



Possession of bed nets in Haut-Katanga (DRC): Prevalence-elastic behaviour or performance of health care system delivery?



Juliette Seban^a, Josselin Thuilliez^{a,*}, Vincent Herbreteau^b

^a CNRS-Université Paris 1, Panthéon-Sorbonne, Centre d'économie de la Sorbonne, Maison des Sciences Economiques, 106-112 Boulevard de l'Hôpital, 75013, Paris, France

^b IRD, UMR ESPACE-DEV, 500, Rue Jean-François Breton, 34093 Montpellier, France

ARTICLE INFO

Article history:

Received 18 December 2012

Received in revised form

28 May 2013

Accepted 6 September 2013

Available online 19 September 2013

Keywords:

Malaria

Prevention

Democratic Republic of Congo

ABSTRACT

This article provides an empirical multi-disciplinary strategy that enables to identify prevalence-elastic behaviours influencing the possession of mosquito nets and to assess the relative performance of health centers in promoting the possession of nets in Democratic Republic of Congo (DRC). We use a household survey conducted in 2009 in Haut Katanga, DRC. We combine these data with estimates on malaria prevalence from the Malaria Atlas project. Results show that households behave rationally with respect to the disease, meaning that the cause for a low possession of nets should be found elsewhere. They also show that health centers are not the most effective in promoting possession of bed nets, in areas where they are most needed for malaria control.

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1. Introduction

Insecticide-treated mosquito nets (ITNs) and long-lasting insecticidal nets (LLINs) are considered essential malaria control strategies that provide personal and community protection. Their efficiency in reducing children mortality and morbidity has been largely documented (Choi et al., 1995; Binka et al., 1996; Hawley et al., 2003; TerKuile et al., 2003; Lindblade et al., 2004; Morel et al., 2005). Recent studies have tried to assess knowledge and beliefs about malaria and bednets: access, ownership, treatment, and use of mosquito nets; consumer preferences regarding mosquito nets; and usage and attitudes regarding other mosquito control products (Kilian et al., 2010). Nevertheless, the factors contributing to the possession of protective bednets are still unclear and the conclusions are often contradictory.

Consequently, despite massive efforts to scale-up ITN/LLINs, malaria remains prevalent in many countries. How can this paradox be explained?

First, ITNs/LLINs are not the only malaria control measure. The policies and strategies for malaria control and eradication are based on rapid diagnosis and Artemisinin Combination Therapies treatment, preventive treatments (Seasonal Malaria Chemoprevention – SMC – and Intermittent Preventive Therapy during Pregnancy), ITN/LLINs and environment management (renewed support for indoor residual spraying with insecticide (IRS)). In many places, both

evidence and modelling have shown that nets are only part of the solution and even with high net usage, prevalence can remain high because of resistance or modified malaria vectors' biting behaviour (Moiroux et al., 2012). Therefore, it is a much more complex situation than simply scale-up of LLINs.

Second, malaria prevalence is supposed to decline in many parts of Africa (Wendy Prudhomme et al., 2010) and ongoing interventions may influence the current situation of malaria. However the renewed efforts toward malaria control are probably too recent to have convincing arguments on a causal effect of malaria campaigns, and it is highly possible that we don't have sufficient retrospective data on the effect of vertical and horizontal control measures (public or private), climatic changes, socio-economic changes, and health systems related factors to identify the precise effect of ITNs/LLINs free distribution campaigns.

Amongst other neglected arguments of particular interest here, the theory of prevalence-elastic behaviour wherein demand for protection is an increasing function of rising prevalence could explain stagnating levels of possession of bednets in some parts of Africa. Under this theory, households don't seek prevention measures if there is no prevalence elasticity (Geoffard and Philipson, 1996; Berthélemy et al., 2013). However, this type of behaviour has not been extensively documented for malaria. Indeed, people maximize their well-being by choosing levels of prevention and therapy subject to the constraints they face. This consideration is obviously irrelevant if individuals lack choices, or if they are not informed correctly.

Alternatively, this paradox could be explained by healthcare system inefficiencies in promoting health education (quality of

* Corresponding author.

E-mail address: Josselin.Thuilliez@univ-paris1.fr (J. Thuilliez).

preventive messages) and distributing bednets (the supply of a commodity). However, there are several difficulties in monitoring and managing the performance of health-care organisations in Africa: (i) lack of appropriate data, and (ii) difficulty in establishing the link between observed health center effort and performance.

Amongst remaining explanations, a number of different demand and supply side factors can influence possession of bednets. On the demand side, financial constraints are the main reasons given by households for not acquiring health products (Guyatt et al., 2002; Bates et al., 2004; Wiseman et al., 2007; Eisele et al., 2009; Afolabi et al., 2009; Krezanoski et al., 2010). Indeed, demand for these products appears quite price elastic. In Kenya, Cohen and Dupas (2010) found that pregnant women universally take up an antimalarial bed net when it is given for free during a prenatal visit, but only 40% buy one at the still highly subsidized price of US\$0.60. In addition, bednet coverage remains inequitable among different socio-economic groups: higher income households are much more likely to possess a bednet (Matovu et al., 2009; Ye et al., 2012; Garcia-Basteiro et al., 2011). However Onwujekwe et al. (2004) showed that demand for bednets increases with income but less than proportionally.

On the supply side, health centers deliver different types of medical activities: curative and preventive healthcare services, in addition to daily health education, which are characterized by different production processes. The literature on the efficiency of health care systems in developing countries generally focuses on hospital level data or other aggregated data (health center, health district, regional or national levels). Patient level data or household data are generally less used for this specific purpose. Nevertheless, the choices people make vary considerably across Africa, depending on the type of delivery strategies that operate in that area. Lack of availability and failure in ITN distribution systems have been identified by Roll Back Malaria as the main limitations (other than cost) of large-scale implementation of ITN use. Cumulative attrition across the different steps of distribution programs, or small failures in the distribution process result in people dropping out of the system (Marchant et al., 2010). In a literature review of 127 reports and studies, Kilian et al. (2010) found that community-based distribution campaigns achieve rapid increases in bednet coverage, but this coverage fluctuates after a few years. Continuous distribution mechanisms (routine services, retail outlets, assisted or unassisted commercial markets) avoid these fluctuations but are much slower in building-up high coverage levels.¹ Continuous promotion of effective maintenance and routine healthcare education is also needed and efforts to replace damaged nets must be implemented (Githinji et al., 2010). However, many of these strategies have not been assessed to date and only some of the existing cost-estimates have been derived using appropriate methods (Kolaczinski et al., 2010).

It should be noted at the outset that our empirical analysis deals with ownership of ITN/LLINs rather than usage in the Haut-Katanga district, in Democratic Republic of Congo. The use of nets is often considered to depend mainly on behaviour and seasonality (Harryson E. et al., 2011). In the literature on delivery strategies, these factors are considered to be independent of the performance of the net distribution strategy (Kilian et al., 2010). Conversely, possession is probably affected by both behavioural factors and the net distribution strategy. Indeed, bednet ownership is the first key step for prevention of malaria through bednet utilization. The gap between net possession and usage is well documented in many demographic and health surveys (DHS) or malaria indicator

surveys made in Africa in recent years. For instance, analysing seven countries in SSA, Khan et al. (2008) report a household ownership of any net of 69% in Mali in 2006 and a 5.7% in Ethiopia in 2005. Following massive and free distribution campaign of ITN/LLINs in Africa, possession of nets is now increasing in many African countries (e.g. in Zambia—Ashraf et al., 2010), but usage remains relatively low (ranging from 1% in Swaziland to 85% in Eritrea according to Noor et al., 2009). However, massive distribution campaigns also depend on countries' specific strategies in link with aid donors, and public, private health services or NGOs acting in the areas, as previously mentioned. From 2004 to 2012, the Democratic Republic of Congo (DRC) received annual disbursements from the Global Fund (from 14,411,85 USD in 2004 to 1.05e+08 USD in 2012). In DRC, the 2007–2008 DHS survey reports that the percentage of households owning at least one net of any type was 28% (16% for an ITN, and 9.2% for LLINs). The percentage of under-5 children sleeping under a net (amongst households with at least one net) the night before the interview was 19%. These figures were higher for the Katanga region however (34.9% for ownership and 28.6% for usage) in the same DHS report.

The empirical approach of this article is two-pronged. First, we study the impact of malaria prevalence on bednet ownership and we provide instrumental variables estimates of this impact in order to examine if behaviours could be a barrier to access. Second, we tackle the considerable challenge of understanding performance without costs or length of stays data, thanks to the literature that examines hospital costs using estimated dependant variable (EDV) models.

2. Material and methods

2.1. Study location

DRC is the second largest and the fourth most populated country in Africa with an estimated population of 67 million in 2010. It is among the poorest countries in the world with a per capita income that remains among the lowest in Africa, and it ranked last in the 2011 Human Development Index (187 out of 187). Since 2001, the country has been recovering from a series of conflicts that began during the 1990s. The humanitarian crisis remains a major concern in many of the more unstable parts of the country. The country has vast natural resources and an annual GDP growth rate (2010) of 6.1%; yet this growth has not translated into an improved quality of life for most Congolese. Key health indicators in the DRC are among the worst in the world. The collapse of the state and waves of humanitarian crises have led to the fragmentation of DRC's health sector which relies heavily on multilateral, bilateral, and financial organizations for assistance. The health sector is chronically underfinanced and most service providers rely extensively on user fees to cover salaries and operating costs of the centers. Service provision is of extremely low quality and there are persistent socioeconomic disparities in access to health care. Malaria is one of the major causes of morbidity in DRC, and a significant contributor to under-5 mortality, accounting for approximately 47% of child deaths and 67% of external consultations (Ministère du Plan et Macro International, 2008). Malaria is thus a major public health issue in DRC.

Haut-Katanga is a remote district of DRC, located about two thousand miles away from the capital, Kinshasa, along the Tanzanian and Zambian borders (Fig. 1). Compared to other regions of DRC, Haut Katanga benefits from a better road infrastructure and is less afflicted by political instability. Haut-Katanga registers a poverty headcount of 0.37, a ratio that is relatively higher than in other districts, which is likely due to the thriving local mining industry (Marivoet, 2002).

¹ Other reviews can be found in Stevens et al. (2005), Hill et al. (2006), Lengeler et al. (2007). Other studies analyze different delivery strategies and the cost-effectiveness of ITN/LLINs (Thomson et al., 1995; Goodman et al., 1999; Chima et al., 2003; Morel et al., 2005; Mueller et al. 2008; Yukich et al., 2009).

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