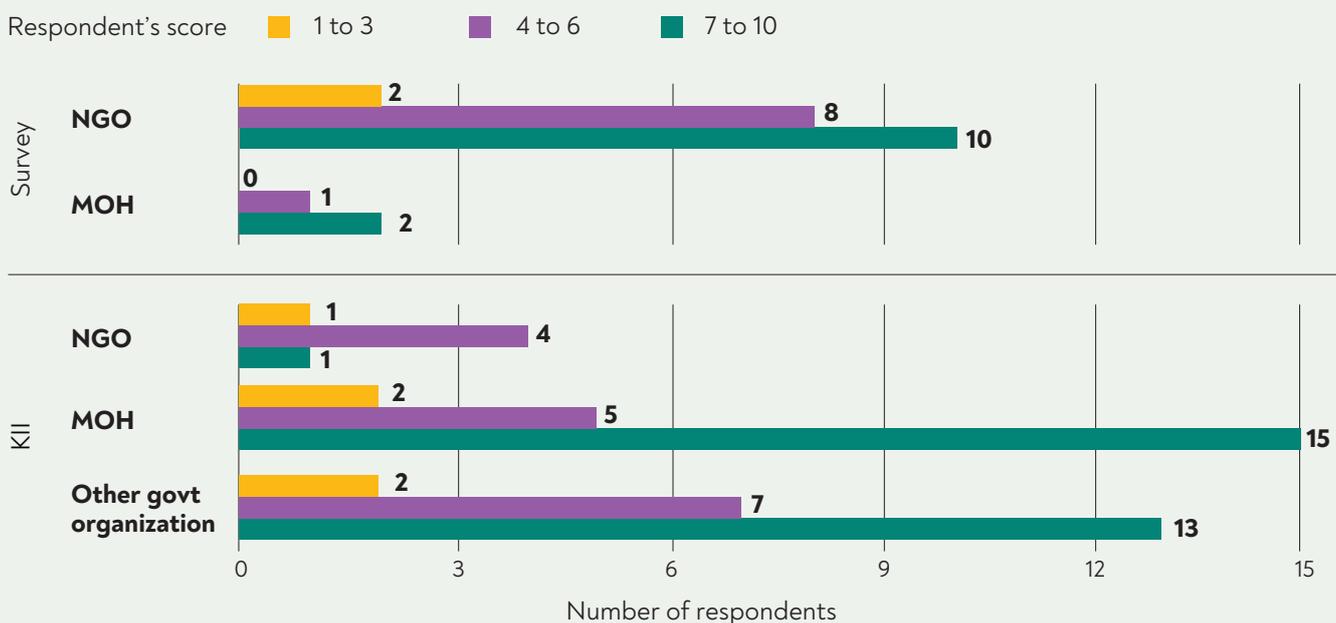
Across respondent type and method of data collection, the majority scored the government response with a score of 7-10, or positive to very positive, with very few scoring at 1-3 (or not all positive, Figure 2).

### Destruction of health facilities in Beira after Cyclone Idai

Source: World Bank Photo Collection



**FIGURE 2.** Respondents' score of the government leadership of the response to the cyclones of 2019



## POSITIVE PERCEPTIONS

There were diverse perceptions from the various key informants on the relative successes versus challenges in the response to the cyclones. A pervasive theme was the heroism of HCW and first responders, despite pronounced personal trauma. One health care worker who participated in the response to both cyclones spoke of her own difficulties during the cyclones, *“It was quite indescribable, emotional as a health worker and [I was] traumatized. I started with Idai in Beira where my main residence is located...and we practically lost almost everything built in the last thirty years.”*

Many of those working in the field echoed this experience, whereas those who coordinated the response spoke to their courage and strength. A policy maker involved in the coordination of resourcing supplies for health facilities after Idai referred to them as soldiers. **[QUOTE 11]**

In the face of the large-scale infrastructure damage, staff from the MOH reported maintaining clinical activities with improvised clinics and temporary structures. In Beira, a clinician from the MOH spoke of the improvisation needed to maintain acute medical services. **[QUOTE 12]**

Another staff member from the Provincial Health Service spoke to the efficient deployment of the mobile clinics. **[QUOTE 13]**

A prevailing perception across KIIs was that, despite what one respondent from a global NGO called a ‘humanitarian circus’, where there was a large international presence with multiple different stakeholders, the government was able to effectively coordinate their actions. Many also commended the response for striving to do as much as possible with limited resources, due to strong political and local will. **[QUOTE 14]**

There was also agreement across occupational category and location that the cholera mitigation and vaccination program was very successful and averted potential disaster. A clinician who managed some of the response to Idai spoke of this achievement. **[QUOTE 15]**

Key informants also noted that the launch of HIV DSD in 2017, and MMD of antiretrovirals, was very helpful in avoiding treatment interruptions. Many clinicians and facility managers provided similar perspectives to those of PLHV, recognizing that DSD for PLHV was extremely helpful during this period, including in mitigating any disruption to the supply chain, as it had already adapted to the provision of larger supplies of drugs to clients at the same visit. A logistics and financial coordinator from the MOH spoke of DSD. **[QUOTE 16]**

Another participant who coordinated accommodation centers at the district level for an Emergency Operating Committee in Dondo also spoke of the reliability supply chain for ART during Idai. **[QUOTE 17]**

## PERCEIVED CHALLENGES

This perception of a reliable supply chain was not universal. More informants in Pemba in Cabo Delgado noted disruption to the supply of medications as well as medical care, including some difficulties in distribution of antiretrovirals due to shortages, transportation logistical challenges for medications and staff, direct damage to pill stocks, or loss of medical records and damaged infrastructure. **[QUOTE 18]**

Several policy makers noted that clients with non-communicable diseases (NCDs) were not as well protected from treatment disruption as PLWH, and had to interrupt their treatments. A key informant from the MOH who coordinated the establishment of the temporary shelters and clinics spoke of the difficulty some clients had in getting treated for chronic conditions. **[QUOTE 19]**

Medical care was also deeply impacted by the flooding and forced displacement, which was associated with high volumes of people needing care in some under-resourced areas, particularly in the conflict-affected rural areas of Cabo Delgado province.

Furthermore, despite what was considered as a strong response, many noted that the government was not adequately prepared for the force of the cyclones, or for the flooding that followed, noting limited infrastructure and resources. The international response also brought forth additional need for coordination, with duplication of efforts in many arenas, and a high administrative burden on the government. A key informant from a global NGO responded. **[QUOTE 20]**

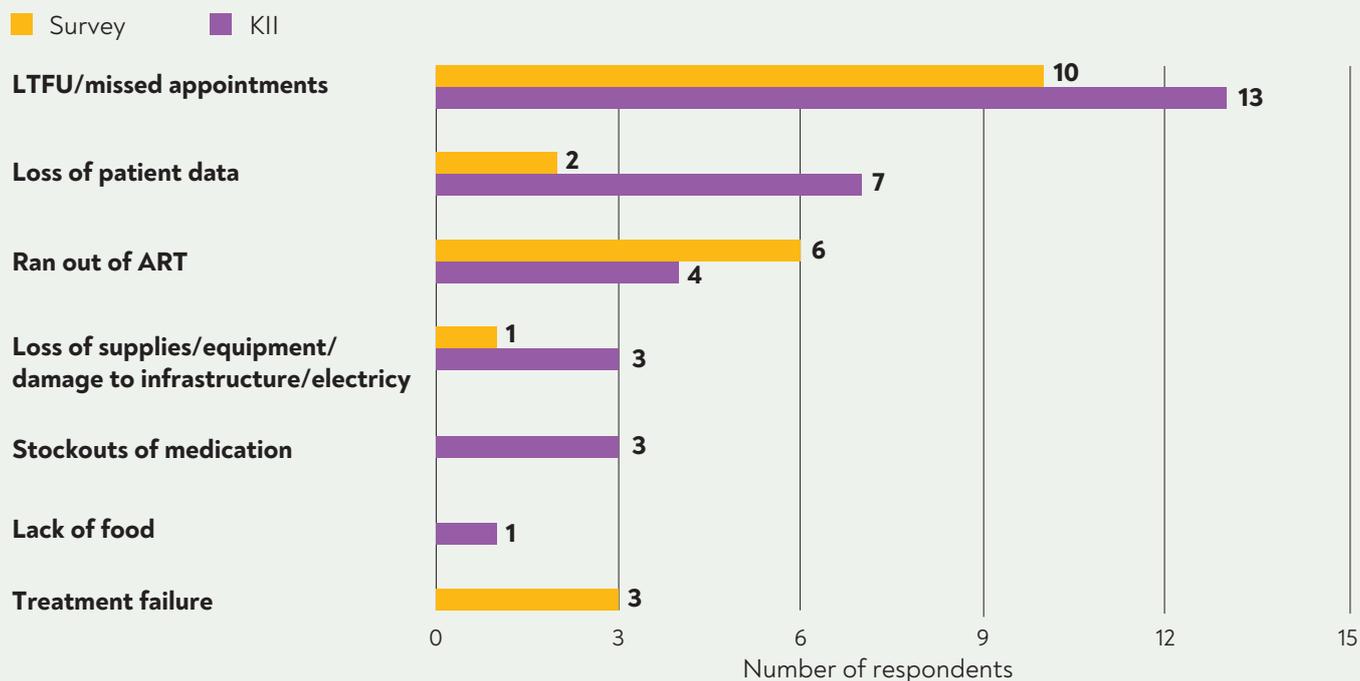
In terms of PLWH, the most important challenge identified by KII participants was missed appointments or loss to follow-up (Figure 3). They also commonly listed participants running out of ART, and loss of patient data due to destruction of patients' ART cards, or of registers at health facilities and hospitals. The mode of data collection (KII vs electronic) did not seem to impact these results.



**Beira Central Hospital temporary surgical tent after Idai destroyed the roof**

Source: World Bank Photo Collection

**FIGURE 3.** Most important impact of the 2019 cyclones on care for PLWH



**[QUOTE 16]**

*“in relation to HIV..., the impact will have been less, because a differentiated model of care was already in development, there was a long-time exemption from medications, that is, the fact that the client did not go to the health unit, did not mean that he did not receive the drug”*

**MAPUTO KII (MOH)**

**[QUOTE 19]**

*“The challenge was ... we had several problems because we had chronic clients, we had no way to get their medication, ... they would arrive at the accommodation centers ...no longer have a card and we no longer had a book recorded with that name”*

**DONDO KII (MOH)**

**[QUOTE 17]**

*“we had all those medicines that are important, including the antiretroviral ones, we had no shortage”*

**DONDO KII (MOH)**

**[QUOTE 20]**

*“The emergency preparedness was very weak. The plan was not there. The capacity and the funding was not there. The surveillance systems [was] very weak as well.”*

**MAPUTO KII (NGO)**

**[QUOTE 18]**

*“the issue of defining alternative transportation logistics ...for the transport of medicines and other consumable medical supplies to the places that are isolated ..This also made it very difficult, it was necessary to make many requests to partners,.. to be able to get them by air ...to those places that were most affected”*

**PEMBA KII (NGO)**

[QUOTE 21]

*“There ...was no way for us to see on TV, radio and we couldn’t hear anything because there was no communication.”*

BEIRA FGD (PLOTH)

[QUOTE 22]

*“when IDAI entered Sofala [INAM] facilities suffered, [INAM] lost the station that helped .... monitor Sofala and we were left without local information.”*

MAPUTO KII (GOVT EMPLOYEE-INAM)

[QUOTE 23]

*“Communication was blocked...you had to make visits from one health unit to another to gather all the information.”*

DONDO KII (GOVT EMPLOYEE)

[QUOTE 24]

*“I participated in a simulation, but all that to me was a joke and we didn’t respect it, coming here to the health unit to ... [simulate a cyclone], what is that!”*

BEIRA KII (MOH)

[QUOTE 25]

*“INAM is [becoming] a very serious institution... They communicate, it is radio, TVs, social network... and in the remote areas, the institutions go and people speak and they have activists in the communities who go and speak with megaphones..”*

BEIRA KII (MOH)

## Government communication and the early warning system

Prior groups have examined how information on the cyclones was transmitted from the Regional Specialised Meteorological Centre (RSMC) in La Reunion to INAM, which issued probabilistic daily cyclone warnings with detailed information on the severity of winds and rain by location, incorporating a cone of uncertainty.<sup>7,19</sup> These included an analysis by cyclone experts at the Earth Institute, Columbia University, who, through interviews with staff from INAM and other organizations, determined that INAM staff gathered information on the cyclones of 2019 primarily through the RSMC’s website, and through emails with staff at La Reunion.<sup>20</sup> The DNRGH also issued warnings of flooding, including a possible breach of a dam in Sofala. During the KIIs conducted in this study, a staff member from INAM described how the meteorological bulletins were shared with the media, the provincial governments and INGD; the latter then shared this information with zones forecasted to be impacted, including districts and local risk management committees, the latter being responsible for dissemination of this information to communities. The disaster management structure is provided in Figure 4.

The risk management committees were made up of multi-disciplinary teams such as education, training, agriculture, food safety, and disease surveillance for water-borne diseases. There was also a focal point for health within INGC who was included in preparatory discussions and provided information on medication stocks within affected regions. These communications allowed organizations to plan the locations of temporary health and shelter centers.

Amongst the key informants, these communications produced quite disparate perceptions on the effectiveness and clarity of warnings and instructions. During the FGDs and KIIs, individuals in both areas impacted by the cyclones reported government communications primarily being shared on television, and, in the case of Idai, FGD participants felt that the potential severity of the cyclone was not fully conveyed. Most employees of the MOH reported warnings focused on



The communication challenges were also attributed by several key informants to a lack of preparation for the intensity of cyclone Idai, and for the flooding which followed, with some ascribing the lack of community preparation to the downplaying of the severity of the warnings, or to the lack of resources in communities to respond. [QUOTE 24]

Many recommended that any emergency preparedness plan should establish a more robust chain of communication, including redundant systems which could be engaged in cases of power loss or isolation of communities. These

redundant systems should be available when key components of the early warning infrastructure are damaged. Finally, informants from the MOH and other government agencies reinforced the need to pair warnings with the necessary resources, such as sandbags or wood to cover windows, so that those most at risk have the capacity to adequately prepare. However, several respondents reported that this system had improved significantly since the cyclones, minimising the damage during more recent events such as Cyclone Eloise, including a respondent from the MOH. [QUOTE 25]

EU response to cyclone Idai in Mozambique  
Source: EU Civil Protection and Humanitarian Aid



# Health system response to the COVID-19 pandemic

FGD and KII participants were asked to provide their perceptions on similarities or differences noted between the response to the two cyclones and to COVID-19 pandemic, and whether they believed there had been lessons learned incorporated into the health system response to the pandemic. Overall, participants in the FGDs and in the KIIs reported similar strengths and concerns about the health system response to the pandemic.

## POSITIVE PERCEPTIONS

Most participants in the FGDs reported satisfaction with the response to the pandemic. They also felt the MOH was communicating the severity of the pandemic effectively. A participant in Maputo spoke of the relatively small death toll as compared to other countries. **[QUOTE 26]**

Among key informants, there was agreement about the effectiveness of the response overall, including in terms of the dedication to protecting health care providers, such as their prioritization for vaccination. Those working with the MOH or other organizations supporting PLWH also spoke of the importance of MMD in reducing risk to clients, as clients no longer had to come to facilities on a monthly basis. Key informants in Maputo believed that ART stocks were sufficiently well managed to ensure that MMD could be supported. MOH staff were also pleased with innovations used to ensure that PLWH remained engaged in their care and therefore adherent to treatment, implementing phone call consultations and mobile units for visits outside of health facilities, as evidenced by a clinician working in Beira. **[QUOTE 27]**

## PERCEIVED CHALLENGES

The most common challenge cited from the COVID-19 pandemic was its immense negative economic impact. FGD participants spoke of job loss, or restrictions such as curfews preventing them from accessing markets where they normally sell their goods. The lockdowns also hindered travel necessary for their jobs. Many of the FGD participants spoke at length about food shortages driving reduced adherence to their medications. Nonadherence with non-pharmacological interventions was also noted to be a widespread problem, particularly in older participants who were most fearful of severe illness if exposed to SARS-CoV-2. **[QUOTE 28]**

Importantly, some clients with chronic conditions were unsure about whether they should be attending their appointments, or were uncomfortable with MMD in a context where they did not feel able to seek clinical advice. A PLWH in Maputo spoke of these fears. **[QUOTE 29]**

Among key informants, many reported disruptions to health care services due to the necessity to tend to people with COVID-19, the reduction in the number of health professionals due to infection or fear of exposure, and limitations in stocks of personal protective equipment (PPE), as described here by a HCW in Beira. **[QUOTE 30]**

Many also noted that chronic conditions were being inadequately treated due to the system's focus on COVID-19. In Maputo, a clinical manager who had coordinated some of the health sector response to Idai spoke of the future burden of neglected conditions. **[QUOTE 31]**

Policy makers also recognized the negative impact of mitigation measures on communities and their economies. Contrary to central-level informants, many working in more remote health facilities felt that the ART supply was disrupted by global problems with the manufacture of various components.

## THE COMPARISON BETWEEN THE RESPONSE TO THE CYCLONES OF 2019 AND THE ONGOING COVID-19 PANDEMIC

Participants in the FGDs and in the KIIs saw very little overlap between the response to the cyclones of 2019 and the ongoing COVID-19 pandemic. One of the primary differences flagged was the severe economic impact that the pandemic was having, exacerbating poverty, and hunger, as described here by a FGD participant in Beira.

[QUOTE 32]

Participants in the FGDs felt that there had been more attention to these issues as part of the cyclone response. Clients also cited that the medical response was substantially different due to ongoing risk to clinicians from COVID-19.

[QUOTE 33]

Among key informants, many noted a lack of material support to respond to the pandemic. This was attributed to shortfalls in international engagement and resources, due to the economic impact of the pandemic on donor country economies.

[QUOTE 34]

These financial limitations hindered the ability to provide services to reduce domestic violence, which many felt had increased substantially as a consequence of poverty and food shortages. An employee at the Provincial Health Directorate of Cabo Delgado spoke of this violence and how the economic devastation of the pandemic had exacerbated it.

[QUOTE 35]

However, it was widely felt that communications were much better during COVID-19, although over a much longer timeframe.

[QUOTE 26]

*“the Government helps us, makes us aware to stay at home. Business people complain that they are losing money, but the Government made the best decision... In many countries a lot of people died.”*

MAPUTO FGD (PLWNCB)

[QUOTE 27]

*“The challenge is to keep the users active in the face of the pandemic, we managed to do those visits in terms of phone calls... for those who couldn't get to the health unit a brigade went to assist in the residence, that was a challenge but we managed to overcome it.”*

BEIRA KII (MOH)

[QUOTE 28]

*“what do I do since I am already old and know that I can easily get the disease? there are people who go to the market and do not put masks and when you ask why you do not put masks the person responds badly.”*

BEIRA FGD (PLOTH)



**Aftermath of Cyclone Idai**

Source: World Bank Photo Collection

**[QUOTE 29]**

*“I have a doubt, I am undetectable and I was given pills for 6 months, besides that there is nothing else you can do?”*

**MAPUTO FGD (PLWH)**

**[QUOTE 30]**

*“we as [health] professionals do not have enough means to care for Covid clients, .. the good PPE is only available at the Covid Center. We are ... doing Covid, the follow-up, the screening and ill-equipped ...for lack of equipment.”*

**BEIRA KII (MOH)**

**[QUOTE 31]**

*“When the pandemic passes we are going to be managing all the problems that we are putting off,.... And this is going to be the same with hypertension consultations, diabetes. They may come every three months, but it is not the same. Before they came monthly, ..”*

**MAPUTO KII (MOH)**

## DISCUSSION

### [QUOTE 32]

*“in IDAI we worked while Covid 19 there is no employment. The schools are closed and the children don’t go to school, that’s worse [than cyclones]... in the IDAI cyclone we had a lot of benefits and in relation to this Covid 19 has a lot of bans and this is causing trauma to people.”*

**BEIRA FGD (PLOTH)**

### [QUOTE 33]

*“The doctors themselves are afraid to contaminate themselves.”*

**BEIRA FGD (PLOTH)**

### [QUOTE 34]

*“here is a difference because in cyclone IDAI the partners came here, in Covid 19 the partners are also suffering, if in Covid 19 it happened while they were well they would help.”*

**BEIRA KII (GOVT EMPLOYEE)**

### [QUOTE 35]

*“two things that are related, for example the food situation,.. their income level has decreased in all aspects,...that can lead to increases in gender based violence, ...when asking the husband why you don’t bring food can be a reason for conflict, it can also raise the level of prostitution, as a source of income.”*

**PEMBA KII (GOVT EMPLOYEE)**

This study is one of the first to examine perceptions of the health system response to a major natural disaster in a country with a high HIV burden, and which includes policymaker, health care provider and client viewpoints. Other studies in different contexts have shown that, with extensive preparation, services can be maintained in the face of these disasters, although not universally.<sup>21</sup> Most of these studies have taken place in high-income settings, and even with these resources, many clients still report disruption to critical services after natural and other disasters.<sup>22</sup>

Although there was extensive damage to infrastructure, as well as to supply chains for equipment, medications and consumables, clients, providers and policymakers noted being relatively satisfied with the response to the cyclones. Adaptations including mobile clinics and tents were supported by international partners, who provided the resources for a quick response to acute emergencies.

Community workers were also a critical component of quality care preceding the cyclones, with home-based support, particularly for those defaulting on care. These health-care workers were mobilized after Cyclone Idai, to provide emergency services in addition to supporting HIV care,<sup>12</sup> although few of our respondents spoke to this. There were some reports of aid not reaching the most vulnerable, including in more remote rural areas, those places cut off by flooding and in conflict areas in Cabo Delgado after Cyclone Kenneth.<sup>3</sup> And although there was commendation for the response to the acute emergencies, particularly to the cholera outbreak,<sup>5</sup> those PLWH not on MMD, or clients with other chronic conditions, also reported loss of access to services and difficulty finding their necessary medications. Those least stable on medication are still the least likely to be enrolled in DSD, and therefore they would have been more likely to suffer adverse consequences, including those newly initiated on treatment, who often require more psychosocial support.

These service delivery adaptations also allowed the minimization of exposure risk of clients to COVID-19, with Mozambique expanding eligibility to new groups of PLHIV, such as those not deemed clinically stable, children and pregnant women, or PLHV who were newly diagnosed.<sup>14</sup> In the case of the COVID-19 pandemic, supply chains were severely compromised due to disruption of manufacturing in India and China, but through advocacy, medication manufacturing was ultimately deemed an essential service. Clients also reported benefiting from ART distribution in the community, although some seemed uneasy with the lack of clinical oversight. The MOH has also expanded virtual adherence consultations during the pandemic, which should address some of these issues, and program data have



### EU provides food support for Cyclone Idai

Source: EU Civil Protection and Humanitarian Aid

shown that there has been minimal impact on treatment uptake and outcomes as a result of these new models of delivery.<sup>14</sup> However, there remain issues with the stock of PPE, endangering clinicians and impacting the effectiveness of the response.<sup>14, 23</sup>

Aside from the physical destruction wrought by both the cyclones and their aftermath, the primary negative impact of the cyclones was on food security. Health care clients and key informants almost universally flagged the destruction to crops and reserves as the most long-lasting and difficult component of the disaster, particularly in areas which had been cut off by the floods. The financial insecurity ensuing from the pandemic lockdowns and the reductions in economic activities have had a similar effect. Food shortages have severe implications with a myriad health, behavioral and psychological effects.<sup>24-27</sup> For example, health facility clients reported that it diminished the benefits of the less intensive models of clinical care, as many stopped medications when they did not have food. This compounding effect on adherence and treatment efficacy has been shown in multiple settings,<sup>28, 29</sup> and reinforces the need for a comprehensive package of services incorporating basic needs into more specialized responses.

## STRENGTHS AND LIMITATIONS

This cross-sectional study benefits from a geographically and professionally diverse sample of respondents, and allowed for capture of not only the effects of the two recent cyclones in Mozambique but also of the COVID-19 pandemic. The diversity of the sample allowed us to also to determine perspectives on multiple levels of health system delivery. The limitations include not having FGDs separated by sex, preventing us from being to assess in more detail whether the cyclones impacted their access to care differently, consistent with other analyses of health care utilization,<sup>30</sup> or

by age. Other studies of service delivery during the COVID-19 pandemic have found that adults over 50 were more likely to default on treatment, likely due to older people's higher risk of severe COVID-19. Other limitations of the FGDs include the urban facility recruitment; the KIIs suggested that rural areas were more adversely impacted by supply chain disruption, becoming unreachable in several cases. This might mean that our FGDs did not fully captured the experience of people in these locations. Furthermore, we were unable to fully evaluate the response to Cyclone Kenneth in Cabo Delgado as it mainly impacted an area north of Pemba<sup>8</sup> which is now a restricted area due to insecurity.

## CONCLUSIONS

In terms of future responses to natural disasters, frameworks for the mitigation of climate change are being developed in Mozambique at the national and local government levels. However, these often require extensive resources, and if the health system is already strained, financing cyclone and flood resistant infrastructure adaptations may be difficult without extensive external financing. Less costly adaptations include expanding DSD into other chronic conditions, while ensuring that community health workers and other health providers can continue to do their work independently through decentralization of management structures. This is of particular importance when the event isolates communities or destroys traditional methods of communication. To strengthen the country's response to future disasters, better early warning systems allowing for preparations including medical supplies and other commodities pre-ordering will be essential to an effective response.<sup>8</sup> As few adaptation measures have thus far been incorporated into training curricula for health workers and policy makers, these changes make take time to be adopted and scaled-up.<sup>1</sup> Further research needs to focus on determining the most effective and sustainable interventions.

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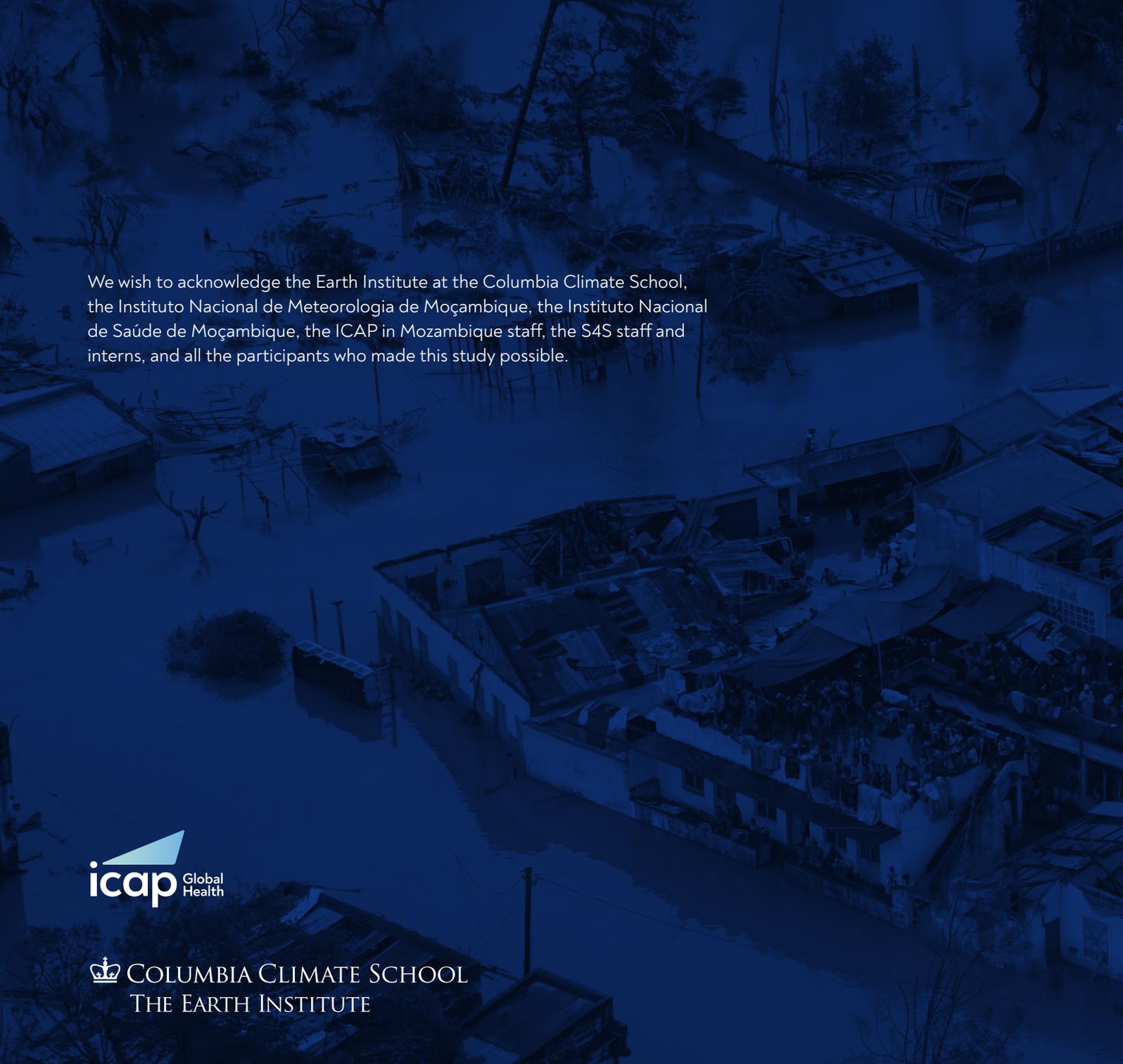
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An aerial photograph of a flooded residential area, likely in Mozambique, showing people gathered on rooftops and in the water. The image is overlaid with a dark blue tint.

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