CIF CLIMATE INVESTMENT FUNDS

EVALUATION & LEARNING INITIATIVE

CLIMATE CHANGE AND HEALTH IN SUB-SAHARAN AFRICA: THE CASE OF UGANDA

The objective of the study is to provide recommendations for enhancing Uganda's health system to support the wellbeing of its population in a changing climate. It begins by assessing the link between changing climatic conditions and the patterns of climate-sensitive disease incidences in Uganda. It then addresses the development of a digital solution for predicting occurrences of climate-sensitive diseases using historical and current weather and health data from nine targeted regions.

CONTEXT

Climate change exposes present and future generations to lifelong health and livelihood harm, particularly in regions with low adaptive capacity, such as Africa. As a developing country with huge dependence on natural resources, Uganda is deeply affected by climate change. Due to increases in the frequency and intensity of weather and climate extremes like floods and droughts, the incidences of water-borne and vector-borne diseases, along with malnutrition-related illnesses, have also risen concomitantly.

In its Strategic Program for Climate Resilience under the Climate Investment Funds' (CIF) Pilot Program for Climate Resilience (PPCR), Uganda underscores the importance of addressing the impact of climate change and variability on human health. The government has made efforts to enhance the ability of its national health system to cope with a growing number of climate-sensitive diseases. For example, it has developed a Health Sector Development Plan that calls for the institution of early warning systems and the dissemination of weather forecasts to help health managers[1] improve overall preparedness and response (MoH, 2015).[2] Despite policy measures such as the Health Sector Development Plan, the country does not yet have a tool to predict occurrences of climate-sensitive diseases based on changes in weather conditions. Such a tool would help prepare the health system to respond to increased occurrences of climate-sensitive diseases. Hence, through this study, a digital solution was developed to address this gap.

KEY FINDINGS

1 **The literature review confirms direct links between climate change and human health.** Mechanisms through which this happens include the disappearance of herbal medicines, the loss of biodiversity leading to malnutrition, as well as the proliferation of disease-carrying pests and vectors due to favorable conditions for their reproduction.

QUICK FACTS

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RELEVANT CIF PROGRAM
Pilot Program for Climate Resilience (PPCR)

EVALUATION FIRM
Climate Change Adaptation Innovation (CHAI)

RELEVANT COUNTRIES
Uganda

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1 Health managers refers to personnel working at national or local government (district) levels, including hospital or health facility directors, whose responsibility is to plan and budget for health-related activities.
2 Ministry of Health, Uganda (2015). Health Sector Development Plan IV (2015 -2020). Retrieved from http://npa.go.ug/wp-content/uploads/2016/08/Health-Sector-Development-Plan-2015-16-2019-20-1.pdf.

2 **Climate change also affects the environmental and social determinants of health.** Stakeholders have observed and experienced changes in the occurrences of climate-sensitive diseases as a result of the changing climate.

3 **The diseases most sensitive to climate change in Uganda include asthma, cholera, dysentery, fever, guinea worm, malaria, skin diseases, typhoid, and yellow fever.** Though not exhaustive, this list offers a critical starting point for guiding future health-related planning and responses to variations in disease occurrences associated with climate change.

4 **Pathways that expose individuals and communities to climate-induced health hazards include droughts, floods, and heavy rainfall.** Droughts affect the availability of a safe and adequate water supply for domestic consumption. Floods contaminate water sources with disease-causing pollutants. Heavy rainfall results in the proliferation of stagnant water, therefore increasing the breeding of vectors, such as mosquitoes, and the prevalence of vector-borne diseases, such as malaria.

5 **Women and children are more exposed to climatic hazards and health issues** since they are the primary population segments involved in farm and off-farm activities.

6 **The predictive model developed was able to forecast the occurrence of climate-sensitive diseases based on historical and current weather and health data.** The predicted disease counts were within the range of the actual disease counts in the historical data, thus proving that it is possible to develop reasonably accurate predictive models to estimate future occurrences of climate-sensitive diseases (see the box for more information).

RECOMMENDATIONS

- **Link weather and climate institutions and officials to those in the health sector and operationalize Uganda's strategic plans that exist in this area.** This entails strengthening the collaboration between institutions involved in the generation and dissemination of climate information (i.e. the Uganda National Meteorological Authority) and the Ministry of Health. This will improve the surveillance and detection of climate-sensitive diseases and improve responses to them.

- **Integrate the digital predictive tool into the national health system.** This will improve the country's preparedness and response capabilities, thus enabling the health system to respond to increased occurrences of climate-sensitive diseases due to a changing climate.

- **Use the predictive tool at all levels of the health system** — from local health facilities and district offices to national health planners, emergency response coordinators and policymakers, including the Office of the Prime Minister — to anticipate the burden of climate-sensitive diseases.

- **Expand the scope of the predictive tool to cover all districts in the country.** Such efforts may be hampered by the lack of weather stations covering all parts of the country and gaps in the availability of health data. An incremental approach can be taken to pair health facilities with a functioning weather station. A full nationwide adoption of electronic health records and better-enforced data standards will also support the scaling up of the tool and enhance its capabilities.

A DIGITAL PREDICTIVE TOOL FOR FORECASTING OCCURRENCES OF CLIMATE-SENSITIVE DISEASES

First, the study looked at nine districts in Uganda representing a range of hydro-climatic, climatologic, and agro-ecological conditions to develop a forecasting model of disease risks based on weather and health parameters. Each district was situated within a 40-kilometer radius of a functioning weather station.

Next, to build the predictive tool, the study team used a "supervised learning" approach of machine learning, whereby historical weather and health data from 2014–2019 were used to train and test the model. The predictive modeling was then developed in the R statistical computing environment using a negative-binomial linear regression algorithm.

The resulting digital predictive model is designed to run as a web and mobile application for use by health facilities, managers, planners, and other stakeholders involved in early warning. The Ministry of Health's Department of Environmental Health and the Division of Health Information was engaged throughout the development process with the aim of institutionalizing the tool. The Ministry of Health recognizes the predictive tool's potential in enhancing the current early warning capacity, risk reduction, and management of national health risks of climate-related morbidity, mortality, and economic loss.