Extreme Weather Events and Health System Resilience

December 9, 2021
Andrea Low, MD, PhD
HIV Clinical and Scientific Director of PHIA
Principal Investigator of S4S
ICAP at Columbia University
Agenda

Welcome
Andrea Low, MD, PhD

Presentations
Chia-Ying Lee, PhD
Tatiana Marrufo, MD, MPH

Panel Discussion
Eduardo Samu Gudo, MD, PhD
Genito Maure, PhD
Waltaji Kutane, MS
Carina Perotti Fux, MD
Erika Rossetto, PhD, MPH, MBA

Reminders:

For questions to the panelists, use the Q&A box

Please use the chat box to indicate your name and organization

The webinar recording and slides will be posted on www.icap.columbia.edu
Chia-Ying Lee, PhD

Lamont Assistant Research Professor
Lamont-Doherty Earth Observatory,
Columbia University
S4S Project: The Meteorological Service for Mozambique

Chia-Ying Lee¹
Colleagues: Suzana Camargo¹ and Adam Sobel² and S4S team
¹Lamont-Doherty Earth Observatory
²Applied Physics and Applied Mathematics

Death toll: 602
Missing: 2,000
Affected: 1,850,000
Damage: $800 million
Objectives

• Survey the cyclone forecast product issued by the Mozambique National Meteorology Institute (INAM)

• Understand communications between INAM to other Mozambique national and local agencies, such as Mozambique Ministry of Health and the Instituto Nacional de Saude (INS).

Interview, literature review and web search of available products during a cyclone event
Cyclones are rare to Mozambique, but the country is extremely prone to cyclone hazards

- Most were tropical depressions (wind speed < 34 kt); only 7 in the recent history reached Intense Tropical Cyclone Strength (>90 kt) (three from 2019 and 2020)
- 40% of land is less than 200 m above sea level
- Not cyclone proof infrastructure
Up to a few days lead time cyclone forecasts

- **Climate projections (10s-100s years)**
  - Long-term city planning for adaptation and mitigation

- **Seasonal-subseasonal predictions (2 weeks to months)**
  - Awareness

- **Mid-range forecasts (7-10 days)**
  - Near-term guidance to set the area of interest, mobilize assessment teams, and provide early warning

- **Weather predictions (5 days)**
  - Emergency response agencies to act upon the short-term forecasts and warnings

**Objective** guidance: observations and output from numerical weather prediction models;

**Subjective** interpretation by forecasters
1. No in-house NWP models
2. Standard Radiosondes and weather station measurement; No functional radar system

3. WMO Regional Specialized Meteorological Centers (RSMC) Météo-France office on La Réunion via:
   • RSMC’s website & bulletins
   • Communicate with La Reunion forecasters through emails, request additional information (e.g., rain and surge) as needed (following WMO protocols)
4. Joint Typhoon Warning Center (JTWC)
   (When the system is too weak, RSMC does not issue advisory, but has a chance to impact the nation)

The 12-hourly track and intensity prediction are made up to 3 day lead time and additional daily location forecasts for day 4 and 5 are provided in a separate section. Surge and storm precipitation predictions are described as well. INAM provides forecasts up to 3 days
INAM’s forecast capability and noted issues

• Lack of funding
  • The **lack of in house regional modeling** further hinders the forecasters’ ability to effectively interpret the model simulations from other global weather prediction centers
  • **Technical issues with INAM’s forecasting systems**, the computer system for comprehensively accessing all the model and observational systems and internet bandwidth
  • The **lack of modern observation systems** INAM often estimates rain using satellite retrieval

• WMO report: INAM lacks the capability to effectively use and interpret some of the high value products offered by the global and regional centres (e.g., Flash Flood Guidance System (FFGS) information on the SWFDP website that was available to INAM)
Operational forecasts & communication

**INAM** – Meteorological warning

**National Directorate of Water Resource Management (DNGRH)** – hydrological hazards and flood risk using INAM’s warning

**National Institute of Disaster Management (INGG)** is responsible for coordinating the response to the warnings

1. INGG provide bulletins to local administrative agency and other relevant agencies across levels
2. Warning communicated to locals via TV, radio, newspaper, local preparation committee, and email (to selected people)
3. INAM provides video broadcasts on its website
4. Social media and cell-phone warning texts are not yet in place
Rarity of cyclones poses challenges in communication:
“Idai and Kenneth, it is phenomena that are so difficult to handle. The government was prepared but the damage was so high. Also, the last storms hit Mozambique at where Kenneth landfall was in 1956, and at where Idai made landfall in 2000. People have never really needed to face such danger. Thus, although the government was willing to act, the community did not want to act.”
Working toward improving forecasts and warnings and the communications

Science for Humanitarian Emergencies and Resilience (SHEAR) program (Emerton et al., 2020)

It is not yet clear how this type of information was directly used for decision-making in the Mozambique government’s emergency management process. It is also not clear whether the health sectors are using any of these products or what information was directly provided from INGC.
Conclusions & suggestions for S4S’ next steps

• INAM’s tropical cyclone forecasts would benefit from (1) additional staff training in gathering and interpreting mass existing data, and (2) conducting in-house weather prediction systems

• INAM tropical cyclone forecast products can contain additional risk/impact-oriented information, such as flooding risk

• INGG would benefit from continuing to use and further improving the existing flood-management bulletins from Emerton et al. (2020)

• **Identify** information needed by health sectors in order to prevent health service interruptions, and the most adequate channel (text, social media, radio, etc.) for disseminating that information

• **Confirm** the time scales of the forecasts needed for the health sectors

• **Understand** the current resources the health sectors receive from INGC during & prior to the events

• **Build** upon the current bulletins by Emerton et al. (2020) to create one for the health sectors, and talk to the authors
Acknowledgement

• Earth Institute for the support of the research
• Special thanks to colleagues at INAM for participating in the interviews: J. Zucule, J. Gonalves, A. Duvane, V. Cambane, J. Sequeira, M. Mustafa
Tatiana Marrufo, MD, MPH
Coordenadora do Programa de Saúde e Ambiente
Instituto Nacional de Saúde,
Ministry of Health, Mozambique
The impact of cyclones and COVID-19 on HIV and the health system in Mozambique: a mixed methods study

Presented by:
Tatiana Marrufo, MD MPH

“Instituto Nacional de Saúde” of Mozambique

December 9th, 2021
Introduction

- Climate change has a profound and escalating impact on the health of people around the world.

- The impacts of climate change affects not only economic stress, migration, and forced displacement, but also hinder access to and engagement in health services.

- HIV prevalence in communities in cyclone path:
  - Idai 13.5-16.3%
  - Kenneth 5.7-13.8%
  - 350,000 (people living with HIV) PLWH
Introduction

Since March, 2020, Mozambique has also had to contend with the COVID-19 pandemic, with a total of over 152,307 confirmed cases and 1941 deaths by December, 2021.

The health system needed to restrict access to routine services as part of their mitigation strategy for control of COVID-19, with a demonstrable negative effect on utilization of HIV testing and treatment services.
Objectives

• 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) that occurred in 2019 and the ongoing COVID-19 pandemic.

• We aimed to:
  ✓ identify strengths and gaps in the health system response to the 2019 cyclones focused on continuity of care for chronic diseases such as HIV;
  ✓ explore the effects of the COVID-19 pandemic on the health system, to elicit opinions on similarities to the cyclones and the response, and
  ✓ understand whether lessons had been learnt from the cyclones on how to manage chronic diseases during emergencies.
METHODS

Interviews: conducted between February and May 2021

Key informants: policy makers and healthcare workers provided by Mozambique INS (Instituto Nacional de Saude)

Snowball Sampling: recruitment of provincial- and district-level health care providers, managers and policymakers based on feedback from the informants

Electronic Questionnaire: distributed to staff of the World Health Organization, the U.S. Centers for Disease Control and Prevention (CDC), and other stakeholders

Focus Group Discussion: three mixed-gender groups recruited via informational or healthcare providers who used a standardized recruitment script.

Groups included PLWH, people living with a non-communicable diseases (PLWNCD), and people attending other outpatient clinics (PLOTH)

A codebook was developed using deductive coding derived from themes in the questionnaire and inductive coding derived from review of the transcripts.
## Sample description

<table>
<thead>
<tr>
<th>Tool &amp; target group</th>
<th># of Participants</th>
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<tbody>
<tr>
<td>Key informant interviews</td>
<td>53</td>
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<tr>
<td>• Sofala (Beira &amp; Dondo)</td>
<td>23</td>
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<td>• MOH</td>
<td>9</td>
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<td>• Other government agency</td>
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<td>• Cabo Delgado (Pemba)</td>
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<td>Focus group discussions with clients at health facilities</td>
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<tr>
<td>Beira</td>
<td>24 (3 FGDs)</td>
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<td>Pemba</td>
<td>24 (3 FGDs)</td>
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<tr>
<td>Maputo</td>
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Focus Group Discussion in Sofala
Destruction of health facilities in Beira after Cyclone Idai
Source: World Bank Photo

"Beira FGD (PLOTI) "Because of the cyclone, they no longer had a ceiling and the ceiling had all come off and they had a hard time recovering processes because they were hit... Plates went out and the freezer, television set, cooler were damaged, the cyclone damaged a lot of things."
People Displaced by Cyclone Idai
Source: Marinho Nhambeto, Kalu institute

Pemba FGD (PLWH) “Even other people who are moving would lose their medication, I don’t know what, that thing of moving out of the neighborhood and going to live somewhere else, I think it would be very complicated to get medication”

Damaged roads in Beira after cyclone Idai, 2019
Source: World Bank Photo Collection

Clients’ Perspectives on the Health System Response to Cyclones
Clients’ Perspectives on the Health System Response to Cyclones

Positive Perspectives

**Beira FGD** “We stayed a long time without power and the lack of water and when we arrived here at the hospital we were quickly attended to, and we were given the medication.”

**Beira FGD** “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.”

**Beira FGD** “Many people suffered from diarrhea and whenever they came here they were taken care of very well.” “During the cyclone, the activists distributed Certainty for us to treat water because when cholera happens it is cholera. People from the hospital are taken care of in the community, they distribute soap.”

**Beira FGD** “The street was stopped and you didn’t know who is alive and who is dead.”

**Beira FGD** “I think that things were not right and people only attended by framing or consideration, things were not right, …, the laboratory also did not work and …and there was no network, we had to go to the central hospital.”

**Pemba FGD** “you couldn’t take that medicine without eating because if you took it without eating they reacted you inside, it was like you drank alcohol…”

**Beira FGD** “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.”

Perceived challenges

- Difficulties Accessing Health Facilities
- Dedicated Health Workers in the Face of Personal Loss
- Destruction of Health Facilities
- Food Shortages
- Management of Cholera Outbreaks
- Quality Services
KII perspectives on the health system response to cyclones

• Most KI had a favorable responses regarding government leadership during the cyclone

• Despite large-scale infrastructure damage, MOH reported continuous clinical activities post-cyclone, using improvised clinics and temporary structure

• There was strong political and local will to do as much as possible, with limited resources

• Supply chain and logistics disruptions impacted clinical care and infrastructure damage directly impacted medical records and pharmacy stocks

• The most important challenge related to PLHIV, per KII was missed appointments and patient discontinuation in care

Source: World Bank Photo

Source: Climate Centre
Clients’ perspectives on health system response to the COVID-19 pandemic

Beira FGD: “The difficulty is this collection that the president has already said that 10 pm has to be in the residence …, I can do an odd job and when it’s time to go home I don’t have time to go home because I don’t have personal transportation.”

Maputo FGD: “I also think it’s good, the Government helps us, makes us aware to stay at home. Businesspeople complain that they are losing money, but the Government made the best decision in telling people to stay at home. In many countries a lot of people died.”

Beira FGD: “The other challenge is that the coronavirus kills …, what do I do since I am already old and know that I can easily get the disease? I stay at home so that I do not get coronavirus, 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.”

- Effective and rapid communication
- Economic impact
- Small death toll compared to other countries
- Restrictions impacted transport to HF and work
- Differentiated service delivery
- Non-compliance to government restrictions

Restrictions impacted transport to HF and work

- Effective and rapid communication
- Economic impact
- Small death toll compared to other countries
- Restrictions impacted transport to HF and work
- Differentiated service delivery
- Non-compliance to government restrictions
KII perspectives on the health system response to the COVID-19 pandemic

- Effective response overall, including dedication to protecting health care providers (i.e., were prioritized for vaccination)
- ART stocks were sufficiently well managed to ensure that MMD could be supported
- Notable disruptions to health care services, given burden of COVID-19 patients
- Reduction in number of healthcare providers, due to infection or fear of exposure
- Limitations in stocks of personal protective equipment (PPE).
- Policy makers also recognized the negative impact of mitigation measures on communities and their economies
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.
- To strengthen the country’s response to future disasters, better early warning systems that allow for preparations, including pre-ordering and distributing medical supplies and other commodities will be essential to an effective response.
- As few adaptation measures have thus far been incorporated into training curricula for health workers and policy makers, these changes may take time to be adopted and scaled-up.
- Additional research needs to focus on determining the most effective and sustainable interventions.
# Acknowledgements

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<th>Mozambique INS</th>
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<td>Tatiana Marrufo</td>
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<td>Miriam Rabkin</td>
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<td>Elidio Muamine</td>
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<th>Mailman School of Public Health</th>
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<td>Mirriah Vitale</td>
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<th>S4S Interviewers</th>
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<td>Chia Ying Lee</td>
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Muito Obrigada!!

Thank you for your attention
Panel Discussion

Waltaji Kutane, MS
Technical Officer for Climate Changes and Health, World Health Organization

Eduardo Samu Gudo, MD, PhD
Deputy Director, National Institute of Health

Genito Maure, PhD
Climatologist and Professor, University of Eduardo Mondlane

Erika Rossetto, PhD, MPH, MBA
Field Epidemiology Training Program (FETP) Resident Advisor, Center for Disease Control
Mozambique Health Vulnerability Index (IVS/HVI)

- **Very high HVI** in 42 districts (31.8% territory, 24.1% population).
- **Eight (08) districts** with highest **too high** (from highest to lowest HVI):
  - Govuro
  - Massingir
  - Marromeu
  - Machanga
  - Nacaraoa
  - Mabote
  - Chibuto
  - Nicoadala

- **15 out of 20 less vulnerable districts** are urban (75%)
Resources

S&G project report on Meteorological service component

Chia-Ying Lee,1 Susan J. Camargo,2 and Adam M Stiefel1,2

1Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA.
2Department of Applied Physics and Applied Mathematics, Columbia University, New York, NY, USA.

April 2021

Meteorological services during tropical cyclone events in Mozambique

1 Objectives

The meteorological component of the S&G project aimed to survey the tropical cyclone forecast product issued by the Mozambique national meteorological institute (INAM) and its communication to other Mozambique institutions and local agents, such as the Mozambique Ministry of Health and the National Agency of Health Sciences and Nutrition (NSN). The original plan was to conduct field visits to the World Meteorological Organization’s (WMO) regional specialized meteorological center (RSMC) in the Southern Indian Ocean at La Reunion, INAM, and the relevant health sectors in summer 2020. Due to the COVID-19 pandemic, the visit was canceled. Instead, we hosted an online interview with INAM staff to understand the procedures and products of tropical cyclone forecasts and conducted a review of recent literature on the current structure of disaster preparedness and response in Mozambique. The minutes of the INAM interview are shown in Appendix A. In the main body of the report, we:

1. Describe Mozambique tropical cyclones characteristics and INAM’s forecasts;

2. Discuss the Mozambique emergency preparedness during tropical cyclone events, and

3. Conclude the issues, identify current challenges, and propose the next steps.

2 Mozambique tropical cyclones and their forecasts from INAM

Based on the observational data in the recent history (1981-2019), there are on average 2 tropical cyclones passing through the Mozambique channel per year and 1.3 of them impacted Mozambique (Fig. 1). The intensity varies from 1.5 in (2014) and only 19 of them reach high impact tropical storm (≥75kts) intensity strength. 13 of Category 1 (≥2.0kts) and few are less than Category 1. Most of the storms that impact Mozambique end as low-impact events. However, Mozambique is remotely situated and more because of the continuous wind in the area of windfall and the dramatic impact of inland and coastal flooding induced by cyclone heavy precipitation and storm surge. Mozambique is a donor nation (experiences of four donor countries with approximately 85% of Mozambique’s topography being less than

Access the reports:
Thank you