LONGITUDINAL STUDY ON CHILD DEVELOPMENT BASED ON WEARABLE TECHNOLOGIES

IN A NUTSHELL

- → Collect children's biomarkers to document child development at high-frequency in Malawi
- → Set up digital disease detection and early warning systems to decrease child mortality and morbidity
- → Evaluate UNICEF's programs at high-frequency
- → Set up Artificial Intelligence for service referrals and communication campaigns

RESEARCHERS

Prof. Dr,
Guilherme Lichand
guilherme.lichand@econ.uzh.ch

Dr. Simon Hänni
simon.haenni@econ.uzh.ch

Dr. Onicio Leal
onicio@gmail.com

MOTIVATION

Data collection in developing countries often involves high time and monetary costs as it is hard to reach families living in remote areas under-connected by transportation and communications infrastructure. In face of those challenges, new technologies such as wearable devices offer a leapfrogging opportunity for the collection of essential data in the developing world as they have the potential to provide cheap, reliable, and novel forms of information. Wearable devices can help us by providing higher frequency and higher quality data to help the world's most vulnerable populations, especially children. They could also allow researchers to pin down precise mechanisms by taking advantage of natural experiments and event studies, on top of randomized control trials. What is more, they provide a bottom-up opportunity to predict heterogeneous impacts of development programs, allowing policy makers, international organizations and donors to customize and fine-tune those programs to maximize their return per dollar invested.

PROJECT PLAN

To our knowledge, this project is the first to attempt the use wearables in the developing world for high-frequency data collection and interventions, in the context of a longitudinal study. The Longitudinal Study on Child Development Based on Wearable Technologies proposes to test novel strategies in data collection on child development in Malawi. In partnership with UNICEF's Office of Innovation and UNICEF Malawi, the research team has tested technologies that will track an array of children's bio-markers at high frequency, in order to collect and act on evidence regarding the mental and physical health of Malawian children living in poverty. The sample size on this project is 10,000 households.

The frequency and scale of the wearable-based data allows researchers to generate data on bio-markers for a population for which there is very little data available. This data will be used to understand childhood health development, their critical inflection points and their impacts on adult outcomes in health and education. We will also develop early-warning systems based on the high-frequency bio-markers and syndromic approaches to evaluate timely responses to early detection of disease outbreaks, preventing the spread of

epidemics. This system will support local surveillance health officials in improving their tools about disease identification and control.

The biggest potential lies in the interventions that wearable-based data could power thanks to Artificial Intelligence (AI). In particular, the project will test a health referral system based on AI, which will allow for interventions via audio or text-messages—in collaboration with local healthcare providers. Ultimately, the study will build a digital platform for data-driven referrals through which beneficiaries will be directed to services predicted as the most beneficial for the development of their children's health at any given time.

POLICY AND PROGRAMATIC IMPLICATIONS

Having access to high-frequency data on children's bio-markers would allow the public health sector to respond in a timely fashion, with immediate potential to decrease child mortality and morbidity and to increase children's cognitive development. What is more, the allocation of public resources will improve by referring children only when needed and significantly faster than current practices, thus averting much of the social and economic costs from negative health shocks by improving the *timing of care*.

In addition, the project will provide first-hand insight on children's life journeys in poor countries and give answers to questions about critical inflection points that typically cannot be answered scientifically with MICS or DHS data—which do not track the same subjects over time or do it with insufficient frequency. Moreover, surveys tend not to keep track of bio-markers *longitudinally*, due to high data collection costs, especially in challenging field settings.

The Ministry of Health of Malawi and other public institutions are playing an essential role in defining the framework within which the project is developing. In the same fashion, the research team is actively collaborating with the National Statistical Office (NSO) in order to implement part of the research activities and data collection on the ground. Furthermore, the data collected for the study will be used to evaluate UNICEF Malawi's new country program and the system developed for AI-based referrals will be integrated to UNICEF's systems (RapidPro).

BENEFITS TO PARTICIPANTS

High-frequency markers will allow researchers to set-up automated early-warning systems based on the readings of wearable technologies. These have the potential to save lives and to boost children's future opportunities. For example, parents will be able to detect earlier if their children have symptoms of malaria or anemia. In addition, this study will allow to substantially advance in child development science while setting out the conditions for the progress of development policies by leveraging on the right technologies to promote the right programs for each child, based on their own life journeys and critical inflection points. Finally, by supporting home visitors and parents with customized SMS messages, based on high-frequency child development data, the project will ensure that content is delivered with high quality and that benefits can be reaped even by families that are not available to receive visits.