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Comparing actual and perceived causes of fever among community members in a low malaria transmission setting in northern Tanzania

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Abstract

Objective—To compare actual and perceived causes of fever in northern Tanzania.

Methods—In a standardized survey, heads of households in 30 wards in Moshi, Tanzania, were asked to identify the most common cause of fever for children and for adults. Responses were compared to data from a local hospital-based fever etiology study that used standard diagnostic techniques.

Results—Of 810 interviewees, the median (range) age was 48 (16, 102) years and 62.8% were females. Malaria was the most frequently identified cause of fever, cited by 56.7% and 43.6% as the most common cause of fever for adults and children, respectively. In contrast, malaria accounted for 2.0% of adult and 1.3% of pediatric febrile admissions in the fever etiology study. Weather was the second-most frequently cited cause of fever. Participants who identified a non-biomedical explanation such as weather as the most common cause of fever were more likely to prefer a traditional healer for treatment of febrile adults (OR 2.7, $p<0.001$). Bacterial zoonoses were the most common cause of fever among inpatients, but no interviewees identified infections from animal contact as the most common cause of fever for adults; 0.2% identified these infections as the most common cause of fever for children.

Conclusions—Malaria is perceived to be a much more common cause of fever than hospital studies indicate whereas other important diseases are under-appreciated in northern Tanzania. Belief in non-biomedical explanations of fever is common locally and has important public health consequences.

Keywords

Africa; fever; malaria; beliefs; Tanzania

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INTRODUCTION

Community understanding of the etiologies of disease in sub-Saharan Africa can differ markedly from western biomedical explanations (Sabuni 2007, Iriso *et al.* 2000). Such local perceptions of illnesses can influence healthcare seeking behavior with important public health consequences (Chibwana *et al.* 2009, Comoro *et al.* 2003). In sub-Saharan Africa, where fever is a common health complaint (Feikin *et al.* 2011), particular attention has been paid to cultural understanding of fever and its causes (Agyepong and Manderson 1994, Molyneux *et al.* 1999).

Many studies investigating local perceptions of fever have been conducted in settings where malaria is highly endemic and have focused on the ability of mothers to recognize the symptoms of malaria in children (Tarimo *et al.* 2000, Comoro *et al.* 2003). These studies have shown that malaria is widely recognized across sub-Saharan Africa as the most important cause of fever (Malik *et al.* 2006, Tarimo *et al.* 2000). In fact, in many settings respondents did not distinguish between malaria and the syndrome of fever itself (Ahorlu *et al.* 1997, Pilkington *et al.* 2004).

The past decade has witnessed a marked decline in malaria-related illness in many parts of sub-Saharan Africa, with multiple countries reporting reductions in the number of malaria cases by at least 50% (WHO 2009, Murray *et al.* 2012). Consequently, an increasing number of people reside in locations where malaria prevalence is low, yet little has been done to assess beliefs about febrile illness in such settings. An understanding of community perceptions of fever is needed to shed light on healthcare seeking behavior in low malaria transmission areas and also to explore the ways in which such perceptions may influence the widespread problem of malaria overdiagnosis (Chandler *et al.* 2008a).

In addition to malaria, studies have demonstrated that many people in sub-Saharan Africa consider non-biomedical explanations of fever to be important causes of febrile disease in their community. These studies have identified a range of non-biomedical explanations for fever, including supernatural causes, such as witchcraft, and more material causes originating in the body, the environment, or social relations, such as teething, over-exposure to the sun, or alcohol (Winch *et al.* 1996, Sabuni 2007). Some studies suggest that individuals are more likely to seek care from traditional healers if they believe the fever to have supernatural origins (Fosu 1981, Comoro *et al.* 2003). However, little is known about how beliefs in non-supernatural but non-biomedical causes of fever, such as weather, affect healthcare seeking behavior.

Community perceptions about causes of fever are best evaluated in the context of local disease prevalence data so that direct comparisons can be made and important discrepancies between actual and perceived causes can be identified. However, such comparisons have rarely been possible. To investigate local perceptions of the causes of fever in a low malaria prevalence setting, we surveyed heads of households in northern Tanzania, where disease prevalence data from a recent study of fever etiologies were readily available.

METHODS

Study location

This survey was conducted in Moshi Urban (population ~ 144,000) and Moshi Rural (population ~ 402,000) Districts of northern Tanzania, an area characterized by low malaria transmission intensity (Hay *et al.* 2009, Oesterholt *et al.* 2006). While the Chagga tribe predominates, many ethnic groups are present in the study area.

Selection of households

Thirty of the 45 wards in Moshi Urban and Rural Districts were selected randomly in a population-weighted fashion, including 22 wards from Moshi Rural District and 8 wards from Moshi Urban District. A starting point in each selected ward was chosen randomly by dropping a pencil on a map or, when no map was available, was chosen randomly while touring the ward on foot by a member of the study team who was not previously familiar with the area. A direction was similarly arbitrarily chosen, and the first 27 households along that direction from the starting point were included in the survey.

Community survey design

Before the community survey, focus group discussions were held to generate a list of possible fever causes to be presented to survey participants. To ensure that the list of causes of fever reflected the full spectrum of local beliefs, focus group discussions were held in two wards in Moshi Rural District and in one ward in Moshi Urban District. Each focus group consisted of 10 community members who represented the sexes, a broad range of ages, and a variety of occupations approximately equally. Focus group members were asked to identify common causes of fever in the Moshi area. While leading the focus group discussions, researchers ensured that participants identified only direct causes of fever. For example, when ‘rain’ was mentioned as a cause of fever, study team members asked participants to clarify whether rain was believed to cause fever directly or indirectly, perhaps by leading to increased numbers of mosquitoes or via some supernatural means. Any direct cause that was identified by more than one member of any focus group was included as an option in the community survey. In some cases, similar responses were grouped into a single option. For example, exposure to sun, hot weather, rain, cold weather, and dust were grouped together as ‘weather.’ Biomedical causes of fever ascertained in recently conducted hospital-based studies of fever etiology and not identified in focus groups were grouped together and included among the survey options as ‘infectious diseases acquired from contact with animals’ and ‘other infectious diseases.’

Community survey administration

The community survey was conducted from 13 June 2011 through 22 July 2011. Tanzanian high school graduates who received specific training in study procedures administered the survey to heads of households in the 27 selected homes in each ward. A head of household was defined as an adult who was responsible for the care of other members of the household. After obtaining informed consent, study team members administered a standardized questionnaire in Swahili, the local language. The questionnaire comprised questions about demographics, socioeconomic status, and healthcare seeking behavior. Respondents were also asked ‘What are the three most common causes of fever among children?’ and ‘Of these, which is the most common cause?’ The same questions were then asked regarding adults. Children were defined as individuals younger than 13 years to be consistent with the definition used in the hospital-based fever etiology study. Because the Swahili word for fever, *homa*, encompasses a broad range of symptoms, the research assistants clarified that these questions specifically referred to fever characterized by elevated body temperature, *joto la mwili*. Respondents were asked to choose these causes of fever from the list of suggested options described above or to choose ‘other’ if their answer did not appear on the list.

Local disease prevalence data

Given the absence of data regarding fever etiologies in outpatient settings, local disease prevalence data were taken from the previously published results of a year-long etiology of fever study conducted among inpatients at two hospitals in Moshi (Biggs *et al.* 2011, Prabhu

et al. 2011, Hertz *et al.* 2012, Crump *et al.* 2011a, b, 2013; Bouley *et al.* 2012). In instances where diagnostic test results were not available for all participants of the etiology of fever study, the proportion of participants who tested positive for a given infection was applied to the whole study population to extrapolate numbers of persons for uniform comparison.

Data analysis

Data were entered using Cardiff Teleform 9.0 (Cardiff Inc., Vista, CA) and analyzed using JMP 8.0 (SAS, Cary, NC). Descriptive statistics are presented as medians, ranges, and interquartile ranges (IQR) for continuous variables and as proportions for categorical variables. Mann-Whitney *U* tests were used to compare differences in medians for continuous data. Pearson's chi-square was used to compare categorical data. A continuous socioeconomic status variable (SES score) was developed by performing a principal component analysis (Vyas and Kumaranayake 2006) using 17 variables related to ownership of assets, housing characteristics, and access to infrastructure. The SES score was used as an approximate measure of the socioeconomic status of the household. Urban residence was defined as residence within Moshi Urban District. For purposes of data analysis, weather, teething, pain, alcohol, and witchcraft were all classified as non-biomedical explanations of fever. Of these, weather, teething, pain, and alcohol were classified as non-supernatural. Although the association between weather and teething is controversial, multiple well-designed studies have failed to identify an independent association between teething and true fever (Wake *et al.* 2000, Tighe and Roe 2007, Ramos-Jorge *et al.* 2011, Macknin *et al.* 2000), and the dangers of misattributing fevers that occur during the teething period to tooth eruption rather than infectious disease have been well-described (Lloyd 1996). Hence it was decided to classify teething as a non-biomedical explanation of fever.

Ethical approval

This study was approved by the Kilimanjaro Christian Medical Centre Research Ethics Committee, the Tanzania National Institutes for Medical Research National Research Ethics Coordinating Committee, and institutional review boards of Duke University Health System and the International Vaccine Institute.

RESULTS

A total of 810 heads of households were interviewed; their sociodemographic features are described in Table 1. The median (range) age of respondents was 48 (16, 102) years, and 509 (62.8%) were females.

The overall prevalence of various etiologies of fever among inpatients in the Moshi area, as previously described (Biggs *et al.* 2011, Hertz *et al.* 2012, Prabhu *et al.* 2011, Crump *et al.* 2011a,b,2013) , are displayed in Table 2. The most common etiologies of fever among both children and adults were infectious diseases acquired from animal contact, such as leptospirosis and Q fever. Malaria was an uncommon cause of inpatient fever.

Beliefs about fever in children

The most frequently cited perceived causes of fever in children were malaria, weather, and teething, identified by 618 (76.3%), 503 (62.1%), and 459 (56.7%) respondents, respectively (Table 3). Figure 1 compares the actual prevalence of various fever etiologies among pediatric inpatients in Moshi with the responses of heads of households when asked to identify the single-most common cause of childhood fever. Malaria was the most common response, cited by 353 (43.6%) respondents, but was present in 6 (1.3%) febrile pediatric inpatients. Infectious diseases from animal contact, which caused 94 (20.2%) fevers among pediatric inpatients, were identified by 2 (0.2%) respondents. Weather and teething, which

were not considered to be an actual etiology of fever in any pediatric inpatient, were identified as the most common cause of fever by 164 (20.2%) and 141 (17.4%) participants, respectively.

Beliefs about fever in adults

The most frequently identified causes of fever in adults were malaria, weather, and typhoid fever, which were selected by 766 (94.6%), 564 (69.6%), and 185 (22.8%) respondents, respectively (Table 4). Figure 2 compares the actual prevalences of fever etiologies among adult inpatients in Moshi to the perceived causes of fever cited by heads of households when asked to identify the single- most common cause of fever in adults. Malaria, which was the actual etiology of fever in 8 (2.0%) adult inpatients, was identified as the single-most common cause of adult fever by 459 (56.7%) of respondents. Infectious diseases from animal contact, which were the most common actual etiology of fever in adult inpatients, were not cited by any participant as the single-most common cause of adult fever.

Correlates of belief in non-biomedical explanations of fever

Table 5 compares the sociodemographic features of participants who identified a non-biomedical explanation as the single-most common cause of fever in children to all other respondents. Belief in a non-biomedical explanation of childhood fever was associated with being a member of the Chagga tribe (Odds Ratio [OR] 1.6, p=0.004) and lower socioeconomic status (p<0.001), whereas urban residence (OR 0.44, p<0.001), completion of primary school (OR 0.47, p<0.001), completion of secondary school (OR 0.55, p=0.006), and ownership of a bednet (OR 0.67, p=0.007) were negatively associated. Heads of household who cited a non-biomedical explanation as the most common cause of fever in children were also significantly more likely to identify a traditional healer as the best treatment option for children with elevated body temperatures for more than three days (OR 2.9, p=0.001). This difference persisted when comparing heads of household who cited a nonsupernatural, non-biomedical explanation such as weather, teething, or pain as the most common cause of fever to all other respondents. Twenty-eight (14.9%) of these heads of households chose a traditional healer as the best treatment option for children with elevated body temperatures for more than three days, whereas only 14 (5.6%) of all other respondents preferred a traditional healer (OR 3.0, p=0.001).

Table 6 presents the sociodemographic features of respondents who identified a nonbiomedical explanation as the most common cause of fever in adults. Such participants were significantly more likely to be older (p=0.003), members of the Chagga tribe (OR 2.5, p<0.001), and of lower socioeconomic status (p=0.005). They were significantly less likely to reside in an urban area (OR 0.22, p<0.001), to own a bednet (OR 0.57, p<0.001), or to have completed primary (OR 0.35, p<0.001) or secondary (OR 0.53, p=0.012) school. Heads of household who cited a non-biomedical explanation as the most common cause of fever in adults were significantly more likely to identify a traditional healer as the best treatment option both for adults with fever (OR 2.7, p<0.001) and for adults with elevated body temperatures for more than three days (OR 3.2, p<0.001). These differences persisted when comparing heads of households who cited a non-supernatural, nonbiomedical explanation such as weather or alcohol to all other respondents: 34 (14.5%) and 33 (14.1%) of these heads of households identified a traditional healer as the best treatment option for an adult with fever and with an elevated body temperature for more than three days, respectively, compared to 34 (5.9%) and 28 (4.9%) of all other respondents (OR 2.7, p<0.001 and OR 3.2, p <0.001, respectively).

DISCUSSION

Our findings demonstrate a substantial discrepancy between actual etiologies and perceived causes of fever in northern Tanzania. Such discrepancies are troubling because they create the potential for real and treatable causes of febrile illness to be overlooked by patients and their caregivers. In particular, community members considered malaria to be the single-most common cause of fever despite malaria being a relatively uncommon cause of inpatient fever. This discordance is important because community misperceptions about malaria prevalence may contribute to malaria over-diagnosis, a widespread problem in sub-Saharan Africa (Chandler *et al.* 2008b, Hume *et al.* 2008), by shaping patient expectations and therefore influencing clinician decision-making. In one study conducted in northern Tanzania, a quarter of physicians reported being afraid that patients might complain if they were not treated for malaria (Chandler *et al.* 2008a). Although the problem of malaria over-diagnosis has complex causes, policy makers should consider the role of community misperceptions when trying to reduce excessive rates of inappropriate malaria diagnosis.

Beyond influencing clinician decision-making, the discrepancy between the actual and perceived prevalence of malaria may have other notable public health implications. Individuals who believe that malaria is a leading cause of fever may be more likely to self-medicate with antimalarials than others. Thus, communities in which there is a large discrepancy between the actual and perceived prevalence of malaria may experience higher levels of inappropriate antimalarial usage resulting in wasted health resources and delay of appropriate care. Self-treatment with antimalarials is a common practice across sub-Saharan Africa (Deressa *et al.* 2003, Hodel *et al.* 2009), and in Tanzania, pharmacies routinely dispense antimalarials without a prescription (Kagashe *et al.* 2011). In such a setting, community misperceptions about malaria prevalence may lead to inappropriate use of expensive first-line artemisinin-based combination therapy (O'Connell *et al.* 2011) and delay in appropriate treatment for other febrile diseases.

In addition to the overemphasis on malaria among survey respondents, we found under-appreciation of other infectious diseases, such as bacterial zoonoses. Bacterial zoonoses are increasingly identified as a major cause of illness in sub-Saharan Africa (Bertherat *et al.* 1999, Steinmann *et al.* 2005, Crump *et al.* 2013), and prevention and treatment strategies are underdeveloped. However, programs to address bacterial zoonoses may be more difficult to design and implement than those for malaria. Because community appreciation of non-malaria etiologies of fever is low, successful public health interventions will likely need to incorporate a large component of education.

After malaria, the most commonly cited perceived cause of fever in both adults and children was weather. Other non-biomedical explanations, such as teething, alcohol, and witchcraft, were also cited frequently. Such non-biomedical explanations for fever have been identified in numerous studies across sub-Saharan Africa. Indeed, weather, teething, witchcraft, and alcohol are perceived to be important causes of fever in many countries in the region, including Nigeria, Ghana, the Democratic Republic of Congo, Malawi, Gabon, Uganda, and Tanzania (Adetunji 1991), Ahorlu *et al.* 1997, Chibwana *et al.* 2009, Pilkington *et al.* 2004, Sabuni 2007, Kengeya-Kayondo *et al.* 1994, Winch *et al.* 1996). Although educational programs would need to be tailored to individual communities, common themes can be identified that are likely to be relevant to many settings within the continent.

Our results demonstrate that individuals who believe in non-biomedical explanations of fever are significantly more likely to seek care from a traditional healer for febrile adults and children. The finding that individuals who perceive witchcraft to be an important cause of fever tend to prefer traditional healers is consistent with the results of prior studies involving

focus groups and semi-structured interviews (Chibwana *et al.* 2009, Pilkington *et al.* 2004). However, the finding that those who believe in non-biomedical, non-supernatural explanations for fever such as weather are also more likely to prefer traditional healers for treatment of fevers is important. Belief in such causes of fever, which is common in sub-Saharan Africa, may be substantially affecting healthcare seeking behavior across the region. Efforts to educate communities about biomedical explanations of fever may therefore increase use of conventional healthcare services for febrile episodes.

This study had several limitations. First, the beliefs of heads of household interviewed in this study may not be representative of the beliefs of the entire community. In particular, younger residents and males were not well represented among survey respondents. Furthermore, the actual etiologies of fever as determined from the inpatient etiology of fever study may not be representative of the spectrum of febrile diseases in the community, some of which may not routinely result in hospitalization (Crump *et al.* 2003). Moreover, tuberculosis was not evaluated comprehensively as part of the etiology of fever study, making comparisons between community perceptions and actual prevalence difficult for this infection. Additionally, the term ‘infectious diseases from contact with animals’ may not have been interpreted by some respondents as including contact with animal products or excreta, making this term an imperfect descriptor of bacterial zoonoses. As with all survey-based studies, participants’ answers may have been subject to social acceptability bias. In particular, regarding the distinction between supernatural and other nonbiomedical causes, some respondents may have been reluctant to identify the cause of fever that they truly believed to be most common, preferring instead to give an answer they perceived to be more acceptable to the researchers. The use of young, relatively educated interviewers to administer the surveys may have heightened social acceptability bias, but the use of focus group discussions to draw out understandings of the causes of disease before developing the household survey options attempted to minimize this bias.

In summary, we found substantial discrepancies between the actual etiologies and perceived causes of fever among community members in northern Tanzania. As a growing proportion of febrile episodes in sub-Saharan Africa occurs in low malaria transmission settings, the overemphasis on malaria and under-appreciation of other important infectious diseases found here merit the attention of policy makers across the region. Most importantly, our findings highlight an important knowledge gap regarding common etiologies of fever that merits attention in community health educational programs. Many fever-related educational interventions in sub-Saharan Africa to date have focused on malaria (Nkuo Akenji *et al.* 2005, Eriksen *et al.* 2010, Okeke and Uzochukwu 2009), but these findings suggest that much more comprehensive fever education programs are needed. Addressing knowledge and beliefs around febrile illness may have many potential benefits, such as a reduction in malaria over-diagnosis, attenuation of inappropriate use of antimalarial drugs, more rapid initiation of appropriate management for non-malaria febrile diseases, improved receptivity of community members to public health interventions for locally important infectious diseases, and an increase in prompt presentation to conventional healthcare services for febrile illnesses.

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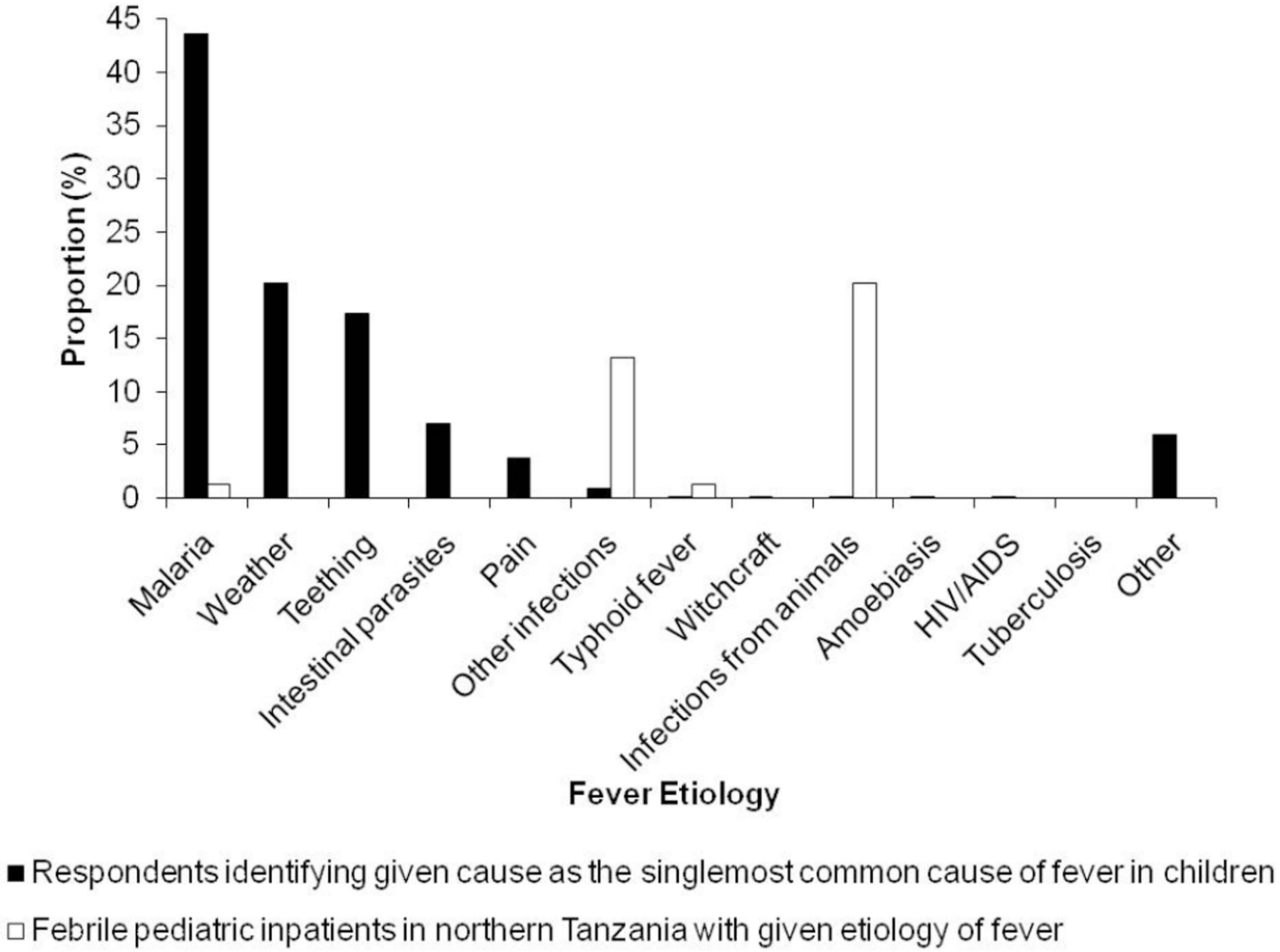

Figure 1.

Actual etiologiesa and perceived causesb of fever among children in northern Tanzania

[a] Actual etiologies of fever among febrile pediatric inpatients in northern Tanzania, 2007–2008 (N=467) (Biggs et al. 2011, Prabhu et al. 2011, Hertz et al. 2012, Crump et al. 2011a, Crump et al. 2011b)

[b] According to residents of Moshi, 2011, in response to the question, 'What is the most common cause of fever among children?' (N=810)

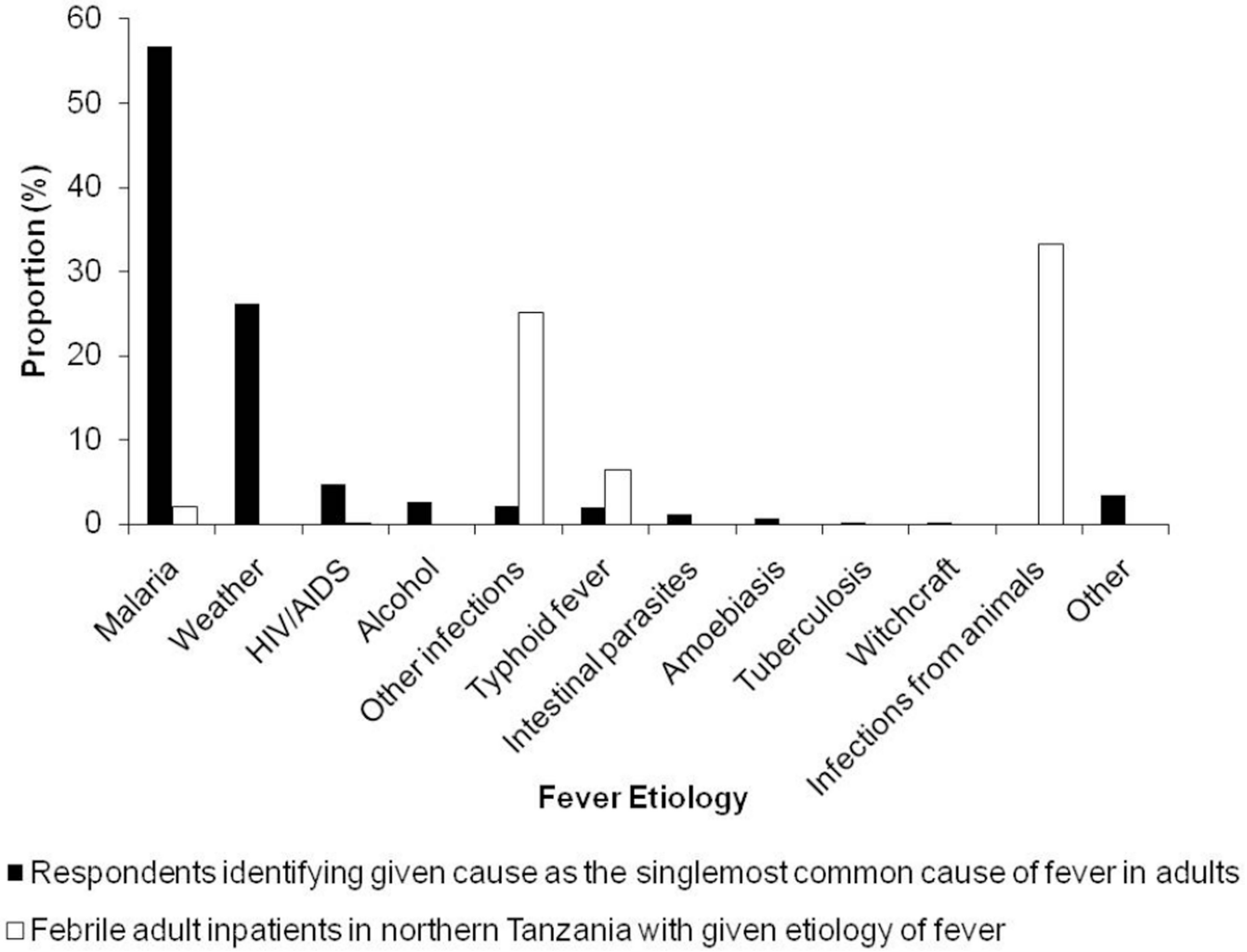

Figure 2.

Actual etiologiesa and perceived causesb of fever among adults in northern Tanzania

[a] Actual etiologies of fever among febrile adults inpatients in northern Tanzania, 2007–2008 (N=403) (Biggs et al. 2011, Prabhu et al. 2011, Hertz et al. 2012, Crump et al. 2011a, Crump et al. 2011b)

[b] According to residents of Moshi, 2011, in response to the question, 'What is the most common cause of fever among adults?' (N=810)

Table 1

Sociodemographic features of heads of households surveyed in Moshi, 2011

	n/N (N=810)	(%)
Urban residence	216/810	(26.7)
Age median (range), years	48(16, 102)	--
Female	509/810	(62.8)
Chagga tribe	607/810	(74.9)
Literate	729/810	(90.0)
Completed primary school	632/810	(78.0)
Completed secondary school	111/810	(13.7)
SES score, median (IQR)	−0.5 (−1.2, 1.0)	--
Knows cause of malaria	764/808	(94.6)
Tested for HIV	428/810	(52.8)
Owns bednet	548/810	(67.7)
Drinks untreated water	642/803	(80.0)

Table 2

Actual etiologies of fever among febrile pediatric and adult inpatients in northern Tanzania, 2007–2008[a]

Etiology of fever among pediatric inpatients	%	Etiology of fever among adult inpatients	%
Infectious diseases from animal contact[b]	20.2	Infectious disease from animal contact[d]	33.3
Other infectious diseases[c]	13.2	Other infectious diseases[e]	25.1
Typhoid fever	1.3	Typhoid fever	6.5
Malaria	1.3	Malaria	2.0
		Acute HIV	0.1

[a] Data from (Hertz *et al*. 2012, Biggs *et al*. 2011, Prabhu *et al*. 2011, Crump *et al*. 2011a, Crump *et al*. 2011b)

[b] Leptospirosis 7.7%, spotted fever group rickettsioses 7.4%, Q fever 2.6%, Brucellosis 2.0%

[c] Arboviral infections 10.2%, invasive bacterial diseases other than *Salmonella* Typhi 2.1%, invasive fungal diseases 0.9%

[d] Leptospirosis 10.1%, spotted fever group rickettsioses 8.7%, Q fever 7.9%, Brucellosis 5.3%, typhus group rickettsioses 1.0%

[e] Invasive bacterial diseases other than *Salmonella* Typhi 10.7%, arboviral infections 5.7%, invasive fungal diseases 5.2%, invasive mycobacterial infections 3.5%

Table 3

Perceived common causes of fever in children identified by heads of households in Moshi, 2011[a]

Perceived cause of fever	# of Respondents (N=810)	%
Malaria	618	76.3
Weather	503	62.1
Teething	459	56.7
Intestinal parasites	306	37.8
Pain	110	13.6
Other infectious diseases	97	12.0
Typhoid fever	63	7.8
Witchcraft	22	2.7
Amoebiasis	22	2.7
HIV/AIDS	10	1.2
Tuberculosis	7	0.9
Infectious diseases from animal contact	7	0.9
Other	206	25.4

[a] In response to the question, 'What are three most common causes of fever in children?'

Table 4

Perceived common causes of fever in adults identified by heads of households in Moshi, 2011[a]

Cause of Fever	# of Respondents (N=810)	%
Malaria	766	94.6
Weather	564	69.6
Typhoid fever	185	22.8
Other infectious diseases	167	20.6
HIV/AIDS	137	17.0
Intestinal parasites	133	16.4
Alcohol	115	14.2
Amoebiasis	102	12.6
Tuberculosis	33	4.1
Infectious diseases from animal contact	5	0.6
Witchcraft	4	0.5
Other	219	27.0

[a] In response to the question, 'What are the three most common causes of fever in adults?'

Table 5

Sociodemographic features and healthcare seeking behavior of participants who identified a non-biomedical explanation[a] as the most common cause of fever in children, Moshi, 2011

	Identified a non-biomedical cause as the most common cause of fever in children (N=338)		**All other participants (N=472)**		**OR (95% CI)**	**p-value**
	n/N	**(%)**	**n/N**	**(%)**		
Urban residence	60/338	(17.8)	156/472	(33.1)	0.44 (031–0.61)	<0.001*
Age, median (range), years	49 (19, 98)		47 (16, 102)		--	0.147
Female	205/338	(60.7)	304/472	(64.4)	0.85 (0.64–1.1)	0.275
Chagga tribe	271/338	(80.2)	336/472	(71.2)	1.6 (1.2–2.3)	0.004*
SES score, median (IQR)	−0.66 (−1.4, 0.08)		−0.39 (−1.1, 1.5)		--	<0.001*
Completed primary school	238/338	(70.4)	394/472	(83.5)	0.47 (0.34–0.66)	<0.001*
Completed secondary school	33/338	(9.8)	78/472	(16.5)	0.55 (0.35–0.84)	0.006*
Tested for HIV	172/338	(50.9)	256/472	(54.2)	0.87 (0.66–1.2)	0.346
Drinks untreated water	268/335	(80.0)	374/468	(79.9)	1.0 (0.71–1.4)	0.976
Have a bednet at home	211/338	(62.4)	337/472	(71.4)	0.67 (0.49–0.90)	0.007*
No antibacterials or antimalarials at home	315/338	(93.2)	431/472	(91.3)	1.3 (0.77–2.2)	0.328
Knows cause of malaria	308/338	(91.1)	456/470	(97.0)	0.32 (0.16–0.60)	<0.001*
Treatment at traditional healer first choice for child with fever[b]	7/188	(3.7)	5/249	(2.0)	1.9 (0.59–6.0)	0.277
Treatment at traditional healer first choice for child with elevated body temperature > 3 days[b]	28/188	(14.9)	14/249	(5.6)	2.9 (1.5–5.8)	0.001*

[a] Non-biomedical explanations were weather, teething, pain, and witchcraft

[b] Question only asked of participants with children at home (N = 437)

Table 6

Sociodemographic features and healthcare seeking behavior of participants who identified a non-biomedical explanation[a] as the most common cause of fever in adults, Moshi, 2011

	Identified a non-biomedical cause as the most common cause of fever in children (N=235)		All other participants (N=575)		OR (95% CI)	p-value
	n/N	(%)	n/N	(%)		
Urban residence	24/235	(10.2)	192/575	(33.4)	0.22 (0.14–0.36)	<0.001*
Age, median (range), years	50 (22, 98)		46 (16, 102)		--	0.003*
Female	139/235	(59.2)	370/575	(64.4)	0.80 (0.59– 1.1)	0.165
Chagga tribe	201/235	(85.5)	406/575	(70.6)	2.5 (1.6– 3.7)	<0.001*
SES score, median (IQR)	−0.61 (−1.4, 0.08)		−0.43 (−1.2, 1.3)		--	0.005*
Completed primary school	151/235	(64.3)	481/575	(83.7)	0.35 (0.25–0.50)	<0.001*
Completed secondary school	21/235	(8.9)	90/575	(15.7)	0.53 (0.32– 0.87)	0.012*
Tested for HIV	113/235	(48.1)	315/575	(54.8)	0.76 (0.54–1.0)	0.083
Drinks untreated water	195/233	(83.7)	447/570	(78.4)	1.4 (0.95–2.1)	0.091
Have a bednet at home	138/235	(58.7)	410/575	(71.3)	0.57 (0.42– 0.79)	<0.001*
No antibacterials or antimalarials at home	222/235	(94.5)	524/575	(91.1)	1.7 (0.89–3.1)	0.110
Knows cause of malaria	209/235	(88.9)	555/573	(96.9)	0.26 (0.14–0.49)	<0.001*
Treatment at traditional healer first choice for adult with fever	34/235	(14.5)	34/575	(5.9)	2.7 (1.6–4.4)	<0.001*
Treatment at traditional healer first choice for adult with elevated body temperature > 3 days	33/235	(14.0)	28/575	(4.9)	3.2 (1.9–5.4)	<0.001*

[a] Non-biomedical explanations were weather, alcohol, and witchcraft