

Identification of hotspots of diarrhoeal disease in Manhiça, Mozambique

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Abstract

Diarrhoeal illness is a major cause of infant and child mortality in Sub-Saharan Africa. Using geographic information systems and statistical modelling to identify spatial and temporal areas of risk can help elucidate social risk factors as well as guide public health interventions. We examine historical data on the incidence of diarrhoea in patients under five years old in the district of Manhiça, Mozambique in order to map risk, identify hotspots, describe associated factors, and generate predictive estimates of disease activity.

Introduction

Diarrhoea is a chief contributing factor to the high rates of infant and child mortality in Mozambique. But risk is not distributed evenly among the population, nor across time. There may exist geographical “hotspots” and temporal “peaks” at which risk is greatest. The identification and understanding of these areas and periods of greatest risk can lead to effective preventive interventions, thereby saving lives and improving the health of children. Additionally, the quantification of risk attributable to geography and seasonality is important in order to gain a full understanding of non-geographic and non-seasonal risk factors for diarrhoea, such as socioeconomic status, pre-disposing illnesses and conditions such as malnutrition, and hygiene-related behaviours.

UNFINISHED *Literature review, overview of CISM demographic surveillance system, overview of INPD and OPD systems, etc.*

Objectives

The **primary** objective of this study is to identify hotspots of risk for infant and child diarrhoeal illness and malnutrition in Manhiça, Mozambique.

The **secondary** objectives of this study are to:

- Produce risk maps of scientific and public health utility
- Create a reproducible research approach using transparent methods, so as to be generalizable to other diseases and areas
- Gain understanding of and estimate the magnitude of differential risk for diarrhoea and malnutrition across space and time, accounting for (and quantifying) non spatiotemporal factors

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Methods

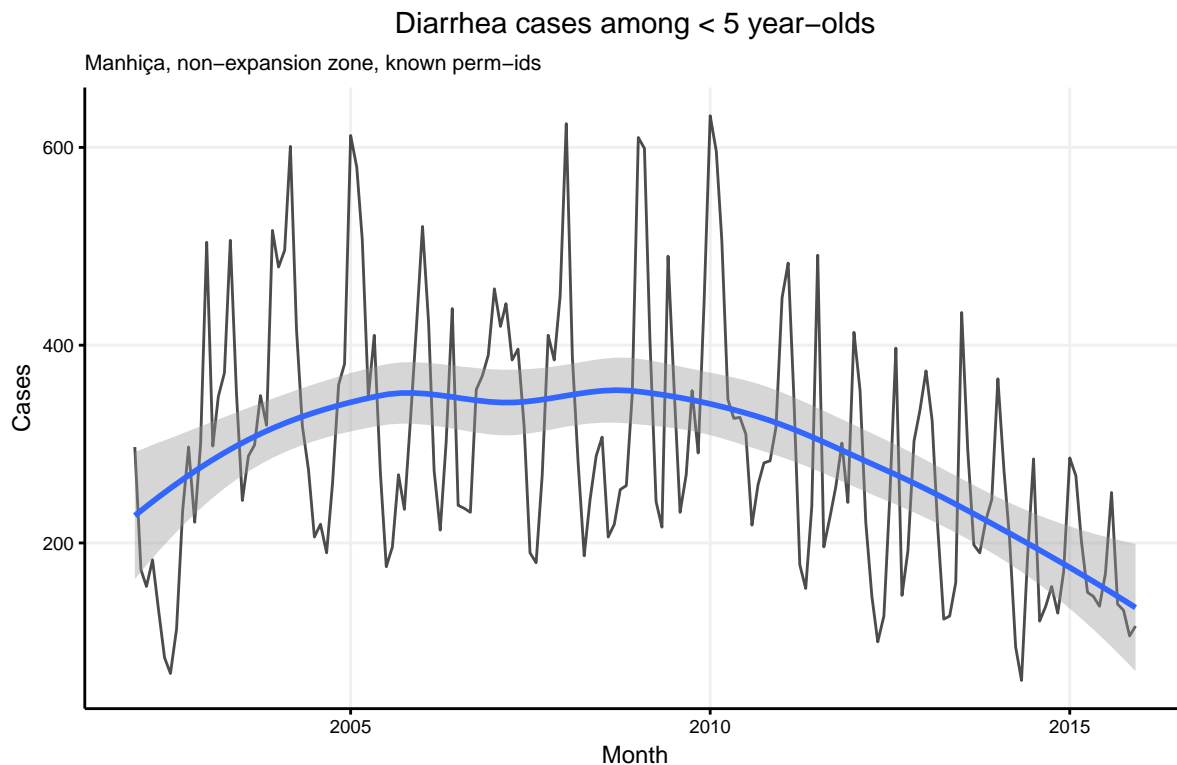
We retrieved data from both the census and the Manhiça District Hospital and health posts in order to estimate both the incidence of diarrhoeal disease, as well as to understand (in terms of geography, timing, and sociodemographic factors) the population at risk. Following data retrieval we modelled the likelihood of our two outcomes (outpatient diarrhoeal disease and conditional admission to inpatient status) as a function of geography using spatial scan statistics, Bernoulli modeling, and kernel density estimation. We then complemented our (purely) spatial estimates with the Kulldorf combinatory method so as to assess seasonality and differential risk over time. We adjust our model for the sociodemographic and economic characteristics of the population, so as to identify both unadjusted and adjusted “hotspots” of risk, and to better understand the role of location, precipitation, seasonality, and other characteristics in determining a child’s risk for malnutrition and diarrhoea. Finally, using simple logistic regression, we estimate the odds of diarrhoeal disease as a function of sociodemographic characteristics, after adjustment for the outcome’s spatio-temporal components.

UNFINISHED *More details, citations, specific filtering and aggregation steps, etc.*

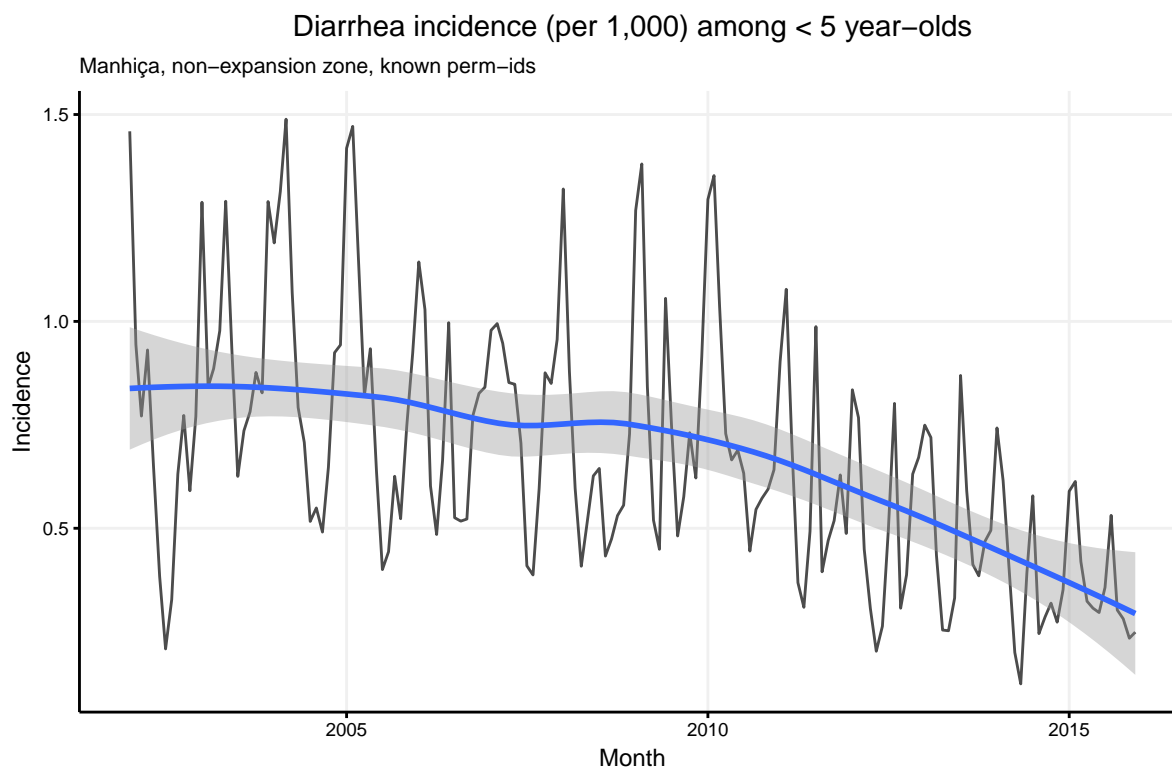
Results

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Overall cases



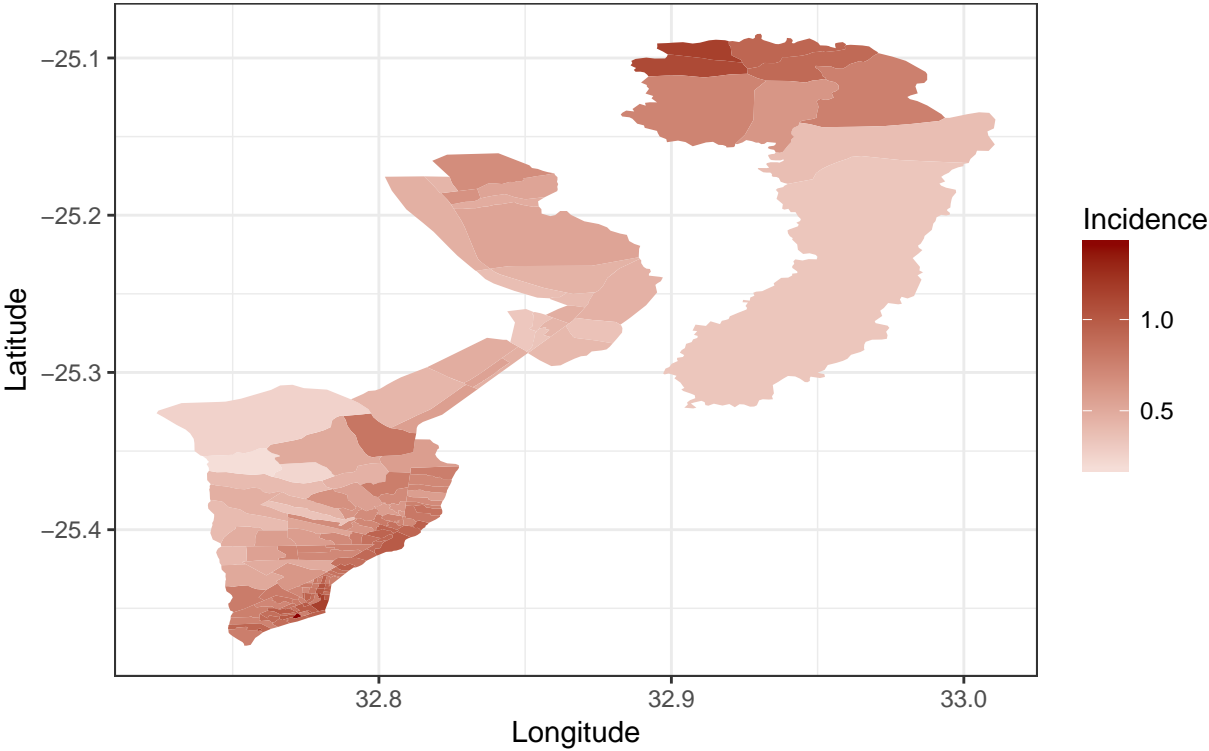
Estimated incidence



All-time risk

Overall incidence per 1,000: entire study period

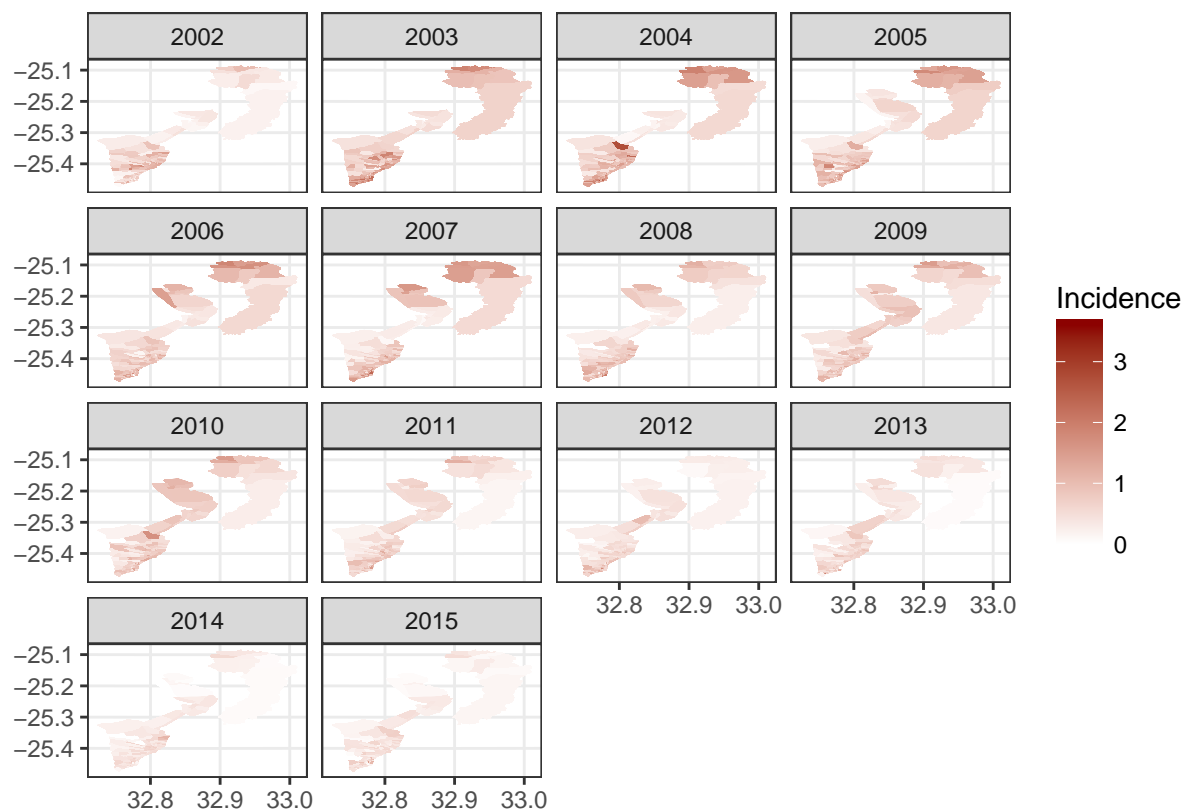
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Yearly incidence

Yearly incidence per 1,000

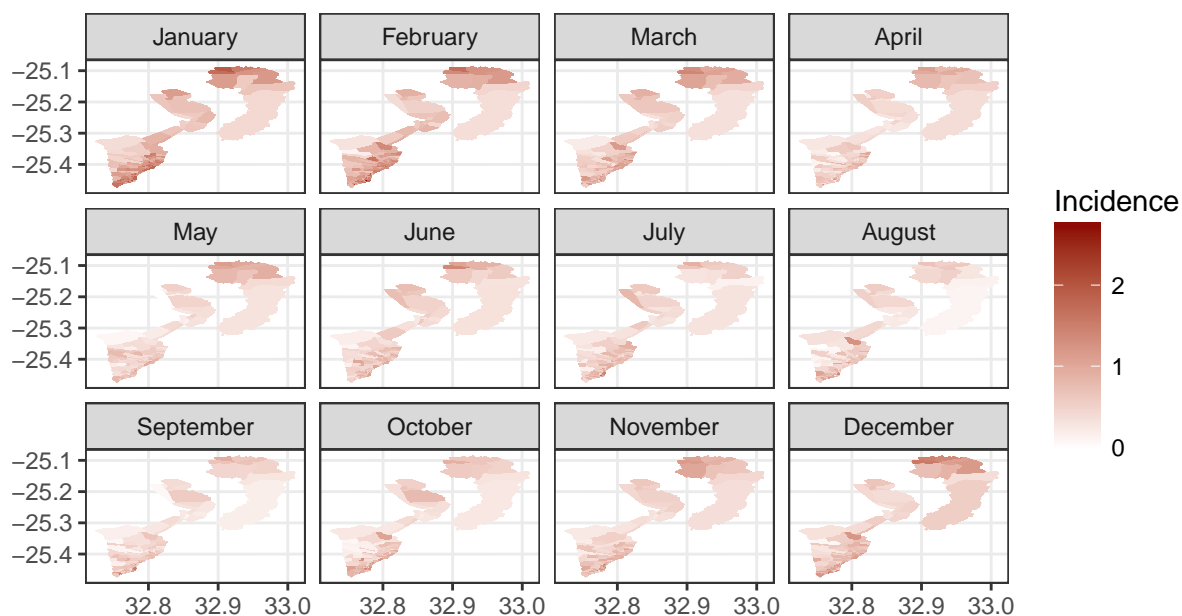
Only known perm-ids with geocoding



Seasonal incidence

Monthly incidence per 1,000

Only known perm-ids with geocoding



Discussion

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Findings pertaining to space, time, and sociodemographic risk factors, implications, usability, applicability to interventions, applicability to clinical decision-making, generalizability of methods to other contexts

References