



Malaria risk behaviours, socio-cultural practices and rural livelihoods in southern Tanzania: Implications for bednet usage

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ARTICLE INFO

Article history:

Available online 24 November 2010

Keywords:

Tanzania
Malaria
Mosquito bednets
Risk
Socio-cultural practices
Rural livelihoods

ABSTRACT

Most malaria risk reduction strategies are firmly embedded in biomedical practices and public health perspectives. National and international programmes to 'control' malaria are particularly characterised by the promotion of public health interventions which converge on the disease vector, the malaria mosquito, notably through the use of indoor household spraying with insecticides, and the deployment of insecticide-treated bednets (ITNs). With convincing evidence for the effectiveness of ITNs in reducing the incidence of malaria, control programmes have emphasised the notion of 'scaling-up' bednet coverage. Much previous research on people's 'compliance' with bednet programmes has tended to focus on the quantification of bednet usage and on deriving explanations for 'non-compliance' based on household or individual indicators such as wealth, age, gender or educational level, or on climatic factors such as season and temperature. However, malaria risk behaviours are also rooted in wider aspects of local livelihoods, and socio-cultural beliefs and practices which interplay with the use and, crucially, non-use, of bednets. This paper draws on empirical data derived from in-depth, one-to-one semi-structured interviews, focus groups and participatory methods (mapping and diagramming) with participants in two villages in rural Tanzania to explore the nature of these practices and vulnerabilities, and their potential impact on malaria exposure risk. Participants included farmers and pastoralists, both men and women, as well as village 'officials'. By eliciting local understandings of malaria-related behaviours we explore how malaria risks are played out in people's everyday lives, and the circumstances and decision-making which underpin non-usage of bednets. Our findings reveal the importance of shifting sleeping patterns in response to livelihood needs and socio-cultural practices and events. These arrangements militate against the consistent and sustained use of the bednet which are called for by public health policies. In particular we demonstrate the importance of the spatial and temporal dimensions of farming practices and the role of conflict over access to shared land; the impact of livelihood activities on malaria risks for school-aged children; risk behaviours during 'special' socio-cultural events such as funeral ceremonies; and routine, outdoor activities around dawn and dusk and the gendered nature of these practices.

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Introduction

There is convincing scientific evidence that insecticide-treated bednets (ITNs) are effective in reducing malaria-related morbidity and mortality (Lengeler, 2004). There is even evidence to suggest that bednet usage not only protects the individual user but may also offer beneficial effects to others living in the community, with bednets serving as traps to kill mosquitoes (Curtis, Jana-Kara, & Maxwell, 2003a; Hawley et al., 2003; Maxwell et al., 2002). Bednets may also act as an effective component of more comprehensive

strategies to reduce malaria rates. Minja et al. (2001), for example, suggest that ITNs provide an attractive approach to complement early diagnosis and treatment strategies particularly where drug resistance has developed in mosquito parasites and where there is limited access to health services. National and international malaria control programmes have therefore emphasised the notion of 'scaling-up' bednet coverage in order to achieve increasingly high percentages of coverage (Roll Back Malaria 2005a). The Roll Back Malaria Partnership in 2005 set a goal, as part of its Global Strategic Plan, that by 2010, '80% of people at risk from malaria are protected, thanks to locally appropriate vector control methods such as insecticide-treated nets (ITNs)...' (Roll Back Malaria 2005b, p. 2). Similarly, writing in 2005 in the context of more concerted efforts to achieve the Millennium Development Goals (MDGs) for malaria

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reduction, economist and Special Advisor on the MDGs, Sachs (2005: 116–117) argued that ‘within three years, virtually every household in the regions of rural Africa where malaria is endemic could be sleeping under insecticide-treated nets’. The World Health Organisation’s goals for malaria reduction similarly reflect an emphasis on scaling-up bednet usage: ‘national health systems in regions endemic for malaria must take rapid steps to make the use of insecticide-treated nets *universal* for young children and pregnant women’ (WHO and UNICEF 2005: 1, our emphasis).

At the same time the potential enormity of ‘controlling’ malaria is reflected not only in some of the language used to describe malaria control programmes as a ‘battle’ (see, for example, Adongo, Kirkwood, & Kendall, 2005) but also in the relatively low percentages of bednet coverage actually achieved. Recent evidence shows, for example, that only three out of 15 sub-Saharan African countries surveyed have more than 25% coverage of ITN possession in households with a child under 5 years old (Eisele, Keating, Littrell, Larsen, & Macintyre, 2009). National and international policy emphasis on efforts to achieve increasingly high percentages of bednet coverage has been matched by reports which draw attention, again in quantitative terms, to the disparity between possession and usage. Thus in Eisele et al.’s (2009) study the proportion of households with children under five years old and possessing one or more ITNs was reported to range from 3.9% to 42% whereas the proportion of such children sleeping under an ITN (including those households without an ITN) was only 1.5–20%. The equivalent proportions for pregnant women were 3.3–44.2% and 1.1–19.7%, respectively.

Policy debates have something of an undercurrent of blaming the user for low usage rates and they focus on ‘successful’ use of bednets as being achievable through health education programmes. Thus, Korenromp et al. (2003) comment that ‘it is important to know whether this [low use rates] is due to affordability and a lack of availability, or the *failure* to use available nets which would suggest a need for health education’ (Korenromp et al., 2003, p693–694, our emphasis). Similarly, Sachs (2005), who intimates that ‘proper use’ of bednets is a stumbling block, advocates that ‘community-based health workers can be trained to help villagers in using the nets properly’ (p. 116).

Much previous research has explained ‘non-compliance’ with bednet programmes in terms of household or individual indicators such as wealth, age, gender, ethnicity or educational level; or through climatic factors such as season and temperature. A number of authors have thus reported on financial cost as a barrier to bednet use (e.g. Doannio et al., 2006; Esse et al., 2008). From a random sample of 204 individuals in the Kilombero Valley, southern Tanzania, the setting for the present paper, 92% reported financial constraints as an impediment to purchasing nets, particularly during the rainy season when cash is restricted (Minja et al., 2001). In relation to strategies to overcome financial barriers and thus to ‘scale-up’ the spatial coverage of bednets, some authors (e.g. Curtis et al., 2003b; Sachs, 2005) have called for highly subsidised or free distribution, and retreatment, of bednets particularly for poor rural populations in sub-Saharan Africa. The Roll Back Malaria strategy has reported on how several countries in Africa are scaling-up ITNs on this basis for pregnant women and children under five years of age (Roll Back Malaria 2005a). Others advocate public–private partnership approaches to bednet distribution such as social marketing schemes. A social marketing approach was used to promote and distribute ITNs in the Kilombero Valley (Minja et al., 2001) with a subsequent reported increase in ITN coverage from less than 10% to more than 50% during a three year period, and a 27% increase in survival of children aged one month to four years (Schellenberg et al., 2001). In contrast, however, research in north-east Tanzania demonstrated that while the use of social marketing

can prove successful as a means of scaling-up bednet use in urban areas, this was not the case in rural settings (Maxwell, Rwegoshora, Magesa, & Curtis, 2006). Policy strategies based on low cost, or free, nets do not necessarily bring about equivalent rates of usage, however, particularly in the longer term, as Toé et al. (2009, p. 6) note for a study in a malaria endemic area of Burkina Faso: ‘it is possible that... people believed it was enough to be an “ITN owner” and accepted a free net because they were offered it, rather than because they planned to use it or thought that they needed it’.

Age of family members has been used in some studies to explain patterns of bednet use and non-use. In a study of six African countries Baume and Marin (2007) found women of reproductive age and children under five years of age to be most likely to use bednets, and children aged 5–14 years and adult males least likely. In contrast, a study in western Kenya, found that adults were more likely to use ITNs than were children under five years of age, with non-use being explained in terms of forgetfulness or ‘low motivation’ (Alaii et al., 2003). From their study of 15 sub-Saharan African countries Eisele et al. (2009) found that infants are more likely to sleep under ITNs than are older children, with the latter ‘losing out’ to their younger siblings. Age and gender may also interplay with social norms and the physical organisation of the house to determine sleeping patterns and bednet management. Thus Toé et al. (2009) noted how, in south-western Burkina Faso, young men slept together while young girls slept in their mother’s room, regardless of whether other empty rooms were available; use of bednets by some family members and not others would therefore upset such patterns. Similarly, disruption of normal sleeping arrangements as a result of the arrival of visitors, children visiting other compounds and not taking bednets along because of their value as a possession, and attendance at funerals was found by Alaii et al. (2003) to affect ITN use by children under five. Intra-household sleeping arrangements are therefore a critical dimension in determining each family member’s access to a bednet and there is an important tension between, on the one hand, the complex and shifting nature of such arrangements and, on the other, the need for consistent and sustained use of a bednet in order for it to be effective.

Rates of bednet usage may also be linked to beliefs around the causes of malaria such that in some communities mosquito bites may be regarded as only one of a number of causes, and measures taken to prevent malaria may therefore be manifested in several ways unrelated to mosquitoes (Toé et al., 2009). Equally some authors have reported how bednet users emphasise their value in terms of protection against ‘nuisance bites’ from mosquitoes over and above protection against malaria *per se* (Adongo et al., 2005; Ng’ang’a et al., 2009). The practicalities of bednet usage including the need to maintain ITNs in good condition are also relevant considerations for facilitating their effective use. As Korenromp et al. (2003) point out large-scale surveys of bednet coverage and usage do not usually consider the physical state of the net, resulting in discrepancies between reported use and effective use. In this respect culturally compelling means of encouraging villagers to repair holes and tears in bednets were proposed by Panter-Brick, Clarke, Lomas, Pinder, and Lindsay (2006) through the use of song in rural Gambia. Chemical maintenance is also crucial and for full effectiveness bednets require periodic insecticide application (retreatment). Schellenberg et al. (2002) reported that less than one-sixth of ITN-owners in the Kilombero Valley, Tanzania, were re-treating them on a regular basis, possibly because of a failure to match expectations regarding bednet performance as mosquito repellents. Similarly a more recent study in the area found that only 20% of bednets had been treated with insecticide in the previous year (Erlanger et al., 2004). Developments in long-lasting insecticidal nets (LLINs) may offer more promise in this respect (Lindblade

et al., 2005) particularly when used in conjunction with combination drug therapy (Bhattarai et al., 2007; WHO World Malaria Report 2008). Participants in some studies have cited problems with hanging and taking down nets, and lack of space in the household as barriers to bednet use (Alaii et al., 2003; Ng'ang'a et al., 2009). Toé et al. (2009) highlighted how, in a small house, non-use can be related to difficulties of having a bulky item, the ITN, which is also a fire risk, in the middle of a multi-purpose room which differs between day-time and night-time in its function and spatial organisation. Some authors have considered re-designing nets to accommodate individual behaviours such as sleeping on roofs rather than indoors (Aikins, Pickering, & Greenwood, 1994). Finally, temperature and season have been reported by some authors as having an influence on bednet usage. Thus Alaii et al. (2003) found that in western Kenya ITNs were more likely to be used by children under five in cooler weather. Similarly a recent study in central Kenya reported how some bednet users valued the warmth which bednets offered at night but that during high temperatures in hot months sleeping under a bednet was uncomfortable (Ng'ang'a et al., 2009).

Much of the research which is based around economic and socio-demographic indicators as explanations for non-usage of bednets sidesteps the ways in which health-related behaviours map onto the basic needs and social norms of everyday life. Some of these explanations serve to inform public health policies which adopt ambitious and prescriptive strategies for bednet distribution. Allied to this are well rehearsed debates on bednet possession versus usage which work alongside policies to 'change behaviour' through health education. Little attention has been directed towards the ways in which malaria risk behaviours in relation to bednet use are more deeply rooted in socio-cultural beliefs and practices and, particularly, in aspects of local livelihood needs. In this paper we explore how these behaviours play out in terms of lived experiences at the day-to-day and seasonal levels in rural southern Tanzania. We focus on risks in relation to potential exposure to the malaria vector, the mosquito and, in so doing, we seek to explore how livelihoods and socio-cultural beliefs and practices are interwoven with the use and, crucially, non-use of bednets. The paper addresses an important research gap through an in-depth exploration of risk behaviours for times when family members undertake activities away from the main home either for short or more extended periods. We place specific emphasis on two aspects which have implications for familial sleeping arrangements, both of which have received negligible attention in the literature: spatial patterns of natural resource usage, particularly use of land for farming, and participation in special social gatherings and events, notably funerals. Importantly, we did not set out to explore (in)consistencies in bednet usage across communities at the outset: rather, emergent themes from grounded theory analysis uncovered the circumstances and decision-making which underpin non-usage of bednets, and the ways in which public health interventions to control malaria are perceived by residents. This has a bearing on our study design which we describe in the following section along with an outline of the study area and methods used for empirical data collection.

Study site and methods

This paper is based on the findings from an in-depth, qualitative study which formed part of a larger research project that aimed to investigate the relationships between natural resources and their management, and health-related behaviour amongst the users of those resources. The study is based in the Kilombero valley, southern Tanzania, an area characterised by seasonal inundation of its extensive wetlands and intense malaria transmission. Kilombero valley, which is bordered by the Udzungwa mountains to the north

and the Mahenge highlands to the south, spans two local government districts in the region of Morogoro: Kilombero District to the north of the Kilombero River and Ulanga to the south. Although rice cultivation is a predominant economic activity the area is characterised by diverse and complex land uses including fishing, forestry, hunting, mining, hydroelectricity generation and tourism, as well as livestock rearing and cultivation of cassava, vegetables, maize, nuts, bananas, sugar-cane and teak. Despite fertile soils there is increasing demand on land, and communities in both districts are vulnerable to seasonal food shortages. While initially an area of relatively low population density, the valley has experienced a natural increase in the long-term population and influxes of new farming tribes and, recently, pastoralists who have come to the valley in search of grazing land for their cattle. The increased population has resulted in local conflicts over shared natural resources such as land, water and fuelwood. The fringes of the inundation zone, where most settlements are located, constitute a focus for livelihood-related conflict over shared natural resources, and 'traditional' farming activities of established ethnic groups now clash extensively with those of more recent immigrants with predominantly pastoralist livelihoods (Brehony et al., 2001, 70 pp., 2004, 59 pp.; Kangalawe & Liwenga, 2005). Development of conflict mitigation strategies has been prioritised by local government and residents (Brehony et al., 2001, 70 pp., 2004, 59 pp.) while regional level policy has turned attention to moving pastoralist communities out of the valley. Such active displacement of people is an issue of national relevance since the Tanzanian Constitution grants to every citizen the right to freedom of movement and to live in any part of the country.

The original tribes in the Kilombero valley were Wapogoro and Wandamba (Makungu, *in preparation*) but our recent community survey of 26 villages in the valley involving 19,539 households, which was implemented as part of the larger research project, confirms that the study area is ethnically diverse providing livelihoods for numerous tribes, the main groups being the Wapogoro (21%), Wahehe (14%), Wandamba (13%), Wangindo (9%), Wabena (7%) and Wasukuma (7%). In addition to the Wasukuma, the main pastoralist tribe, there are other pastoralists in smaller numbers such as the Maang'ati and the Maasai. The area is also mixed religiously, with 68% of people identifying as Christian and 28% as Moslem. The qualitative research was carried out over a period of two years (January 2008–January 2010) in two of the 26 villages, one located in Kilombero District and one in Ulanga District. The two villages were selected primarily on the basis of their mixed livelihood base of both farmers and pastoralists/agro-pastoralists, with consequent shared use of land for both paddy cultivation and animal pasture, and hence potential for health-related conflict. In addition the Ulanga village is part of a Demographic Surveillance System (DSS) which has been undertaken in the Kilombero valley since the late 1990s to monitor population patterns and migrations (Armstrong Schellenberg et al., 2001) and this provided provisional baseline population and socio-economic data. It was also apposite to include a village in each of the two districts which were cooperating with the research. Finally, we had access to local gatekeepers in each village including village leaders and elders, and both communities are reasonably physically accessible year-round.

The methods included focus groups, participatory activities and in-depth, one-to-one semi-structured interviews. These three methods were 'conversational and informal in tone', allowing for discussion and 'participants' own words rather than a 'yes or no' type answer' (Longhurst, 2010, p. 105). Two Tanzanians and one UK based researcher were responsible both for collection of the data and its subsequent analysis. All of the research encounters were conducted in Swahili and were recorded with permission of the respondents; recordings were then translated and transcribed into

English by the researchers. As Müller (2007) notes, the act of translation is itself not only subjective but also political and we are aware of our complicity in this process. Given that the translators were also researchers, however, we feel that much of the authenticity of each encounter is captured in the extracts which we present here. Extracts from narratives which are included in this paper are identified only by gender, livelihood group and village district; all names are pseudonyms.

Given the social context it was important initially to meet with village leaders to introduce the aims and proposed methods of the study, to seek permission to recruit participants and to make arrangements for data collection. There were four focus groups, each of 10–12 participants, in each of the villages, divided according to gender and main livelihood: male farmers, female farmers, male pastoralists and female pastoralists. As many women are not used to being asked for their opinions (Momsen, 2006) and are often quiet in mixed groups, it was important to have a forum in which women felt comfortable and able to speak. Division of the focus groups based on gender therefore facilitated any differences in views, everyday activities and behaviours around malaria risks to become apparent. Although the village leaders that we worked with acted as gatekeepers (Scheyvens & Storey, 2003), selecting the focus group participants on our behalf, it would have been unacceptable to the community to select the participants ourselves. The focus groups met twice, once in the first year of the research, and again during the second year. Groups comprised the same participants with the exception of a few individuals who were absent from the area at the time. The individuals involved in the focus group discussions also took part in three participatory methodologies, particularly useful in capturing 'knowledge from the perspective of those being researched' (Beazley & Ennew, 2006, p. 191), where the participants would use their own concepts and ways of understanding. In the first year of the research, each focus group developed a group map of their village. In the second year the focus group participants took part in firstly, a detailed pictorial representation of their daily activities for wet and dry seasons and, secondly, a mapping exercise that showed their subjective spatial view of conflict in their communities. The participatory mapping and pictorial representations, as well as the discussions surrounding the activities, confirmed that perceptions of the reasons for, and spaces of conflict varied, and that risks and activities associated with health were often gendered.

To support the information gained in the focus groups, in-depth, one-to-one semi-structured interviews were held with a range of participants from the two villages: 14 participants in the Kilombero village and 15 in the Ulanga village. Interviewees included farmers and pastoralists, both men and women, as well as officials such as village heads, religious leaders, school-teachers and village-based health care professionals. Semi-structured interviews were selected in order to explore in more depth the ways in which health practices were embedded (Crang, 2002) in the everyday decisions and livelihood practices of individuals and households. About half of the interview participants were selected from members of the focus groups, and the remaining half were people considered both by village leaders and ourselves as researchers to be influential and knowledgeable about their villages and health practices. The findings from the qualitative research methods were subsequently used to inform a community survey questionnaire from which we were able to assess the representativeness of the qualitative responses. For example, having found from focus group members that bednets were seldom used when people were away from the main village home, a question in the survey revealed that the vast majority of respondents did not use bednets at these times.

Through these methods a wide range of issues were explored to elicit participants' views and experiences. As the research was carried out over a two year period the participants came to know the

researchers, and their responses particularly in the second year highlighted the tensions and problematic nature of their livelihoods; the at times conflictual relationships between pastoralists and farmers; and the difficult context of following health-related advice. Discussion included access to and management of natural resources; conflict around those resources and potential resolution strategies; day-time and night-time activities including sleeping arrangements for family members; health care services and participants' views of such services; and institutional strategies for controlling malaria, and views on the limitations of such strategies.

In analysing the spoken narratives and participatory data, a grounded theory type approach was adopted whereby those involved in data collection and facilitation and the principal investigator worked together, and where theory is generated from data, both in terms of process and analysis (Glaser & Strauss, 1967). A number of guiding principles were adopted in drawing on this approach in the present research. First, to have an 'open mind' to the data and through narratives capturing the respondents' understandings of health issues. Secondly, to use an iterative process whereby analysis of data from focus groups was used to inform topic guides for semi-structured interviews, which were themselves analysed and used to inform the focused community questionnaire; in addition, as part of the research dissemination process, two-way discussions with participants raised further issues which were incorporated into the interpretation of data. Thirdly, the outcome is a conceptual approach that is grounded in the data rather than imposing a theoretical position (Punch, 2005). After translation and discussion amongst all the researchers, the transcripts from the focus groups and semi-structured interviews were coded around particular issues raised by the respondents in a 'fluid and dynamic process' (Cope, 2010, p. 448). These codes were then linked into themes that reflected the main ideas to emerge from the research. Codes, while being a way of conceptualising research data, do not provide an explanatory framework (Crang, 2005). For this it is important to link such thematic content to 'patterns and structures of meaning that may not be apparent to the informants themselves' (Crang, 2005, p. 226). Such social patterns, grounded in the data and emerging from the research, include attention to family and community power relations; the tensions between traditional and new, scientific knowledge; and the influence which difficulties over access to natural resources such as sufficient land, clean water and adequate fuelwood have on the ability to follow health promotion advice.

The study was granted ethical approval by the local academic ethics committee in the UK, the institutional review board of the Ifakara Health Institute, Tanzania and the Tanzanian National Institute for Medical Research. All research participants were provided with verbal and written explanations of the study (including information sheets and consent forms) in Swahili which emphasised confidentiality, anonymity and the option to withdraw from the study at any time. Written and/or oral informed consent for the study was obtained from all participants and village heads.

Findings and discussion

The main focus of the research was how local people's behaviours, practices and attitudes mapped onto malaria-related risk in rural southern Tanzania. As indicated in the previous section many issues emerged during research encounters with participants but this paper focuses on two dominant themes which are discussed in turn below. These overarching themes are livelihoods and shared natural resources, and social gatherings and 'special' cultural events. Importantly, some themes and sub-themes arose unexpectedly from the narratives; we did not, for example, set out to explore issues of bednet use during social events but this arose as an important aspect

of malaria-related behaviour and, indeed, is a theme which is under-researched in the context of malaria risk exposure.

Livelihoods and shared natural resources

Previous top down policy initiatives of state-led collectivization and market driven liberalization (Forster & Maghimbi, 1999) appear to have brought little improvement to small scale peasant production in the Kilombero valley. Because of the early attempts to build communal villages (Sender & Smith, 1990, Kangalawe & Liwenga, 2005) and the specific hydrology of the study area, which is characterised by seasonal inundation of the river valley, farmers often live some distance from their fields for many weeks or months of the year (Hetzel et al., 2007, 2008; Armstrong Schellenberg et al., 2001). Individual dwellings within villages are widely dispersed and village boundaries cover several km². During the rainy season, also the main period for rice cultivation, when much work is needed on the farms, some families move from the village to stay overnight on their farming plots (*shambas*). These spatial patterns of settlements and fields mean that to reach the farms often involves several hours' walk and many find it impractical to walk back and forth each day. This spatiality can have a bearing on decisions relating to protection from mosquito bites as illustrated by one focus group participant:

'Sometimes when we go farming in the valleys [protection from mosquitoes is not possible]. You might go with the intention of coming back but find that it gets dark and so you decide to sleep there'(Male agro-pastoralist, Kilombero village).

Activities and practices related to livelihoods and the management of natural resources, notably land, emerged as critical aspects of malaria risk for residents of the study area. Diminished natural resources, especially land and water, conflict over access to these resources, and subsequent loss of income and food were perceived to be the result of rising population numbers with each livelihood group (farmers and pastoralists/agro-pastoralists) blaming the other. With increasing pressure on land in other regions of Tanzania, pastoralist communities have moved into the valley with their cattle herds in recent years in search of grazing land. While efforts have been made to have villagers and district officials collectively decide on shared use of land through participatory land-use planning and the formation of Land Use Planning Committees and Conflict Resolution Committees (Brehony et al., 2001, 70 pp., 2004, 59 pp.), conflict over land remains an important issue. Thus farmers felt that more land would be available to them if the pastoralists were to leave the area while pastoralists commented that cattle tracks were being taken over by farmers, and that they should have access to more grazing land and tracks for moving animals to pasture land. Such tensions were manifested as an additional part of the rationale for sleeping away from villages for long periods during the growing season, as one farmer explained:

'...mainly we are forced to do so [spend time away from the village] by distance and also to protect plants from destruction by cattle and wild animals. We stay there from the beginning of farming up to August and then come back'(Female farmer, Ulanga village).

Livelihood choices are also interwoven with sleeping arrangements, and therefore risk of malaria, since accommodation at the *shambas* comprises small, temporary and rudimentary shelters constructed from branches and straw and often mounted on stilts (Hetzel et al., 2008). Protection from biting mosquitoes seems likely to be more limited under such circumstances than in accommodation in main village residences both because of the more substantial, brick-built nature of most village houses and because of

the practical challenges in *shamba* huts relating to sleeping arrangements, e.g. using a mattress or hanging bednets to accommodate all family members. Hetzel et al. (2008), however, report that for a sample of between 72 and 104 households (and an average of 5.92 members per household) in the Kilombero valley, 96.8% of the *shamba* huts had a mosquito net, with 59.2% having an insecticide-treated bednet. Over the course of a six-month study period during the wet season in 2005 the study reports that 98% of people sleeping at their *shambas* 'reported to have used a mosquito net (treated or not) the preceding night' (p6, our emphasis). The study used a structured questionnaire at the household level, however, so caution needs to be exercised in terms of potential over-reporting, particularly in a region which has been the site for a large-scale ITN marketing campaign (Schellenberg et al., 1999) where a desire to satisfy the researchers may be a consideration. Hetzel et al. (2008) also reported that only 28% of households owned three or more mosquito nets which may raise potential concerns regarding adequacy of net provision for large family groups. Our qualitative observations and data indicate a more complex scenario which calls for further and more comprehensive ethnographic investigation, since some participants reported bednet availability in *shambas* and others contradicted this.

Our findings support those of Hetzel et al. (2008) in terms of the composition of family groups staying at their *shambas*. Several of our participants particularly, but not only, women, referred to practices of taking very young children with them to the *shambas* but leaving school-aged children behind for significant periods of time particularly during harvest. Hetzel et al. (2008) explain this practice in terms of the requirement for 'compulsory' attendance at school but our findings uncovered a more nuanced set of interpretations around 'risky behaviours' amongst school-aged children left unsupervised in the village. These behaviours, which are inter-related and have an important gender dimension, relate to food security, sexual health and well-being, and poor school-attendance (Makungu, in preparation). In addition some participants commented on the potential for enhanced malaria exposure, as one participant explained:

'School children are left at home. This leaves them with less care but more freedom; for example they can play until late and so are being bitten by mosquitoes'(Female farmer, Kilombero village).

Similarly, one father, Saleem (S) recounted to the interviewer (I) how his daughter had died while he was away from the village working on his *shamba* and how his practice had since changed:

I: So she [12 year old daughter] got sick when you were in the shamba?

S: Yes, but they came to tell me about her illness then I came here and I found her sick... she had a headache so we took her to [name] Health Centre. She was admitted for four days then we came here to [name] Hospital where she died.

I: ...they told you the cause of the illness?

S: Yes, they said it was malaria... she became sick in the night... they came to tell me later in the afternoon... it means she was alone there until we came... if I had been there when she started to feel sick I would have helped... this year I have moved them all to the shamba(Saleem, male farmer, Ulanga village).

We do not have additional evidence to substantiate, or otherwise, the cause of death in the case of this participant's daughter. It may be worth noting though that recent literature has reported widespread over-diagnosis of malaria in Tanzania and other parts of Africa (Chandler et al., 2008; Reyburn et al., 2004).

Many parents expressed concern and unease with the practice of leaving children behind in the village while they stayed at the

family farm. Access to transport may have a bearing on the practice, one mother, for example, reporting how she travelled back and forth by bicycle between village and *shamba* in order to take care of her children:

'Myself I'm not sleeping there [at the shamba]... I go to the shamba by bike and then I come back because I have children there so I have to cook for them... when they come [home] from school if I stayed in the shamba who would take care of them?'(Hasina, female farmer, Ulanga village).

The impact of livelihood-related parental mobility on children left at home unsupervised in rural African settings has largely gone unrecognised and deserves more attention in the literature. In one notable and recent exception, research in Botswana found that parents often had to choose between leaving children alone or being unable to feed them and meet basic needs and that poverty and insufficient societal support led to this choice (Ruiz-Casares & Heymann, 2009).

Livelihood activities and natural resource management also intersect with malaria risk in terms of specific daily tasks and responsibilities, particularly where these activities involve raised exposure potential through being outdoors at dawn and dusk. One such task relates to the need to collect fuelwood, a duty allocated to women. Traditionally fuelwood was collected freely from forests in the study area but participants recounted how, following the designation of the Udzungwa Mountains National Park, fuelwood collection is allowed only once a week, on a specific week-day morning. This task had to be carried out before their daily farming and household activities, so most women would be collecting wood early in the morning. A further problematic aspect of natural resource management which participants identified is access to, and collection of, water, particularly during the dry season, again a task carried out by women and young girls. The limited number of water pumps in both study villages means that there are often queues of women waiting (itself a source of conflict), while children play around the pump and near stagnant water puddles. Many women have to walk long distances to the pumps and this task is often done in the late evening, sometimes up to 11pm, or very early morning. Both the time of day and the environment therefore increase the risk of malaria for women and their children:

'Water is a big problem for us living a bit far away [on the periphery of the village]. We have to go to fetch water even at night and so get bitten by mosquitoes. So some of us get malaria as a result of this'(Female pastoralist, Kilombero village).

Social gatherings and 'special' events

The discussion so far has focussed on situations when villagers spend time away from the main home for livelihood-related reasons, either on a seasonal basis or for daily work activities. We have considered how these practices map onto malaria risk behaviours in terms of changing exposures to mosquito bites through non-usage of bednets. Our findings also show how social activities and events take on particular salience for malaria-related risks and bednet use. These activities are germane not only in the context of day-to-day socialising but also in relation to more extended social gatherings and important cultural events. The gendered nature of some everyday social encounters was evident through differences in activities undertaken around dusk time. Thus female participants described the need to carry out household chores in the evening, while several of the men made references to socialising, drinking alcohol and watching television together outdoors at these times without protection from mosquito bites.

The practice of drinking alcohol in outdoor beer clubs in villages, a specific cultural norm that could not accommodate bednet use, was reflected on in different ways by participants in relation to malaria risk. Thus, one participant jokingly referred to drinking alcohol as a means of dulling the sensation of mosquito bites:

'I believe many people are not sleeping under bednets... even bed sheets... their bed sheet is the local beer... When a person drinks a lot it means he will not sense the mosquito's bites [laughs]'(Jabar, male farmer, Ulanga village).

This is consistent with the findings of Winch et al. (1997) who reported that for some men in some settlements in Bagamoyo District, north of Dar es Salaam, inebriation was perceived as a means of both removing the feelings of being bitten by mosquitoes and of reducing perceived vulnerability to diseases in general. In a similar vein, drinking beer has been referred to in other research in the Kilombero valley as an explanation for making men strong by strengthening their blood and hence making them less susceptible to illnesses such as malaria (Hausmann Muela, Muela Ribera, Mushi, & Tanner, 2002). Alcohol consumption also met with occasional criticism in terms of perceived inappropriate use of income as illustrated by one focus group participant:

'Those who drink never miss money. He is ready not to have a mosquito net but has money for drinking; a child not to have an exercise book but he has money for a drink'(Male pastoralist #7, Kilombero village).

Our findings also show how one of the most important limitations of regular use of bednets relates to occasions when villagers sleep away from home for 'special' social gatherings. These include social events – often each month during the dry season when socialising between families is common – and attendance at ceremonies such as funerals. The latter are of particular interest as they can last for several days and because cultural norms dictate the practices around sleeping arrangements. At funerals people are expected to follow traditional practices which are specifically grounded in beliefs against the use of bednets, even though people might be aware that sleeping without a bednet will lead to an increased risk of malaria transmission. Attendance at a funeral then is marked by disruption of 'normal' sleeping arrangements by sleeping away from home, often outdoors, for a number of days.

With one or two notable exceptions these practices and the relationship with bednet (non)usage has received little attention in the literature. In a study of ITN use in western Kenya, Alaii (2003, 175 pp) referred to how the temporary migrations involved in funeral attendance influence bednet usage. She draws on pragmatic explanations relating to the impracticalities of mounting bednets and in terms of families locking up bednets to prevent theft by visiting funeral attendees. Marsland (2006, 2007) writes of how, in Kyela District in south-west Tanzania, bylaws were introduced in 2002 in an attempt to legislate against traditions which were considered by Tanzanian officials to be 'unhygienic', leading to the spread of infectious diseases. These included forbidding women from sleeping outside without bednets at funerals with failure to adhere to such bylaws leading to a fine or imprisonment. Marsland (2006) comments on how these regulations to enforce women to sleep under a bednet at funerals represent male disciplining of women and that 'mosquito bites are traditionally symbolic of a woman's suffering when in mourning' (Marsland, 2006, p. 5). Whilst it could be argued, as Marsland (2006) does, that bednets are a symbol of 'modernity' we did not find views relating to their use at funerals to be gendered. Instead, both men and women said they had to be 'uncomfortable' when at funerals, drawing on

notions of discomfort and pain which should be felt as part of the mourning process and respect for the deceased, as explained by the following participants:

'...if you use bednets it means mosquitoes cannot bite you... if they don't bite you it means you're very comfortable... you will not feel the pain of the burial... If they bite you it means you will not sleep, you will keep on thinking about the dead person'(Jabar1, male farmer, Ulanga village).

'...it is a place for mourning... a sad situation not a joyful place... if you sleep under a net there it means you want to have a comfortable sleep...'(Saleem, male farmer, Ulanga village).

They will interpret that [taking a bednet to a funeral] as you are not feeling sad...maybe you are happy... you want to enjoy. People who hold the funeral might think that you are not concerned about the death...'(Female farmer, Ulanga village).

Others expressed views in relation to potential accusations of being 'proud' and 'showing off' if a bednet were to be taken to a funeral and the implications of this with respect to the disapproval of others:

'...people will gossip! ... People will say that this person is so proud, she can't sleep without a net here...'(Hasina, female farmer, Ulanga village).

'...you know even to sleep on a mattress is not normal. People will say "why is this person sleeping on a mattress while we are in mourning?"'(Jabar1, male farmer, Ulanga village).

Several participants explained the reasoning behind not taking a bednet as relating to 'traditional beliefs'. One farmer reflected on this in terms of living in rural rather than urban areas:

'...in this village still we hold... they call it primitive traditions... Thinking like you can't sleep in a bed when you are in a mourning period; there is no justification but just concepts which we hold from our parents... One day I went to [large town] and there was a burial and we slept under nets... that's [large town]...'(Andwele, male farmer, Ulanga village).

A few participants were more explicit and occasionally made references to witchcraft as a reason for not using bednets:

'I did not use mosquito nets there.... they can suspect you of witchcraft activities.... you can't take a net or pillow - it is against our tradition...'(Omari, male school-teacher, Ulanga village).

Behaving appropriately according to norms and values passed on through generations was regarded as sufficiently important that participants felt unable to follow health advice to use a bednet, though they often recognised the need to do so for their own personal health. Local cultural norms and collectively supported social practices then accompany more 'modern' and scientific understandings of disease exposure and aetiology. Rather than seeing bednet use as 'regulation' then it may be more helpful to appreciate the ways in which modern biomedical knowledge, which is often based on the individual, is interfaced with strong, traditional communal beliefs that make it difficult for people in rural areas to change their risky behaviour.

These findings relate to attitudes towards the bednet as a material object which is somehow 'out of context' for 'special' events. Other concerns were expressed in relation to the bednet as a less than perfect prevention device given the daily rhythms of ordinary, everyday life. As noted in other studies in the Kilombero valley (Hausmann Muela et al., 2002; Minja et al., 2001) many participants argued that bednets could be only a partial solution, given that so many of their activities are conducted outdoors:

'Like when you are talking outside, you can't use a net and then you find yourself bitten and malaria comes'(Male farmer #2, Kilombero village).

Paradoxically, in this respect Hetzel et al. (2008) suggest that life in the more spatially dispersed *shambas* may offer some form of protection from mosquito bites given that there are fewer opportunities for socialising.

At the same time some of our research participants reflected on the continuous presence of malaria *despite* their own, and others', ownership or use of bednets, sometimes drawing on inflated numbers to emphasise their frustration:

'Malaria in this area is serious in both wet and dry seasons. Even though 95% of people have mosquito nets, but it is still a big problem'(Male pastoralist #7, Ulanga village).

'I don't understand why I sleep under a bednet for 365 days of the year, and they say that the mosquito is transmitting malaria during the middle of the night... I don't know why I'm still getting malaria'(Andwele, male farmer, Ulanga village).

Ng'ang'a et al. (2009) reported a similar finding in central Kenya where participants were disappointed when, despite continued use of bednets, they still experienced episodes of illness. Some of our participants felt frustrated at the perceived lack of progress in finding either a cure or adequate prevention methods while Minja et al. (2001) noted that Kilombero villagers were 'less interested in imperfect disease control tools like ITNs and are more convinced by health tools that confer full benefits in terms of risk reduction. They expect health experts... to provide perfect solutions to the problem of malaria' (p621). However, there was also a lack of precision about the use of the term 'malaria'. As other research has shown, 'malaria' is used as a 'label' to signal illness and fever, often including other illnesses, through a lack of a diagnosis, or intentionally to cover less acceptable illness (Mwangi, 2006). Similarly Minja et al. (2001) draw attention to the difference between lay concepts of 'malaria' (mild malaria) which was linked to mosquitoes by most of their study respondents in the Kilombero valley, and more serious, life-threatening malaria-related conditions such as '*degedege*' (convulsions). The latter are believed by some lay people to have supernatural causes for which amulets prepared by traditional healers, not bednets, are the preferred mode of protection.

Conclusion

The effectiveness of insecticide-treated bednets (ITNs) as physical and chemical barriers to malaria-carrying mosquitoes has led to public health policies which call for scaling-up bednet coverage, often through targeted programmes. The success of ITNs as malaria prevention tools, however, depends on their 'regular' and 'proper' use (Lengeler, Grabowsky, McGuire, & deSavigny, 2007). Policies based on widespread distribution have therefore engendered a series of studies which seek to explain, often in quantitative terms, the reasons for 'non-compliance' with bednet usage. These studies often draw on individual indicators such as wealth, age or gender in much the same way as reasons for participation (or otherwise) in clinical trials have been based on distinct and pre-defined social characteristics (Fairhead, Leach, & Small, 2006). Rather less attention has been directed towards exploring the ways in which bednet use, and non-use, are embedded in more nuanced and complex socio-cultural dimensions of individual, household and community life, including local livelihood needs.

In this paper we have attempted to fill some of this research gap by exploring daily and seasonal practices related to rural livelihoods and socio-cultural beliefs in southern Tanzania. In an attempt to turn

the spotlight on some of the ways in which malaria-related risks are played out as part of everyday lived experiences we have shown how livelihood activities and socio-cultural practices form a critical backdrop against which decisions relating to bednet (non)-usage are played out. Specifically, our findings have uncovered a number of regular and commonly occurring situations in which it is inappropriate or impractical to use a bednet. These relate to variable sleeping arrangements in response to seasonal activities and special events and these are manifested in a number of different ways. First, the physical distance of farming land from village residences in our study area generates a need for many adults to be away from the village household for extended periods of time in order to carry out farming-related activities. Second, this spatiality is itself overlaid by conflict and tensions between different livelihood groups over access to, and use of, land in ways which feed into sleeping arrangements. Third, livelihood strategies based on extended periods away from the home village have impacts for children of school age through parental decisions to leave them behind in the village. Fourth, during some 'special' events and ceremonies, particularly funerals, where people often sleep outdoors, cultural norms forbid the use of bednets out of reverence for the deceased. The ways in which 'modern' scientific knowledge and public health messages interact with collectively supported beliefs and practices relating to such social gatherings deserves much more detailed consideration. Finally, there are several circumstances in which malaria transmission risk is enhanced by taking part in routine, daily activities out of doors around dawn and dusk. These include socialising, drinking and watching television in open spaces, and work-related activities such as queueing for water, collecting fuel-wood and conducting outdoor household activities, practices which have an important gender dimension.

Our findings draw attention to the shifting nature of sleeping arrangements not only on a daily and seasonal basis but also in terms of responses to specific socio-cultural practices. Such changing patterns point to some of the limitations of use of the bednet as a barrier to infection, often militating against its consistent and sustained use which public health policies and strategies call for. This promotion of bednets as a protection against malaria transmission is embedded in a biomedical ethos which is itself informed by scientific malaria research around the disease vector. And yet even some of these scientific debates are raising questions about the implications of the sustained use of ITNs themselves. Thus some recent work in northern Tanzania indicates evidence for mosquito behavioural adaptation through changes in biting patterns (Braumah et al., 2005). This evidence suggests that in areas where ITNs had been used for a number of years mosquitoes may be changing their peak biting times from the middle of the night to early and late night-times in order to avoid contact with the bednet. There are also questions around the possibility of impaired immunity as a result of reduced malaria transmission arising from long-term bednet usage (Askjaer et al., 2001; Maxwell et al., 2002). Paradoxically then this literature suggests that the sustained usage of ITNs may initiate additional impediments to the reduction of malaria morbidity and mortality.

Our work has pointed to some of the problematic nature of policy expectations around the consistent and sustained use of the bednet in rural southern Tanzania. We therefore support the assertion that 'it is, of course, a mistake to think that bednets will provide a universal solution [to malaria transmission], especially given the discipline required' (Turnbull, 2000, p. 175) 'in the disordered, complex world of tropical disease' Turnbull (2000, p. 177). Bearing in mind the partial and imperfect nature of the bednet as a public health intervention, however, it remains appropriate to attend to the need for enhanced policy formulation. While some attention has been drawn to improving policy through recognition of social and cultural influences on the treatment of

malaria in Tanzania (Kamat, 2006) a more informed and nuanced set of policies which considers social and cultural norms is needed in relation to its prevention. For example, there is still an implicit assumption that if ITNs are made available they will be used on a nightly basis and by all members of a household, or at least those most vulnerable (infants and pregnant women); in other words that there is consistency in sleeping arrangements. Our findings offer up a challenge to this assumption.

Malaria control programmes based on exposure reduction through bednet usage offer solutions which can remain only short-term and partial unless and until these are linked to the more fundamental environmental, social, economic and political contexts of the disease (Stratton, O'Neill, Kruk, & Bell, 2008). Rather than policy-makers focusing on 'changing behaviour' of people in rural areas, therefore, a more holistic approach to health interventions is necessary, that considers the limited 'choice' available to many families, and in particular providing alternative means of protection when they are active in outdoor spaces. On the basis of the findings of our research we offer a number of suggestions which may help to shape such an approach. First, there is a need for policy-makers to take more specific account of the daily and seasonal practices related to livelihoods and socio-cultural norms which interplay with malaria risk. Decision-making around bednet use, or non-use, may be informed by multiple demands relating to land-use, family relations and social commitments and these complexities deserve recognition and understanding by malaria programme planners and managers. Second, policies should recognise that non-usage of bednets is not simply a function of tangible factors such as cost and training in how to use them. This acknowledgement may then help to temper some of the currently ambitious targets for mass bednet distribution and instead engender more sustainable strategies. Third, the role of public health education programmes should be re-considered such that public health messages are less prescriptive and more clearly embedded in the local context, paying particular attention to circumstances in which people deviate from 'normal' sleeping patterns. In this sense, local health care professionals and practitioners may themselves need clearer guidance on conveying realistic messages which respect local norms and behaviours. Finally, given the interconnectedness of shared natural resource use and health-related behaviour it would seem prudent to develop more integrated well-being policies which recognise the importance of both poverty reduction strategies and health promotion. Existing local and district level health management structures could offer an important platform for the implementation of such policies.

In order to reduce the gap between bednet ownership and usage, public health strategies should seek to encompass more of the myriad, nuanced and inter-related socio-cultural and economic explanations for non-use which interplay with the everyday ways in which people live their lives. In this sense, then, if ITNs are to remain a critical component of national and international malaria control, there is an urgent need to move beyond explanations of 'non-compliance' at the individual and household level to an appreciation of how malaria-related behaviours map onto the 'reality' of rural livelihoods.

Acknowledgements

The research described was supported by Grant Number R21ES014585 from the National Institute of Environmental Health Sciences. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Environmental Health Sciences or the National Institutes of Health. We acknowledge colleagues involved in the larger project particularly Mathew Alexander, Henk van den Berg, Gerry Killeen, Rose Nathan, Robert Sumaye and Chris Thomas. We thank

Beccy Thomas for community survey data analysis. Finally we are indebted to the research participants who gave their time to take part in the study.

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