Knowledge and practices on malaria in Tubu village, in a malaria-endemic area in northern Botswana: implications for interventions

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Abstract

Background. Health education based on understanding community and individual knowledge, attitudes and practices on malaria is gaining momentum as one of the methods for malaria control. The purpose of the survey was to assess peoples' knowledge and perceptions on malaria in order to generate information to contribute to the malaria elimination programme being implemented by the Ministry of Health of Botswana.

Materials and Methods. A cross-sectional structured questionnaire-based survey and participatory rural appraisals were conducted to assess the knowledge and practices regarding malaria among all the 71 households of Tubu village, located on the fringes of the Okavango Delta. Relative frequencies were calculated using the SPSS version 20.0 package.

Results. Information dissemination by the Government through different structures, by the media as well as individuals in the community, played a vital role in making the community aware of malaria. Respondents showed some basic knowledge on malaria transmission (95.8%), signs and symptoms (88.7%) and prevention measures (98.6%). They associated malaria with rainfall, floods and harvesting. Respondents indicated that mosquitoes were abundant in grassy areas (60.6%) and stagnant waters (59.2%). 98.6% of the respondents said insecticide-treated bednets were the main method for malaria prevention. As the first option, all respondents who had a history of a malaria episode visited the clinic and not traditional medical practitioners. However, there were few respondents (14.1%) with misconceptions on malaria aspects like where mosquitoes breed.

Conclusions. Generally, the high level of awareness and good practices shown by the community were ideal for sustainable implementation of community-based malaria intervention programmes. Misconceptions on malaria need to be corrected as these may have some detrimental effects on the Ministry of Health's goal of malaria elimination in Botswana by 2016.

1 Introduction

Despite impressive progress in malaria control interventions in many endemic countries malaria remains the most important vector-borne parasitic disease worldwide [1] and is endemic in more than 100 countries worldwide [2]. About half the world's population (3.3 billion) is at risk of contracting malaria [3], and approximately 75% of the cases occur in Africa, with the remainder occurring in Southeast Asia, the western Pacific and the Americas [4]. In 2010, there were about 219 million malaria cases and an estimated 660 000 malaria deaths [3]. Approximately 90% of all malaria deaths occurred in the World Health Organization (WHO) African Region, mostly among children under five years of age [3]. Malaria related morbidity and mortality have a crippling effect on social and economic development of most countries in Africa through incapacitation of the labour force, lowering of educational achievements and discouragement of tourism and business investments [5]. With the exception of southern African countries, many countries in the continent do not have successful malaria control programmes due to lack of adequate health infrastructures, financial and human resources [6].

It was estimated that 37% of all inhabitants of Botswana are at risk of malaria [7]. Malaria is distributed in the northern half of the country. In most parts of the country transmission is seasonal with only a few places of perennial transmission, particularly in the Okavango and Chobe districts [7]. Although the country profile is designated as epidemic for malaria, parts of the Ngami and Okavango Delta are endemic [7]. This is primarily attributed to persistent swamps within the Delta area that provide breeding sites for vectors. Inspired by an overall decline of malaria prevalence (4.2% in 2000 to 1% in 2008 of the total population), Botswana has embarked on a malaria elimination programme with an achievement target by 2016 [8]. Six strategies through which the elimination goal can be realised have been adopted; 1) programme management and coordination, 2) vector control and personal protection, 3) case management and chemoprophylaxis, 4) information, education and communication and advocacy including community mobilisation, monitoring and evaluation, 5) surveillance and research, 6) epidemic preparedness, response and control [9].

Most of national malaria control programmes, including Botswana, put more emphasis on parasite and/or vector control neglecting the target population's knowledge, attitudes and practices in the transmission and control of the disease [10]. The scope of malaria control is changing

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worldwide [11]. More emphasis is being placed on community participation in malaria control and prevention measures than on exclusive use of insecticides. In view of this, health education based on understanding community and individual knowledge, attitudes and practices (KAP) on malaria is moving to the forefront as a measure necessary for malaria control [12]. A compendium of reports on knowledge, attitudes and practices related to malaria disease are available from around the world [13-15]. All these studies indicate that misconceptions on malaria transmission and risk factors still exist and impact negatively on malaria control programmes [16].

Malaria control programmes must therefore also consider the broad, complex and interrelated factors that influence human behaviour [11]. Decisions made by individuals or communities to practice protective measures are related to knowledge and beliefs of the people [11]. The importance of information on KAPs in designing and improving malaria control activities has been emphasised [17]. An understanding of community perceptions and practices on malaria is crucial for policy makers to incorporate disease control interventions into the socio-cultural dimensions of the affected communities [18]. KAP studies are also essential in establishing epidemiological and behavioural baselines and may be used to identify indicators for monitoring malaria control programmes [17].

Perceptions on malaria are very heterogeneous, can vary from community to community and among individual households [19] and also according to geographical area, ethnic group, religious beliefs and cultural backgrounds [20]. It is against this background that this study was conducted in Botswana to acquire information about the particularities of the local situation. Documented information on the KAPs associated with malaria transmission in Botswana is lacking. The study aimed at assessing the KAP on malaria among a small community in Tubu village, situated in a malaria-endemic area in the Okavango Delta, northern Botswana. The results of the study may contribute towards designing basic, effective and sustainable community-based malaria control strategies suited to the local conditions of the Okavango delta. Implementation of basic community-based malaria control strategies is expected to contribute significantly towards the larger objective of the Ministry of Health, Botswana of malaria eradication by the year 2016.

2 Materials and Methods

2.1 Study Area

The study was conducted in Tubu village on the banks of the Thaoge River, one of the distributaries of the Okavango Delta. Tubu village, in the Okavango sub-district, stands at an altitude of about 950 m above sea level and between latitude 19°35'S and longitude 22°27'E. There were approximately 71 households with a total population of 483 [21] at the time that the study was conducted. The major sources of income were crop and livestock production. Flooding occurs every year but the extent of flooding varies. The community practices flood recession farming locally known as 'molapo' farming. They plough their fields along the banks of the river as the flood recedes and in some instances they plant crops when taking advantage of a raised water table caused by flooding.

The village has a Chief and tribal administration offices. Discussions on customary law and other issues pertaining to the development of the area are done at a central place (locally known as the 'kgotla') within the village. The Chief is the Head of the 'kgotla'. A Village Development Committee (VDC) exists to guide development planning and implementation in the village. The village is also serviced by a social worker and a Health Post staffed with a nurse, nurse aid and a health education assistant. The social worker identifies underprivileged individuals and households in need of Government support in the form of food subsidies while the nurse and nurse aid treat patients presenting with any form of disease including malaria. The health education assistant (HEA) disseminates health education information on the prevention of diseases and is responsible for notifying the community ahead of any malaria intervention exercises to be conducted by the Ministry of Health. Gumare Hospital, which is 10 km east of the village, offers an array of general health services to the local community. The hospital also serves as the district health centre for critically ill patients referred from all the district Health Posts including Tubu. The most prevalent diseases in the study area include HIV/AIDS, TB, high blood pressure, diarrhoea (stomach problems), malaria, cervical cancer, diabetes, oral health, mental health, injuries, and disabilities, among other ailments [22]. According to the Annual Ministry of Health report of 2012, since 2005 reported annual malaria cases in the Okavango sub-district have been fluctuating with unconfirmed cases ranging between 4686 in 2005 and 10993 in 2006 and confirmed cases ranging between 791 in 2006 and only 5 in 2012. Over the period 2005 and 2012 the highest annual national record of 16 malaria deaths was reported in 2006.

The study area hosts a large project focusing on the eco -health approach for the improvement of livelihoods of 'molapo' farming communities. The project, known as the Botswana Eco-health Project (BEP), commenced in April 2010 and sought to assess the impacts of hydroclimatic changes/variability on the 'molapo' farming system. BEP is being implemented through the following three major themes: Health, agricultural production and food security and environment/biodiversity with five cross cutting themes, namely hydrology, GIS/remote sensing, governance and land-use policy analysis, social and gender analysis and communication. This study was conducted under the health theme of the BEP project.

2.2 Selection of participants

The survey was conducted from 12 to 16 June 2012. From the household listing compiled for the BEP project the target sample size, determined by a sample size calculator [23] was 61 household heads. Due to the fact that Tubu is a relatively small village, whose layout of households by wards is within close proximity, a census was done con-

sisting of individuals representing all the 71 households. The questionnaire was administered at the household to any adult person present on that day with preference for the head of the household if they were present. Only one person per household was interviewed.

Random selection of participants for the Participatory Rural Appraisal (PRAs) exercise was done. Numbers 1 to 4 were assigned to individuals from the community who had come to attend the PRAs for the overall BEP project. All individuals assigned a similar number were grouped together to participate in the KAP survey.

2.3 Study design and methods

The study was a descriptive cross-sectional survey. Trained field staff with Ordinary Level secondary education qualifications administered a structured questionnaire. Another trained field staff with a first-degree qualification directly supervised these field staffs. The principal researcher for the study project was in charge of supervision.

To ensure collection of accurate and good quality data, pre-testing of questionnaires was carried out two weeks prior to the actual data collection exercise. Pre-testing was done in a 'cattle post' area, further up the Delta, with almost similar socio-demographic patterns as Tubu village. Nine questionnaires were administered during the pre-test survey. Following the pre-test survey the questionnaire was revised on the basis of responses given to improve clarity and add essential questions that had been omitted in the original questionnaire. Vague questions in the original questionnaire were either omitted from the final one or improved. The pre-test exercise was also used to standardise the manner in which the administrators of the questionnaire would conduct the interviews and to ensure that they had a common understanding of each question. In order to standardise the administration of the questionnaire among the different interviewers each question had the English and the native local language ('Se Tswana') versions written on the questionnaires. A secondary education teacher, in consultation with the project investigators, translated the questionnaire into the local language.

The Participatory Rural Appraisal (PRAs) technique, using the closed scoring/ranking approach, was used to crosscheck some of the responses from the questionnaire interviews. The maximum number of participants at any given time during the interviews was 16, thus providing a total ranking capacity (*n*) of 160.

2.4 Ethical considerations

Permission to carry out the study was obtained from the Ministry of Health, Republic of Botswana [Ethical Clearance Reference No: PPME 13/18/1 Vol. VII (179)]. Meetings with the community leadership and other interested community members were held to introduce the study, clearly explaining its objectives. On the day of the interview verbal consent was sought from each participant and the survey objectives were also clearly explained. Participants were informed that they could refuse to participate in the study and not be prejudiced. Respondents were assured that all the information captured on the data sheets would be treated with confidentiality and that no answers would be linked to individuals in the final analysis and presentation of findings.

2.5 Statistical Analysis

Descriptive statistical analysis was carried out using SPSS, version 20.0 for windows. Relative frequencies of all the survey variables were determined. Most of the variables had provisions for multiple responses. Appropriate graphs and tables were displayed showing differences in the relative frequencies of various variables. Relative frequencies of responses from PRAs were calculated based on observed scores (*n*) versus overall total number of expected scores (160).

3 Results

3.1 Socio-demographic characteristics

The study participants consisted of 21 (29.6%) males and 50 (70.4%) females, the majority being above the age of 18 yrs [67 (94.4%)]. Only 4 (5.6%) respondents were below 18 yrs old. The maximum number of people residing in a single homestead was 20; the minimum was 1. A total of 483 individuals resided in all the 71 study homesteads, thus giving an average household size of 7 people. Male-headed households comprised of 57.7% (41) of the households visited. Of the respondents, 30 (42.3%) were the household heads, 19 (26.8%) were children of the household heads, and 11 (15.5%) were partners to the household heads. The rest were parents [2 (2.8%)], grandchildren

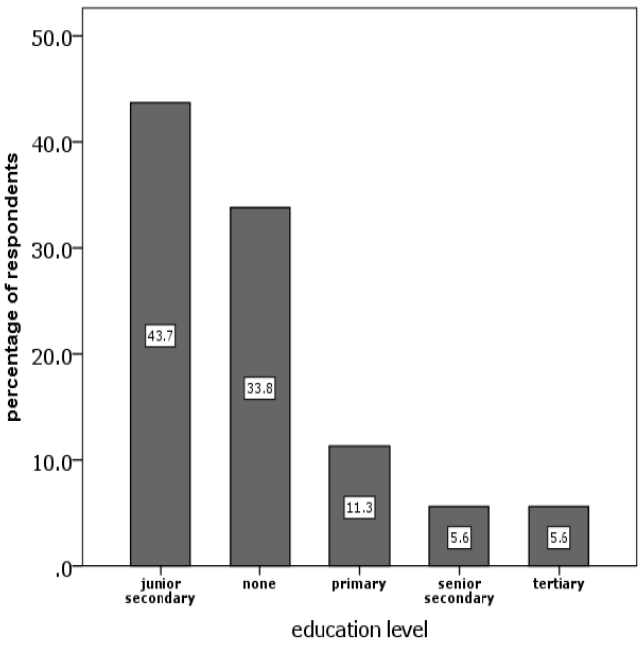

Figure 1. Education levels of respondents in Tubu village.

[4 (5.6%)], in-laws [2 (2.8%)], brothers/sisters [1 (1.4%)] to the household heads, or had other relationships [2 (2.8%)]. Half the respondents [36 (50.7%)] were single whilst 17 (23.9%) were cohabiting, 10 (14.1%) were married and an equal number of 4 (5.6%) were either widowed or never married.

There was a mixture of education levels with 31 (43.7%) individuals having completed junior secondary, 4 (5.6%) had completed senior secondary, 8 (11.3%) had completed primary school, 4 (5.6%) had attained tertiary education and 24 (33.8%) had never gone to school (Fig. 1). Only 6 (8.5%) were formally employed and the rest [65 (91.5%)] were not. Most respondents [63 (88.7%)] received a monthly income of less than US$63. Only 2 (2.8%) received a monthly income between 63-125US$, whilst 1 (1.4%) received between 125-250US$, and 5 (7%) received more than US$250.

Of the homesteads, 60 (84.5%) were involved in 'molapo' crop farming whilst 10 (14.1%) were not crop farmers but involved in animal husbandry only. Only 1 person (1.4%) was involved in dry-land crop farming. The 'WaYei' tribe constituted 90.1% (64) of the respondents, the 'HamMbukushu' 4.2% (3), the 'Banderu/Herero' 1.4% (1), and other minority tribes 4.2% (3).

3.2 Knowledge on malaria

Malaria was mentioned by 62 (87.3%) interviewees as the most common disease. Others mentioned HIV/AIDS [46 (64.8%)], 29 (40.8%) tuberculosis, 7 (9.9%) hypertension, and 3 (4.2%) did not have an idea of the most common diseases in the village. Twenty-two (31%) indicated other diseases were more common than those mentioned above and these included influenza, general cough, headache, anaemia, fever and stomach problems. Malaria, with 71.8% (51) responses, was perceived as the major problem, followed by HIV/AIDS with 16.9% (12) of the responses, then tuberculosis [5.6% (4)] and finally hypertension [1.4% (1)]. Only 2.8% (2) of the responses indicated that they had no idea of the major health problem in their area. Nine people (12.7%) thought that some other diseases were major problems and again these included influenza, general cough, headache, fever and stomach problems.

Malaria transmission as the result of a mosquito bite was mentioned by 66 (93%) of the interviewees. Other causes of malaria, like dirty water and unhygienic surroundings were mentioned by 12.7% (9) and 7% (5) of the respondents, respectively. An *infectious* mosquito bite as the cause of malaria was mentioned by only 2 (2.8%) people. Six (8.2%) of the respondents did not know what transmitted malaria. Different places regarded by the community as where mosquitoes emerged from included

Table 1. Respondents' knowledge on signs and symptoms of malaria.

Responses	N	%
Anaemia	71	100
Headache	50	70.4
High fever	43	60.6
Shivering	43	60.6
Vomiting	38	53.8
Dizziness	23	32.4
Madness	19	26.8
Aching bones	18	25.4
Appetite loss	10	14.1
Don't know	8	11.3

Note: Percentages add up to more than 100 due to multiple responses

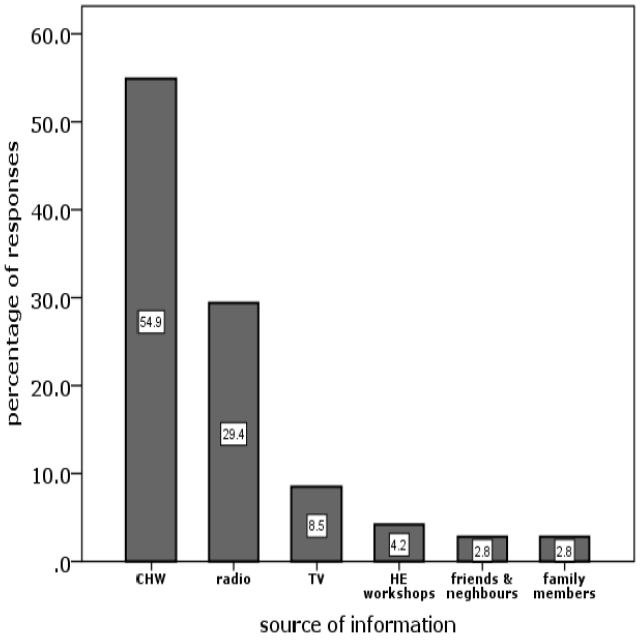

Figure 2. Primary source of information on malaria in Tubu village. Multiple responses were obtained from respondents on the sources of information on malaria. HE W/shops stands for Health Education Workshops.

Table 2. Mode of information dissemination on malaria by the Government of Botswana.

Responses	N	%
Clinic posters	37	52.1
'Kgotla' meetings	30	42.3
Radio	25	35.2
Public lectures	10	14.1
TV	10	14.1
Newspaper	3	4.2
Don't know	13	18.3
Others	12	16.9

Note: Percentages add up to more than 100 due to multiple responses

Table 3. Malaria prevention methods known by the respondents.

Malaria prevention method	N	%
Insecticide-treated bednets (ITNs)	70	98.6
Clearing of grass	34	47.9
Use of repellents	24	33.8
Wearing long-sleeved shirts	21	29.6
Avoiding stagnant water	19	26.8
Indoor residual spraying (IRS)	12	16.9
Use of aerosols	8	11.3
Use of traditional methods	6	8.5
Other methods	6	8.5
Burning cow dung	2	2.8
Don't know	1	1.4

Note: Percentages add up to more than 100 due to multiple responses

grassy areas [60.6% (43)], followed by stagnant water [59.2% (42)], un-hygienic conditions [46.5% (33)], cans [18.4% (13)] and houses [14.1% (10)]. Eleven respondents (15.5%) did not know from where mosquitoes emerged. Signs and symptoms mentioned by the respondents included anaemia, headache, high fever, shivering, vomiting, dizziness, madness, aching bones and loss of appetite (Table 1).

The majority [60.6% (43)] of respondents indicated that malaria was most prevalent during the rainy season. Other respondents indicated that it was most prevalent following the rainy season [14.1% (10)], after harvesting [11.3% (8)], during the rainy season after experiencing the floods [8.5% (6)] and after harvesting following the rainy season [5.6% (4)].

The respondents stated as their primary source of information the HEA, followed by radio, television, health education workshops, friends/neighbours and family members (Fig. 2). As part of community education respondents said that they encouraged each other to use bednets [31% (22)], have a clean environment [12.7% (9)], wear protective clothing [8.5% (6)] and practice personal hygiene [2.8% (2)]. Thirty-five (49.3%) interviewees indicated that they did nothing to educate each other about malaria. The Government of Botswana made people aware of malaria through putting posters at clinics, 'kgotla' meetings, radio programmes, public lectures, television programmes and newspapers (Table 2). When asked about the last time they had heard about malaria messages from various sources, 35.2% (25) indicated that it was less than a month before the date of the interview. Fifteen (21.1%) had heard about malaria issues between 1 and 6 months ago and 33.8% (24) more than six months ago. Only 9.9% (7) did not remember when they had last heard about malaria issues.

3.3 Malaria prevention methods

Malaria prevention methods known and practised by the respondents are shown in Tables 3 and 4, respectively. Most [68 (94.4%)] of the respondents were not aware of

Table 4. Malaria prevention methods practised in Tubu village.

Malaria prevention methods	N	%
By individual respondents		
Use of ITNs	69	97.2
Clearing of vegetation	18	25.4
Avoiding stagnant water	9	12.7
Reliance on IRS	4	5.6
Use of aerosols	3	4.2
Wearing long-sleeved clothes	1	1.4
By the community		
Use of ITNs	69	97.2
IRS	15	21.1
Clearing of vegetation	9	12.7
Use of repellents	6	8.5
Use of aerosols	2	2.8
Wearing long-sleeved clothes	2	2.8
Anti-malaria tablets	1	1.4
Nothing	1	1.4

Note: Percentages add up to more than 100 due to multiple responses

traditional herbs that cure malarial disease. Only 2.8% (2) knew some of traditional herbs for treating malaria such as *Eucalyptus* species locally known as 'lebolokomo' [1 (1.4%)] and *Cynodon dactylon* also known as 'motlhwa' [1 (1.4%)]. Most [69 (97.2%)] of the respondents were aware that IRS was implemented by the Government. Spraying cycle was believed to be once in a year by 94.4% (67) of the respondents. Few [2 (2.8%)] indicated that it was done twice a year whilst 2.8% (2) were not aware of IRS activities.

3.4 Health seeking behaviour

All the 71 respondents mentioned that whenever they felt sick they sought treatment from the clinic. All the 38 (100%) individuals who indicated that they had suffered once from malaria sought treatment at a health facility. All the 71 respondents did not know of any traditional medical practitioner in their village who could treat malaria disease.

3.5 Participatory Rural Appraisals

The community was aware of how immunity protects one from malaria. They indicated that most of the local inhabitants were not easily affected by malaria because they had developed natural immunity, which in the local 'SeTswana' language is described as 'bo kgoni ba go itshireletsa'. The most common diseases as scored by the participants included HIV/AIDS (44.4%, n=71), malaria (31.3%, n=50) and flue (21.3%, n=34). Other diseases mentioned included high blood pressure, fever and TB which accounted for proportions lower than 10% individually. Six point-three per cent (n=10) indicated that at least

one member of their household had suffered from malaria in the past. Most of the scores, ranging from 54 to 73, indicated that cases of malaria are experienced between the months of October and March, with most cases occurring in December.

4 Discussion

The major primary source of information on malaria in the study area was the HEA. In Botswana HEAs interact with the community on a daily basis since they reside within the community. Therefore delivery of health education messages to the community occurs frequently. This is contrary to findings from Swaziland [24] where it was noted that the most common source of information on malaria was through health facilities and not specifically CHWs. Studies in Ethiopia also showed that most of the respondents knew about malaria related information through mass media, friends, family members [25] and relatives [11]. In our study only 35.2% had heard about malaria less than a month before the survey took place. This survey was conducted during the season (June) when malaria transmission is traditionally very low and not many people were therefore concerned about malaria at that time.

The major disease problem and most common disease mentioned by the community was malaria, followed by HIV/AIDS and other ailments. The respondents showed some general awareness on malaria aspects. Results from PRAs also demonstrated a broader awareness level of malaria. The community was able to associate malaria with rainfall, floods and the harvesting period. Similar findings were noted during the PRAs when respondents mentioned that malaria was experienced between the months of October and March, which coincided with the rainy season and harvesting period. Since the community had basic information on general malaria aspects such as mode of malaria transmission as well as signs and symptoms they were unlikely to have mistaken malaria for other diseases to be the most common and problematic in the village. In a similar study conducted in Shorobe village located in the periphery of the southern part of the Okavango delta in Botswana, high level knowledge about malaria was observed and it resulted in residents employing adequate measures to prevent contracting malaria (BEP Third Interim Technical Report, unpublished data). Such level of awareness as noted in Tubu village was also observed in Swaziland where almost 93.1% of the respondents had heard about malaria [24]. In different settings of Mpumalanga Province, South Africa, approximately 93% [26] and 72% [27] of the respondents had heard about malaria. Studies conducted in Gokwe district [13] and Honde Valley [28], both in Zimbabwe, reported that the community had widespread knowledge about the morbidity of malaria but showed little understanding about its transmission, treatment, and prevention. A good overall knowledge of malaria was noted in northern Sri Lanka [29]. Similar observations were made in rural northwest Tanzania [16] where 99.5% of the respondents knew about malaria. However, in a rural area of Myanmar, it was found that although malaria was perceived by the local people to be a major health problem, knowledge on the mode of transmission and correct treatment for malaria was relatively low [30]. It is usual that communities living in malaria-endemic areas such as Tubu village have higher awareness of malaria than those in areas experiencing negligible, non-endemic, or epidemic malaria transmission.

The majority of respondents from questionnaire interviews and PRAs were aware that malaria is transmitted through a mosquito bite. A comparable observation was made in other endemic countries such as India [10], Ghana [31] and Ethiopia [11,25]. The high level of awareness of the people in this study could be because there is year-round exposure to mosquito bites and also the Government's efforts to make people aware of malaria through 'kgotla' meetings, radio programmes, public lectures, television programmes, newspapers and most of all through posters in clinics. Annual mosquito control activities (IRS) in the area by the Government could be indirectly contributing to the general awareness about the cause of malaria. A few responses attributed the presence of malaria transmission to dirty water and unhygienic environments. Such environment-related misconceptions were found to be common in many rural areas of sub- Saharan Africa [32-33]. Misconceptions may arise from the manner in which malaria health education campaigns are conducted, that may lead to misinterpretations [32].

The respondents' knowledge on signs and symptoms of malaria was overwhelming. They were able to mention most of the signs and symptoms associated with a malaria attack. Anaemia, headache, fever, shivering, vomiting, loss of appetite and dizziness were some of the most common signs and symptoms mentioned. This corroborates findings from studies conducted in southwest Ethiopia [20] and southern Ethiopia [34] where residents of the study areas showed high levels of knowledge on symptoms of malaria mentioning fever, chills and headache as the most common signs. It is not surprising that the community was aware of what causes malaria, sources of mosquitoes and the signs and symptoms of malaria, given that a substantial number of the respondents had attended at least primary school education in which the curriculum had some aspects on common diseases and were also well informed of malaria issues through the community health worker, Government programmes and other forms of media. It has been observed that educated communities understood the modes of malaria transmission better since they have multiple sources of information compared to uneducated communities [32]. Acquisition of such knowledge reduces tendencies to seek services from traditional practitioners, as they are well knowledgeable about the signs and symptoms of malaria. In support to that most of our study respondents who had suffered from malaria sought treatment at the health facility and not from traditional practitioners and also did not have an idea of traditional herbs used to cure malaria or traditional practitioners who could cure malaria. Similar observations were made in Ethiopia [11] and southwest Ethiopia where the community sought timely assistance from health facilities and not traditional healers, contrary to the belief in some African countries that severe malaria is caused by supernatural forces [20]. Stud-

ies in Ethiopia [25] and in Swaziland [24] obtained similar findings on health-seeking behaviour. Free health services and an easily accessible health facility (within a kilometre radius) in Tubu village could contribute towards the preference for health centres rather than services offered by traditional healers. The same observation was made in an Ethiopian community that preferred to seek treatment at health facilities because these were located within the study area and accessibility was very high among the local inhabitants who also received free treatment [11]. The health seeking behaviour in Tubu village, dominated by the 'WaYei' tribe who have had access to health facilities for many years, could have also changed, in line with the general belief in Botswana that modern medicine works better than traditional 'tswana' medicine [35].

The community was well aware of the different possible sources of mosquitoes. During our survey it was observed that dense vegetation close to breeding sites provided shelter for outdoor resting adult Culicine mosquitoes and breeding of both *Anopheles* and Culicine mosquito species took place in stagnant water bodies around the village. Previous studies in Ethiopia confirmed similar findings whereby the community identified stagnant water as the source of mosquitoes [25,34]. Knowledge of mosquito breeding habitats is important if appropriate malaria control methods through community participation are to be implemented. The proportion of responses showing comprehensive knowledge about malaria prevention methods was very high. Our findings were consistent with a study in Mozambique whereby the majority of respondents were well aware of various methods to prevent malaria [36]. The use of insecticide treated bednets (ITNs) is regarded as a highly effective method of malaria prevention, which indeed has been shown in many other studies around the world [37]. In sub-Saharan Africa, promotion and distribution of ITNs have been going on for more than 10 years. Governments, semi-Governments, private and non-governmental organisations have been involved in bednet sourcing and distribution. Therefore the high level of knowledge on the use of ITNs as a malaria prevention method is not surprising. In Tubu village most of the people acquired bednets from the council, clinic or shops. The number of mosquito nets per household ranged from 0 to over 6, thus giving almost every individual of any household the opportunity to sleep under a mosquito net. The observed ITNs awareness level in Tubu village is more than the level of awareness recorded in other countries such as Ethiopia [38], Ghana [18] and Uganda [39]. An almost similar level of awareness (97%) was recorded in Bangoma district, Kenya [40]. In the present study most of the respondents knew about IRS and its frequency. Knowledge by the community on IRS activities increases the likelihood of them fully accepting the programme, thereby leading to high IRS coverage of the target structures by the Ministry of Health's national malaria control programme.

Few respondents showed misconceptions about malaria such as the mode of transmission and sources of mosquitoes. Similar observations were made in almost all KAP studies on malaria [10,19,33,39]. It is critical to correct such misconceptions through simple health education messages if malaria prevention and the national elimination programmes have to sustain and increase their successes by the year 2016.

5 Conclusions

The present study has shed light on the level of understanding about malaria within the community in Tubu village, Botswana. It yielded information useful to health education promoters and policy makers for guidance towards malaria elimination campaigns involving the community. Areas requiring strengthening and those needing comprehensive activities to package health information and to initiate behaviour change have been identified.

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