COMMUNITY KNOWLEDGE AND PERCEPTIONS ABOUT MALARIA AND PRACTICES INFLUENCING MALARIA CONTROL IN MPUMALANGA PROVINCE, SOUTH AFRICA

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Objective. To assess community knowledge and perceptions about malaria and its control in a rural setting.

Design. Descriptive cross-sectional survey.

Setting. Tonga district with a population of 116 418, seasonal malaria with an annual incidence of 3 200 cases.

Subjects. Female heads of 299 randomly selected households.

Methodology. A total of 299 households were selected from a random sample of 30 clusters. Community knowledge and perceptions about malaria and its control were assessed by interviews with the female head of each of the 299 selected households.

Results. Respondents ranked malaria as the third most serious health problem facing the community after TB and AIDS. Seventy-two per cent (214/299) of respondents reported that they knew what malaria disease was and of these, 92.1% (197/214) mentioned mosquito bites as the cause of malaria. The respondents' understanding of the causal role of mosquitoes in malaria was significantly related to their knowledge about disease symptoms ($P < 0.001$). Reported community compliance with the malaria control programme (MCP) was satisfactory; 86.6% (259/299) of respondents reported that their homes had been sprayed during the past 2 years but 10.0% (30/299) did not know why homes were sprayed. Hospitals or clinics were the facilities where respondents most commonly sought treatment for fever; 66.9% (200/299) reported that they would seek treatment immediately after the onset of high fever. Specific practices such as replastering or washing of inside walls compromised the effectiveness of the MCP. Personal preventive measures were sometimes used against malaria (50.8%, 152/299) and use was positively associated with education level ($P = 0.001$). Respondents expressed their desire for more information about malaria and their willingness to contribute to the control of malaria in their community.

Conclusion. The survey collected information which was directly relevant to the development of health education messages to increase community awareness of the problem of malaria, to emphasise the importance of early diagnosis and prompt treatment of malaria, to improve community understanding of the function of indoor residual spraying, and to enlighten the population of the role of mosquitoes in malaria transmission and the availability and benefits of personal protection measures against mosquito bites.

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Malaria poses a major challenge to global public health and exacts an enormous toll in terms of morbidity, mortality and economic underdevelopment. Annual malaria cases worldwide are estimated to be 300 - 500 million, with 2.7 million deaths.[1] Sub-Saharan Africa bears the brunt of this burden and accounts for 90% of malaria cases and most deaths.

In South Africa, malaria was eliminated from large areas by the introduction of a residual indoor insecticide spraying programme in 1946.[2] Currently malaria only occurs in well-defined Lowveld areas in Northern Province, Mpumalanga and KwaZulu-Natal with usually fewer than 10 000 cases per annum and mortality less than 0.5%. However, the recent resurgence of malaria is cause for concern. For example, in 1996, 30 000 people were notified with malaria and 130 deaths were reported. Mpumalanga contributed a third of these cases and more than 6 000 malaria cases have been reported in the province in each of the past 3 years.

Environmental factors and behavioural patterns of vectors and human populations combine to provide favourable conditions for malaria transmission. While much is known about vector biology and behaviour and the malaria parasites, the importance of human behaviour in malaria transmission has been largely overlooked. Failure to consider community attitudes and beliefs regarding malaria has contributed to the inability of programmes to achieve sustainable control.[3] Involvement of local communities as stated in the Alma Ata declaration is necessary if sustainable control is desired.[4] Community involvement which places greater responsibility for reducing disease morbidity and mortality on the community has evolved in response to limits imposed by both financial constraints and existing social and cultural structures on the ability of current approaches to solve existing health problems.[5] The extent of a population's co-operation is a key element in the success of any primary health programme. The World Health Organisation study group on vector control of

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malaria emphasised the importance of taking into account community attitudes and the acceptability of insecticide use, so that malaria control programmes (MCPs) become more responsive to community needs.[5]

An intimate knowledge of community attitudes, knowledge and behaviour can assist the reformulation of control programme strategy and form the basis of appropriate health education messages. Although satisfactory spraying coverage is documented in Mpumalanga, the community knowledge, attitudes and practices regarding malaria control have never been explored despite decades of indoor insecticide application for vector control. Furthermore, no specific community malaria education programme currently exists in the province.

There have been anecdotal reports of negative attitudes towards chemical spraying and misconceptions about the MCP in Mpumalanga, with community absenteeism and lock-up of dwelling on spraying days. Limited community knowledge and misconceptions about malaria and its control have been reported elsewhere.[7-14] A cross-sectional survey was conducted to assess community knowledge, attitudes and practices regarding malaria as a disease and its control, with the primary aim of making the provincial MCP more responsive to community needs.

METHODOLOGY

The study was conducted in November 1997 in Tonga health district (25°15'S, 32°15'E), Mpumalanga province. The district has a population of 116 418 people and borders Mozambique in the east and Swaziland in the south. Malaria transmission in the district is seasonal with an annual peak from January to May. Approximately 70% of the province's malaria cases occur in the district. *Falciparum* malaria accounts for in excess of 90% of reported cases while *malariae* and *ovale* malaria make up the difference. *Anopheles arabiensis* is the major malaria vector in the area. Cornerstones of control are the annual indoor residual insecticide spraying which is carried out by the MCP, and early diagnosis and treatment at 10 primary health care clinics. DDT was replaced with synthetic pyrethroids, deltamethrin, for intradomiciliary spraying in 1994.

A modified two-stage cluster sampling method based on the methodology of traditional Expanded Programme on Immunisation (EPI) coverage surveys was employed to select a representative sample of 299 households from the study area.[15] There were 13 localities in the study area, each with an average number of 7 clusters with approximately 100 households in each cluster. First, a census of all communities in Tonga district was obtained by the Mpumalanga MCP. Cluster-sampling methodology was used to select the 30 clusters for inclusion in the study with probability proportional to size. In each sampled cluster, a central location was identified and the direction in which the first household was located was randomly selected by spinning a bottle on a flat surface. Houses along the directional line in which the bottle pointed were counted to the edge of the cluster and the first household was chosen by selecting a random number from the total number of counted houses. The second household was the house with a doorway nearest to the first. Ten households were sampled in each cluster except for one in which only nine households were sampled. The senior female head of the household was interviewed.

A structured questionnaire which had been translated into the local language and rigorously pilot-tested under field conditions was used for data collection. The questionnaire covered important sociodemographic characteristics, malaria knowledge, treatment-seeking behaviour, compliance with the MCP, primary preventive measures and aspects of community participation in the MCP. Sixteen local female school teachers from the district were recruited and trained to conduct the interviews. They were trained in the classroom before performing pilot interviews under close scrutiny. Interviews were conducted over two consecutive weekend days. Data were entered using a customised Access for Windows 95 database and analysed with the SPSS for Windows Statistical Software Package.

RESULTS

Sociodemographic characteristics of respondents

A total of 299 questionnaires were completed by the senior female heads of randomly selected households, whose ages ranged between 16 and 85 years (mean 36 years). Of the 299 respondents, 121 lived in traditional mud structures and 178 in 'Western' brick dwellings. The level of formal education in this study population was low, with only 4 (1.3%) of the respondents reporting tertiary education. One hundred (33.4%) and 57 (19.1%) had completed primary and secondary education, respectively; 138 respondents (46.2%) had not received any formal education. Most of the study subjects (81.9%, 245/299) were unemployed; only 9.7% (29/299) had full-time formal employment, 3.4% (10/299) were pensioners and the remainder were either traditional healers or students.

Community knowledge and perceptions of malaria

Respondents were asked to list the three major health problems in their community. Malaria was considered a major health problem by 19.7% (59/299) of respondents and was ranked third after tuberculosis (50.2%, 150/299) and AIDS (45.8%, 137/299) (Table I).

Most respondents (71.6%, 214/299) reported knowing what malaria, *'malaleveva'* (Siswati) is. The most frequently mentioned symptoms associated with malaria were shivering, headache, fever and sweating, but 46 respondents (15.4%) reported not knowing the symptoms of malaria (Table II). Only 21 respondents mentioned fever, sweating and shivering. There

Table I. Priority health conditions identified by Tonga community

Condition	Number (%)
Tuberculosis	150 (50.2)
AIDS	137 (45.8)
Malaria	59 (19.7)
Chickenpox	20 (6.7)
Sexually transmitted diseases	20 (6.7)
Eye conditions	16 (5.4)
Diarrhoeal diseases	11 (3.7)
Measles	9 (3.0)
Bilharzia	7 (2.3)
Don't know	74 (24.7)

Table II. Symptoms of malaria as reported by respondents

Symptoms	Number (%)
Shivering	189 (63.2)
Headache	112 (37.5)
Fever	95 (31.8)
Sweating	91 (30.4)
Tiredness	33 (11.0)
Body pains	31 (10.4)
Nausea	27 (9.0)
Diarrhoea	15 (5.0)
Anorexia	10 (3.3)
Don't know	46 (15.4)
Other	15 (5.0)

was no association between recognition of fever as the key symptom of malaria and respondents' education level (Fisher's exact test $P = 0.946$).

Two-thirds of respondents (197/299) mentioned mosquito bites as the cause of malaria (Table III). Respondents' understanding of the mosquito's role in transmission of malaria was significantly associated with their knowledge about fever as a major symptom of malaria ($\chi^2 = 18.42$; $P < 0.001$).

When asked about the usual source of their malaria information, 59.9% (179/299) of households reported receiving

Table III. Cause of malaria as reported by respondents

Cause of malaria	Number (%)
Mosquito bites	197 (65.9)
Bedbugs	16 (5.3)
Swimming in or drinking dirty water	14 (4.7)
Food	2 (0.7)
Witchcraft	1 (0.3)
Don't know	66 (22.1)
Other	3 (1.0)
Total	299 (100)

Table IV. Sources of malaria information

Source of information	Number (%)
Hospital/clinic	179 (59.9)
Radio	63 (21.1)
Malaria teams	25 (8.4)
Other community members	18 (6.0)
Community health workers	10 (3.3)
Specific health education programmes	9 (3.0)
Schools	9 (3.0)
Print media	3 (1.0)
None	10 (3.3)
Don't know	11 (3.7)

information from either hospitals or clinics (Table IV). Radio was also a commonly mentioned source of information (21.1%, 63/299), with 61% (95% CI 55.4 - 66.8%) of respondents indicating that they had a radio in their home.

Treatment-seeking behaviour

The majority of respondents (92.3%, 276/299) reported that they would seek treatment for a severe febrile disease from a hospital or clinic. Other service providers mentioned were private doctors (6.7% 20/299) and traditional healers (1.7%, 5/299). Only 4 respondents (1.3%) mentioned self-treatment. Two hundred respondents indicated that they would present immediately after developing a high fever, 29 would seek treatment the next day, 13 when their condition worsened, 11 would only seek treatment after 3 days or longer, and 42 respondents were unsure. Reasons for not seeking treatment on the day of fever onset were provided by 45 respondents and included inaccessibility of health care (8.9%, 4/45), delaying until disease worsens (62.2%, 28/45) and a belief that febrile disease spontaneously resolves (6.7%, 3/45), while the remainder either provided nonspecific reasons or were uncertain.

Compliance with the MCP

Two hundred and fifty-nine respondents (86.6%) reported that their homes had been sprayed during the past 2 years and 239 (79.9%) indicated that they believed that the Department of Health was spraying houses to kill mosquitoes which cause malaria. Other reasons provided for the spraying programme were killing of cockroaches (19.9%, 58/299), other insects (10.0%, 30/299), and germs (8.4%, 25/299). Thirty respondents (10.0%) reported not knowing why spraying was done. Only 21.4% (64/299) of respondents expressed objections to having their houses sprayed. Reasons given for this unwillingness included the mess left by spraymen on the floor (22), walls (15), or furniture (15) and the disruption caused by moving furniture (8). Virtually all respondents (94.3%, 282/299) were satisfied with the conduct and attitude of spraymen and 88.0% (263/299) of study subjects reported a willingness to allow

spraymen into their homes. However, when prompted to state specific concerns, 9.0% (27/299) said that spraymen were not careful with household items, 17.7% (53/299) reported damage to property and 15.4% (46/299) complained that spraymen made an unnecessary mess.

Respondents were asked whether they had received any information on malaria from spraymen. Seventy per cent (208/299) reported being informed about malaria transmission, 67.8% (202/299) about the reasons for spraying, 66.9% (200/299) about the dangers of malaria, and 37.5% (112/299) about malaria prevention.

When asked about replastering of mud wall surfaces, 57 of 121 respondents (47.1%) reported replastering their walls once a year, 37 (30.6%) twice a year, 12 (9.9%) three or more times per year and 4 (3.3%) reported never replastering. Eleven (9.1%) were unsure how often they replastered. Forty-two of the 121 respondents (34.7%) reported replastering the wall surfaces immediately after spraying, with a further 18 (14.9%) replastering within a week and 15 (12.4%) within a month. The most popular month for this activity was December (Table V). Reasons provided for replastering were aesthetic/decoration (64.5%, 78/121), normal maintenance (36.4%, 44/121), removing insecticide smell (12.4%, 15/121), covering spray marks (3.3%, 4/121), and as a treatment for bedbugs (4.1%, 5/121). Among the 178 subjects living in 'Western' brick dwellings, 77 (43.3%) washed their walls once a year, 29 (16.3%) twice a year, 25 (14.0%) three or more times a year, and 18 (10.1%) were uncertain of their frequency of wall washing. Only 16.3% (29/178) reported never washing their wall surfaces. Forty-two respondents (22.6%) washed their walls immediately after spraying, 22 (12.4%) within a week and 25 (14.0%) within a month. December was again the month when most washing (34.3%, 61/178) was done (Table V).

Respondents were asked whether they had observed any change since the spraying programme replaced DDT with pyrethroids. Seventy-four respondents (24.7%, 74/299) reported an improvement, with 11 (14.9%) and 7 respondents (9.5%) reporting that pyrethroids were more effective than DDT against nuisance insects and mosquitoes, respectively. Eighteen (24.3%) reported that pyrethroids gave no smell and 19 (25.7%) respondents reported that pyrethroids left no marks on sprayed surfaces while 19 (25.7%) gave nonspecific responses.

Preventive measures

A total of 152 (50.8%) respondents reported previous use of either modern or traditional means of personal prevention measures against malaria (Table VI). There was a positive association between education level and use of medically recommended malaria prevention measures ($\chi^2 = 16.40$; df = 3; $P = 0.001$). Only 11.4% (34/299) of respondents had heard of bed nets and only 4.0% (12/299) had ever used a bed net (Table VI).

Table VI. Preventive measures used by the study subjects against malaria

Preventive measure	Number (%)
Mosquito coils	85 (28.4)
Repellents	50 (16.7)
Chemoprophylaxis	41 (13.7)
Knockdown sprays	13 (4.3)
Mosquito nets	12 (4.0)
Burning cow dung	9 (3.0)
Environmental sanitation	5 (1.7)
Burning wood fires	3 (1.0)
Closing doors and windows at night	2 (0.7)
Boiling leaves	2 (0.7)
Burning donkey dung	1 (0.3)

Community participation in the MCP

In response to the question on whether respondents wished to be involved in malaria control, 265 (88.6%) respondents expressed their desire for more information on malaria. Specific areas mentioned were malaria prevention (33.2%, 88/265), malaria transmission cycle (26.4%, 70/265), disease recognition and pathogenesis (20.8%, 55/265), and treatment of malaria (15.8%, 42/265); the rest supplied nonspecific responses. Seventy respondents believed that they could contribute to malaria control by sharing their knowledge with the community and 17 desired to use personal protection measures. Other specific means mentioned for contributing to malaria control in their area were presenting early to a health centre for treatment when ill (8), taking chemoprophylaxis (8), completing treatment (4), providing transport to sick persons (5) and allowing spraymen to perform their function (2).

Table V. Replastering and washing of house walls by month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Replastering	9	1	10	12	1	22	2	1	3	4	13	48
($N = 121$)	7.4%	0.8%	8.3%	9.9%	0.8%	18.2%	1.6%	0.8%	2.5%	3.3%	10.7%	39.7%
Washing	17	4	11	17	6	28	10	7	7	9	25	61
($N = 178$)	9.6%	2.2%	6.2%	9.6%	3.3%	15.7%	5.6%	3.9%	3.9%	5.1%	14.0%	34.3%

DISCUSSION

The majority of the people in Tonga district are currently unemployed and have limited formal schooling. Poverty and underdevelopment must be tackled concurrently with malaria in order to achieve maximum community co-operation. An example is India, where success in malaria control was achieved by linking malaria vector control to income-generating schemes.[16] Literacy level is an important determinant of health status and is closely linked with poverty. The low educational level in Tonga district may hamper the dissemination of information about malaria and its control. The study demonstrated a positive association between education level and the use of personal protection measures. The community in Tonga district is socially heterogeneous, as evidenced by the different types of dwellings. Community participation in health programmes is often less effective in heterogeneous communities because of variable socio-economic interests.[5,17]

Malaria was recognised as an important community problem in Tonga district. TB and AIDS were considered priorities by the community with malaria ranked third, which is in concert with the epidemiological order of priorities. Tanner[18] emphasises that health interventions must meet a felt need in order to be accepted and supported by the community. For this reason, the malaria control activities should be integrated into the holistic human development concerns/priorities of the community, which include tackling the problem of HIV/AIDS in order to maximise community acceptance and support.

Decades of successful malaria control by indoor spraying in Tonga district has succeeded in reducing vector populations in houses but this should not be allowed to lessen community appreciation of malaria as a disease problem with resultant reduction in community participation. Ongoing awareness initiatives are required to solicit and sustain community interest. It is necessary to give health education to spraymen as well. There were concerns that spraymen might break people's furniture. It is encouraging that successful health education on malaria has taken place at hospitals and clinics. Radio may, however, present a useful medium for communicating key health messages, as 60.0% (179/299) of respondents have a radio at home.

Hospitals and clinics were recognised as the source of treatment for high fever. As Tonga district experiences summer seasonal malaria, people in the area are non-immune to malaria and it is therefore important that febrile patients seek correct treatment promptly in order to avert complications and deaths. About a third of the respondents reported delaying before presenting for treatment of high fever and this might lead to unnecessary complication and deaths.[19]

The percentage of homes that were sprayed was high but replastering and washing of treated wall surfaces compromises optional control. Local enquiry revealed that people in Tonga culturally decorate their dwellings during December in preparation for Christmas festivities. Only a small proportion of respondents gave insecticide-related reasons for replastering or washing of walls. This finding compares favourably with that of a KwaZulu-Natal study in South Africa, which found that only 16.4% of those who replastered their houses in the deltamethrin-sprayed area did so for reasons related to the insecticide.[20] The practice of replastering or washing of treated wall surfaces may be evidence of either non-compliance or a misunderstanding of the function of residual insecticide house spraying or both. It is important that local people are made aware of practices that may compromise malaria control.

There was little use of personal protection measures by the Tonga community, particularly by those with a low formal education level. Appropriate, simple, and affordable personal protection measures to decrease exposure to infective mosquito bites are reviewed by Curtis.[21] Personal protection measures are important in Tonga, where long-term malaria chemoprophylaxis is not advisable and achievable and where the malaria vector is both exophilic and endophilic. The challenge for the future is to promote the concept of individual responsibility for malaria prevention by advocating the use of established appropriate measures for personal protection, and by developing new affordable methods for individual protection. There is very limited knowledge and use of bed nets in Tonga, and any attempt at the introduction of bed nets in the area would require a massive concurrent educational campaign.

Malaria vector control in Mpumalanga is vertical and fits the public health model described by Rifkin,[5] where experts define, manage and evaluate the programme and communities are mobilised and educated about the threat and transmission of malaria and how personal responsibility can reduce the risk. Currently community participation in malaria control in Mpumalanga involves acceptance of intradomiciliary application of insecticides, adherence to treatment regimens, and donation of blood for active case detection.

This vertical approach to malaria control has recently been reviewed in South Africa.[22] Not only does it entail high costs, but in addition labour disputes, refusal of communities to comply with spraying activities, and altered vector and human behaviour have made it difficult to sustain even when sufficient financial resources are available. Increasing attention is being focused on true community involvement as encapsulated in the concept of primary health care (PHC).[5] The underlying philosophy of the PHC approach is that communities should themselves be responsible for the health of their members and must play an active role in identifying and solving their own health problems. There are, however, very few examples of successful malaria vector control where community participation was elicited although some other

vector-borne diseases have been successfully controlled through community participation.[23-28]

Certain malaria vector control activities may be amenable to integration into district health service activity but a better understanding of community beliefs, practices and views about the programme is essential for planning greater community involvement in malaria control and other development programmes, and modifying current malaria vector control to respond better to community needs.

CONCLUSION

Formal education is limited in Tonga district and community-based health programmes and health education messages must recognise underdevelopment as a problem demanding attention in order to win community co-operation. Community knowledge about malaria and the role of mosquitoes in transmission is satisfactory. Malaria is perceived as a major public health problem by the community in Tonga district and is ranked third after TB and AIDS, but the historical success of the malaria control programme in reducing vector populations and disease incidence could lead to community nonchalance. Targeted health education is needed to increase and sustain community awareness of malaria as a public health problem in order to achieve greater community co-operation in malaria control. Although the majority of people in the district seek treatment for high fever from clinics and hospitals, one-third delay seeking treatment for acute febrile episodes. There is need to reinforce the importance of early diagnosis and treatment of malaria. The percentage of homes that were sprayed was high and a good rapport exists between the community and the spraymen. However, replastering and washing of sprayed wall surfaces compromises the success of the spraying programme. Health education is urgently required to improve the Tonga community's understanding of the function of the indoor residual insecticide spraying. The use of personal protection measures was low and positively associated with education level. Knowledge about and use of bed nets was negligible. The community in Tonga needs to be enlightened on the availability and benefits of personal protection measures against mosquito bites. There was an expressed desire from survey respondents to become more actively involved in local malaria control, and research on how this desire can be translated into action is required.

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