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Health Seeking Behavior after Fever Onset in a Malaria-Endemic Area of Malawi

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Abstract. Informal sources of care may lead to ineffective use of antimalarial drugs. A survey conducted in Malawi estimated the frequency of use of informal and formal services, medications, and household costs. A total of 508 household interviews were conducted. Treatment with an antimalarial was reported in 24% of young children accessing the informal sector and in 91% accessing formal services. Informal care was associated with shorter travel and waiting times, a lower proportion of carers or feverish adults missing work or studies and losing earnings, and a lower proportion of older children missing studies or work. Total out of pocket costs of fever episodes constitutes between 9% and 14% in young children and 18% in adults of their total available resources. Patients may perceive informal services to be associated with opportunity cost advantages; however, these may be associated with health risks of inadequate prescribing, particularly in young children.

INTRODUCTION

In countries where malaria is endemic, failure or delay in seeking treatment of common symptoms such as fever or headache from providers of effective case management may have fatal consequences, particularly in young children. Although there is convincing evidence that use of ineffective antimalarial drug therapy may be responsible for increasing mortality trends in sub-Saharan Africa, arguably an equally important contributor to the problem is the observed practice of self-medication and increased reliance on informal sources of care.

Older patients frequently turn to shops or chemists for their treatment of a fever or headache.[1] Because of weak regulation, drug treatment obtained from shops or chemist may be inappropriate or inadequate because of the poor quality of the compound or an incorrect dose or treatment schedule.[2] Moreover, antimalarial drugs that are reserved for the most severe forms of the disease often find their way to informal vendors and are, therefore, susceptible to misuse by patients using those sources for their care.[1,3,4] This common misuse is likely to result in unnecessary pressure for the selection of resistance to rescue drugs.[5] This may be particularly problematic when national control programs change recommended malaria treatments.

Previous studies have looked at the factors affecting the decision by symptomatic patients in malarious areas to use certain sources of treatment. In areas where use of public formal care is associated with out-of-pocket costs, studies have shown that private care, defined as fee paying non-governmental health care facilities, is seen as costly but the most effective option, whereas a delay in seeking public formal care is common, because of the out-of-pocket costs of seeking health care.[6,7] Documented strategies adopted by fever sufferers to reduce the cost impact of treatment seeking include self-treatment within the day of fever onset or watchful waiting in the hope of spontaneous resolution of symptoms.[1,6–9]

In Malawi, consultation and medication in public health facilities are free. Despite this, patients still incur out-of-pocket costs for transportation to public health facilities or have to pay for treatment bought from shops and informal vendors. A knowledge and practice national survey has documented that informal sources are commonly used,[10] but it did not seek to identify treatment sequences.

This study investigates the impact of fever and consequent treatment seeking from informal and formal sources of health care in urban and rural areas of the Zomba district, Malawi. It describes the sequence of treatments that patients follow after symptom onset, thus providing a snapshot of treatment pathways during a febrile episode.

MATERIALS AND METHODS

A target of 500 households in the district of Zomba was visited during February 2004 and invited to participate in a survey of health seeking practices prompted by fever. The survey took place during the rainy season (November to March) to coincide with peak malaria transmission. The sample was selected using an Expanded Program of Immunization (EPI) cluster sampling technique, following methods similar to those used in previous studies of health seeking behavior.[10] Participating households were selected in clusters of 16 in two stages. In the first step, traditional authorities (TAs) were randomly selected among all such units in Zomba. A TA is an area representing a group of several villages that report to one higher chief. In Malawi, all the enumeration areas are marked according to TAs for all purposes of household enumeration or census, whether at the district, regional, or national level. In the second step a spinning wheel was used to indicate the direction in which, starting from the centre of the village households were enumerated up to the village boundary to determine the set of units to sample from. The first household was selected at random by shuffling an opaque bag of different numbers, one for each enumerated household, and selecting a number from the bag, blindfolded. Subsequent households were those nearest to the household in turn. This process continued until 16 households had been visited by between two and four interviewers in the TA. This method is commonly used, despite its potential limitations in obtaining representative samples,[11] by researchers in situations such as that presented here, where household enumeration maps were not available to the investigators for random sampling.

The data collection was conducted by a team of one social science researcher and four data collectors, all of whom

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were Malawians. None were health professionals. Before data collection, the team went through a 3-week preparatory training that involved collecting background data using qualitative research methods, translation of the questionnaire from English to Chichewa (the predominant local language), and pilot testing the questionnaire in one village.

The head of household was the primary interviewee; other members of the household willing and able to participate in the survey were also invited to do so. Individuals who consented were asked questions related to demographic and socio-economic characteristics, including household size, assets and monthly expenditure, sex, age and level of education, and the occurrence of fever in household members in the 2-week period immediately preceding the interview. For those with a reported episode of fever, information on the duration of the episode, treatment-related actions after the onset of symptoms, type of care and medications (prompted by visual aids of locally available drugs) used, and time and monetary costs of care received was sought.

The analysis estimates the magnitude of impact (i.e., risk of fever experience in the past 2 weeks, fever duration, and time off work and out-of-pocket-costs of treatment) of fever on individuals categorized by type of care first sought. Treatment sources were classified into one of three categories: formal health care facility (hospital inpatient, hospital outpatient, health center, dispensary, and private clinic), informal drug use (drug self-medication, pharmacy/chemist, shop), and traditional medicine (traditional self-medication, traditional healer). In the analysis of out-of-pocket costs, the minority of cases whose initial source was formal private (i.e., private clinic) were omitted, because combining them with free health care services may cause ambiguity in interpreting cost estimates, from a measure of outcome, as intended here, to a measure of valuation of perceived quality (e.g., willingness to pay) in the eyes of initially private service users. Capturing private service use as a first instance in a separate group would be ideal but would require a much larger study than this. The cost of later switching to private service is included, however, as a valid measure of impact, because it may more naturally be interpreted as reflecting dissatisfaction with the outcome of initial treatment and the need to incur excess costs.

Means, SEs, and confidence intervals (CIs) were adjusted for the characteristics of the survey design: sampling probabilities, stratification (peri-urban), and clustering (by household unit). Tests of difference in proportions were based on cumulative normal (probit) regression analysis adjusting for individual and household characteristics including age, sex, education, household size, monthly per capita expenditure (i.e., the ratio of household expenditure to household size) and assets, and two-step self-selection terms for the type of source used as proposed by Heckman (Appendix 1).[12] Tests of difference in monetary costs of health seeking actions were based on censored quantile (median) regression analysis following Portnoy,[13] to account for censoring of the total cost and fever duration values of incomplete fever episodes at the time of interview. Tests of time costs of access to first source of health care sought were based on quantile regression analyses,[14] adjusting for the predetermined covariate set.

Data collection forms were standardized and double entered into SPSS databases in Malawi. The analysis was conducted using STATA 9 (Stata Corp., College Station, TX) and R. None of the questionnaires carried names of participants; instead, study numbers were used as personal identifiers. Data records were treated confidentially and only available to the staff directly concerned with this research. Ethical approval was obtained from the University of Malawi in Zomba and the Research Ethics Committee of the Liverpool School of Tropical Medicine.

RESULTS

A total of 508 households were approached to participate, of which 35 declined to participate (6%) and were replaced with their nearest neighbor, so that the same total was interviewed: 80 in peri-urban areas, 64 in urban areas, and 364 in rural settlements. Of a total of 368 children < 5 years of age from these households, 26.6% (95% CI: 21.4%, 31.8%) reported experiencing fever in the 2 weeks preceding interview day. In the 665 children 5–14 years of age, 11% (95% CI: 8.0%, 14%) reported experiencing fever in the same period; 12.7% (95% CI: 10.4, 15) of 1,310 adults (≥ 15 years of age) reported fever.

A description of participant households in the study by area of residence is presented in Table 1. Table 1 provides a contrasting picture of asset possession between urban and rural areas. The larger apparent differences correspond to housing quality (i.e., roofing and wall materials), utilities (i.e., electricity), and services (i.e., refrigeration, radio, and television), car ownership, and household expenditure, all of which point to more sophisticated living conditions in urban areas. As expected, more households own their land in rural areas (98.92%) than they do in urban areas (60.94%). Households in peri-urban areas generally approach the conditions prevailing in rural areas of Zomba, with the exception of possession of a radio (88.7%), household size (4.91), and agricultural land owner-

TABLE 1
Household characteristics by residence

	Rural (N = 364)	Urban (N = 64)	Peri-urban (N = 80)
Household size	4.45	5.20	4.91
Roofing (grass thatched or tin with no ceiling; %)	94.78	29.69	75.00
Walls (mud, unburned brick or other, non-burned brick; %)	67.03	6.25	26.25
No. cattle	0.03	0	0
No. chickens	3.34	3.55	3.04
No. pigs	0.02	0	0
No. goats	0.69	0.14	0.47
No. sheep	0.02	0	0
Agricultural land ownership (%)	98.92	60.94	68.75
Hectares of agricultural land owned*	1.20	1.20	1.14
Electricity at home (%)	0.00	93.75	23.75
Radio at home (%)	69.50	98.43	88.75
Television at home (%)	0.27	73.43	12.5
Refrigerator at home (%)	0.00	60.93	11.25
Bicycle (%)	51.92	53.12	46.25
Oxcart (%)	1.09	1.56	0.00
Car (%)	0.00	35.94	5.00
Monthly expenditure ($)†	19.47	286.73	57.51
Per capita monthly expenditure below poverty line (%)‡	87.00	41.18	49.21

Exchange rate $1 = Kwacha 108.8374; average for February 2004. Source: IMF.[14] Reflated to 2006 prices using CPI (annual averagel all items BLS).[15]
* Conditional on household owning land (rural: N = 360; urban: N = 39; peri-urban: N = 55).
† The number of households reporting monthly expenditure residing in rural areas was N = 340 (6.60% non-response rate), in urban areas was N = 63 (1.57% non-response), and in peri-urban was N = 77 (3.75% non-response).
‡ Profile of poverty in Malawi in 2006: for urban areas, MK113.39 (US$ 0.91); rural south MK32.90 (US$ 0.25).[16] Poverty lines reflated to 2006 using the Rural and Urban (all items) Consumer Price Index for Malawi, NSO.[17]

ship (68%), which approximate values in urban areas. Around 1 in 4 peri-urban households had walls that were made of mud, or a material other than burned brick, whereas that was the case in slightly > 1 in 20 urban and 2 of 3 rural households. The proportion of households living in poverty on the basis of per capita daily expenditure and poverty lines (i.e., the cost of acquiring a basket of basic goods in the market) accounting for the difference in cost of living between urban and rural areas in Malawi was in rural areas 87%, while that in peri-urban and urban areas of Zomba was 49% and 41%, respectively. The fact that urban areas have a four-fold advantage in mean monthly expenditure ($286.73 versus $57.51) and comparable household sizes (5.20 versus 4.91) to the peri-urban, points to a greater degree of consumption inequality in the former relative to the latter.

Mean reported out of pocket costs of fever episodes per household over the 2-week period of analysis also varied by location of residence: US$1.05 in urban areas and US$0.21 in rural areas (difference: US$0.83; 95% CI: −0.32, 1.99). Peri-urban areas had an estimated cost of US$0.36 (difference with rural: 0.15; 95% CI: −0.12, 0.41). In terms of the proportion of households whose costs amounted to 10% or more of their total expenditure over a fortnight, 3.2% of urban households, 7.8% of peri-urban households, and 7.5% of rural households reported significant costs.

The probability of reporting fever, seeking treatment, and antimalarial access by age is shown in Figure 1. In rural and peri-urban areas, the probability of reporting a fever continuously decreases with age during childhood but increases at ~30 years of age. In urban areas, there is a minimal gradient with age throughout childhood and generally fewer reports of fever, probably representing lower rates of transmission. An antimalarial access gap in children is apparent in the rural areas. In the peri-urban households, a similar gap, partly driven by treatment inaction, is observed but estimated imprecisely. The majority of adults with fever report using antimalarials in urban areas, whereas < 50% of them do so in rural settings (i.e., the height of the antimalarial use curve is ≥ 60% of the height of the fever curve in the urban areas compared with < 50% in the rural areas throughout the adult age range). At all ages, antimalarial use seems to be more frequent in urban areas, despite the generally lower incidence of fever than in rural areas. This is only a tentative suggestion of possible gaps in access to antimalarial treatment, which clearly require larger epidemiologic studies to test for differences in consumption between areas while controlling for possible environmental and social confounders.

An estimated 70% (95% CI: 53, 93) of children < 5 years of age reported sleeping under a bednet the previous night; the figures for older children and adults were 54% (95% CI: 41, 71) and 64% (95% CI: 53, 78), respectively. Higher household expenditure per capita was found to be associated with an increased probability of reporting having slept under a bednet, after controlling for education (maternal for children and own education for adults) and sex. Further analysis showed that the effect was driven by differences between the highest quintile per capita expenditure group and the rest in all three age groups.

Health seeking patterns, treatment given, and fever duration. The frequency of use of formal services as a first treatment option varied inversely with age, with young children reporting more frequent initial treatment seeking from such sources than older children and adults (36% versus 30% and 24%; Figure 2). This corresponded with a direct relationship between use of informal services and age.

The drug treatment used first varied depending on the initial source sought. Sulphadoxine-pyrimethamine, the first-line therapy at the time of the study, was given more frequently in the formal sector than in the informal one independently of age group. Quinine, the second-line therapy, was the reported

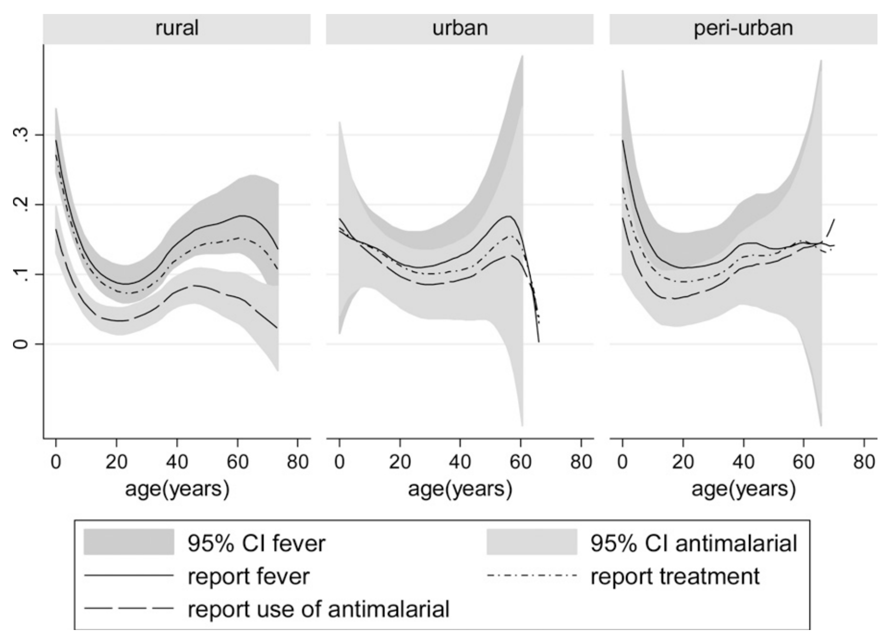

FIGURE 1. Two-week probability of fever, treatment seeking, and antimalarial access across areas in Zomba in 2004. Non-parametric analysis with local polynomial (of second degree) regression: rural and < 5 years of age, N = 285; rural and age 5–14 years, N = 478; rural and ≥ 15 years of age, N = 854; urban and < 5 years of age, N = 24; urban and age 5–14 years, N = 85; urban and ≥ 15 years of age, N = 224; peri-urban and < 5 years of age, N = 59; peri-urban and ages 5–14, N = 103; peri-urban and ≥ 15 years of age, N = 232.

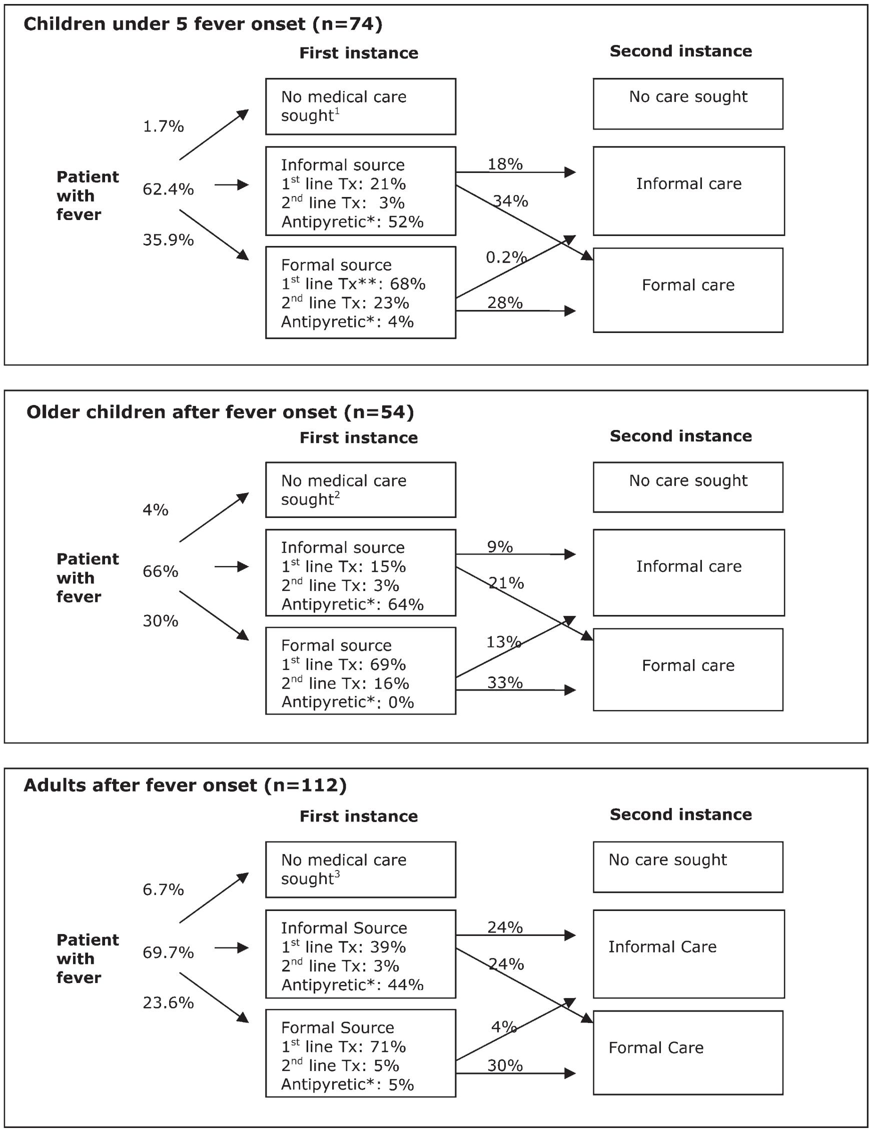

FIGURE 2. Sequences of treatment sources sought by age group (cases without fever on day of survey): 1, traditional medicine was used by 1.6% (0.1% did not seek treatment); 2, traditional medicine was used by 2% (2% did not seek treatment); 3, traditional medicine was used by 3.4% (3.4% did not seek treatment). *Exclusive prescription/acquisition of antipyretics/analgesics. **Includes 4.5% reporting use of SP + chloroquine.

treatment of 16–23% of children on their first visit to a formal facility. Antimalarial therapy, whether first- or second-line therapy, was much more commonly used in the formal sector in children < 5 years of age: 91% versus 24%. Use of chloroquine was not reported. In this age group, reported treatment with antipyretics or analgesics alone was 4% and 52% in the formal and informal sector, respectively. These numbers are based on cases whose fever had resolved by the time the interview was conducted; the only occurrence of chloroquine use alone was reported in an older child who had fever on the day of interview (Table 2).

Switching from informal to formal services (34%) was most frequent in children < 5 years of age, whereas older children and adults reported such behavior in 21% and 24% of cases, respectively. Switching in the opposite direction, from formal to informal sources, was mostly an occurrence in older children (13%; Figure 2).

Overall fever duration by source: formal versus informal sector. Young children that attended the formal sector reported a mean duration of fever of 6 days (median, 6; N = 30; censored: 5), whereas informal sector users reported 4.8 days with fever (median, 3; N = 59; censored: 12); the estimated adjusted median difference between formal versus informal sources was 1.3 days (95% CI: –0.89, 3.55). Fever duration in older children using formal sources was 5.8 days (median, 5; N = 19; censored: 2), whereas for informal sector users, it was 4.7 days (median, 4; N = 43; censored: 8); the adjusted median difference was 0.7 days (95% CI: –2.25, 3.58). Adults seeking formal services reported a mean duration of fever of 6.4 days (median, 7; N = 32; censored: 6), whereas those visiting the informal sector reported a mean duration of 5 days (median, 4; N = 104; censored: 26); this corresponded to an adjusted median difference in the reported duration of fever of 1.8 days (95% CI: –0.63, 4.14).

Out-of-pocket and productivity costs by source: formal versus informal sector. Excluding observations whose first source was a private formal clinic (8% in children < 5 years of age and adults and 4.5% in older children), overall 27%

TABLE 2
Fever prevalence and frequencies of health seeking behavior actions (%, unless otherwise stated)

	Children < 5 years (N = 368)	Older children (5–14 years) (N = 665)	Adults (N = 1,310)	All ages (N = 2,343)
Slept under a bednet previous night	41 (N = 158)	35 (N = 251)	39 (N = 541)	38.5 (N = 950)
Fever in last 14 days	26.6 (N = 100)	11.0 (N = 70)	12.7 (N = 167)	14.4 (N = 337)
Fever on day of survey	6.0 (N = 21)	1.8 (N = 13)	3.9 (N = 48)	3.6 (N = 82)
Number of days with fever (mean)	5.1	5.0	5.2	5.1
Sought treatment	96.1 (N = 90)	97.9 (N = 65)	88.0 (N = 142)	92.2 (N = 297)
Accessed antimalarial*	63.3 (N = 59)	52.6 (N = 35)	59.2 (N = 91)	58.9 (N = 185)
Number of antimalarial treatments for those with access (mean)	1.1	1.3	1.1	1.2
Accessed antimalarial (without fever on day of survey)†	69.0 (N = 52)	54.8 (N = 30)	67.2 (N = 77)	64.5 (N = 159)
Any visit to formal health sector†	56.6	40.7	39.4	44.9
Any visit to formal health sector (without fever on day of survey)†	60.6	42.0	42.1	47.8
First visit was to informal sector†	64.5 (N = 59)	67.7 (N = 43)	73.9 (N = 105)	69.6 (N = 207)
First visit was to informal sector (without fever on day of survey)†	62.4 (N = 47)	65.9 (N = 35)	72.1 (N = 79)	67.6 (N = 161)
First visit was to formal health sector†	34.2 (N = 30)	27.2 (N = 19)	22.6 (N = 32)	27.2 (N = 81)
First visit was to formal health sector (without fever on day of survey)†	36.0 (N = 25)	30.1 (N = 17)	24.4 (N = 26)	29.4 (N = 68)
Drugs prescribed on first visit to informal service seekers‡				
SP	21.2	15.2	38.7	27.9
Quinine	2.6	3.0	3.2	3.0
SP + chloroquine	0	0	0	0
Antipyretics/analgesics only	52.5	63.6	43.7	51.1
Drugs prescribed on first visit to formal service seekers§				
SP	63.8	69.1	71.3	67.8
Quinine	22.6	15.6	4.9	14.3
SP + cloroquine	4.5	0	0	1.8
Antipyretics/analgesics only	4.5	0	4.9	3.6

Figures reflect adjustment for sampling design of survey (probability of sampling, stratification, and clustering).
* Either SP or quinine.
† As a proportion of those who sought treatment.
‡ Informal service seekers are those that sought treatment from an informal health care facility as their first source of treatment. Drug treatment frequencies exclude those with fever on day of survey.
§ Formal service seekers are those that sought treatment from a formal health care facility as first source of treatment. Drug treatment frequencies exclude those with fever on day of survey. One older child with fever on day of survey reported purchase of chloroquine only.

of formal service users in the youngest group (N = 23) paid out-of-pocket costs for services received as a result of fever; the expense was either related to travel (16%) or medication (11%) costs (Table 3). The two cases reporting a payment for medication at initial or subsequent visits in the formal sector (mean US$1.15) corresponded to those subsequently switching to private services (mean US$0.15 for informal service users implicit in Table 3). Formal public services resulted in higher (lower) overall mean (median) total costs (mean difference, US$0.13; median difference, US$0.07; adjusted P = 0.40) than those of informal services; the opposite was the case when total costs were measured as a proportion of per capita household fortnightly expenditure (i.e., half monthly per capita expenditure): 9% versus 14% (median, –4.36%; P = 0.50), respectively; these differences were indistinct from zero, however, at conventional levels of statistical significance. Two cases were reported to have prompted the sale of assets; these occurred in the group of informal seekers. Three cases (6.1%) initially seeking informal sector services reported having borrowed money to pay for treatment as opposed to one case (3.8%) in the formal sector group (P = 0.22).

In comparison, the estimated overall mean out-of-pocket costs for the health seeking of older children was around US$0.43 among both the informal and formal service users' groups. Mean overall medication costs were also similar (US$0.27–0.29); formal service users reported paying for medications in 38% of cases, as opposed to 90% of informal service seekers (Table 2). The small size of the formal group (N = 15) may have rendered its mean cost estimates, in particular the overall mean total costs as a proportion of per capita expenditure (mean, 25%; median, 0), unreliable. Informal service seekers reporting no payment were all self-medication cases, whereas payers among formal service seekers (N = 5) were the result of switching to private formal service use. Costs were met by borrowing money in 18% (three cases) of the formal sector seekers' group versus 5% (two cases) of those seeking informal sources on a first instance. No individuals reported selling assets.

In adults, an observed overall mean difference in out-of-pocket costs of informal and formal (public) service users, $0.73 versus 0.54 (medians, 0.15 versus 0; P = 0.46), respectively, was driven by reported travel costs (Table 3). As a proportion of household per capita expenditure, both amounts were practically the same (18%; median, 15% versus 0%; P = 0.20). Only 27% of public formal service users reported paying for seeking or receiving health care, whereas 96% of informal service users reported payment. Two cases were reported to have led to asset disposal to meet the cost of treatment, one in each of the formal and informal care seekers' groups. The frequency of cases borrowing money was 3.8% (one case) in the formal care seekers' group versus 3.6% (four cases) in those seeking informal care initially.

For those that took children < 5 years of age to formal providers, their travel time took longer than those that used informal sources (Table 4). The adjusted median additional time (data not shown) was estimated to be 17 minutes (95% CI: 9, 25) for travel time and 59 minutes (95% CI: 58, 60) for time spent at the clinic. Carers of feverish young children were reported to be as likely to miss work or studies and to lose earnings in formal care as in informal care (P = 0.60; Table 5). The same pattern appears for older children, with informal services associated with shorter reported travel and waiting durations (Table 4). In terms of productivity costs, the only apparent difference was in the frequency with which older children missed work or studies, with formal care appearing

Table 3

Out-of-pocket costs of informal and formal service users prompted by an episode of fever (in 2006 US$)*

Costs	< 5 years of age (N = 82)†			5–14 years of age (N = 59)‡			Adults (≥ 15 years of age) (N = 126)§		
	Formal (N = 23)	Informal (N = 59)	P	Formal (N = 16)	Informal (N = 43)	P	Formal (N = 26)	Informal (N = 100)	P
Patients paying (%)									
Travel	16.1	8.3	0.01	15.2	5.0	0.01	4.5	11.9	0.53
Consultation	0	2.1		0	2.5		4.5	2.3	0.32
Medication	10.4	95.7	0.05	38.4	90.0	0.1	27.5	96.1	0.01
Any costs	26.6	95.7	0.1	46.0	90.0	0.7	27.5	96.1	0.01
Overall mean (non-zero median) amount paid by patients ($)									
Travel	0.26	0.10	NA	0.15	0.11	NA	0.04	0.19	NA
Consultation	0	0.01	NA	0	0.04	NA	0.02	0.02	NA
Medication	0.12	0.14 (0.06)	0.3	0.29	0.27 (0.10)	0.71	0.48	0.53 (0.14)	0.34
Total	0.38	0.25 (0.07)	0.4	0.43	0.42 (0.10)	0.82	0.54	0.73 (0.15)	0.46
Total percent per capita expenditure‖	8.7	13.7 (4.36)	0.5	24.6	10.5 (3.63)	0.98	18.3	17.5 (6.22)	0.20

Includes cases with (censored) and without fever on day of interview and only those with complete cost data.

Tests of difference in costs were based on *t* distribution of estimated coefficient and SE for group indicator in censored median regression analysis that adjusted for covariates age, sex, bednet use the previous night, having a radio, total number of persons in the house, maternal/head completed primary education or above, and residence (peri-urban, urban), following the methods of Portnoy.[12] Tests of differences in proportions were based on probit regression analysis adjusting for the same set of covariates as for costs.

* Exchange rate: $1 = Malawian Kwacha 108.8374 in average for February 2004; source: IMF.[14] Reflated to 2006 prices using CPI (annual average all items BLS).[15]

† Excludes six cases that used formal, private health services in the first instance. One case did not provide information on any of these variables in the formal group.

‡ Excludes three cases that used formal, private health services in the first instance.

§ Excludes six cases that used formal, private health services in the first instance. An additional five cases (informal group) had missing values on medication costs.

‖ As percent of per capita household expenditure. Monthly household expenditure divided by household size was further divided by 30.5 (days) and multiplied by 14 to make them comparable to out of pocket costs, which referred to a 2-week observation period. Because of missing data in per capita monthly expenditure, the number of observations available for analysis was as follows for formal and informal, respectively: < 5 years of age, N = 23 and 59; 5–14 years of age, N = 15 and 38; adults, N = 26 and 89.

NA = not applicable.

to have a wider impact on these activities than that associated with informal care ($P = 0.006$; Table 5). The respective median number of days older children from both groups spent off work or studies was 4 and 2 days ($P = 0.56$).

Adults had longer travel times and amounts of time spent waiting for and receiving care at the formal clinic than in the informal sector (Table 4). The (adjusted) median additional time spent with the former relative to the latter was 19 (95% CI: 14, 24) and 58 minutes (95% CI: 57, 59), respectively. Higher frequencies of patient and carer productive time and earnings losses were reported with formal care than with informal care (after adjusting for observed confounding and sample selection; $P < 0.05$; Table 5). Formal service seekers reported a median additional half a day off work or studies over the 2.60 days of the comparator group that does not seem significant ($P = 0.64$).

DISCUSSION

This study was conducted in the district of Zomba, Malawi, in 2004. Since then, the major change in malaria treatment in this area has been the introduction, in 2008, of co-artem to replace sulphadoxine-pirimethamine (SP) as the first-line malaria treatment supported by the Ministry of Health. This change in policy is only just being rolled out, and artemisinin combination therapy is not officially available outside the formal health sector, although it is emerging as such. It is too early to say what effect the change of first-line drug has had on treatment seeking behavior, although there has been considerable adverse publicity about side effects with co-artem. There have been intensive bednet campaigns over the last 2–3 years, but the proportion of 5 year olds sleeping under nets is still between 15% and 30%.[19] Although data for children are unavailable, sentinel reports have documented and increase of reported malaria cases for all ages by 28% in 2005 and 2006.[20] There are very limited data on the proportion of fevers caused by malaria in Zomba or indeed in Southern Malawi and no data on the difference between rural and urban settings in Zomba. Households from all three residential groupings were at similar altitude, which is one of the major determinants of the proportion of fevers caused by malaria in relatively close geographic areas.

Table 4

Time spent seeking care (first visit)

	Formal	Informal	P*
Children < 5 years of age	(N = 30)	(N = 59)	
Travel time (minutes)	30	15	0.0001
Time waiting in clinic (minutes)	30	1	0.0001
Individuals 5–14 years of age	(N = 19)	(N = 43)	P†
Travel time (minutes)	30	10	0.0001
Time waiting in clinic (minutes)	120	1	0.0001
Adults (> 14 years of age)	(N = 32)	(N = 104)‡	P†
Travel time (minutes)	30	10	0.0001
Time waiting in clinic (minutes)	60	1	0.0001

Analysis adjusts for sampling design of survey.

*Test of differences based on quantile regression analysis controlling for age, sex, occupation, having a bike, having car, and residence (peri-urban, urban, or rural).

†Test of differences is based on quantile regression analysis controlling for age, sex, occupation, having a bike, having car, and residence (peri-urban, urban, or rural).

‡ One case had missing values for both variables in the informal group.

The study found that approximately one in four children < 5 years of age in Zomba had fever at sometime over a 2-week period in summer, whereas fever occurred in approximately one in nine older children and adults. These figures are consistent with those used by government health planning and monitoring agencies.[17] In children < 5 years of age, the proportion experiencing fever was 27.4% and 30% in rural and peri-urban areas and 16.7% in urban areas. The lower urban frequency in children probably reflects reduced urban malaria transmission: the lack of variation in adults could reflect either the effect of acquired immunity to malaria or the fact that a lower proportion of fevers are likely to have been caused by malaria, particularly in areas with high HIV prevalence.

Analysis of the health seeking patterns confirmed the extensive use of the informal sector by all age groups, although the younger the child, the more likely it was that formal care was

TABLE 5
Total reported productivity costs of fever to carers, older children, and adults

	Formal	Informal	P*
Children < 5 years of age	(N = 59)	(N = 30)	
Carer missed work† or studies (%)	53.4	50.5	0.70
Overall work/study days missed (median)	2.67	2.52	NA
Carer lost earnings (%)	3.8	14.1	0.60
Overall earnings ($) losses (median)	0.37	0.55	NA
Children 5–14 years of age	(N = 19)	(N = 42)‡	
Child missed work or studies (%)†	81.4	63.9	0.01
Overall work/study days missed (median)	4.07	1.92	0.56
Carer missed work§ or studies (%)	49.8	43.4	0.34
Overall work/study days missed by carer(median)	2.49	1.30	NA
Carer lost earnings (%)	30.9	15.7	0.34
Overall earnings ($) losses (median)	1.51	0.38	NA
Adults (≥ 15 years of age)	(N = 32)	(N = 104)‡	
Missed work or studies (%)	78.8	65.3	0.00
Overall work/study days missed (median)	3.15	2.61	0.64
Lost earnings (%)¶	29.0	22.4	0.00
Overall earnings ($) losses (median)	0.57	0.77	NA
Carer missed work or studies (%)**	34.2	27.1	0.01
Overall work/study days missed by carer(median)	1.03	1.08	NA
Carer lost earnings (%)††	15.8	3.5	0.02
Overall earnings ($) losses by carer (median)	0.46	0.03	NA

Note "work" refers to paid or unpaid work.
* Proportions: F test based on adjusted probit regression with covariates in age, sex, household size, household income (four cases dropped from analysis because of missing data in household income), and a selection-into-care-mode term.[12] Work study days missed by adults and older children is based on censored quantile regression following Portnoy,[13] adjusting for the same set of covariates as for proportions except for selection terms.
† The analysis was limited to 89 patients who reported having sought informal or formal care; because 5 of these had missing data on household monthly expenditure, the sample size for testing differences was 84.
‡ One case did not provide information on any of these variables in the informal group.
§ Of the available cases (N = 61), some had missing information on household expenditure and were therefore excluded from sample on which tests were conducted (N = 55). The variable of lost earnings of carer had one additional case with missing information (N = 54).
¶ Two and 10 cases were not asked this question (because they were between 14 and 16 years of age and originally classified as children) in the formal and informal groups, respectively (estimating sample, N = 124). A further eight individuals had missing data on household expenditure and were thus omitted from the statistical analysis of differences.
** The statistical analysis of differences was based on N = 125 individuals because 11 cases had missing data on household expenditure.
†† One individual had missing data on this variable.
NA = median testing not performed because medians were both zero.

sought initially; although only 30% of children 5–14 years of age turned to such care, 36% of younger children did. Formal care, at any instance, was used by 59% of young children compared with 36% and 40% in older children and adults, respectively. About two of three adults seek care initially from the informal sector and ~25% subsequently sought further care from the formal sector. One in 15 feverish individuals seeks care from a traditional source or none at all. These results are similar to a previous study[18] that showed 53% of children < 10 years of age in Malawi were taken to a clinic, doctor, or hospital for their fever.

This study showed that switching from informal to formal care services was relatively common and varied by age from 1 in 10 cases in older children to 1 in 4 cases in adults to 1 in 3 cases in young children, an observation consistent with previous evidence from rural Kenya. Nyamongo[6] showed that 77% of 35 adults switched from self-treatment to formal health care, and Geissler and others[19] found that 72% of common illnesses in 53 children 11–17 years of age were not reported to an adult carer but were treated autonomously in 19% of cases. Our findings highlight the importance of distinguishing between age groups in evaluating health seeking behavior and public health programs for common illnesses such as fever.

It is estimated that SP consumption in children < 5 years of age accounts for only 14% of the total drug use in Zomba. This is lower than the 20% reported by Guyatt and Snow[20] for an area of seasonal malaria transmission of Kenya (estimated fever prevalence of 9%). Treatment access by feverish individuals in that study (75% in those < 5 years of age versus 81% in older children and 67% in adults) was also higher than that observed in our study (69%, 63%, and 66%, respectively). A difference in access was also observed between the rural and urban settings. As also pointed out by the authors of the Kenyan study, because younger children are at greater risk from malaria, these data suggest an inequitable access to malaria treatment of the youngest members of the population. It is also of concern that feverish children < 5 years of age in our study were reportedly treated with antipyretics alone in 52% of cases in the informal sector compared with 4% in the formal one. This has implications for policies that seek to make antimalarial treatment with artemisinin combination therapy available through formal and market networks.[21] Efforts directed at educating informal vendors in sound prescribing practice such as in Marsh and others[22] are crucial but may also need to be coupled with strong regulation.

This study also complements studies that estimated the impact of childhood and adult fevers on household resources.[23–27] We examined the economic impact of fevers for either the affected individual or the carer according to use of the informal or formal sector. In older children, the informal sector is estimated to result in shorter reported durations of fever than treatment in the formal sector (a difference of 2.3 days; 95% CI: –0.63, 5.37), whereas no apparent difference was noted in children < 5 years of age or adults. These estimates of mean fever difference were adjusted for the possibility that patients chose formal services for more severe illnesses. Indeed, the far greater use of quinine, the second-line therapy, in children on an initial visit to formal services (16–23% versus 3%), suggests that children initially attending formal services may have more severe fevers than children attending informal services first.

The tendency by the more severe cases to seek treatment at formal sector facilities may be caused in part by earlier actions by those who seek treatment at informal sources. This would be consistent with the documented relative proximity of informal vendors in Zomba, as measured by the shorter travel time to provider, and waiting times at the facility in older children and adults. Individuals weigh this against the additional out of pocket medication costs associated with informal sources, because public formal services are free in Zomba. Although few individuals who sought formal services subsequently used a private clinic or turned to informal vendors and had to pay for medications during their fever spell, the effects of the costs for the small proportion that did (4.5% in adults and 6% and 8% in older [5–14 years of age] and young children) meant that medication costs overall did not differ between informal and formal seekers in any age group. Indeed, travel costs may constitute the greater burden in children < 5 years of age seeking formal care. It is estimated that the total out-of-pocket costs of fever to affected individuals constitutes between 9% and 14% in young children and 18% in adults of their total available resources for consumption (i.e., household per capita expenditure).

Urban–rural socio-economic disparities were mirrored by the magnitude of reported out-of-pocket costs to households. Nevertheless, households in rural and peri-urban areas were twice as likely to forego a substantial share of income as urban households were. Thus, our results suggest variation in frequency of occurrence and economic impact of fevers from urban to rural/peri-urban areas within the same district. Further research on this factor, involving larger numbers of individuals within groups defined by age and urbanity of dwelling, is warranted.

In addition to direct financial costs, the type of provider also had a potential effect on the education of school age children, because informal care was estimated to result in a lower proportion of children missing school caused by fever. The risk of missing work and losing earnings by both sufferers and their carers was lower in adults treated informally relative to treatment in the formal sector ($P < 0.05$). However, in young children, informal care did not seem to make any difference in terms of productivity costs to carers. Although these figures include controls for sample selection bias, they must be considered with caution because of the intrinsically arbitrary nature of any such controls and the small sample.

In conclusion, our results suggest that, in Zomba, informal sources (self-medication, shops, or pharmacy) of health care are a common convenient first choice to treat fever, with reduced initial opportunity costs, whereas formal services are more often sought by the more severe feverish cases or the most vulnerable (i.e., the very young). Informal sources seem to benefit adult patients, carers, and school age children in reducing time off work or studies because of illness; adult patients and their carers are also less likely to lose earnings as a consequence of fever. However, switching of health care providers occurs relatively frequently among young children and adults and is highest among those seeking informal sources in the first instance. There is evidence of inequitable access to treatment of children < 5 years of age, particularly in rural areas, with concerns about inappropriate prescribing for this group in the informal sector that once again emphasize the importance of engagement with the informal sector to improve the management of malaria in this setting.

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APPENDIX 1

In this case, it was assumed that, for an individual to have reported a dichotomous outcome (e.g., missed work or studies), the person had to "overcome" three hurdles, each of which was represented by a normal distribution (probit): 1) conditional on having fever, the individual could have an observed or unobserved first response; 2) conditional on having an observed first response, this could be either to seek care or not to seek care outside of the home; 3) conditional on seeking care out of home, the individual would choose between informal and formal care. Thus, a seemingly unrelated probit regression model of three equations using the GHK simulator[28] was used to estimate the three 'inverse mill ratios' used to adjust for sample selection using the two-step Heckman approach.