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ORIGINAL ARTICLE

Knowledge of human social and behavioral factors essential for the success of community malaria control intervention programs: The case of Lomahasha in Swaziland

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Background: Although malaria control programs have made rapid progress recently, they neglect important social and behavioral factors associated with the disease. Social, political, and cultural factors are involved in malaria control, and individuals in a community may be comfortable in behaving in ways that, to an outsider, may seem contrary to commonly held perceptions. Malaria control efforts can no longer afford to overlook the multidimensional human contexts that create and support varying notions of malaria and its prevention, treatment, and control. This study aimed to assess the knowledge and perceptions of malaria issues in the community, and to identify practices that support or hinder the progress of malaria control programs.

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Methods: A triangulation study involving individual interviews, focus group discussions, and observatory analysis between 2003 and 2010 at Lomahasha, a malarious community on the eastern border of Swaziland and Mozambique, was conducted.
Results: Results indicated that a high knowledge level and good perception of the disease were observed in the age group of < 40 years, contrary to those in higher age groups, among the Lomahasha community members. However, behavior of certain community groups includes practices that are not supportive of the national control program's aspirations, such as delay in seeking medical attention, staying outdoors until late, maintaining stagnant water in roadside excavations, and seeking medical assistance from wrong sources. Malpractices are more commonly observed among men, boys, and those who drink alcohol.
Conclusion: This study suggests a thorough community diagnosis before all intervention programs for malaria control are instituted.

Introduction

Malaria is a major public health problem in Sub-Saharan Africa. Deaths and illnesses contribute to a vicious cycle of ill health and poverty.[1,2] African heads of state agreed in the Abuja Declaration to a concerted effort to reduce the burden of malaria in the continent and endorsed the goal of the Roll Back Malaria Partnership of halving malaria deaths by 2010.[3] Most endemic African countries emphasize prompt access to effective treatment as the most important control strategy for young children and pregnant women.[2] Initiatives to address access to treatment at local level, e.g., strengthening home-based management, have also been attempted.[4–6] At a community level, however, a lot more complex factors influence prompt access to effective treatment besides availability and affordability.[7] An understanding or explanation of the illness in a way that is different from the biomedical explanation influences the decision regarding whether to seek treatment or not, and when and where to seek treatment.[8,9] The success of intervention programs such as insecticide-treated nets (ITNs) depends on the cooperation of the community members, such as being under a net or indoors during the peak biting times (i.e., 5 PM to midnight). Reduction of mosquito breeding sites (environmental management) has long-term implications, and has been advocated for in many developed and developing countries.[10]

Considering the complexity of the issues surrounding all these intervention programs, there is no doubt that it requires cooperation of the people at the center of the problem. Their willingness to act is influenced by their knowledge and perceptions of the disease. However, their day-to-day behavior is also very crucial and is determined by other factors that may not have to be related to the knowledge and perceptions of the illness. The key elements of such programs are the generation of a feeling of empowerment, local ownership, and responsibility,[11,12] and the application of action-oriented and participatory approaches.[13–15] Any public health effort, for effective malaria control, would be delinquent and short-sighted if it did not pay significant attention to how behavioral and social factors contribute to risk for and prevention of malaria infection. Unfortunately, most intervention programs ignore this critical requirement. Brown[16] noted that little has been written about social factors in the modern resurgence of malaria. This is because the focus of public health, and malariology in particular, has been narrowly fixed on the parasite and the mosquito vector. The bigger picture that increased rates of malaria morbidity, although directly influenced by changes in the parasite and vector, are more directly caused by human behaviors has been neglected. Intervention programs would achieve much if efforts were made to correct disease-promoting factors and support disease-preventing factors.

This study recognizes the benefits of an interdisciplinary approach to the control of malaria, especially among poor communities. The knowledge and perceptions of malaria in the Lomahasha community were explored and applied to different etiological models that guide behavior of individuals and groups. Behavioral patterns of groups of people in the community have been studied over a period of time (2003–2010) while noting complimentary and exacerbating behavior to malaria control interventions.

Malaria control intervention measures, including indoor residual sprays (75% of homesteads annually), case detection and management, and surveillance, have been deployed at Lomahasha for many years, in addition to those methods used by individual families to prevent mosquito bites. In order to reach set targets with the Roll Back Malaria Partnership, the Swaziland National Malaria Control Program (SNMCP) introduced the ITNs strategy in 2003, and Lomahasha is one of the areas that were prioritized. However, success of the ITN strategy depends on the behavior and perceptions of community members about the use of nets and the disease. If individual community members do not stay under nets during the peak periods of mosquito biting, then the benefits and effectiveness of the program cannot be realized. This study aims to explore the common behavior, beliefs, and practices of the Lomahasha community that influence malaria control intervention programs.

Materials and methods

Study area and living conditions

Lomahasha (32° 0′ 0″E, 25° 58′ 60″S), located in Lubombo Province, is a mixture of semiurban and rural settlements in a malaria endemic community on the eastern border of Swaziland. The community shares frequent human movement with Southern Mozambique (Figure 1), an area with a high malaria prevalence.[16,17] The homesteads consist of traditional (stick and mud) dwellings (60%), brick houses (39%), and a mixture of traditional and modern dwellings (1%). A majority of members of the community are uneducated (10.8%), have only primary education (29.7%), or have secondary education (56.8%). Only 2.7% have tertiary education. As a result, a large proportion is either unemployed (46%) or in temporary/informal employment (32%) in the sugarcane and citrus industries located close by. Only 8% are in formal employment. A majority of homesteads survive through subsistence cultivation of maize, the staple crop, in small farms allocated by the local authority to families. Lomahasha is semiarid and often has water shortages. Impounded water sources in roadside excavations are used by many families for domestic purposes. Only 618 homesteads (25%) have access to piped water sources, and these tend to be around the urbanized border area. Homesteads located away from these sources get their domestic water from rivers (13%), springs (52%), wells (7%), and other sources (2%). Needless to mention, all these sources dry up during certain times of the year.

Semistructured individual interviews

The study utilized methodological triangulation to bring about a strong pressure for valid, reliable, and robust conclusions to provide a firm basis for action. Three methods were utilized: individual interviews, focus group discussions, and observation. An exploratory study using a semistructured questionnaire containing both quantitative and qualitative items was used to collect data from 174 respondents on their knowledge and perceptions of malaria disease. Data were collected by students holding a second-level Diploma in Environmental Health who had completed a course in research methods. They were further trained for 1 day on the completion of the questionnaire and were involved in the pretesting at Siphofaneni, another malaria endemic area in the Middleveld of Swaziland. The students were placed strategically around the Lomahasha village to collect data from all directions. They stood on walkways and roadsides, and interviewed all the people who were passing by. All questionnaires were completed in 1 day only. All respondents consented to the interview. This study was approved by the Ethics and Scientific Committee of the Ministry of Health, Swaziland.

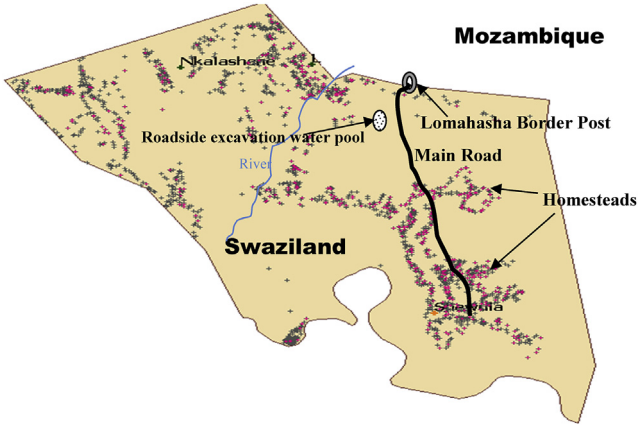

Figure 1. Map of Lomahasha.

Focus group discussions

Ad hoc discussions were held with 16 different groups identified during visits: boys (in 2 soccer groups), women (in 1 water source), men and women (in 2 shebeens); women (at 3 bus stops), and families (in 8 homesteads equally spread out in the community). Each focus group discussion was guided by a set of qualitative questions that helped in having a short discussion of $\geq$ 30 minutes. All groups that were approached consented to take part in the discussion without any persuasion.

Observation study

Eighteen visits (6 each year in 2004, 2006, and 2010) were made to the study area to observe the behavior of individuals and groups. Each visit lasted from morning until late evening, during which one or two researchers would drive around the different areas of the community noting behaviors that might be impacting malaria control. A further 11 homesteads were visited to observe a typical Lomahasha day for different members of the family.

Statistical analysis

All statistical analyses were carried out using SAS 9.3 (SAS Institute, Inc., Cary, NC, USA). A univariate analysis was carried out to independently determine whether age and education status were associated with knowledge of key malaria symptoms and with prevention methods for prevention of mosquito breeding. A univariate analysis was also carried out to independently determine whether any of the prospectively defined independent factors (age, sex, and economic status) was significantly associated with the ownership of a bed net and with appropriate assistance-seeking behavior. Throughout the analyses, confidence limits were set at 95%.

Results

Knowledge and perceptions of symptoms

This community exhibited high knowledge of malaria and correctly associated it with symptoms such as headache (160/174, 92%), fever (169/174, 97%), and sweating (103/174, 59%). Compared with the age group of $<$ 20 years, the knowledge of key malaria symptoms was found to be significantly higher in the age group of 20—39 years

($p = 0.034$), but was not significantly different among the other age groups. Probably, the 20–39-year age group benefits from health education interventions they receive during antenatal care visits. In addition, no significant variation of knowledge of key malaria symptoms was observed among participants with different levels of education (Table 1). Forty-one percent (71) of the respondents experienced a malaria episode in 2004, and a further 56% (97) acknowledged to a household member to have had the disease. However, a smaller group (3%, 5/174), consistently among those over 50 years old, mentioned that the symptoms are as a result of eating sugary foods resulting in "*inyongo*" (bile)—a traditional diagnosis for acidic bowel contents but with symptoms closely resembling those of malaria. Only 13% (9) of those who reported to have had episodes of malaria claimed to have received a feedback of their diagnosis. The rest claimed to have submitted a blood sample and were successfully treated presumptively.

Mosquito breeding prevention methods

A good proportion (86%, 150/174) of the respondents mentioned that the mosquito vector is responsible for transmission. We note again that persistently those in the age group of 50 years and above mentioned the housefly to be responsible for transmission. Three percent (5) said that it is transmitted by a snail or by "the food we eat." Eighty-four percent (146) correctly identified mosquito breeding habitats as stagnant or slow-moving water. However, draining stagnant water was mentioned by only 57% (99) of the respondents as a method of preventing mosquito breeding. A further 59% (103) also mentioned destruction of temporary water containers. Three percent mentioned construction of toilets and adoption of hygienic practices. Generally, knowledge of prevention methods for mosquito breeding was good in the age group of < 20 years. All the other groups (20–39 years, $p = 0.006$; 40–49 years, $p = 0.008$; and ≥ 50 years, $p = 0.003$) had significantly lower knowledge levels (Table 2).

Table 1 Knowledge of key malaria symptoms among participants of Lomahasha village in Swaziland.

	Know symptoms	Do not know symptoms	Odds ratio	95% CI	*p*
Age (y)					
< 20	43 (25)	9 (5)	1.00		
20–39	59 (33)	31 (19)	0.40	0.15–0.97	0.034
40–49	11 (6)	8 (5)	0.28	0.08–1.09	0.056
≥50	10 (8)	3 (2)	0.70	0.14–4.75	0.694
Total	123 (71)	51 (29)			
Educational status					
None	14 (8)	4 (3)	1.00		
Primary	29 (16)	22 (13)	0.38	0.08–1.44	0.16
Secondary	77 (45)	24 (13)	0.91	0.20–3.30	1.00
Tertiary	3 (2)	1 (1)	0.86	0.05–56.11	1.00
Total	123 (71)	51 (29)			

Data are presented as *n* (%).
CI = confidence interval.

Table 2 Knowledge of methods for prevention of mosquito breeding among participants of Lomahasha village in Swaziland.

	Know prevention methods	Do not know prevention methods	Odds ratio	95% CI	*p*
Age (y)					
< 20	45 (26)	7 (4)	1.00		
20–39	59 (34)	31 (18)	0.30	0.10–0.77	0.0060
40–49	8 (5)	10 (6)	0.12	0.03–0.50	0.0008
≥50	5 (3)	9 (5)	0.09	0.02–0.40	0.0003
Total	117 (67)	57 (33)			
Educational status					
None	6 (3)	8 (5)	1.00		
Primary	29 (19)	23 (13)	1.68	0.44–6.74	0.55
Secondary	70 (40)	31 (18)	3.01	0.83–11.38	0.02
Tertiary	12 (7)	2 (1)	8.00	1.02–92.68	0.04
Total	117 (67)	57 (33)			

Data are presented as *n* (%) unless otherwise indicated.
CI = confidence interval.

Malaria prevention methods

Of the respondents, 97% (169/174) believed that malaria can be prevented. The rest claimed that any attempts to prevent the disease have failed. Methods of prevention mentioned include draining swamps and stagnant water (36%), burying or destroying cans and tins in pits (25%), clinic visits (25%), use of bed nets (14%), and spraying (11%). Eleven percent, commonly from those aged 50 years and above, included methods such as proper disposal of rubbish, keeping home clean, sanitary disposal of feces, boiling all drinking water, keeping food covered, and avoiding eating sweet foods. However, no significant difference in the knowledge of prevention methods was observed between the age group of < 20 years and the other age groups, including those of 50 years and above (Table 2). Knowledge was found to be significantly lower among those with no education and those with primary education only, compared with those with secondary ($p = 0.02$) or tertiary education ($p = 0.04$; Table 3).

Table 3 Methods used at respondents' homes to prevent mosquito bites, as informed by participants of Lomahasha village in Swaziland.[a]

Method	*n/N*	%
Applying skin lotions	50/174	28.6
Using Bed nets	48/174	27.7
Using window screens	40/174	22.8
Applying commercial sprays	50/174	28.6
Using garlic as skin lotion	5/174	2.90
Using mosquito coils	15/174	8.60
Burning "umsutane" (plant)	5/174	2.91
Burning tissue paper	5/174	2.90

[a] Some participants mentioned more than one method.

Prevention of mosquito bites

Seven methods were identified to be used in respondents' homes to prevent mosquito bites. Applications of skin lotions, commercial sprays, bed nets, and window screens were the most commonly cited methods (Table 3). Some methods whose efficacy is unknown were also mentioned, i.e., burning "umsutane" (a locally growing plant) or toilet tissue paper, and using garlic as a skin lotion.

Ownership of bed net

Of the respondents, 68% (118) claimed to have seen or heard of bed nets, but only 33% (57) of the respondents claimed to possess a bed net (Table 4). The influence of age, sex, and economic status on the ownership of a bed net was investigated. The ownership of a bed net appeared to be highest among the age group of 20–29 years ($p = 0.01$). Bed net ownership was found not to be significantly different between the age group of < 20 years and the other age groups (Table 4). Moreover, the number of women owning bed nets was more than that of men ($p = 0.0009$). However, bed net ownership was found not to be different among different socioeconomic levels of homesteads. Six percent claimed that the nets at their homes were previously used by a pregnant member of the family and were no longer used. Of the respondents, 96% claimed that they were desperately in need of the bed nets. They claimed to have seen the advantages of a bed net at their home, clinic, neighboring homesteads, and friends' place, and in demonstrations, books, or other countries. We also noted that even the group that did not associate mosquito bites with malaria wanted the bed net "to prevent disturbance by mosquito bites while sleeping". However, they emphasized that the net does not prevent malaria.

Table 4 Information on ownership of bed net, collected from participants of Lomahasha village in Swaziland.

	Own a bed net	Do not own a bed net	Odds ratio	95% CI	*p*
Age (y)					
< 20	25 (14)	27 (16)	1.00		
20–39	24 (14)	66 (38)	0.39	0.18–0.86	0.01
40–49	5 (3)	13 (7)	0.41	0.10–1.49	0.17
≥50	3 (2)	11 (6)	0.29	0.05–1.32	0.13
Total	57 (33)	117 (67)			
Sex					
Male	3 (2)	31 (18)	1.00		
Female	54 (31)	86 (49)	6.49	1.86–34.48	0.0009
Total	57 (33)	117 (67)			
Economic status[a]					
Low	38 (22)	84 (48)	1.00		
Middle	14 (8)	24 (14)	1.29	0.55–2.93	0.55
High	5 (3)	9 (5)	1.23	0.30–4.40	0.77
Total	57 (33)	117 (67)			

[a] Economic status was determined by observing whether the family had a modern house, car, or electricity. The results of the observation were assessed as follows: low socioeconomic status—none of three present; middle socioeconomic status—one or two of the three present; and high economic status—all three present.
Data are presented as *n* (%) unless otherwise indicated.

Treatment-seeking behavior

A majority of the respondents (75%) sought medical assistance appropriately from health facilities when they suspect malaria (Table 5). Fourteen percent (24) claimed to either treat themselves at home or seek assistance from relatives. Three percent (6) claimed to consult traditional healers, and a further 3% (5) claimed to use laxatives.

Appropriate treatment-seeking behavior appears to differ between male and female participants ($p = 0.004$). There was no significant difference between those without education and those with only primary education ($p = 0.085$). Treatment-seeking behavior varied significantly between those with no education and those with secondary education ($p = 0.001$) but, surprisingly, not in those who had tertiary education ($p = 0.587$). Most respondents claimed to seek medical attention within 4 days, but a reasonable percentage (27%) claimed to seek medical attention within 1–2 weeks. Most claimed that they wait for further development of symptoms to exclude influenza and "*inyongo*." *Inyongo* seems to be popular and very closely related to malaria; its similar symptoms are often confused with those of malaria.

Day-to-day activities

Seven groups of two to six soccer players were found next to their homesteads between 8:16 PM and 10:34 PM. They had split from the same team, but stopped to chat from about 7:30 PM after they stopped training. They claimed to chat every day, sometimes beyond 12 PM, except in winter when they disperse earlier. When asked whether they get mosquito bites, they said that even though they get the bites, they like being together than being alone at home. Eight of the boys claimed to have had bouts of malaria between 2004 and 2007. From the discussions, one could tell that the group does not take the disease seriously. They claimed that it was easy to cure even without going to hospital. They constantly mentioned that they were more worried by human immunodeficiency virus (HIV)/AIDS that had no cure and being together kept them safe. A larger percentage of the boys in each focus group persistently claimed that they close windows in their rooms when they get home. The rest claimed that somebody closes all the windows, including those of their rooms. One claimed: "Nobody gets into my room and so nobody can close my windows". There was a general agreement that they enjoy a certain degree of privacy in their rooms, and other members of their families seldom enter these rooms. Those whose windows are closed by other members of the family claimed to have this privacy as well, but gave permission for closure of windows. A few claimed that they never close the windows all night because it is too hot inside the room.

Nine groups of women were found at about 4:34–6 PM next to water sources, some of which were reservoirs created from water impounded in roadside excavations.

Table 5 Appropriate assistance-seeking behavior of participants in Lomahasha village in Swaziland.

	Appropriate	Not appropriate	Odds ratio	95% CI	*p*
Age (y)					
<20	38 (22)	14 (8)	1.00		
20–39	80 (46)	10 (6)	2.94	1.09–8.10	0.020
40–49	9 (5)	9 (5)	0.37	0.10–1.30	0.087
≥50	4 (2)	10 (6)	0.15	1.57–33.51	0.002
Total	131 (75)	43 (25)			
Sex					
Male	33 (19)	19 (11)	1.00		
Female	103 (59)	19 (11)	3.12	1.38–7.03	0.004
Total	131 (75)	43 (25)			
Educational status					
None	8 (5)	10 (6)	1.00		
Primary	36 (21)	15 (9)	3.00	0.86–10.54	0.085
Secondary	84 (48)	17 (10)	6.17	1.85–20.59	0.001
Tertiary	3 (2)	1 (1)	3.75	0.23–216.15	0.587
Total	131 (80)	43 (25)			

Data are presented as *n* (%) unless otherwise indicated.
CI = confidence interval.

Some would be found to have already filled up their containers but would remain to chat with their friends. They claimed to collect water every day in the late afternoon because "it was too hot during the day". Seven of the women claimed that they never arrive at their homesteads after sunset because water is not permitted into their homesteads after sunset. This is an old Swazi practice, and it is still observed in some homesteads here. All the women claimed to close windows at their houses at sunset to protect members of the family from mosquito bites and for their own safety during the night. Six women claimed that their husbands always open the windows on arrival late at night after a drinking spree. Five of the women claimed to have had malaria, but they all said that they "do everything to avoid mosquito bites, but mostly being indoors early or sleeping under the net". Those who did not have nets started asking if they could be helped to acquire the nets. The whole group indicated a strong belief in the efficacy of nets in preventing malaria. Seven of the women claimed to also use lotions and commercial sprays such as "*Doom*" to protect themselves and other family members, especially when they are forced to keep windows open at night.

Men (13) and women (6) found in several shebeens all tended not to care much about malaria. They all claimed discomfort from closed windows or sleeping under the net. There were claims that "mosquitoes do not bite a drunk individual because the alcohol in the blood repels them." When asked if any members of their families had had malaria in the previous year, they said everybody has had malaria including the rich, Christians, and even family members of community health workers (*bagcugcuteli*). This group was found to remain in shebeens, sitting outside until as late as 11 PM. Men usually leave later than women. During rainy days, drinking was found to take place inside the traditional kitchen (*lidladla*) until late. The kitchen is shared with other members of the family who also do their cooking there. Because of the drinking visitors, often the door and windows are kept open. When asked if the family members wished to close the windows, they replied in the affirmative but felt that it would be impolite to their customers.

Men and women found at bus stops had varying opinions because they came from various parts of Lomahasha and beyond. Those not from Lomahasha claimed to frequently visit their relatives there. Most people in these groups blamed the government for not helping malaria endemic communities. They felt that Swazi communities had too many responsibilities such as building schools, paying for their children's education, buying dipping chemicals and commercial malaria preventives, etc. They clearly viewed malaria control as a responsibility of the government. They wanted the government to buy everyone a bed net and put up screens on the windows. One even mentioned: "Everything for malaria control, such as bed nets is from donors, our government does not see malaria as a problem at all."

They criticized the government for being more concerned about supplying water for sugar cane cultivation and not for domestic use in homesteads. They particularly singled out the Lomahasha water problem as an old one that aspiring Members of Parliament always use when campaigning, by making empty promises to residents. One mentioned that the Malaria Control Program was understaffed and is always insufficiently funded to deal with all aspects required for the control of the disease in their community. Just like those found in shebeens, this group also did not want to own the problem probably because some of them were not from the area or any other malarious region.

It was observed that most homesteads (64%) were headed by women because the male head of the family had either died, or was working too far and returned on weekends. The majority of the unemployed men spent most of their time drinking. It was noted that during the morning hours, most family members engage in domestic work, especially in the fields, in summer until about 10 AM. After this time, they disperse to serve individual chores,

but women still have domestic duties such as washing, collecting firewood, etc. On very hot days, most washing is done in small streams or several large pools of water created by a collection of water in roadside excavations. Other activities around these water pools included block making (both cement and mud), bathing or swimming (young boys), drinking (domestic animals), and watering of small gardens by the homesteads located near the sources. From such a variety of activities, it became clear that members of the community value these water sources. In the evening, women and girls engage in preparation of supper, while most young and adolescent boys go for their sporting practice or visit their friends. Most homesteads visited in the evening reported that their young boys are still out with friends even after 10 PM. This practice tends to increase when one moves toward the urbanized parts around the border. A number of these boys were found chatting with friends just outside the fences of some homesteads. The privacy practiced by the boys in their rooms, as established in focus group discussions, was further confirmed in most homesteads. Discussion with parents suggested that at times they would never know whether their male children were back or not because they would go to their separate house units.

Discussion

Malaria control at Lomahasha can only be successful and sustainable if the community considers the disease as one of its major problems and has the willingness and knowledge to participate in its prevention and control. It appears that little attention has been given to social and behavioral factors in malaria control efforts at Lomahasha. However, to change human behavior or to make people accept new kinds of health behavior is difficult.[18] The knowledge level of malaria issues in the Lomahasha community is high, so their behavior is not influenced by a lack of knowledge but by other underlying factors. However, an information gap exists among those older than 50 years who still hold false notions about the etiology of malaria and hence seek for health assistance from wrong sources. The younger groups probably benefit from school curricula that include topics on tropical diseases. Efforts to educate the people in the $\geq$ 50-year-age group are necessary because they have the responsibility to adopt malaria control interventions within families and communities. Knowledge of methods to prevent mosquito breeding is poor (average 68%), and tends to decrease with increasing age above 40 years and decreasing education status, and these need to be vigorously supplemented in order for members of the community to participate in programs aimed at reducing mosquito populations.

Owing to social factors such as the lack of a good supply of water for domestic purposes, the community wants to protect water bodies after rains; hence, a significant percentage of those interviewed refused to mention draining of stagnant water as a method of mosquito control. In turn, these protected water sources become breeding habitats for mosquitoes. Boys seem to value the time they spend together, but the absence of youth clubs and centers force them to remain exposed to mosquito bites for as much as 4 hours while enjoying each other's company. Unfortunately, this is also the peak biting time for *Anopheles* mosquitoes.

Some members of the Lomahasha community, such as football-playing boys and alcohol imbibers, are so used to the disease that they perceive it as a part of their lives. When people live with a disease for a long time, they tend to regard it as a part of their everyday life.[19] Groups of people tend to have ideas (explanatory models) about their illnesses, i.e., how they become ill and what they can do to prevent and treat illnesses. However, these perceptions are weighed against other societal values and often rate lower. Karamagi et al[20] said that certain signs and symptoms are given unique names such as "*ndenge-ndenge*" for throes of malarial convulsions in East Africa. At Lomahasha, treatment is often delayed for 1 week or 2 weeks because victims want to make sure that they are not suffering from *inyongo*. The signs and symptoms of *inyongo* are very similar to those of malaria. There is no doubt that such delays often end up in fatal consequences. In addition, the belief that malaria is easy to cure leads members of this community to seek assistance within their community rather than visiting health facilities. Such perceptions vary within a cultural entity and are often affected by education level. The level of education is generally low among the people of Lomahasha, and even lower among the older age groups and hence the higher prevalence of such perceptions among them. The appropriate assistance-seeking behavior of females are three times better than that of males ($p = 0.004$). This is probably because women (rather than men) attend antenatal care in health facilities where they receive health education that improves their understanding of disease etiology. The improved understanding, therefore, influences their decisions regarding when and where to seek health assistance. Efforts to target the male counterparts, probably at drinking areas or employment sites, are required. As malaria is curable, the disease is perceived to be less dangerous compared to other community health problems. The Lomahasha community is one of the communities in Swaziland with a high HIV/AIDS prevalence, which results in a shift of the focus from malaria. This observation confirms the findings of a study by MacLachlan and Namangale[21] conducted among university students in Malawi, who clearly rated HIV as more important than any other infectious diseases.

Gramiccia[22] stated that, "Any attempt at educating people in self-help in malaria control should take into consideration the many serious scourges affecting the particular population and the order of priority given them by the people." Owing to water shortage issues, this community value impounded water in roadside excavations, but such ecological changes increase the risk for this disease. Inhorn and Brown[23] claim that, "Development projects of dam construction and settlement in Third World countries have probably done more to spread diseases such as trypanosomiasis, schistosomiasis and malaria than any other single factor." Road construction companies leave excavations unlevelled with the belief that they would be helpful to the water-starved communities. There is no doubt that the Lomahasha community benefits from the roadside excavations that periodically trap and preserve water long after the rains have stopped. It is probably the reason that draining water sources was listed only by a

minority of people as a method of mosquito control. Lomahasha is a poor community, and the people there are more concerned about alleviating their poverty than malaria control interventions. The importance of good recognition of malaria issues in a community's priority list further confirms Messing's[24] assertion about subsistence and health care prioritization in Ethiopia. This assertion was supported by the observations made at Lomahasha.

Regarding bed net ownership, acceptance, and usage, a total of 1075 ITNs had been distributed in the Lomahasha community in January 2007 Swaziland National Malaria Control Program (2007).[25] This covers 44% of pregnant women and 24% of children younger than 5 years. A majority of the nets were reported and observed to be fully utilized by pregnant women (105 nets), children younger than 5 years (730 nets), and people of other age groups (240 nets). Bed nets are not readily available in local shops and are available only from donations through the SNMCP. Nonetheless, studies to determine net usage are required because this study describes reports of only those interviewed.

A study by Bradley et al[25] in the Gambia showed an inverse correlation between bed net usage and mortality due to malaria. Snow et al[26] showed that bed nets result in a reduction of the number of infective bites. Reduction of mortality and morbidity was also alluded to by Bermejo and Veeken.[27] Owing to the worldwide acceptance of this method to offer a degree of protection, it was enlisted among strategies in Lomahasha malaria control policies in 2003. Bed net distribution largely prioritised pregnant women and children under 5 years, hence the high ownership among those in the childbearing ages (20—39 years). However, during one of the visits, we observed distribution of a truckload of bed nets on Africa Malaria Day. The bed nets were distributed indiscriminately to all age groups and sexes. There was a scramble for the bed nets, suggesting positive attitudes and acceptance if we assume the bed nets would be used for the right purpose, i.e., for protection against mosquito bites. However, there is a misconception among a small proportion of the community that this strategy is for pregnant women and children only. This notion seems to prevail more among young boys. These members stated that, although there were bed nets at their homesteads, they were no longer used because there were no pregnant women or children to use them.

Large-scale distribution of bed nets is important in the Lomahasha community to increase the coverage. Strategies to increase distribution could benefit from partial contribution of members of the community through the purchase of subsidized nets.[28] Most members of this community are poor and believe that bed net purchase is a responsibility of the government. Some members of focus group discussions blamed the government for failing to provide more bed nets.

Behavioral and anthropological approaches are required to influence community cooperation regarding the usage of bed nets. The efficacy of bed nets is dependent on their efficient use during the peak biting hours. If people are not staying under them during these hours, bed nets lose their effectives.[10,29,30] The two species of mosquitoes responsible for transmission of malaria in the Lomahasha community are *Anopheles gambiae* and *Anopheles arabiensis*.[17] *A. arabiensis* is also an outdoor feeder and transmit the disease to those that remain exposed during the peak biting hours. Young and adolescent boys, and men and women who remain outside while socializing (chatting and drinking) in the evening would not get any protection from bed nets even if they retire to sleep under them, because they would already have been bitten and infected. Although the rule that prevented women from bringing water into homesteads after sunset was meant to prevent them from cheating their husbands, it also protects them from mosquito bites where it is still practiced. Some women were found to be exposed to bites by staying outdoors late in the evening either chatting or still queuing up for their turn to collect water from the limited wells or springs. Water supply for domestic purposes could significantly alleviate the problem.

Lomahasha is one of the areas with a high malaria incidence in Swaziland. The absence of adequate diagnostic facilities at the clinic delays results for many people and can lead to overdiagnosis and overprescription. Many patients claim that they never got to know the results of the blood investigation following blood withdrawal for thin- and thick-smear slide preparation. However, the recent introduction of rapid diagnostic tests is likely to improve the situation. It is important that patients are made aware of diagnostic results, so that they can take precautions to prevent reinfections.[31] Owing to the high burden of disease generally among residents of Lomahasha, construction of a laboratory with basic diagnostic facilities is justifiable.

Evidence associating socioeconomic factors and health, including the risk for malaria, is accumulating worldwide. The lower the health status, the higher the risk. Malaria-prone developing countries and communities need to understand that investing in health makes acceptable economic sense. Therefore, the problem of malaria has to be presented to communities and funding agencies as a wider effort to intervene in economic development meant to improve the lives of the people. This interdisciplinary approach would ensure sufficient funding of intervention programs to cover the social and human behavioral aspects noted, in addition to the parasitological and entomological factors. However, more studies of this nature need to be conducted in the other malarious communities of Swaziland to confirm these observations before the necessary approach to control malaria among Swazi communities is adopted.

Conflicts of interest

The authors declare no conflicts of interest in this study.

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