Geographical disparities of cause-specific under-five mortality rates from 2007 to 2010 in Rufiji District, Tanzania

John S. Noronha\textsuperscript{1}, Almamy M. Kante\textsuperscript{1,2}, Christine E. Chung\textsuperscript{2}, Honorati Masanja\textsuperscript{1}, Mrema Sigilbert\textsuperscript{1}, Rose Nathan\textsuperscript{1}, Ahmed Hingora\textsuperscript{1}, James F. Phillips\textsuperscript{2}

Background

In recent years there has been an observed decline in child mortality due to access to new and efficient health services, health education, vaccinations and malaria programs. A recent analysis of Tanzania Demographic Health Surveillance (DHS) data reported a drop of 24\% in child mortality between 2000 and 2004 (Masanja et al., 2008). If current trends are sustained, Tanzania will be amongst the very few African countries that are on course to achieve the MDG 4 target of reducing child mortality.

It is well known that there are substantial area variations in child mortality rates in the coastal region of Tanzania (Masanja et al., 2005). Area variations in mortality may be due to characteristics that relate to the area itself (contextual factors) or to the characteristics of the individuals who live in these areas (sociodemographic or compositional factors). Few studies have been published concerning child mortality in this region of Tanzania by looking at sociodemographic factors (Masanja et al., 2005; de Savigny et al., 2004). Other studies elsewhere have documented substantial regional variation in child mortality between the poorly developed rural area and well developed urban area (Bauze et al., 2012; Kumar et al., 2012; Wang et al., 2005). In China, for example, the regional disparity of infant mortality rate increased between the remote and coastal regions from 2001 to 2005 (Wang et al., 2005).

We extend this body of research by hypothesizing that even within rural, remote areas, there exists spatial disparity in child mortality and that this disparity varies by the cause of mortality. The objective of this study is to investigate the geographical disparities of cause-specific under-five mortality in Rufiji Health Demographic Surveillance System in order to guide policies aimed at tackling the cause-specific factors contributing to child mortality.

Data and Methods

The data for this study is based on the Rufiji Health Demographic Surveillance System (HDSS) (see Figure 1). Rufiji HDSS extends between latitudes 7.47° and 8.03° South and longitudes 38.62° and 39.17° East. The HDSS has a total population of 94,476 that covers 38 villages within the Rufiji district. Data on deaths, births, migrations and pregnancy events are collected through quarterly round visits by the DSS interviewers and the reporting of vital events by community based key informants. Cause of death information is recorded by using the verbal autopsy method, which is one of the most reliable means of establishing causes of deaths in many developing countries where routine data systems are lacking or fragmented.

We combined all deaths of children under five that occurred between 2007 and 2010 for each village within the Rufiji DSS and multiple it by the proportion of deaths assigned to each cause to yield the cause-specific under-five mortality rate at the village level. We rank the mortality rates and focus on the leading four causes in subsequent statistical analyses.

\textsuperscript{1} Ifakara Health Institute, Dar es Salaam, Tanzania
\textsuperscript{2} Mailman School of Public Health, Columbia University, New York, USA
We then mapped the individual cause-specific deaths and calculate the local Moran’s I spatial statistic using ArcGIS software to determine the presence of spatial clustering of cause-specific mortality at the village level.

Once cause-specific death rates are tested for spatial clustering, we test for associations between the mortality clustering and contextual factors and sociodemographic characteristics. This includes an examination of the absolute income hypothesis by looking at individual income, controlling for household size and other factors like availability of health facility. A Poisson generalized linear model is used for analysis. This modelling and mapping approach is a useful preliminary tool enabling public health planners to determine statistically valid geographical variations in mortality and to develop effective interventions.

**Preliminary Results and Discussion**

A total 2801 under-five deaths were recorded in Rufiji DSS between 2007 and 2010. We find evidence of statistically significant spatial clustering of mortality rates by village for malaria, pneumonia, birth asphyxia and prematurity/low birth weight. Clustering of malaria-related deaths has been observed in Kibiti B and Ikwiriri villages, pneumonia-related deaths in Pagae village, birth asphyxia in Jaribu Mpakani, and prematurity/low birth weight in Kimbuga.

Cause-specific mortality rates varied by village with Nyamwimbe leading with 14.9 deaths per 1000 live birth from malaria and 3.74 death per 1000 live birth from pneumonia, Mangwi village with 6.01 death per 1000 live birth from birth asphyxia, and Nyambili with 5.69 per 1000 from prematurity/low birth weight.

We expect to find clustering of under-five mortality in the villages where there is poor accessibility to healthcare and where poverty is concentrated.

**Conclusion**

We observe geographical disparities of cause-specific under-five mortality in Rufiji HDSS. These disparities may be due to differences in socioeconomic circumstances and healthcare accessibility. Malaria, pneumonia, birth asphyxia and prematurity/low birth weight were the four main contributors to geographical disparity in this area between 2007 and 2010.

Ultimately, this research trajectory offers potential for identifying the fundamental role that place (environmental aspect of an area) versus people (structural attributes of an area) play in the leading causes of death in the coastal region of Tanzania. This research is part of our larger efforts to strengthen the health system in Tanzania.
References


Figure 1. Map of the Rufiji Demographic Surveillance System, Tanzania