Acta Tropica 175 (2017) 50–59

Contents lists available at ScienceDirect

Acta Tropica

journal homepage: www.elsevier.com/locate/actatropica

Indigenous environmental indicators for malaria: A district study in Zimbabwe

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ARTICLE INFO

Article history:
Received 13 October 2015
Received in revised form 16 August 2016
Accepted 24 August 2016
Available online 30 August 2016

Keywords:
Malaria
Indicators
Early warning systems
Indigenous knowledge systems
Zimbabwe

ABSTRACT

This paper discusses indigenous environmental indicators for the occurrence of malaria in ward 11, 15 and 18 of Gwanda district, Zimbabwe. The study was inspired by the successes of use of indigenous knowledge systems in community based early warning systems for natural disasters. To our knowledge, no study has examined the relationship between malaria epidemics and climatic factors in Gwanda district. The aim of the study was to determine the environmental indicators for the occurrence of malaria. Twenty eight key informants from the 3 wards were studied. Questionnaires, focus group discussions and PRA sessions were used to collect data. Content analysis was used to analyse the data. The local name for malaria was 'uqhuqho' literally meaning a fever. The disease is also called, "umkhuhlane wemiyane" and is derived from the association between malaria and mosquitoes. The findings of our study reveal that trends in malaria incidence are perceived to positively correlate with variations in both temperature and rainfall, although factors other than climate seem to play an important role too. Plant phenology and insects are the commonly used indicators in malaria prediction in the study villages. Other indicators for malaria prediction included the perceived noise emanating from mountains, referred to as "roaring of mountains" and certain behaviours exhibited by ostriches. The results of the present study highlight the importance of using climatic information in the analysis of malaria surveillance data, and this knowledge can be integrated into the conventional health system to develop a community based malaria forecasting system.

1. Introduction

Early warning systems provide communities with relevant, topical information on environmental conditions so that they can assess levels of risk and make informed decisions to protect their safety (Centre for international studies and Cooperation, 2011). Most early warning systems are self-monitored by villagers and this empowerment indicates that the community is a key stakeholder in the early warning strategy (Centre for international studies and Cooperation, 2011).

A malaria early warning system is a series of approaches that refine the understanding of geographical variation of malaria risk in a dynamic environment and usually comprises forecasting, early warning and early detection. In this context, forecasting refers to seasonal climate forecasts; early warning refers to the monitoring of meteorological conditions and early detection is case surveillance (Hay et al., 2003; Cox and Abeku, 2007). The same authors argued that much research on malaria early warning systems has focused on methodological or scientific issues and that it is probably the practical aspect of implementation that has been a barrier to their uptake.

Malaria early warning attempts to predict epidemics before unusual transmission activity begins usually by using weather variables that predict vector abundance and efficiency and therefore transmission potential (Thomson and Connor, 2001; Thompson et al., 2005). Seasonal climate forecasts accurately predict the average season's weather, increases in mosquito density and survival including mosquito and parasite development rates (Thomson and Connor, 2001). The same authors postulate that vector and parasite dynamics will accurately predict increases in the entomological inoculation rate which will be directly related to the number of malaria cases. Rainfall anomalies are widely regarded to be a major

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http://dx.doi.org/10.1016/j.actatropica.2016.08.021

driver of inter-annual variability of malaria incidence in semi-arid areas of Africa (Thompson et al., 2005).

A model to analyse the spatial temporal role of climate in inter-annual variation of malaria incidence in Zimbabwe for the period 1988–1999 showed that high annual malaria incidence coincided with high rainfall and relatively warm conditions while low incidence years coincided only with low rainfall (Mabaso et al., 2006). The study demonstrated that mean values of temperature, rainfall and vapour pressure are strong predictors of increased malaria incidence.

Since the occurrence of malaria is determined by variations in climatic factors epidemics may be predicted using these factors. Indigenous knowledge systems have been used by local populations to develop mitigation and adaptation strategies to reduce their vulnerability to climate variability (Nyong et al., 2007; Jiri et al., 2016; Orlove et al., 2010; Anandaraja et al., 2008; Pareek and Trived, 2011). Even though indigenous knowledge is the basis for local level decision making in many rural communities, it has value not only for the culture in which it evolves but also for scientists and planners working to improve the lives of rural communities (Soropa et al., 2015). This knowledge is however rarely taken into consideration in the design and implementation of modern mitigation and adaptation strategies. Indigenous cultures have warning systems for various hydro- meteorological events that have proven effective for generations in warning local populations about impending threats (Glantz, 2009; Soropa et al., 2015). Communities in hazard prone areas have generated a vast body of knowledge on disaster prevention, mitigation, early warning, preparedness and response and post disaster recovery (Pareek and Trived, 2011; Armatas et al., 2016). People in malaria prone areas therefore have potential to develop malaria early warning systems using indigenous knowledge systems to reduce their vulnerability to malaria outbreaks. Indigenous knowledge is one of the tools of early warning apart from Geographic information system (GIS), remote sensing and forecast warning terminology (Glantz, 2009). Scientific forecasts tend to be applicable to relatively large areas and lack specificity. The information is usually disseminated late and in unfriendly languages with technical jargon that limits the uptake of such warning information (Mapfumo et al., 2015).

Indigenous knowledge is a body of knowledge, skills and technology, which belongs to a particular geographical community (Ndangwa, 2007). It is based on practical experiences and can be preserved and harnessed for the benefit of both present and future generations, which live in these communities (Mapira and Mazambara, 2013). Indigenous knowledge refers to practices that evolved through trial and error and proved flexible enough to cope with change (Eyong, 2007). Integration of indigenous knowledge and scientific warning systems seems to be a key possible thrust to reduce vulnerability, enhance resilience and increase the adaptive capacity of rural communities (Jiri et al., 2016). In order to integrate indigenous knowledge into conventional health systems there is need to acknowledge that indigenous knowledge has provided people with the capability of dealing with past and present vulnerabilities. Several studies have shown how indigenous knowledge is utilised in forecasting climatic variations in agriculture (Jiri et al., 2016; Armatas et al., 2016; Mapfumo et al., 2015; Byg and Salick, 2009; Nethononda et al., 2013; Kalanda-Joshua et al., 2011; Chang'a et al., 2010; Kihupi et al., 2002; Mhita, 2006; Ayal et al., 2015; Mahoo et al., 2015; Gukurume, 2014).

Local communities in different parts of the world have continued to rely on indigenous knowledge to conserve the environment and deal with natural disasters and this knowledge is still intact in many parts of Africa and other regions of the world (Kijazi et al., 2012). Indigenous knowledge on rainfall prediction in Zimbabwe was demonstrated in several studies (Soropa et al., 2015; Risiro et al., 2012; Shoko and Shoko, 2013; Mudzengi et al., 2013; Makwara, 2013). Local communities in Zimbabwe have been coping with droughts through the integration of scientific and indigenous weather forecasting methods (Shumba, 1999). The same methods can be utilised for the prediction of malaria.

In response to the need to develop malaria early warning systems in Africa, the World Health Organisation published a framework proposing the generic concepts and potential early warning and detection indicators for use in Malaria early warning systems (Thomson and Connor, 2001). The framework has seasonal climate forecasting and environmental monitoring as some of its components and is mainly directed for utilisation by the health systems.

Communities are capable of forecasting rainfall using various environmental and astronomical indicators as well as plant phenology, behaviour and movement of birds, animals and insects as demonstrated in studies discussed earlier. If the community's ability to relate rainfall to the occurrence of malaria is established, their ability to predict malaria can also be enhanced. The studies done in Zimbabwe have focused on rainfall prediction for agricultural purposes. The utilisation of indigenous knowledge systems for the prediction of malaria in Zimbabwe and specifically in Gwanda district has not been demonstrated. We assessed the perception of local communities on the environmental indicators for the occurrence of rainfall as a precursor to the occurrence of malaria in ward 11, 15 and 18 of Gwanda district in Matabeleland South, Zimbabwe. Community perceptions of malaria as a disease and the factors that they perceive as affecting its occurrence were also assessed.

2. Methodology

2.1. Study area

The study was conducted in wards 11, 15 and 18 of Gwanda District in Zimbabwe. Fig. 1 shows the position of Gwanda District in Matabeleland South, Province and the location of the province in Zimbabwe.

Zimbabwe has seasonal and geographic variation in malaria transmission that corresponds closely with the country's rainfall pattern (Mabaso et al., 2005). Malaria transmission mainly occurs during the rainy season between November and April, with average temperatures ranging from 18 and 30 ° Celsius. The peak transmission season for malaria is between February and April. The annual rainfall in Gwanda district is less than 700 mm (President's Malaria Initiative, 2016). The low rainfall received in the area has necessitated the construction of dams and setting up of irrigation schemes. People in the District mainly survive through subsistence farming, cattle ranching, brick moulding, irrigation farming, gold panning, fishing, vending and cross border trading.

A ward is an administrative area under a district that consists of an average of 10 villages and each village consists of an average of 100 households. Wards 11, 15–18 and 20–24 in the southern part of Gwanda experience unstable malaria. There are 12 146 households and an overall population of 50434 people in these wards (Zimbabwe National Statistics Authority, 2013). Gwanda has recorded the second highest mortality due to malaria in Matabeleland South Province in the period 2009–2013 as shown in Fig. 2. The highest mortality was in Beitbridge district with 29 deaths followed by Gwanda district with 11 deaths (District Health Information, 2016).

The district also recorded the second highest incidence of malaria during the same period as shown in Fig. 3. Malaria control is mainly through indoor residual spraying, the use of insecticide-treated nets (ITN) and larvaciding. Communities are not directly involved in the planning of these control measures but are usually informed when decisions have been made at the district level.