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Use of electricity and malaria occurrence: Is there a link? The case of Malawi

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ABSTRACT

Sub-Saharan countries are facing a number of similar challenges, including their need to increase electricity access for both urban and rural dwellers and to limit the cases of malaria related morbidity and mortality.

This study explores the link between using electricity, for either lighting or cooking purposes, and the occurrence of malaria cases using country-representative household level data for Malawi.

The descriptive statistics and the econometric results highlight the fact that those household members living in 'electrified' households are more likely to experience malaria. The interpretations behind those results can be diverse; as evidence suggests, malaria vectors are attracted by electric lights and outdoor lighting available after the sunset may change people habits and increases their exposure to those vectors.

This study aims at raising the attention to a nexus which has very rarely been studied theoretically and even less empirically, despite the fact that electricity projects are now in the agenda of several Sub-Saharan countries and that malaria still continue to constitute a major threat for an incredible high number of people, most of all children and pregnant women.

1. Introduction

Electricity is considered to be a condition *sine-qua-non* needed for improving several aspects of everyone's life and for promoting the economic development of a given country (World Bank, 2008). Still, the electrification rate of many Sub-Saharan African countries is relatively low, between 30% and 64% in urban areas and even less in rural areas where the share of the population having access to electricity is as low as 10% (IEA, 2014). This last decade has witnessed an increase in the share of urban and rural dwellings being electrified thanks to the proliferation of electrification projects in several developing and transition economies in Africa, Asia and Latin America (Kaygusuz, 2012).[1]

The full spectrum of spillover effects stemming from the availability and the use of electricity is still being investigated and it would be difficult to enumerate and rank them without taking into consideration the specificity of a country and a number of micro and macro indicators related to it (Pellegrini and Tasciotti, 2012). In a nutshell, the use of electricity for both cooking and lighting purposes may bring the household a number of benefits -from saving time otherwise spent collecting firewood and cooking using firewood to increased study time for children in schooling age, from greater security to extended hours for businesses to be open. In addition, electricity allows the household to have access to media devices -television and radio- with that generating a number of benefits for all the household members – greater awareness, access to news and lower fertility rate among others (Grimm et al., 2015). The consequences of using cleaner sources of energy, especially for cooking, are significant for both children and adults' health and it translates into a decrease in the occurrence of respiratory diseases and eye infections (Aman et al., 2015).

While the positive households impacts related to the use of electricity are here acknowledged beforehand, this study aims at pointing out a potential negative impact by exploring the link between the use of electricity and the incidence of malaria at the household-member level. This study looks at the case of Malawi where the incidence of malaria is still extremely high with the entire population being at risk, 775 thousand suspected malaria cases in 2010 and 400 malaria attributed deaths in the same year (WHO, 2012). At the same

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[1] For more information on the electrification projects which have been undergoing in the last few years, please refer to the following websites. Please consider that the list is not exhaustive of the whole spectrum of project available in developing countries. http://www.minbuza.nl/en/Key_Topics/Development_Cooperation for rural electrification projects in Africa and Asia. See http://www.fres.nl/ for projects undergoing in South Africa, Mali and Burkina Faso. See http://www.lightingafrica.org/ for the 'Lighting Africa' project. The project's longer-term goal is to eliminate market barriers for the private sector and to reach 250 million people in Africa without electricity, and using fuel based lighting, by 2030.

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time, current electrification rate in Malawi is still relatively low with 37% of the household being connected to the grid or using solar panel in urban areas and 2% in rural ones (IEA, 2014) even though the share of 'electrified' dwellings is believed to increase in the near future (Kaygusuz, 2012).

The link between the use of electricity and malaria occurrence is not extremely easy to disentangle even though there are few available studies pointing out the mechanisms through which this relation may occur. There are at least four reasons to believe that the use of electricity may impact the incidence of malaria. First of all, artificial light is a powerful insect attractant and evidence suggests that light traps are used by both entomologists and epidemiologists to capture insects (Barghini and de Medeiros, 2010). Second, electricity -as well as gas- used for cooking purposes replaces biomass thus eliminating the amount of indoor smoke which results in a substantially improved indoor air quality on one side and in an increased density of malaria vectors which, now, are not repelled by the smoke (Dube et al., 2011). Third, the availability of artificial light may alter the lifestyle of any community as, for instance, night lighting increases outdoor activities and people's exposure to malaria vectors (Taylor, 1997). Lastly, electricity gives the household the possibility to access to mass media devices – television and radio above all- and hence to anti-malaria campaigns (Grimm et al., 2015). It is important to keep in mind than the four channels may affect different household members in distinct ways; as an example, women are believed to spend more time cooking, hence the lack of smoke and the increased presence of malaria vectors in the kitchen may affect women more than men. Likewise, men may spend more time outside the house with artificial lights available in the streets after the sunset. In this context, the effects electricity may have in terms of malaria occurrence is not only a matter of theoretical hypothesis but also a matter of empirical measurements for the household as a whole and for all its members.

A correct understanding of the malaria transmission channels is crucial to limit and possibly stop malaria occurrence. From an historical point of view, diseases caused by parasites have affected the humankind for several millennia and, to date, they still represent a major global threat for the world and for the poorest strata of the populations. Such diseases constitutes a barrier for human health and for the economic development of the country people live in (WHO, 2012). Malaria, which has been on the face of the earth for as long as we know, is a mosquito-borne disease caused by single-cell parasites which, invading the red blood cells, are responsible for high fever, and, lastly, for brain damage and death (Kilpatrick and Randolph, 2012). Nowadays there are more than 3.4 billion people at risk of contracting malaria, with the majority of them living in the most vulnerable and less developed areas of the globe; about 450 thousand people, predominantly children and pregnant women, die each year for malaria related cause (Zhou, 2015). Due to the severity that malaria still has in terms of morbidity and mortality, the 2015 Nobel Prize in Medicine has been assigned to 'Youyou Tu for her discoveries concerning a novel therapy against Malaria' and for having 'developed therapies that have revolutionized the treatment of some of the most devastating parasitic diseases'.

The objective of this study is to assess whether the nexus between using electricity, for either lighting or cooking purposes, and the occurrence of malaria exists and which is the sign and the magnitude of this relation. This study uses a country-representative household level data representative of both urban and rural Malawi. Both the descriptive analysis and the econometric results suggest the fact that those urban and rural household members living in 'electrified' dwellings are more likely to experience malaria. The interpretations behind those results are multiple: malaria vectors are attracted by electric lights and outdoor lighting available after the sunset changes people habits and increases their exposure to those vectors.

This study aims at raising the attention to a nexus which has seldom been studied empirically, despite the fact that electricity projects are now in the agenda of several Sub-Saharan countries; furthermore, malaria still constitutes a major threat for an incredible high number of people in several areas of the globe, with children and pregnant women being the ones at higher risk. The objective of this study is twofold: it advices development practitioners as well as central and local government of those countries where electrification projects are taking place and malaria is still a threat to consider the implementation of anti-malaria strategies -e.g. anti-malaria campaign, free use of treated bednets, extensive use of repellant. In addition, this study advocates the collection of ad-hoc household level data with a particular focus on the type of energy used and the aimed at studying this link in several other countries where malaria is endemic.

The rest of this study is organized as it follows; Section 2 discusses the main studies on the topic electricity-malaria while Section 3 provides the readers with an overview of the electrification situation in Malawi and describes the severity of malaria in the country. Section 4 offers a brief description of the household level data used and few descriptive statistics. The empirical strategies and econometric results are in Section 5 followed by the conclusions and the policy implications of the study.

2. Is there a link between electricity and malaria? Evidence from the literature

There is only anecdotal evidence on the possible link between the use of electricity and the occurrence of malaria among family members which clashes with the many findings about the links between electricity and the occurrence of the Chagas disease and the leishmaniasis. The Chagas disease is commonly transmitted to humans and other mammals by an insect vector whereas the Leishmaniasis is a disease caused by protozoan parasites that belong to the genus Leishmania and which is transmitted by the bite of certain species of sand fly. The occurrence of these two types of disease has proved to increase in electrified areas (please refer to Barghini and Medeiros, 2010, for a comprehensive list of studies on that topic).

According to the literature on malaria and to a more recent study which investigated on the existence of the very same nexus (Pellegrini and Tasciotti, 2015), malaria incidence (*MI*) is a phenomenon that can be directly linked to the amount of malaria vectors in one given area – *vector density*- and to the *exposure*, which indicates the amount of time household members spend in places where malaria vectors are present (formula (1)).

$$MI = f(vectordensity,\ exposure) \quad (1)$$

2.1. Vector density

There are several studies showing that mosquitoes are attracted to light and that malaria vectors are captured using light traps (Barghini and de Medeiros, 2010). This suggests that the indoor use of lights after sunset can increase the overall density of malaria vectors, considering the fact that houses in Malawi and in many other developing countries may present multiple entry points for malaria vectors. Other examples regarding a positive correlation between vector density and electricity come from Yamamoto et al. (2010), who found how households living in Burkina Faso in electrified houses are recorded to have higher occurrence of malaria. Their result is related to the lack of smoke previously produced by biomass used for cooking purposes. Smoke is supposed to prevent insects from entering into the dwelling biting. A very similar result has been found in a study conducted in rural areas of Papua New Guinea (Paul et al., 1995) and Kenya (Seyoum et al., 2002). Those results are in line with the habits many communities living in rural areas have to use aromatic smokes in addition to wood smoke -i.e. traditional fumigants, to deter mosquitoes. In rural Gambia, tree bark combined with synthetic perfumes -locally known aschurai- reduced the number of mosquitoes entering in the room. Traditional fumigants