

Thesis Summary

論文の内容の要旨

The Health-Economic Burden of Climate Change and Climate Variability: An Empirical Study from Uganda

(気候変動・気象変化の健康・経済的負担：ウガンダにおける実証的研究)

Akampunguza Precious
アカンプムザ プレシヤス

Supervisor: ONUKI Motoharu

Healthy lives for all is a key pillar of sustainable development as envisioned by SDG 3. The realization of this goal is however likely to be jeopardized given the current trend of climate change and climate variability. The Intergovernmental Panel on Climate Change projects possible increases in surface temperature in the range of 2-4°C by 2100. Similarly, heat waves, cyclones, droughts, floods and other extreme weather events have also increased in severity and frequency. The potential impacts on the Health sector are diverse and are both direct and indirect. Indirect effects include but are not limited to injuries, illnesses and deaths due to heat waves, floods and other extreme weather events. Indirect effects include increased incidence of vector borne disease like malaria and dengue fever which result from increased multiplication of disease-causing vectors and/or their expansion into previously inhabitable regions. Torrential rainfall that results in massive flooding could also be associated with increased spread of water-borne diseases like diarrhea. Malnutrition is another potential indirect effect of climate change and climate variability. Floods, prolonged droughts and other extreme weather events often reduce food production and jeopardize food security, leading to increased malnutrition rates especially among children. In challenge is more pronounced among poor agrarian communities which are heavily reliant on rain- research concentrates on the Global North while Sub-Saharan Africa is less represented, partly due to data limitations. This is the main motivation for this dissertation, which attempts to provide micro level empirical evidence on the association between climate change and climate variability on the one hand, and their respective health-economic burden in Uganda.

Uganda has experienced major changes to its traditional climate. Between 1960 and 2010, surface temperatures are estimated to have risen by 1.3°C and are anticipated to rise further by 1.5°C by 2030. Although rainfall totals have not changed tremendously, the frequency of torrential rains and unpredictability of rainy seasons pose major threats especially to rural smallholder livelihoods. The number of droughts experienced in some vulnerable regions are particularly worrisome: Between 2001 and 2011, the country experienced five major droughts with devastating consequences. The effect of climate change in general and weather shocks in particular are projected to cause economic damage worth 2-4% of GDP in the four sectors of Agriculture, Water, Energy and Infrastructure. The micro level impacts however remain less investigated especially with regards to public health.

The main objective of this dissertation is to quantify the effects of climate change and climate variability on the incidences of morbidity due to selected climate-sensitive diseases, as well as their economic burden in terms of related healthcare expenditure. The dissertation is organized into six chapters. Chapter 1 introduces the dissertation by providing the background, objectives and structure of the dissertation. The conceptual frame work of the relationship between climate change and health relationship along with detailed literature review and description of the study area – Uganda and the Teso sub-region – are provided in Chapter 2. Chapter 3 the describes in detail the socio-economic, health and climate change status of the study area. The chapter finds decreasing rainfall in the first rain season (March-May) and increasing temperature in the second dry season (December-February) especially in the past three decades between 1980 and 2010.

Chapter 4 examines the relationship between climate change and the incidence of diarrhea using outpatient and long-term rainfall and climate data from the Teso sub-region, one of the most vulnerable sub-regions in the country. The study’s novelty is the use of outpatient diagnosis data to measure the monthly number of hospital visits linked to diarrhea, as opposed to self-reported illnesses elicited through household surveys. Hypothetically, the number of diarrhea cases is expected to respond to extreme weather, given that the disease is highly sensitive to water availability. Indeed, results confirm this hypothesis: As Figure 1 below shows, monthly rainfall and hospital visits due to diarrhea are negatively and significantly correlated, indicating that dryer months are associated with higher cases of diarrhea, particularly in the second dry season (December-February).

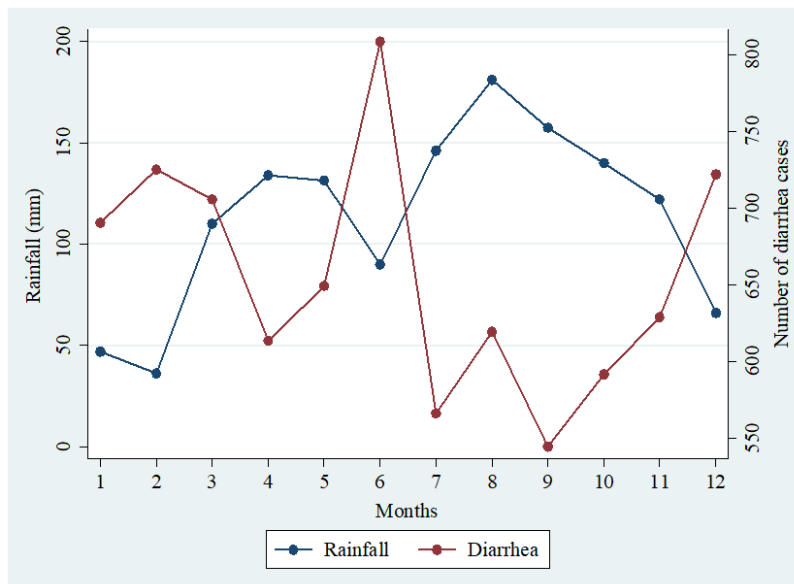


Figure 1: Monthly rainfall and diarrhea cases in Teso sub-region: 2006-2011
Source: Author’s own illustration based on outpatient data.

Poisson regression results show that during months when rainfall is 20% lower than the month-specific long-term (1921-2005) average, the number of diarrhea cases increases by 11-20%. Analysis disaggregated by age and gender categories indicates that monthly diarrhea cases for males aged 0-4 years, females aged 0-4 years, males aged five years and above and females aged five years and above increase by 13-18%, 11-19%, 17-20% and 12-26%,

respectively, when monthly rainfall is 20% lower than the month-specific long-term average. In line with previous literature, and based on focus group discussions during data collection, the pathway of this observed effect seems to be reduced availability of clean water during relatively dry months. This leads residents to use unsafe water for drinking and cooking as well as deterioration in hygiene conditions like hand washing after toilet, ultimately quickening the spread of diarrhea pathogens among the residents.

Chapter 5 investigates the quantitative link between drought exposure at the household level and morbidity of household members using nationally representative household survey data from Uganda. The main hypothesis in the chapter is that households affected by drought face greater health burden in terms of its members reporting more illnesses. The study utilizes longitudinal survey data from the Uganda National Panel Survey (UNPS) collected by the Uganda Bureau of Statistics in four waves: 2009/10, 2010/11, 2011/12 and 2013/14. Approximately 3,000 households were interviewed in each of the UNPS waves. The Health module elicited information on the illnesses household members suffered in the 30 days before the survey year, which is used in constructing the outcome variables of interest. Marginal effects from Probit regression models presented in Figure 2 reveal that members of drought-affected households are approximately 10 percentage points more likely to report illnesses in general. Further results disaggregated by type of illness show that the likelihoods of reporting fever, cough, diarrhea and severe headache are 11-14, 7-8, 5-8 and 12-14 percentage points higher, respectively, among drought-affected households relative to unaffected ones albeit a marginally significant coefficient for diarrhea. This indicates that drought exposure deteriorates the health of members of affected households.

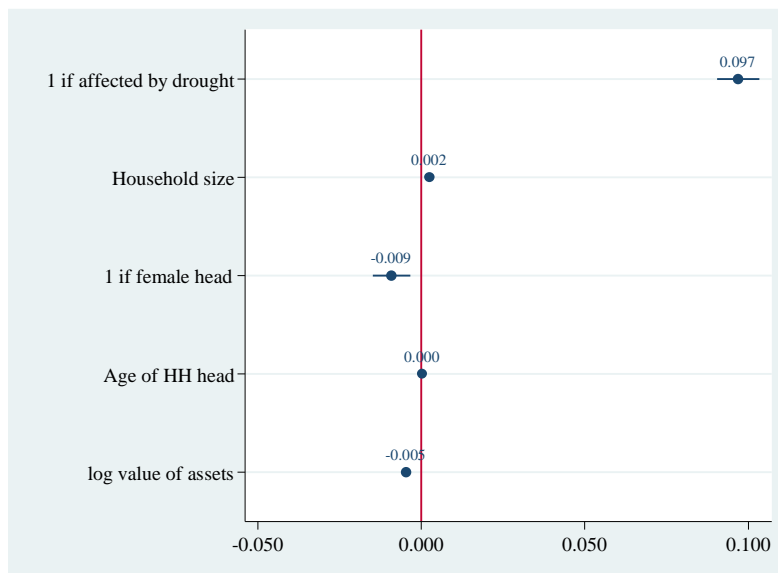


Figure 2: Marginal effects of drought exposure on the likelihood of reporting illness

Source: Author's own illustrated based on Uganda National Panel Survey data

In Chapter 6, the financial burden associated with drought exposure among affected households in Uganda are unraveled. Like in Chapter 5, analysis in this chapter utilizes UNPS data covering a panel period of four years between 2009 and 2014. Information on household expenditure on healthcare and other consumption components is

drawn from the Expenditure section of the household module. This is the source of the main outcome variable, which is the per capita spending on healthcare for the household members that reported illnesses. Results indicate substantial increase in per capita healthcare expenditure while non-health expenditure significantly reduces when a household is affected by a drought. Specifically, Tobit Random Effects estimates presented in Figure 3 below reveal that drought exposure increases household per capita expenditure on health by 22.6% while non-health expenditure reduces by 9.6 percent. This perhaps indicates that households reallocate resources from non-health consumption to supplement healthcare expenditure related to the treatment of drought-induced illnesses.

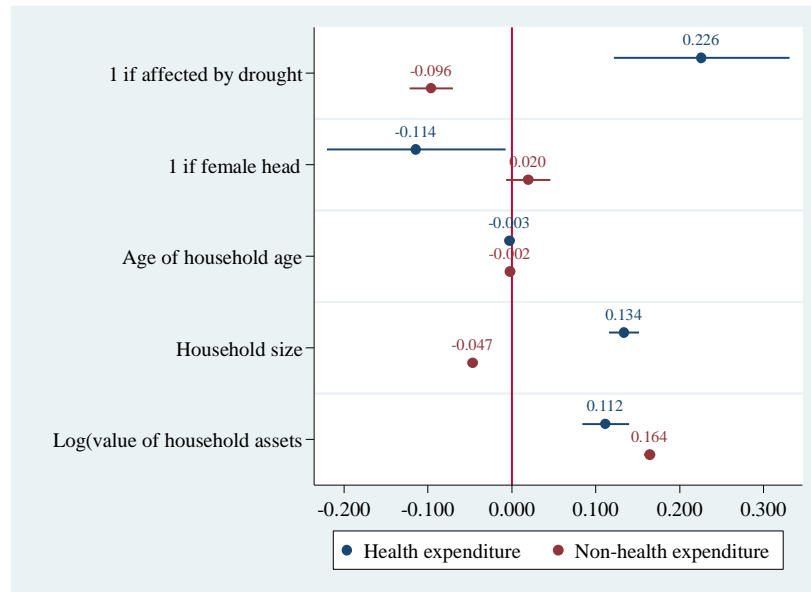


Figure 3: Effect of drought on household per capita health and non-health expenditure

Source: Author's own illustrated based on Uganda National Panel Survey data

Finally, chapter 7 concludes the dissertation by summarizing the main findings and their implications. Overall, results reveal that climate change and climate variability have a negative effect on human health, which in turn burdens affected households financially in terms of increased expenditure on healthcare services. The results presented in the dissertation carry key implications for the resilience of human health and healthcare systems amidst climate change and climate variability. First, they provide empirical estimates on the micro level impacts of climate change and weather extremes. In particular, empirical evidence on the impact of drought on health has been critically lacking in Uganda particularly and Sub-Saharan Africa generally. Providing knowledge on this association is a first step to the incorporation of climate knowledge in healthcare planning processes, for example the integrated disease surveillance and response systems in order to increase the resilience of the Health sector, households and individuals. This could indeed help in better prediction of disease outbreaks and design appropriate response strategies. Secondly, the finding that diarrhea cases increase during dry months calls for the need to properly plan water resources especially during periods of extreme weather. Finally, the huge drought-related healthcare cost implies that even with the free healthcare policy institutionalized in 2001, households continue to face huge out-of-pocket expenses to access medical care. This suggests critical need to rethink the policy to ensure comprehensive access especially by the rural poor.