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Household and socioeconomic factors associated with childhood febrile illnesses and treatment seeking behaviour in an area of epidemic malaria in rural Ethiopia

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Summary To assess household and socioeconomic factors associated with childhood febrile illnesses and treatment seeking behaviour, a study was conducted in Adami Tulu district in Ethiopia during the peak malaria transmission season in 2003. All mothers/caretakers of children <5 years of age were interviewed regarding their household characteristics, history of febrile illness (malaria) among children and actions taken 2 weeks prior to the survey. Of 3873 children, 21% had experienced fever in the past 2 weeks. Household ownership of a mosquito net (odds ratio (OR) = 0.4, 95% CI 0.3—0.7) and prior spraying of the house with aerosols (OR = 0.7, 95% CI 0.5—0.9) or DDT (OR = 0.8, 95% CI 0.6—0.9) were associated with lower risk of febrile illnesses, whilst sharing the house with livestock increased the risk (OR = 1.3, 95% CI 1.1—1.6). Treatment was sought for 87% of febrile children, with public facilities, private clinics and community health workers accessed fairly equally (26—27%). Home management was uncommon (6.4%). More febrile children from households in the middle (37.1%) and highest (44.6%) wealth categories sought treatment within 24 h compared with the lowest category (18.3%). Widescale use of vector control measures such as mosquito nets and insecticide spraying of houses can effectively reduce the incidence of febrile illnesses among children.

1. Introduction

Ethiopia has one of the poorest overall health indicators in the world. It has one of the highest under-five mortality rates (140/1000 live births) even among countries in sub-Saharan Africa, although this figure has shown a

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modest decline over the past decade (Ministry of Health, 2004/2005). Acute febrile illnesses are the leading causes of morbidity and mortality among children under-five in the country (Central Statistical Authority (Ethiopia) and ORC Macro, 2001, 2006), of which malaria is the primary cause of illness and death particularly in malaria-endemic areas. Malaria in Ethiopia is seasonal and epidemic type and is often cited as one of the main causes of hospital admissions (17.8%) and deaths (28%) among children (Ministry of Health, 2004/2005).

Housing conditions and environmental factors significantly contribute to the variations in malaria incidence. A study by Gamage-Mendis et al. (1991) found a strong association between malaria incidence and the type of housing construction in Sri Lanka. Several studies suggest that the risk of malaria is strongly associated with distance from mosquito breeding sites (Clarke et al., 2002; Ghebreyesus et al., 1999; Konradsen et al., 2003; Minakawa et al., 2002; Staedke et al., 2003; Thomas and Lindsay, 2000). In northern Ethiopia, household factors such as earth roof, sharing the house with livestock, presence of windows and open eaves were significantly associated with malaria incidence among children (Ghebreyesus et al., 2000).

In addition to variations in household and environmental factors for high child morbidity and mortality due to malaria, the variation in the impact of the disease on the health of children is also thought to be due to differences in the treatment seeking behaviour of households for their children (Baume et al., 2000; Müller et al., 2003; Thind and Cruz, 2003). Treatment seeking behaviour usually depends on access to health services, costs and quality of services, perceived severity of the illness and cultural beliefs about the cause and cure of illness (McCombie, 1996; Müller et al., 2003). Disparities in socioeconomic status are also the most important causes of variation in care seeking and significantly contribute to delays in seeking treatment for malaria (McCombie, 1996). In Kenya, decisions to seek health care for childhood illnesses were strongly associated with household expenditure (Taffa and Chepngeno, 2005). In rural Tanzania, treatment seeking behaviour for children was worse in poorer households than in relatively rich families (Schellenberg et al., 2003); children from wealthier families were more likely to visit a health facility when ill.

Multiple strategies have been endorsed by the Roll Back Malaria initiative to reduce child morbidity and mortality from malaria in Africa (WHO, 2000a). Utilisation of preventive interventions such as insecticide-treated nets (ITN) (Roll Back Malaria, 2002; WHO, 2000a, 2000b) as well as prompt treatment of fever with effective antimalarial drugs through the existing health delivery systems and alternative community-based interventions decrease the overall mortality rate in children (Kidane and Morrow, 2000; WHO, 2004, 2005). However, very little is known about household socioeconomic determinants that play a role in the incidence of febrile illnesses and the subsequent care-seeking behaviour among children under-five in a rural area of Ethiopia characterised by seasonal malaria transmission with frequent occurrence of epidemics. This paper describes the household and socioeconomic factors associated with childhood febrile illnesses, with fever considered a proxy for malaria, as well as factors influencing treatment seeking behaviour of families for febrile children.

2. Materials and methods

2.1. Study area and population

This community-based cross-sectional survey was conducted during the peak malaria transmission season (October—November) in 2003 in Adami Tulu district, south-central Ethiopia. The district is situated in part of the Great East African Rift Valley that crosses the country. The average altitude of the district ranges from 1500 m a.s.l. to 1600 m a.s.l. The capital of the district, Zeway, is located at a distance of 160 km southeast of Addis Ababa. The district had an estimated population of 145 000 in 2002, of which 18% were <5 years of age (Central Statistical Authority (CSA), 1998). The people mainly belong to the Oromo ethnic group and are predominantly Muslims. The main occupations are subsistence farming. Rainfall is inadequate and seasonal and lasts between the months of May and November, with the greatest intensity between June and August. The health facilities within the district included 2 health centres, 3 health stations, 2 health posts, 1 malaria control laboratory (MCL) and 13 private clinics. There were also 34 village-based community health workers (CHW) specifically trained for malaria, one mission clinic and more than 11 drug shops and rural drug vendors.

The district is characterised by seasonal malaria with a frequent occurrence of epidemics, often from September to December, following a heavy summer rainfall (Abose et al., 1998; Mengesha et al., 1998; Negash et al., 2005). *Plasmodium falciparum* and *P. vivax* are the two predominant parasites responsible for malaria in the district. During 2003, of 18 312 blood samples examined at Zeway MCL from self-reporting patients, 43% were positive for malaria (Zeway MCL, unpublished data, 2003). *Plasmodium falciparum* constituted 72.2% of the infections, with the remainder due to *P. vivax* (27%) and mixed infections (0.8%) of both species. The number of malaria cases reached a peak during October—November with the highest slide positivity rate (62%).

The district is also characterised by widespread occurrence of malarial drug resistance to chloroquine and sulfadoxine/pyrimethamine (SP) (Abose et al., 1998; Jima et al., 2005). Although SP was the first-line treatment for uncomplicated malaria at the time of the study (Ministry of Health, 1999), Ethiopia changed the antimalarial drug policy and adopted artemether/lumefantrine (Coartem®) as first-line treatment in 2004 (Ministry of Health, 2004). Most malaria transmission in the district is due to *Anopheles arabiensis*; *A. pharoensis* is considered as a secondary vector (Abose et al., 1998; Seyoum et al., 2002).

2.2. Selection of study subjects

The district is administratively organised into 62 rural kebeles and four towns. A kebele is the lowest administrative unit with a population of 1000—3000. A list of all rural kebeles, including the estimated number of households and population, was obtained. Based on geographical homogeneity, all kebeles in the district were classified into three strata with the assistance of the District Health Office (DHO) malaria control experts. Each stratum was assumed to include kebeles located in similar geographical areas and with a similar history of malaria. Six kebeles were randomly selected from each stratum, making a total of 18 kebeles in the study. All households with at least one child <5 years of age were included in the survey through house-to-house visits. A household was defined as a group of people including husband, wife, children or others living together sharing the same house.

2.3. Data collection

All mothers/caretakers with children under-five were interviewed using pre-tested structured questionnaires that were administered in Afan Oromo, the language of the study area. In the study area, malaria is locally called '*busa*'. Information on sociodemographic characteristics, housing conditions, household assets and malaria-related prevention measures were collected. History of febrile illness (malaria) over the last 2 weeks in all children under-five, the care the child received at each healthcare provider and any other treatments the child received at home were also recorded. For each child with febrile illness, details were documented on the sources of care and the time at which treatment was sought after symptom onset.

Exposure data on potential risk factors included child's age and sex, roofing material, presence of windows, whether the households used methods of prevention such as the use of aerosols or DDT against mosquitoes, presence of opening holes on walls that might allow mosquito entry, possession of a mosquito net, and whether the house was shared with animals. Ownership of a mosquito net was confirmed by direct observation. There was no history of using mosquito nets in the area. We did not set out to determine systematically known mosquito breeding sites in relation to the location of the households since most breeding sites were dried at the time of the survey. Eighteen local interviewers recruited from the selected kebeles and trained for 5 days collected the data using the local language. Data collection instruments were piloted in one of the kebeles not included in the survey. The first author and two health workers from the DHO supervised the data collection.

2.4. Data analysis

Data were entered directly into Epi Info software version 6.04d (CDC, Atlanta, GA, USA) and transferred to SPSS version 11 statistical software package (SPSS, Chicago, IL, USA) for analysis. Univariate and multivariate (adjusted) odds ratios with their corresponding 95% CI were calculated to assess the relationships of household socioeconomic factors with the incidence of malaria-related febrile illnesses and the subsequent timing of treatment seeking after illness onset using logistic regression techniques.

Early or prompt treatment seeking was defined as those febrile children who sought any form of treatment within 24 h of illness onset (WHO, 2004), whilst treatment seeking after 2 days (48 h) was considered as delay in seeking treatment. Ten independent predictors were included in the logistic regression model to assess their effect on the occurrence of febrile illnesses. Five predictors assumed to affect treatment seeking behaviour were included in the logistic regression model to identify factors associated with the timing of seeking treatment after illness onset. In addition, differences in proportions were compared for significance using χ^2 test. A *P*-value <0.05 was considered significant.

A relative household wealth index was constructed using principal component analysis (PCA) (Filmer and Pritchett, 2001; Kemble et al., 2006; Schellenberg et al., 2003). Data on household assets, housing construction, main source of drinking water and educational status of the mother/caretaker were the input to the PCA. The survey included questions on ownership of a radio (24.1% of households possessed a radio), bicycle (17.4%), cart (12%), metal or wood bed on a bed frame (20.8%) or mosquito net (5.3% of the households had one or more) as well as whether the wall of the living house was constructed of cement or mud block (4.5%), possession of a corrugated iron sheet roof (9.5%), number of rooms (6.4% of households had more than one room), access to safe drinking water (34.5%) and percentage of educated mothers/caretakers (18%). Although additional variables such as ownership of house, type of floor and availability of latrine were assessed, only the above ten variables were retained in the final PCA model based on the weights assigned to the variables by the first PCA. The remaining variables were assigned weights <0.1 and were dropped from the final model.

The first principal component explained approximately 22% of the variability in the ten variables and assigns greatest weights to ownership of an iron sheet roof (0.77), ownership of house wall constructed from cement or mud block (0.58) and access to a protected source of drinking water (0.53); the least was assigned to educational status of the mother/caretaker (0.18). Based on the distribution along the index, all the 2372 households surveyed were classified into terciles: poorest (34.8%), middle (31.5%) and wealthiest (33.8%). Finally, sources of treatment were classified as: (i) public health facilities that included the health centre, health station/posts and MCLs; (ii) private clinics; (iii) CHWs; and (iv) home treatment. Home treatment was defined as treatment for malaria (fever) given to children who were not taken to a health facility or before they were taken to a health facility or CHW.

2.5. Ethical considerations

Verbal informed consent was obtained from all mothers/caretakers who participated in the study after explaining the purpose and objectives of the study. Any patient with symptoms suggestive of clinical malaria was treated with SP according to the national guidelines at the time of the study (Ministry of Health, 1999). Patients with other illnesses were advised to seek treatment from appropriate care providers.

3. Results

Of 3708 households visited in 18 rural kebeles, data were collected on 2372 households (64%) with at least one child under-five. Of 3873 children, 817 (21%) were reported to have experienced febrile illness (*busa)* episodes in the past 2 weeks. Of those, 70.5% had recovered from the illness at the time of interview, according to the respondents.

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Children who had a recent febrile illness (*busa*) episode ranged in age from 2 months to 59 months, with a male:female ratio of 1:0.99. The average age was 32 months (median 36 months). The most common symptoms included fever (99%), shivering/chills (92.2%) and vomiting (55.1%).

Study households used different methods to prevent mosquito bites, which included spraying house with aerosols (15.6% of children belonged to houses sprayed with aerosols) and houses sprayed with DDT during the preceding summer in indoor residual spraying (IRS) programmes (37% of children were from houses sprayed with DDT); 6% of all children were from households who had at least one mosquito net at the time of the survey. Table 1 gives the factors associated with febrile illnesses among children under-five. Households who used aerosols, houses sprayed with DDT during the preceding summer and households possessing a mosquito net demonstrated significantly lower risks of febrile illnesses. In contrast, sharing the primary living house with livestock, particularly during the night, had significant positive associations with the occurrence of febrile illnesses. The percentage of children from households in the lowest socioeconomic category reporting febrile illnesses (*busa*) (21%) was not different from households in the middle (22.5%) or wealthiest (19.8%) socioeconomic categories (Table 1). The gap between the poorest and wealthiest socioeconomic categories in the incidence of fever was approximately 1% (not statistically significant). There was no association between the reported prevalence of febrile illness with age and sex of the children, type of roof, presence of windows and presence of opening holes on the walls of the houses.

Table 1 Factors associated with the occurrence of febrile illnesses among children under-five (with estimated odds ratios) in Adami Tulu district, south-central Ethiopia

Characteristic	Febrile illness		Odds ratio (95% CI)	
	Yes	No	Univariate	Multivariate
Child age				
≤2 years	374	1352	1.1 (0.9–1.3)	1.1 (0.9–1.2)
>2 years[a]	443	1704	1	1
Child sex				
Female	406	1481	0.9 (0.8–1.2)	1.1 (0.9–1.2)
Male[a]	411	1575	1	1
House sprayed with aerosols				
Yes	107	498	0.8 (0.6–0.9)	0.7 (0.5–0.9)*
No[a]	710	2558	1	1
House sprayed with DDT[b]				
Yes	270	1161	0.8 (0.7–0.9)	0.8 (0.6–0.9)*
No[a]	547	1889	1	1
Household possessed mosquito net				
Yes	24	200	0.4 (0.3–0.6)	0.4 (0.3–0.7)*
No[a]	793	2856	1	1
Type of roof				
Thatched	751	2763	1.2 (0.9–1.6)	1.0 (0.7–1.5)
Corrugated[a]	66	293	1	1
Windows present				
Yes	126	500	0.9 (0.7–1.2)	1.0 (0.9–1.4)
No[a]	691	2556	1	1
Opening holes on walls present				
Yes	480	1711	1.1 (1.0–1.3)	1.1 (0.8–1.2)
No[a]	337	1345	1	1
House shared with livestock				
Yes	616	2135	1.3 (1.1–1.6)	1.3 (1.1–1.6)*
No[a]	201	921	1	1
Socioeconomic category of households				
Poorest	279	1047	1.1 (0.9–1.3)	0.9 (0.8–1.2)
Middle	279	963	1.2 (0.9–1.4)	1.1 (0.9–1.3)
Wealthiest[a]	259	1046	1	1

[a] Reference group.
[b] Data missing for six children.
* Statistically significant ($P < 0.05$).

Table 2 Initial treatment choices among mothers/caretakers of febrile children by socioeconomic category of households in Adami Tulu district, south-central Ethiopia

Socioeconomic category	Public facility (*n* (%))	Private clinic (*n* (%))	CHW (*n* (%))	Home treatment (*n* (%))	Treatment not sought (*n* (%))	Total (*n* (%))[a]
Poorest	35 (12.5)	77 (27.6)	99 (35.5)	25 (9.0)	43 (15.4)	279 (100)
Middle	86 (31.0)	66 (23.8)	68 (24.5)	13 (4.7)	44 (15.9)	277 (100)
Wealthiest	102 (39.4)	67 (25.9)	54 (20.8)	14 (5.4)	22 (8.5)	259 (100)
Total[a]	223 (27.4)	210 (25.8)	221 (27.1)	52 (6.4)	109 (13.4)	815 (100)

CHW: community health worker.
[a] Data missing for two children from the middle category who sought any treatment.

Table 3 Time of seeking treatment after symptom onset for febrile children in relation to socioeconomic category of households in Adami Tulu district, south-central Ethiopia

Time of first treatment initiation[a]	Total[b]	Socioeconomic category of household			
		Poorest	Middle	Wealthiest	*P*-value
Within 24 h (*n* (%))	224 (31.8)	41 (18.3)	83 (37.1)	100 (44.6)	<0.001*
24—48 h (*n* (%))	243 (34.5)	80 (33.0)	73 (30.0)	90 (37.0)	0.259
After 48 h (*n* (%))	238 (33.8)	115 (48.3)	77 (32.4)	46 (19.3)	<0.001*
Total (*n* (%))[b]	705 (100)	236 (33.5)	233 (33.0)	236 (33.5)	

[a] Sources of treatment included public, private, community health worker and home treatment.
[b] Data missing for three children who sought any treatment.
* Statistically significant.

The overwhelming majority of febrile illness (*busa*) episodes were followed by some type of action by the mothers or families (87%). Approximately 27% of the febrile children visited a public health facility, followed by private clinic (26%) and CHWs (27%) (Table 2). Among children who sought any form of treatment, only 6.4% of cases of fever benefited from a practice of home treatment by mothers/caretakers. Approximately 13% of the febrile children were neither treated at home nor taken to a health facility at the time of the interview.

Differences were observed in the sources of care between households among the different socioeconomic categories. Care seeking for children from the public health facility was lower among poorer (12.5%) than wealthier (39.4%) households (Table 2). Children from poorer households were more likely to be taken to CHWs (35.5%) than children from wealthier households (20.8%). In addition, initiation of home treatment was also higher in the poorer households. There was indeed a variation among children who did not seek any care. Approximately 9% of children from the wealthiest households compared with 16% in the middle and 15% in the lowest wealth index categories did not seek any treatment at the time of the study. When mothers/caretakers were asked why the febrile child was not taken to a health facility, 44.2% said that it was mild illness. Financial problem (32.1%), shortage of time (10.9%) and long distance from the health facility were also some of the reasons mentioned by the respondents.

Households in the middle and highest wealth categories were more likely to seek treatment for febrile illnesses in their children within 24 h compared with those in the lowest category (Table 3). Among children in the poorest category, only 18.3% sought treatment within 24 h of symptom onset compared with 37.1% and 44.6% in the middle and wealthiest households, respectively. Seeking treatment after 48 h of illness onset was more common among children from households in the poorest socioeconomic category than those in the middle and highest wealth categories.

We also examined factors associated with early treatment seeking for febrile children and found that mothers/caretakers of children from the poorest socioeconomic category of households sought treatment later than those in the middle and wealthier categories of households (Table 4). The association between socioeconomic status and early treatment seeking was statistically significant. Age and sex of the child, educational status of the mother/caretaker and family size were not significantly associated with early treatment seeking behaviour.

4. Discussion

This study provides important information on household and socioeconomic factors associated with febrile illnesses among children under-five and treatment seeking behaviour in an area where malaria transmission is characterised by frequent epidemics with varying magnitudes within and between years. Of the numerous studies conducted to investigate risk factors for malaria, very few have simultaneously examined household and socioeconomic factors affecting treatment seeking behaviour for febrile illnesses. In our survey, the reported prevalence of febrile illness during the preceding 2 weeks was high (21%), but it was relatively low compared with the 36% prevalence of fever among

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Table 4 Factors associated with treatment seeking behaviour among children under-five with febrile illnesses (with estimated odds ratios) in Adami Tulu district, south-central Ethiopia

Characteristic	No. of days with symptoms before seeking treatment		Odds ratio (95% CI)	
	<2 days	≥2 days	Univariate	Multivariate
Child age				
≤2 years	199	107	1.0 (0.7–1.4)	0.9 (0.7–1.4)
>2 years[a]	230	124	1	1
Child sex				
Female	218	105	1.2 (0.9–1.7)	1.2 (0.9–1.7)
Male[a]	211	126	1	1
Educational status of the mother/caretaker				
No education	349	201	0.6 (0.4–1.1)	0.8 (0.5–1.3)
Literate[a]	80	30	1	1
Family size				
<6	161	93	0.9 (0.6–1.3)	0.9 (0.6–1.2)
≥6[a]	268	138	1	1
Socioeconomic category of households				
Poorest	105	110	0.2 (0.2–0.4)	0.2 (0.1–0.4)*
Middle	147	76	0.5 (0.3–0.8)	0.5 (0.3–0.8)*
Wealthiest[a]	177	45	1	1

[a] Reference group.
* Statistically significant ($P < 0.05$).

under-five children from rural Tanzania (Schellenberg et al., 2003) and 33% in Nairobi slums (Taffa and Chepngeno, 2005). Of the potential household risk factors for febrile illness included in the multivariate logistic regression analysis, household ownership of a mosquito net as well as household spraying with aerosols and spraying of insecticide (DDT) in IRS programmes during the previous summer were associated with a lower risk of febrile illness, whilst keeping livestock indoors increased the risk of febrile illness.

The relationship between household risk factors and risk of malaria has been demonstrated in a number of studies. Ghebreyesus et al. (2000) reported that children from houses possessing windows had a higher prevalence of malaria compared with children whose houses did not have windows, but we did not find a significant association between febrile illness in children of families from houses with windows, thatched roofing material or the presence of opening holes on walls, which may be due to the effect of homogeneity. The lack of association of febrile illness or malaria risk with specific house features such as a roof is inconsistent with other studies (Gamage-Mendis et al., 1991; Ghebreyesus et al., 2000; Koram et al., 1995; Lindsay and Snow, 1988). In an endemic region of Sri Lanka, the risk of malaria was found to be 2.5-fold higher in residents of poorly constructed houses than in those living in good houses (Gunawardena et al., 1998). However, it should be noted that the latter studies compared malaria cases, whilst in the present study febrile illnesses were considered.

Literature on the effect of cattle near or in houses in relation to malaria is inconsistent (Bøgh et al., 2002; Bouma and Rowland, 1995). The differences between the studies could be due to local context. In northern Ethiopia, keeping cattle in the house was found to be a risk factor for the occurrence of malaria among children (Ghebreyesus et al., 2000). Similar observations were recorded in the present study area, where the highest prevalence of malaria was reported among children from families who kept cattle (Seyoum et al., 2002). In this study, increased malaria prevalence was associated with livestock keeping. The same study revealed that the highest human biting rate for *A. arabiensis* was from dwellings shared with livestock compared with those without livestock. Anopheline mosquitoes commonly found in the study areas are *A. arabiensis* and *A. pharoensis*. On the basis of our finding, it is impossible to recommend zooprophylaxis as an intervention method for malaria control in our study area where most mosquitoes are endophilic (Abose et al., 1998). The suggestion not to keep livestock in or near the house based on the results of our study should be carefully examined and should be based on the local context of how households value their cattle.

Spraying houses with insecticides such as aerosols was associated with protection against malaria in a periurban area of The Gambia (Koram et al., 1995). Although we only assessed possession of nets rather than actual utilisation by children, mosquito net ownership in our study population was associated with a low prevalence of febrile illness, suggesting the importance of widescale implementation of ITNs as a malaria control strategy in malarious areas of the country. Treated mosquito nets have been shown to provide strong protection against malaria and are currently widely applied as a vector control measure for malaria control particularly in sub-Saharan Africa (Alonso et al., 1991; D'Alessandro et al., 1995; Roll Back Malaria, 2002).

Our findings of the percentage of febrile children from the poorest and relatively wealthier households indicate no statistically significant difference between the two categories. This could be due to the narrow gap in the socioeconomic categories in the study households. Most studies in developing countries that used the same approach of morbidity assessment found no differences among the socioeconomic categories of the households (Brooker et al., 2004; Filmer, 2005; Schellenberg et al., 2003). However, the influence of household socioeconomic status on healthcare seeking was found to be significant in our study, which is consistent with the findings of many other studies (Filmer, 2005; Schellenberg et al., 2003; Thind, 2004).

Febrile children from households with the poorest socioeconomic status were more likely to be taken to CHWs and practiced more home treatment. Given the lower fees and greater proximity to most people in the study area, it is not surprising that CHWs were highly utilised as the first source of treatment. In addition, most children who did not receive any type of care on the day of interview belonged to the poorest category of households. Lack of money and the expectation that the illness would be self-limiting were the most important factors for not seeking health care, followed by other factors such as shortage of time and long distance from the health facility. The widespread use of CHWs and the private sector indicates the need to strengthen the community-based malaria control interventions and highlights the importance of private providers for malaria treatment.

In addition to socioeconomic status, McCombie (1996) summarised various studies identifying the positive association between treatment seeking behaviour and factors affecting it. The unavailability of appropriate services at public health facilities and the high cost of treatment at private clinics appear to affect the healthcare-seeking behaviour of mothers. Our study findings indicate that economic barriers affect care-seeking behaviour, with the non-poor most likely to use public and private health facilities, whilst the poor typically use CHWs and home treatment. These differences in patterns of care seeking between households in the lowest and relatively higher wealth index in this rural area call for an intervention that might improve the livelihood of the households and increase equitable access to basic healthcare services for children in rural areas.

Most deaths among young children occur within 2—3 days after the onset of symptoms (Greenwood et al., 1987), yet in our study only 27% of the total febrile children under-five had sought any treatment within 24 h of the onset of symptoms, very much lower than the finding observed in an area of low transmission in Uganda (Ndyomugyenyi et al., 2007) and Kenya (Guyatt and Snow, 2004). Since prompt treatment with effective antimalarials is one of the key strategies for malaria control in sub-Saharan Africa, the present study finding has strong implications for improving early diagnosis and prompt treatment with an effective drug. Although the signs and symptoms of malaria are generally non-specific, in stable malaria transmission areas or during the peak transmission season of unstable malaria the presence of fever or a recent history of fever is a good diagnostic criterion for malaria in the absence of microscopic examination (Ministry of Health, 1999, 2004; WHO, 1993, 2000b).

There are issues that warrant caution in interpreting the results of the study. Although 74.3% of 145 blood slides collected from febrile children under-five in five villages during the study period were microscopically confirmed to be malaria (Adami Tulu DHO, unpublished data, 2003), the incidence of fever was assessed based on self-reported data that may be susceptible to information bias. Information on net treatment and actual utilisation of nets by children was lacking. However, our study findings have important policy implications. Improving the housing characteristics and socioeconomic status of the community in the long-run will have a greater impact on the incidence of febrile illnesses. However, this requires strong collaboration among different sectors and community groups to bring about the envisaged changes. Access to health services can be improved through working in partnership with private healthcare providers and CHWs. The use of vector control measures such as ITNs on a wide scale and insecticide spraying of houses can effectively reduce the incidence of febrile illnesses among children.

Authors' contributions: WD was the principal investigator of the study and took the leading role in all aspects of the study from conception and design to the final analysis and preparation of the draft manuscript; AA and YB participated in the conception and design of the study and reviewed the manuscript for intellectual content. All authors read and approved the final manuscript. WD is guarantor of the paper.

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