Use of health care among febrile children from urban poor households in Senegal: does the neighbourhood have an impact?

Georges Karna Kone, Richard Lalou, Martine Audibert, Hervé Lafarge, Stéphanie Dos Santos, Alphousseyni Ndonky and Jean-Yves Le Hesran

1Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CR CHUM) et Université de Daloa (Cote d’ivoire), 850 rue saint Denis Montréal, Canada, 2UMR 151 IRD/AMU, Laboratoire Population–Environnement–Développement, Aix-Marseille Université, centre Saint-Charles, Case 10, 3, place Victor-Hugo, 13331 Marseille cedex 3, France, 3CERDI, CNRS, 65 Boulevard François Mitterrand, 63000 Clermont-Ferrand, France, 4University of Paris Dauphine 32, avenue Henri Varagnat 93143 Bondy cedex, France

*Corresponding author. Georges Karna Kone, Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CR CHUM) et Université de Daloa (Cote d’ivoire), 850 rue saint Denis Montréal, Canada. E-mail: karnageorges@gmail.com, karnageorges@yahoo.fr

Accepted 31 December 2014

Urban malaria is considered a major public health problem in Africa. The malaria vector is well adapted in urban settings and autochthonous malaria has increased. Antimalarial treatments prescribed presumptively or after rapid diagnostic tests are also highly used in urban settings. Furthermore, health care strategies for urban malaria must comply with heterogeneous neighbourhood ecosystems where health-related risks and opportunities are spatially varied. This article aims to assess the capacity of the urban living environment to mitigate or increase individual or household vulnerabilities that influence the use of health services. The data are drawn from a survey on urban malaria conducted between 2008 and 2009. The study sample was selected using a two-stage randomized sampling. The questionnaire survey covered 2952 households that reported a case of fever episode in children below 10 years during the month before the survey.

Self-medication is a widespread practice for children, particularly among the poorest households in Dakar. For rich households, self-medication for children is more a transitional practice enabling families to avoid opportunity costs related to visits to health facilities. For the poorest, it is a forced choice and often the only treatment option. However, the poor that live in well-equipped neighbourhoods inhabited by wealthy residents tend to behave as their rich neighbours. They grasp the opportunities provided by the area and adjust their behaviours accordingly. Though health care for children is strongly influenced by household socio-economic characteristics, neighbourhood resources (facilities and social networks) will promote health care among the poorest and reduce access inequalities. Without being a key factor, the neighbourhood of residence—when it provides resources—may be of some help to overcome the financial hurdle. Findings suggest that the neighbourhood (local setting) is a relevant scale for health programmes in African cities.

Keywords Access to health care, Dakar, equity, malaria, multilevel analysis, neighbourhood, poverty, social network
KEY MESSAGES

- Self-medication is a widespread practice among households in Dakar, particularly among the poorest.
- The neighbourhood (local setting) is a relevant scale for health programmes in African cities.

Introduction

Improving access to health care for vulnerable populations is clearly a poverty alleviation policy in developing countries. Despite many political commitments [Alma Ata (1978)\(^1\), the Bamako Initiative (1987)\(^2\), the Millennium Development Goals (2000)\(^3\)], the poor still do not easily access high-quality health care (Haddad and Fournier 1995; Audibert et al. 1999; Brunet-Jailly 1999; Cissé et al. 2004). In West Africa, the number of outpatient consultation per person per year is less than 0.6 while WHO’s standard recommends one consultation per person per year (Ridde et al. 2012). However, health expectations have become more pressing with changing lifestyles and increasing school enrolment rates. Growing inequities in access to health care are increasingly less accepted by the populations and expectations from government are rising.

Governments have adopted various strategies to increase access to health care for poor people in the last decades. After a period of free health care in the 70s and 80s that did not withstand the hazards of state budgeting, the implementation of a health care payment policy has made high-quality care more available but has also increased inequities. Since the mid-2000s, financial access has been the key issue in the strategies for strengthening health systems. Depending on the country and disease, recommended strategies have ranged from subsidizing health providers (for selected populations) so as to keep their fees low to developing equity funds that support the health costs of targeted populations (such as poor or elderly people). These health financial policies, however, did not have the expected effects. Free health care has enabled non-poor households to save money while unpredictable subsidies have disrupted the management of providers (Ridde et al. 2012). These policies have eventually aimed at changing poor populations’ environment (subsidies for health care providers) or their personal capacities to access health care (third-party payment) without taking into account the role of residential location and individual characteristics in health care decision making.

Research on determinants of health care demand is based on two main theoretical approaches: a ‘public health’ and a ‘liberal’ approach. These studies—mostly influenced by a public health rather than an economic approach—have focused on the concepts of need and access and overlooked health care demand (WHO 2000)\(^4\).

Public health perspectives consider that health care demand is not a choice but a response to an absolute need. The barriers can include an overly wide cultural distance between patients and modern medicine, an economic distance between the low income of patients and health cost, or a ‘geographic’ distance. Under this approach, the government must seek to reduce these distances to meet health needs. Thus, this strategy is mostly context-based (lower fees, availability of care) or individual-based (third-party payment).

Liberal economists’ perspective tends to overlook the necessity of health care needs and consider patient-consumers as basically rational. Thus patients seek to maximize their well-being given the individual’s utility function defined by personal characteristics. In other words, a patient may decide to consume health care services if the utility is greater than the one related to another use of his/her resources (Grossman 1999). In this line and despite on-going debates, the government must support free markets. Within this approach, Amartya Sen considers that the government must create an environment that provides a set of possible choices for the most deprived populations (Sen 1993; Sen 1999; Sen 2002; Robeyns 2003).

Most studies focusing on the impact of health payment policies on health care use have adopted one or another of these rationales. They tackle individual/household socioeconomic characteristics that would impede meeting the needs. The roles that context and individuals play have however not been clearly shown. Some less orthodox studies have used specific conceptual frameworks to address these two levels of determinants (Andersen 1995; Diez-Roux et al. 1997; Chaix and Chauvin 2002; Davidson et al. 2007; diez-Roux 2007; Smiley et al. 2010). Our study on urban health care use is based on Andersen’s approach.

The socio-spatial context is usually studied using the urban and rural divide. These settings, however, are not homogeneous and in particular urban areas.\(^5\) Given the recent and fast growth\(^6\) of cities in Africa, their reorganization is an on-going process between a ‘stabilized pole’, in terms of economic activities and level of equipment and public services,—and an ‘unstabilized pole’ owing to a high presence of informal activities in an unplanned setting (Faye and Thioub 2003; Goerg 2003). The African city can be described not only as ‘dual’ but also as plural with segregations identified between different neighbourhoods or larger housing areas. The neighbourhood is a place where its residents have access to resources and exchange views on practices and ideas. Thus the neighbourhood shapes behaviours but is also the result of behaviours. The neighbourhood eventually becomes a vector of social identity (Goerg 2003). In these conditions, studies based on an approach that overly focuses on individual factors may have a limited explanatory power (Diez-Roux et al. 1997; Stierle et al. 1999; Chaix and Chauvin 2002; Carpenter and Ducharme 2003; Davidson et al. 2007).

This article aims to assess the relative effects of neighbourhood and individual characteristics on health care use in Dakar, Senegal. We assume that the low use of health care among the poor is partly due to the lack of opportunities provided in their residential location. We analysed health care use among febrile children aged less than 10 years in a population-based study carried out during the malaria high transmission season (July to October) in Dakar. Fever during this period was considered a proxy for malaria.
The analysis of interconnections between individual and context determinants of health care use in urban areas should contribute to: 1) improve the relevance of theoretical approaches to demand behaviours in Africa, 2) better understand behaviours of urban populations in Africa and 3) reinforce policies promoting health care access for the most deprived populations.

Context of the study area

The human development index ranked Senegal at 157 out of 177 in 2008 (PNUD 2008). Nearly half of households (42.6%) in Senegal live below the poverty line (ANSD 2007)

Malaria is a major cause of morbidity and mortality in Senegal, particularly among children below 5 years of age. To increase the use of new treatments against malaria, Senegal has adopted a drug subsidy policy in 2006 thanks to the Global Fund. A low-cost combination therapy based on artemisinin and amodiaquine was available in public health centres and private pharmacies (300 FCFA for infant and child dosage and 600 FCFA for adult dosage). Two years after the implementation of this subsidy policy, there were still inequities of access to health care (Ndiaye and Ayad 2009; ANSD 2011). The demographic and health survey conducted between 2010 and 2011 shows that only half of febrile children (52%) used health services in Dakar (ANSD 2011).

Urban malaria remains a public health issue. During the rainy season, fevers are common and mostly considered as malaria-related with a presumptive or confirmed diagnosis. Findings now show that the malaria vector adapts better to the urban environment than what had been claimed by past studies (Pages et al. 2008; Diallo et al. 2012).

Conceptual framework

We believe that the Andersen’s conceptual model of health care use is the most appropriate to study context factors. Andersen classifies the variables likely to affect health care use decision-making into predisposing, enabling or need factors (Andersen 1995). Predisposing factors include demographic characteristics (age, gender, etc.), social structure (i.e. social networks, education) and health beliefs. Enabling resources are distinguished into individual/household and context/community determinants of health care use. Both community and individual enabling resources must be present for use of health services to take place (income, availability of health staff and facilities, etc.). There must also be a perceived need for health care among the target population.

Studies on the demand for health care in developing countries have mostly used a microeconomic framework based on neoclassical theory (Audibert et al. 1999; Cissé et al. 2004). Therefore we believe that using Andersen’s conceptual model should contribute to enrich the debate, just like previous studies carried out in Latin and North America (Himes and Rutrough 1994; Diez-Roux et al. 1997; Marpsat 1999; Pickett and Pearl 2001; Andersen et al. 2002; Carpentier and Ducharme 2003; Diez-Roux 2007; Aremu et al. 2008; López-Cevallos and Chi 2010; Smiley et al. 2010).

Methods

Sample and data collection

Data were collected in Dakar between 2008 and 2009 as part of a research program on urban malaria. This program (Actu-Palu) had two objectives: 1) to highlight and describe the urban contexts that have contributed to the resurgence and development of malaria in Dakar; and 2) to assess the capacity of the residential location to mitigate or increase people’s vulnerabilities impeding access to health care. The project clearly focused on the urban setting, within which attitudes, perceptions and health practices are shaped.

A survey was conducted among the population of the Dakar metropolitan area. The sample was based on two-stage sampling. In the first stage, clusters or census districts (CDs) were randomly selected within strata defined for the 2002 general population and housing census (RGPH). After carrying out a principal component factor analysis of socio-demographic and economic data from the 2002 RGPH, five types of CDs (Map 1) were obtained using the dynamic cloud classification (k-means methods). The first three types are primarily from the commune of Dakar. Type 1 (blue) includes CDs made up of households with good living conditions; Type 2 (green) comprises middle-class households; and Type 3 (orange) comprises poor households. Type 4 (pink) and Type 5 (yellow) are CDs made up of poor households, mainly from Pikine Ancien (Type 4) and Pikine Extension (Type 5).

The area covered by the survey includes 40 communal districts (communes d’arrondissement) (CAs) from the four communes of Dakar metropolis. The population of the four communes was estimated at 1983093 inhabitants and the number of households at 270,669 in 2002 (ANSD 2006). All of the 40 CAs are made up of approximately 2000 CDs, with an average population of 1037 inhabitants (141 households and 86 compounds per CD).

In total, 50 clusters (neighbourhood or equivalent CDs) were selected from the entire Dakar metropolitan area (Map 1). A list of households was drawn up from a census of the households in each of these clusters; a sample of 60 households per CD was randomly selected in the second stage. The total sample included 3000 households.

The three questionnaires used for the survey were based on validated data collection tools (Roubaud and Razafindrakoto 2005; Franckel et al. 2008; Chauvin and Parizot 2009; Souares et al. 2009). The household questionnaire included four modules that addressed characteristics of household members, housing, household environment and household economic status. It was administered to the head-of-household, when available. The women’s questionnaire concerned only mothers/guardians and documented their socio-demographic and cultural characteristics, participation in and use of social networks, knowledge and attitudes about malaria and health in general, and perceptions about medicines and the neighbourhood’s health care facilities. It ended with questions on health care seeking behaviour during the last episode of fever for children aged less than 10. To be selected, the reported illness must have ended at the time of the interview and must have occurred in the 30-day period before the survey. The neighbourhood questionnaire was used to collect quantitative data on the neighbourhood’s collective facilities, environment and history of settlement. It was filled
out during focus groups carried out with the neighbourhood’s key informants. The survey was carried out from 15 September to 22 December 2008 and covered the period of high malaria transmission; the rainy season (July–October) was characterized by extreme flooding in Dakar that year.

**Definition of variables**

The use of health care is generated by a health problem. This study deals with children below 10 years presenting with a simple fever.

Health care use is defined as a resort to a public or private health provider. A ‘non-resort’ means that there were no visits to modern health facilities. This includes cases when no treatment whatsoever was administered, which is seldom the case, or when self-medication is used. Self-medication is defined as the use of drugs or other treatments by individuals selected without any professional prescription except from pharmacists to treat self-diagnosed symptoms. Although resorting to traditional healers are quite common in developing countries, reporting this type of care remains very low in urban settings (about 5% according to the literature on health care in developing countries).

Self-medication was set as the dependent variable in our analysis model (yes = 1) compared to visit to health care facility (no = 0).

The independent variables (individual, context and living neighbourhood characteristics) are classified according to Andersen’s conceptual framework.

Predisposing factors include the proportion of under-tens in the household, level of education (no education, primary, secondary and more) and health literacy (low versus good) for mothers/guardians of sick children, and mothers/guardians’ social network (low versus good). Child age and gender were left out from the model on the basis of statistically based arguments. The model including these two predictors was compared with a model without them. Child age and gender did not significantly improve the initial model nor did they contribute to predict the dependent variable. They were both excluded from the final models.

The social network indicator was created on the basis of nine questions reported in the survey; among these, three were used to build a social network score. These questions concerned the number of people with whom the mother/guardian has strong social relationships regarding health and money matters. This estimated score accounted for 58% of social network variability between mothers/guardians. The higher the score, the more important is the mother’s/guardian’s social network.

Individual/household enabling factors include the household standard of living (very poor, intermediary and very rich household). Estimating the household standard of living is
much debated in the literature. Income is considered as partially reflecting the economic and financial status of households and individuals: income reflects cash (immediate resources) while assets refer to the potentialities of the economic status. Therefore, we needed to use several indicators. In line with several authors (Sahn and Stifel 2000; Filmer and Scott 2008), we have built housing and assets indices using a principal component analysis. The very poor households were defined on the basis of the concept of hard-core poverty illustrated in Figure 1. They were identified by both monetary and wealth approaches and belonged to the first quintile of all the four following household standard of living dimensions: income, expenditure, housing and assets (Bradshaw 2001; Bradshaw and Finch 2001; Delhausse 2002; Diagne et al. 2005; Roubaud and Razafindrakoto 2005). The very poor households accounted for about 10% of studied households ($N = 257$). The very rich were only identified using the monetary approach (last quintile of both income and expenditure) because none of the studied households belonged to the last quintile of all the standard of living dimensions. Ten percent of the studied households were identified as very rich ($N = 322$). The remainder was made up of intermediary categories, which seemed to be homogeneous relative to health care use. In this article, the three-category variable will be worded as: poor, intermediary and rich households.

Enabling resources at the community level concern health provision (health facility and pharmacy densities), the neighbourhood’s standard of living and the intensity of social relationships within the neighbourhood.

The density of health facilities (excluding pharmacies) was tested in the first draft of the model. Including this variable in the model did not change the strength and direction of the statistical association of other contextual variables (including the neighbourhood economic level) with the dependent variable. Differences between ORs adjusted and non-adjusted by health facility density were always very low. We also observed that health facility and pharmacy densities had a positive impact on self-medication. However, the effect of health service density was less important and less significant than the effect of pharmacy density. For this reason, we dropped the health facility density and used the pharmacy density in our final model.

The neighbourhood’s standard of living—poor, heterogeneous and rich—was estimated using the percentage of poor and rich households for each neighbourhood. If the percentage of poor (quintiles 1 and 2) [or rich (quintiles 4 and 5)] households in a neighbourhood was equal or higher than 45%, the neighbourhood was classified as poor (or rich). For the other cases, the neighbourhood was considered as heterogeneous (neither poor nor rich). Among the 50 neighbourhoods, 18 were poor, 10 rich and 22 heterogeneous.

The neighbourhood’s level of social relationships was assessed (score) using an array of questions dealing with social and cultural identity, associative life and frequency of social relationships within neighbourhoods.

Andersen’s need factors were expressed in this study by the people’s perception of the risk of flooding in their neighbourhood. This variable is a proxy for people’s perception of a risky environment. This risk perception should drive people to feel more vulnerable and thus to resort more to health facilities.

The total sample included 2952 households (a response rate of 98.4% households) of which 28,698 were individuals, including 7413 children below 10 years. A total of 1272

![Figure 1](image_url) Hard-core poverty. Source: Authors
mothers/guardians who reported an illness episode with one of their children aged < 10 years were interviewed. The ‘neighbourhood’ survey took place in the 50 living neighbourhoods of the surveyed households.

Data analysis
We constructed indicators to characterize individuals, households and neighbourhoods. Synthetic indices were constructed (based on the score method) using a principal component analysis for quantitative variables and a factor analysis for discrete variables. We built indices for social capital, knowledge about maternal and child health, risk of flooding in the neighbourhood (presence of wetlands, flooding in 2005 and 2008) and types of dwelling and property owned by the household. These last two indices, combined with income and overall expenditure (per adult equivalent in the household), were used to classify households and neighbourhoods according to their economic status.

Then we conducted a bivariate analysis between independent variables and the dependent variable (see Table 1). We finally did an econometric analysis based on the multilevel approach (Goldstein and Jon 1996; Woodhouse et al. 1996; Diez-Roux et al. 1997; Goldstein et al. 2007). This method required a hierarchical database that takes into account the context (neighbourhood) and individual/household levels. Hierarchical data allow for a better assessment of the standard deviations of the parameters for context effect (Goldstein 1995; Kleinschmidt et al. 1995; Palmer et al. 1998). A multilevel logit regression was used to analyse the dependent variable: self-medication (non-use of modern health care services) vs use of modern health care services. For each block, independent variables were introduced in the model based on the explanatory dimension and according to Andersen’s conceptual framework.

To measure the effect of context on poor people, we introduced interaction terms between poor households and rich neighbourhoods, poor households and neighbourhoods with a high level of health facilities, and poor households and neighbourhoods where residents have a strong social network.

To assess the overall spatial context effect, we calculated the intra-neighbourhood correlation co-efficient (Ω) from the empty model of the multilevel logit regression. There is an effect when the co-efficient is different from zero (Diez-Roux et al. 1997; Mooij 1998; Palmer et al. 1998; Pampalon et al. 1999; Diez-Roux 2007). The Moran’s global index of spatial autocorrelation was also estimated.

The estimation of the multilevel model begins with an empty model, then a model with individual variables, and, lastly, a full model (individual and context variables). For each of the full-model estimations, a single interaction variable was introduced.

The descriptive analysis and construction of indices were done with Stata/SE software, version 11.2. The multilevel regression was performed using Mlwin 2.10 software (University of Bristol).

Table 1  Description of variables relative to self-medication

<table>
<thead>
<tr>
<th>Individual variables</th>
<th>Self-medication as first resort for health care (N = 1272)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modality</td>
</tr>
<tr>
<td>Proportion of children under 11 years in the household</td>
<td>Average (SD)</td>
</tr>
<tr>
<td>Mother’s/guardian’s education level</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td>Secondary or higher</td>
</tr>
<tr>
<td>Mother’s/guardian’s social network level</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Mother’s/guardian’s health literacy level</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Household income level</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>Very Poor</td>
</tr>
<tr>
<td></td>
<td>Rich</td>
</tr>
<tr>
<td>Neighbourhood variables (contextual)</td>
<td></td>
</tr>
<tr>
<td>High density of pharmacies in the neighbourhood</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Neighbours’ network (relationships between neighbourhood residents)</td>
<td>Weak</td>
</tr>
<tr>
<td></td>
<td>Dense</td>
</tr>
<tr>
<td>Neighbourhood flood risk level</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Neighbourhood income level</td>
<td>Heterogeneous</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
</tr>
<tr>
<td></td>
<td>Rich</td>
</tr>
</tbody>
</table>

Sources: Authors.
Results
Health care use among urban children with fever
The use of health care among urban children with fever is charted in Figure 2. Several characteristics about the use of health care in an urban setting can be drawn from these results. Using modern medicine is an established fact: 98% of mothers/guardians reported having either visited a modern health facility or used modern drugs. This is true for 95% of the poorest even though nearly 50% of the mothers/guardians and household heads in this category have no education. This result suggests that residential location has a strong influence on individual behaviours: using modern health care has become ‘normal’ in cities to the extent that even women from families whose characteristics would presume more ‘traditional’ behaviour (no education, poor, etc.) have adopted this modern’ behaviour.

For febrile children, half of the mothers/guardians saw a doctor or nurse, and the other half obtained drugs immediately. In this respect, rich and poor people behaved equally.

The patients that self-medicated rarely bought an antimalarial treatment and used instead a fever-reducing drug (paracetamol or aspirin). This behaviour reflects the mothers’ empirical knowledge of the effectiveness of these antipyretic drugs for children.

Rich and poor people did not opt for the same ‘health care provider’: while nearly almost all rich people turned to pharmacists, more than 40% (20/46) of the poor population used the informal market. Therefore, the behaviour of ‘rich’ people is consistent with the economic rationality of using health care. Culturally close to modern medicine, rich people save their time and money while minimizing risks (go through the pharmacist). Recognizing the utility of modern medicine, poor people call on the informal market, which is more adapted to their financial constraints.

The outcome of self-medication is more critical. For the ‘rich,’ resorting to prescribers as a second resort was necessary in 48% of cases of self-medication (23/48). Yet, this only occurred in 17% of cases among poor people. The poor probably forgo opting for prescribers. This explanation, however, needs further investigation.

Determinants of self-medication: bivariate analysis
Modern self-medication accounted for just under half (44%) of first resorts. The non-use of modern health facilities is positively associated with individual characteristics, such as the mother’s/guardian’s level of education, social network and health-care knowledge (prob. $\chi^2 < 1\%$, Table 1). However, the non-use of modern health facilities is not associated with household characteristics such as economic and living conditions or the proportion of children under 10.

There is also a significant association between the variables related to residential location and household health care

![Figure 2](image_url) Health care use for rich and poor children with fever (example based on 100 children in each group). Interpretation: 95 ‘poor’ children and 100 ‘rich’ children sought modern medicine (with or without prescription) as a first resort. Source: Authors
behaviours. Self-medication is more common in neighbourhoods with a high density of pharmacies (51% vs 49%) or primarily inhabited by rich households (53% vs 47%, see Table 1). We clearly can point out there was a lower level of self-medication in neighbourhoods with high environmental risks (39% vs 61%), with a high level of neighbourly relations (45% vs 55%) and mainly inhabited by poor households (38% vs 62%).

Determinants of self-medication: multilevel analysis
The overall effect of spatial and social context was assessed by two methods. The value of Moran’s index of spatial autocorrelation was 0.36 ($P = 0.002$), supporting the use of a statistical method to assess spatial context effect. On the basis of the multilevel model, we also found that the intra-neighbourhood correlation (Ω) was different from 0 ($Z = 0.055/0.022 = 2.5; \text{Prob} < 5\%$). The empty model gave an estimated variance between neighbourhoods of $\delta^2_w = 0.008$ and a variance between individuals from the same neighbourhood of $\delta^2_u = 0.238$. These two variances were significant at the 5% level. They indicate an overall trend that individual characteristics are dominant and that behaviours differ more between households from the same neighbourhood than between different neighbourhoods. Some 3.25% of the total variance for self-medication is ascribed to the difference between neighbourhoods (specificity).

Graph 1 shows the variance for self-medication within each neighbourhood. It does point out that self-medication varies between neighbourhoods. We can note that the dispersion of self-medication is about the same in all the neighbourhoods (Supplementary Appendix S1).

Table 2 shows that education ($P < 1\%$), social network ($P < 10\%$) and health literacy ($P < 5\%$) of the sick child’s mother/guardian are positively associated with self-medication as first treatment. Febrile children whose mothers/guardians have an education level equal to or higher than secondary are twice as likely to be treated through self-medication as a first resort than children whose mothers/guardians have not been to school (OR = 1.93 [1.63–2.29]). Similarly, children whose mothers/guardians belong to a dense social network (vs a weak social network) or those who have a high health literacy (vs a low level) are more likely to be treated by self-medication (respectively, OR = 1.25 [1.09–1.43] and OR = 1.35 [1.19–1.52]). As previously found, the effect of the household’s economic status is not significant ($P < 15\%$). In case of first treatment, the use of self-medication among children with fever is similar among rich and poor households compared to intermediary households.

The residential location affects health care use through pharmacy density ($P < 5\%$), the intensity of neighbourly relations ($P < 5\%$) and environmental risks ($P < 1\%$). Households located in neighbourhoods with a high density of pharmacies or with significant interaction between neighbours have a higher probability of using self-medication (respectively, OR = 1.40 [1.21–1.61] and OR = 1.36 [1.18–1.57]). In contrast, households located in neighbourhoods with an environmental risk (risk of flooding) are more likely to consult a doctor as a first resort (OR = 0.52 [0.43–0.61]).

The interaction variables show that poor households are less likely to use self-medication when they live in a rich neighbourhood ($P < 15\%$; OR = 0.662) or in a neighbourhood with numerous health facilities ($P < 1\%;$ OR = 0.560). In both cases, they will use health care more than if they lived in neighbourhoods that are poor or have little health care facilities. Conversely, poor households living in a neighbourhood with a strong social network (relationships between neighbours) are more likely to use self-medication than poor households in other contexts ($P < 10\%;$ OR = 1.093). Therefore, these results demonstrate that there is a neighbourhood effect in health care use in Dakar and point out some of its mechanisms at play.

Discussion
During the last decade, urban malaria has become a major health issue in Africa as a result of various environmental, climate and population changes. Moreover, fever in children during the rainy season is more often presumed by families and health providers to be due to malaria. Among the 854 households having visited a health facility to manage child fever, 88% of children were under antimalarial treatment while only 17% were tested with a rapid diagnostic test. Opting for self-medication or a treatment in a health facility mainly depends on mothers’/guardians’ characteristics. Nevertheless, the social and economic characteristics of neighbourhoods are related to health care among households.

Individual determinants
The descriptive analysis (Table 1) shows that both rich and poor households self-medicate as much as they seek treatment from

Graph 1 Caterpillar plot of the variance for self-medication in neighbourhoods in Dakar. Source: Authors
<table>
<thead>
<tr>
<th>Individual Variables</th>
<th>Empty Model</th>
<th></th>
<th>Individual Model</th>
<th></th>
<th>Full Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of children under 10 years in the household</td>
<td>Average</td>
<td>0.081 (0.424)</td>
<td>0.254 (0.431)</td>
<td>0.627 (0.263)</td>
<td></td>
</tr>
<tr>
<td>Mother/guardian's education level</td>
<td>None</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>0.268 (0.13)**</td>
<td>0.237 (0.131)*</td>
<td>0.664 (0.172)*****</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary and higher</td>
<td>0.66 (0.169)*****</td>
<td>0.587 (0.173)*****</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother/guardian's social network level</td>
<td>Low</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dense</td>
<td>0.22 (0.135)*</td>
<td>0.239 (0.137)*</td>
<td>0.206 (0.125)*****</td>
<td></td>
</tr>
<tr>
<td>Mother/guardian's health literacy level</td>
<td>Low</td>
<td>Ref</td>
<td>Ref</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>0.28 (0.124)**</td>
<td>0.3 (0.125)****</td>
<td>0.239 (0.137)*</td>
<td></td>
</tr>
<tr>
<td>Household income level</td>
<td>Average</td>
<td>0.078 (0.123)</td>
<td>0.925 [0.81–1.04]</td>
<td>0.992 [0.87–1.12]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very Poor</td>
<td>−0.078 (0.123)</td>
<td>−0.008 (0.126)</td>
<td>−0.308 (0.232)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rich</td>
<td>−0.225 (0.227)</td>
<td>0.799 [0.63–1.00]</td>
<td>0.735 [0.58–0.93]</td>
<td></td>
</tr>
<tr>
<td>Neighbourhood-level variables (contextual)</td>
<td>High density of pharmacies in neighbourhood</td>
<td>No</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>0.334 (0.144)****</td>
<td>1.397 [1.21–1.61]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relationships between neighbours (neighbourhood social network)</td>
<td>Weak</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dense</td>
<td>0.312 (0.143)****</td>
<td>1.366 [1.18–1.57]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neighbourhood flood risk level</td>
<td>Weak</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>−0.664 (0.172)*****</td>
<td>0.515 [0.43–0.61]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neighbourhood income level</td>
<td>Heterogeneous</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor</td>
<td>0.626 (0.149)</td>
<td>1.064 [0.92–1.23]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rich</td>
<td>−0.195 (0.193)</td>
<td>0.823 [0.67–0.99]</td>
<td></td>
</tr>
<tr>
<td>Interaction with the poverty level variable (Poor household)</td>
<td>Poor household living in rich neighbourhood</td>
<td>No</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>−0.450 (0.378)*</td>
<td>0.662</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor household living in neighbourhood well-equipped in health facilities (Pharmacies)</td>
<td>No</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>−0.757 (0.274)*****</td>
<td>0.560</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor household living in neighbourhood with a strong social network</td>
<td>No</td>
<td>Ref</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>0.438 (0.285)*</td>
<td>1.093</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td>−0.239 (0.075)*****</td>
<td>−0.703 (0.21)*****</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variance</td>
<td>0.120 (0.056)*****</td>
<td>0.075 (0.048)**</td>
<td>0.00 (0.000)</td>
<td></td>
</tr>
</tbody>
</table>

***P < 0.01  
**P < 0.05  
*P < 0.10  
P < 0.15
Neighbourhood determinants

The effect of context has been well documented in the analysis of health care use, particularly by comparing urban and rural settings (Marpsat 1999; Andersen et al. 2002; Béland et al. 2002; Carpentier and Ducharme 2003; Costa et al. 2003; Davidson et al. 2007; Diez-Roux 2007; Aremu et al. 2008; Choi 2009; López-Cevallos and Chi 2010; Aranda et al. 2011; Santos et al. 2012). We have dealt with this question in depth in an intra-urban scale—the neighbourhood. Overall, our results show the existence of a context effect on the use of health care in the case of febrile children. Although context effect only accounts for a small part of the total variance (3.4%), it is significant at the 5% level and is consistent with the literature (Palmer et al. 1998; Pickett and Pearl 2001).

Using the full hierarchy model, we have tried to understand the mechanisms operating at neighbourhood level in relation to people’s health care behaviour. The neighbourhood can delimit an environmentally risky area when there is dense vegetation and stagnant water that can expose residents to infections and, more specifically, to vector-borne diseases. The neighbourhood’s health care supply and socio-economic level play an important role in explaining neighbourhood variation in health care use. Lastly, social support and connectedness within neighbourhoods are also key factors.

Based on an economic rationale, the high density of public and private health facilities is frequently associated with a high presence of private pharmacies. This association is particularly clear for the central neighbourhoods of Dakar. Some 50% of neighbourhoods with a high number of health facilities also have a high density of pharmacies. Conversely, neighbourhoods with a low density of health facilities are also deprived of pharmacies.

We found that poor households living in economically well-off neighbourhoods are more likely to visit a health centre in the event of a febrile child. There are several explanations for this situation:

Rich neighbourhoods can affect health behaviours by providing both quantity and high-quality equipment and facilities and a social environment where rich households can influence their less well-off neighbours. A greater availability of quality health supply can reduce the geographic distance between the patient and health care providers and reduce the indirect health care costs. Visiting a health care facility is less expensive for poor households that live in a rich neighbourhood (1577 FCFA (US$3) on average) than for poor households living in a poor neighbourhood (1942 FCFA (US$3.8) on average). Moreover, poor households tend to visit health facilities that are consistent with their income level and the neighbourhood’s health supply (public health care). Poor households also comply with health and social norms shaped within rich neighbourhoods. These explanations are supported by numerous studies that show that the economic affluence of the neighbourhood’s population and the quality of health care in the neighbourhood are important factors for health care use (Lavy and Quigley 1993; Stierle et al. 1999; Sahn and Stifel 2000; Mariko 2003). The neighbourhood, however, can promote self-medication when it is under-equipped and inhabited by poor households.

On the basis of previous results, we believe that the poor and rich households that live in a rich neighbourhood take advantage of community resources. The poor actually use more public health facilities and the rich more private pharmacists as first treatment. For the poor, the visit to the neighbourhood’s public health facility is a rational choice given their constraints: lower knowledge about medications and lower capacity to move outside the neighbourhood. Rich households, however, have enough health literacy to reduce the costs. Visiting a health care facility is less expensive for poor households that live in a rich neighbourhood (1577 FCFA (US$3) on average) than for poor households living in a poor neighbourhood (1942 FCFA (US$3.8) on average). Moreover, poor households tend to visit health facilities that are consistent with their income level and the neighbourhood’s health supply (public health care). Poor households also comply with health and social norms shaped within rich neighbourhoods. These explanations are supported by numerous studies that show that the economic affluence of the neighbourhood’s population and the quality of health care in the neighbourhood are important factors for health care use (Lavy and Quigley 1993; Stierle et al. 1999; Sahn and Stifel 2000; Mariko 2003). The neighbourhood, however, can promote self-medication when it is under-equipped and inhabited by poor households.

Lastly, the study showed that the environmental risk encourages people to visit health care facilities as first treatment. Natural areas in neighbourhoods (wetlands, swamps, thick vegetation) near built-up areas, recurrent flooding and unsanitary public constructions (open channels for wastewater...
drainage) could increase the perception of a health hazard, driving people to visit health care providers for fever.

Neighbourhoods with an environmental risk are mainly located in the eastern-central and eastern areas of the Dakar metropolis (Supplementary Appendix S2). In these neighbourhoods, market gardening is widespread along water points and ponds (niayes), and the risk of flooding is higher. The nearly constant presence of water and vegetation cover is conducive to the development of mosquitoes and their breeding sites. Some studies have reported the presence of Anopheles arabiensis in specific areas of Dakar, such as the niayes (Trape et al. 1992; Diallo et al. 2000; Machault et al. 2009; Drame et al. 2012). Other ones have shown the adaptation of malaria vectors to urban settings, particularly in polluted water, and indigenous transmission in several African cities (Chinery 1984; Robert et al. 2003; Sattler et al. 2005; Awolola et al. 2007; Diallo et al. 2012). Some entomological studies appear to indicate that heavy rain (and the subsequent flooding) has a positive influence on the development of malarial mosquitoes in cities (Pages et al. 2008; Machault et al. 2009). All these observations indicate an indigenous malaria transmission in Dakar that is characterized by high inter-annual and spatial variability; this spatial heterogeneity was detected at the urban neighbourhood scale. Therefore, people living in environmentally risky neighbourhoods and who are aware of environmental health threats tend more to consult health care professionals rather than self-medicate when they are sick.

If confirmed by others, these results would show that cultural distance to modern medicine for the urban poor is no longer a barrier: the objective risks are clearly understood, as well as the usefulness of seeking care. Progress in universal primary education and urban lifestyle are probably the main causes of this cultural change. Urban populations in Dakar are ready to seize the opportunities that the older and more affluent neighbourhoods enjoy.

Our results are consistent with the views of Amartya Sen that suggest that social inequalities (particularly for health) can be reduced by strengthening poor individual capabilities, in other words, by increasing the opportunities provided by their living environment as well as their ability to use them effectively (through human and social capital). We can ask whether specific government efforts to provide health care supply and other public services in poor neighbourhoods would not be likely to produce better health care access among the poor than exemption policies that are not very readable, functional or manageable, leading them to be discredited ultimately.

Conclusion

This study clearly shows that mothers’/guardians’ education, social network and health literacy levels strongly influence health-seeking behaviours contrary to the household economic characteristics. The neighbourhood in which people live has also an effect on care-seeking behaviours, particularly among poor people. Its influence operates in three ways: the residential context provides residents health care supply, which can vary in quality. The neighbourhood shapes the representations of risk attributed to fever. In a high-risk environment, the need for medical advice is more important. Seeking modern care as a first resort is more frequent, even among mothers/guardians whose individual characteristics would predict using self-medication. This result shows an accurate perception of the risks and utility of modern health care, regardless of household economic status and education level. Third, poor people living in affluent neighbourhoods visit medical facilities more frequently even though they opt for self-medication in any other circumstance.

Like in many West African cities, self-medication is a widespread practice in Dakar, particularly among the city’s poorest people (Gobbers et al. 2002). This corresponds to different rationales between rich and poor people. Typically, we can describe the following behaviours: 1) Rich people, who are culturally, economically and geographically close to modern medicine, adopt a rational attitude consistent with their knowledge about health. If the child’s caregiver thinks that the fever is not critical and if he/she can easily visit a health provider as a second resort in case symptoms get worse, then self-medication is opted for as first alternative using drugs bought in the pharmacy; it saves on the cost of consultation. 2) The poor, who are less close culturally and economically to modern medicine, also adopt a rational attitude. Self-medication is the most preferred option as it is less expensive, and all the more so since neighbourhood influences make this practice acceptable and socially familiar. Other neighbourhood characteristics also increase poor people’s use of health services. Visits to health facilities increase when health care supply is closer, more available and of higher quality, like in rich neighbourhoods. Similarly, the cost of using health facilities is no longer a major barrier when people believe there is a high environmental risk. When the neighbourhood is an area that provides resources, it can help lift financial barriers and lessen unequal access.

Supplementary Data

Supplementary data are available at HEAPOL online.

Funding

This project was funded by the national agency of research of the French government (ANR 07-SEST-001). GKK received financial support from IRD. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Conflict of interest statement: None declared

Endnotes

1 The purpose was to increase the availability of free primary health care.
2 The aim was to strengthen the availability of high-quality health care through a community financial contribution while securing access for the most impoverished populations.
3 They have focused on the commitment of governments and partners in the fight against poverty, reduction of infant mortality and malaria control.
4 It is clear that when WHO experts (2000 Report) suggested an analysis of the health system, they identified four main functions including...
providing services, creating resources, financing and general administration. They did not analyse the demand.

3 The same is true for rural areas where cultural and geographical (in terms of time) distances have decreased significantly.

4 In less than a generation, Dakar’s population has increased from 500,000 to 217,000 inhabitants (2002).

5 Using the number of persons who could be turned to in case of need (advice, money, childcare) and vice versa.

6 From answers suggesting how to treat malaria (fumigating, consulting the traditional healer; using a cool wrap; praying).

7 The percentage of variance that is ascribed to a ‘neighbourhood effect’ is calculated using the following formula: \[ \frac{0.008}{0.029} = 0.029 \]


References


Drane PM, Machault V, Diallo A et al. 2012. IgG responses to the gSG6-P1 salivary peptide for evaluating human exposure to Anopheles bites in urban areas of Dakar region, Senegal. Malaria Journal 11: 72.


Ndonky A, Lalou R... en cours. Y a-t-il un effet de contexte spatial sur le recours aux services de santé en cas de fièvre à Dakar?.


