Self-reported Fever May be a Poor Proxy for the Prevalence of Malaria

Omoniyi Alimi, John Gibson
Department of Economics, University of Waikato, New Zealand

Introduction

Research in health economics often relies on self-reported data. Patterns found with such data may change when actual health measurements are used[1,2]. It is therefore important to assess the validity of self-reported measures, in case they provide misleading evidence. An emerging literature links the critical problem of child malaria to deforestation in tropical countries[3,4]. Some of these studies use remote sensing data on forest change and survey reports made by mothers of whether their child had a fever[5]. For example, an influential study from Nigeria estimated the prevalence of malaria by asking mothers whether their child had been ill with a fever during the two weeks preceding the survey[6].

These studies treat all type of forest loss the same even though forest cover may range from mixed grasslands to denser rainforest. It may be important to account for the differences in forest types because the ecological pathway linking deforestation to malaria may depend on the type of forest disturbed. Existing evidence also often ignore substantial spatial spillovers in malaria and deforestation (with Santos and Almeida, 2018 being a notable exception).

Our study examine the relationship between deforestation and malaria using self-reported fever and measured malaria from Rapid Diagnostic Tests (RDT) for parasite antigens in a blood drop, and microscopic examination for Plasmodium in blood slides (RDT and Microscopy tests). It takes into account different definitions of forest and incorporates spatial spillovers in both malaria and forest loss.

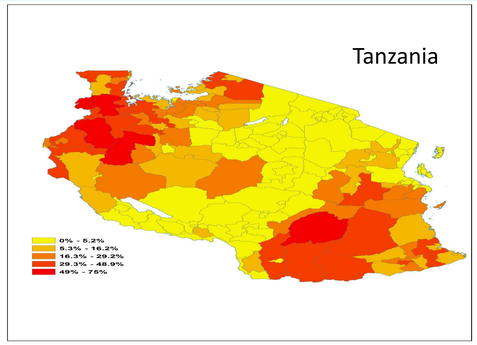
Data

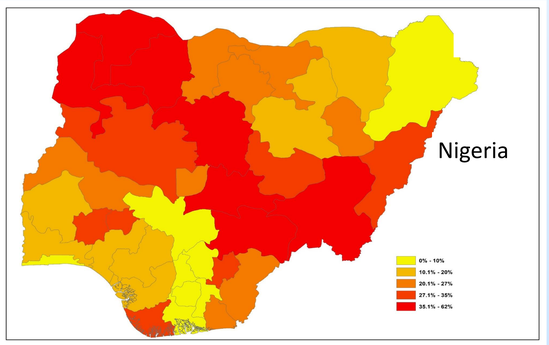
We use Demographic and Health Survey (DHS) data from Nigeria and Tanzania[7,8,9,10,11,12]. We contrast estimated impacts of deforestation on measured forms of malaria (from RDT and Microscopy) with the impacts on mother's report of children's fever (coming from the same DHS samples). Our analysis is at the district level in Tanzania and States in Nigeria.

Our forest data comes from earth observation remote sensing[13]. We use estimates of forest cover in 2000 and estimate gross loss for each year since then. We define different thresholds of forest cover and forest loss based on the percentage of each pixel covered by vegetation taller than 5metres high.

Methods and Results

Presence of Spatial Spillovers in both Malaria and Forest Loss





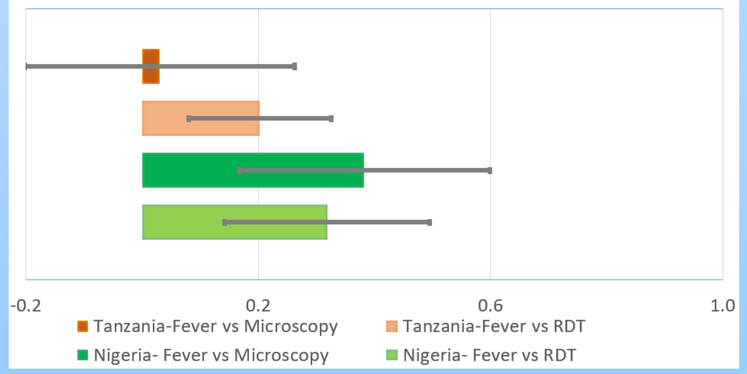
Non-random spatial patterns are apparent when looking at maps of malaria prevalence rates in both Nigeria (Microscopy) and Tanzania (RDT). In Tanzania, malaria rates are highest in the West and then in the South-East with low rates in the centre. In Nigeria, the highest rates are in the North-Central and North-West regions extending to Taraba State in the North- East while the lowest rates are in parts of the South West, South-South and South-East regions. We also find evidence of non-random spatial patterns in forest cover and loss in both countries.

Self-reported fever a good proxy for measured malaria?

To check if self-reported fever is a good proxy for actual measured malaria, we examine the relationship between of self-reported fever and measured malaria in DHS surveys where both measures have been collected. We estimate:

$$lnF_{it} = \alpha + \beta_1 lnM_{it} + \delta_i + \theta_t + \mu_{it}$$

Where lnF_{it} is the log of fever rate in area i at time, lnM_{it} is the log of measured malaria (either RDT and Microscopy), δ_i are area fixed effects for area i and θ_t are time effect dummies. To account for 0, both fever and malaria rates were Inverse Hyperbolic Sine (IHS) transformed. The figure below reports the results of β_1.

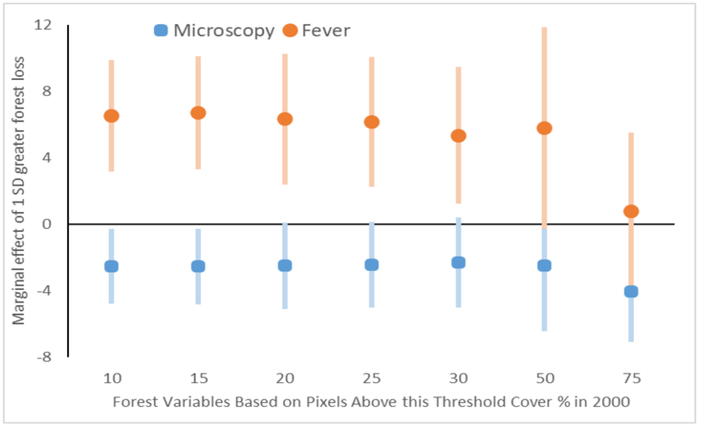


In both countries, we reject the hypothesis of β_1=1 which is in contrast to what we will expect fever is a perfect proxy for measured malaria.

Malaria and Deforestation link

Our results show no apparent relationship between forest changes and actual malaria indicators. The figure below shows the results of implementing a fixed effect model allowing for unobservable characteristics at the district level in Tanzania. It presents a comparison between fever and microscopy measured malaria for different thresholds of forest cover and forest loss. We find no evidence that deforestation causes more malaria in children when using actual measured malaria. The results for Nigeria are similar, and the conclusions do not change when we use models that account for spatial spillovers

Microscopy-measured malaria vs fever: FE no spatial lags



Conclusion

The findings here provide caution about using self-reported fever data as a proxy for malaria and is in line with the literature where the validity of self-reported measures have been questioned.

Our analysis finds no evidence for the claim that deforestation causes more malaria in children contrary to earlier evidence which relies on proxy measures.

References are available through the QR code at the top right-hand corner