



Assessment of individual and household malaria risk factors among women in a South African village



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ARTICLE INFO

Article history:

Received 7 October 2015
Received in revised form 2 December 2016
Accepted 9 December 2016
Available online 10 December 2016

Keywords:

Malaria
Risk factors
Malaria among women
Malaria elimination
South Africa

ABSTRACT

There is need to understand how various malaria risk factors interact at the individual, household and community levels, as well as wider contexts, in order to guide the design and implementation of effective and more comprehensive control strategies. Using a cross-sectional approach, this study investigated various malaria risk factors among residents of Mgedula Village, a malaria-endemic community located in Jozini Local Municipality, UMkhanyakude District, South Africa from May to August 2014. Data from 121 randomly sampled women were collected using close-ended questionnaires. The women were aged between 18 and 40 years; and had been residents in the study area for five years or more. A multivariable logistic regression model was used to measure the association between a history of malaria infection in the previous 12 months and various potential risk factors. The results showed that practicing animal husbandry (OR 20), residing in household structures that had not been sprayed (OR 16.7) and cross-border movement (OR 14.3) were greatly associated with malaria infection. Other factors that were significantly associated with this infection included illiteracy (OR 9.1), having a largely populated household (OR 6.1) and low income (OR 1.65). Individuals with a history of malaria infection were less likely to lack basic malaria-related knowledge (OR 0.58), to have negative attitude towards malaria (OR 0.29) and also to have poor malaria practices (OR 0.3). There was no association between a malaria episode and residing at a long distance from the health facility. Indoor residual spraying indicated a notable reduction of malaria risk at the community level. However, other socio-economic, geographical and socio-demographic factors interacted at different levels to increase this risk among different individuals and households. To achieve malaria elimination by the year 2018, these aspects should be considered when developing and implementing elimination strategies at the individual, household and community levels, among high-risk populations.

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1. Introduction

Malaria is a key public health threat with approximately half the global population estimated to be at risk of the disease (Singh et al., 2014). Affecting mostly children and pregnant women, malaria burdens are mostly reported in sub-Saharan Africa, the region accounting for over 81% of the global number of cases and 91% of the global malaria-related mortality (Singh et al., 2014; Mendis et al., 2009). A number of measures to control and eliminate the disease have been put in place at local, national and global settings (Mendis et al., 2009). Malaria control programmes, which mainly operate at

the national, provincial and district levels have been established in all malaria-endemic countries.

In South Africa, malaria is still endemic in Limpopo, Mpumalanga and KwaZulu-Natal Provinces that border Zimbabwe, Mozambique and Swaziland, with approximately 6 million people in the country living under malaria risk (Maharaj et al., 2012). However, by adopting the National Malaria Elimination Programme with a target to eliminate the disease by the year 2018, South Africa has made notable progress in reducing its morbidity and mortality. Progress has particularly been noted between the years 1999 and 2011, within which reported malaria cases were reduced by 91% and malaria-related mortality was reduced by 81% (Maharaj et al., 2012). Ecological changes, an increase in immigrants in and out of highly infested areas, poorly implemented surveillance systems and degradation of healthcare infrastructures are some of the factors that have been reported as contributing to the current malaria

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burden in South Africa's endemic areas (Hlongwana et al., 2009; Morris et al., 2013).

KwaZulu-Natal Province has reported great progress in the fight against malaria, with a reduction of up to 54 cases per 1,000,000 population at risk reported in 2013 from 4 718 reported cases per 1,000,000 population at risk recorded in 2000 (KwaZulu-Natal Department of Health, 2014). In 2013, the province recorded a lower malaria burden than Mpumalanga and Limpopo, which reported 919 and 437 cases per 1,000,000 population at risk, respectively (KwaZulu-Natal Department of Health, 2014). Malaria cases in KwaZulu-Natal are mainly reported in three districts, namely UMkhanyakude, Zululand and uThungulu, with the former accounting for up to 80% of the total number of cases in the province (Morris et al., 2013).

Assessing the various malaria risk factors and investigating their interaction at various levels have played key roles in designing and implementing comprehensive measures directed at preventing, controlling and eliminating malaria (Somi et al., 2007). Factors assessed include gender; malaria-related knowledge, attitude and practices; mobility and travel; ethnicity; occupation; socio-economic status; and type of household structure (Krefis et al., 2010; Stefani et al., 2011). Other factors include literacy level of the household head; size of the household; number of rooms used for sleeping; proximity of household structure to vector-breeding site(s); presence of livestock and other domestic animals, among others (Woyessa et al., 2013; Chirebvu et al., 2014). Recently, additional efforts have been made to investigate the influence of climatic factors on the rates of malaria infection and transmission (Ermert et al., 2011; Berrang-Ford et al., 2012). However, a large proportion of the studies investigating malaria risk factors do not usually consider the wide range of factors, which makes results more prone to confounding effects due to factors that are not included in the analysis. Cross-border movement has been the major malaria risk factor in the endemic communities of Jozini Local Municipality due to their proximity to the Republic of Mozambique and Republic of Swaziland (Maharaj et al., 2012).

A number of factors such as diminished immunity (especially during pregnancy) and reduced access to health services have been shown to predispose women to a greater risk of malaria infection (Shulman and Dorman, 2003). Malaria prevention among women of child-bearing age is of prime concern because the disease has been associated with maternal anaemia, low birth weight delivery as well as maternal and perinatal mortality (Marchant et al., 2011). Therefore, understanding the malaria risk factors among women of child-bearing age is one of the important ways, through which effective measures can be designed and implemented in order to halt the perilous effects of the disease.

Malaria elimination in UMkhanyakude District has particularly been hampered by human cross-border movements due to the district's geographical location, bordering the highly endemic countries of Mozambique and Swaziland (KwaZulu-Natal Department of Health, 2014; World Health Organization, 2009). There is great contrast between South Africa and Swaziland, in comparison to Mozambique, regarding their positions on the malaria-control continuum. Although South Africa and Swaziland are currently in the pre-elimination phase and target elimination by 2018 and 2015 respectively, Mozambique is still in the control phase (Maharaj et al., 2012).

Progress in the fight against malaria in South Africa has largely been attributed to Indoor Residual Spraying (IRS) using Dichlorodiphenyltrichloroethane (DDT) (Mendis et al., 2009). Based on a mosaic IRS strategy, the KwaZulu-Natal Provincial Malaria Control Programme is currently using DDT to spray traditional structures (un-painted walls made of materials like straw, mud, clay and dung) and also maintaining the use of pyrethroid (deltamethrin) to spray modernized structures (KwaZulu-Natal

Department of Health, 2014). Other key strategies implemented by the control programme in KwaZulu-Natal are household and community dissemination of malaria-related knowledge, aimed at improved modification of malaria-related attitudes and health-seeking behaviour;

and proper case management, entailing prompt diagnosis, followed by proper treatment using artemisinin-based combination therapies (ACTs), as recommended by the World Health Organisation (WHO) (Mendis et al., 2009; Maharaj et al., 2012; KwaZulu-Natal Department of Health, 2014).

UMkhanyakude District records the greatest number of malaria cases in KwaZulu-Natal Province. Still, no recent study has assessed malaria risk factors at the individual and household levels in this district, particularly not in the endemic communities of Jozini Local Municipality. It is against this background that this study was conducted and aimed at investigating a variety of malaria risk factors among women in Mgedula Village, Jozini Local Municipality in 2014, in order to provide the Malaria Control Programme (MCP) with information that may guide the development and implementation of more comprehensive measures targeted at households and individuals that are at the highest malaria risk. It was important to focus on women because their particular vulnerability to malaria, most especially when pregnant; they are also, in most cases, directly responsible for the wellbeing of other family members, particularly children, who also are highly vulnerable to malaria. Women are also assumed to be more knowledgeable of household day-to-day activities and can thus be used as proxies for the general household malaria-related perceptions and practices (Singh et al., 2014). We hypothesized that a history of previous malaria infection would not be associated with various individual and household risk factors among the women.

2. Materials and methods

2.1. Study setting and location

The study was conducted in Jozini Local Municipality in the north-western part of UMkhanyakude District, which is situated in the north-eastern part of KwaZulu-Natal Province, one of the three malaria-endemic provinces in South Africa. According to the census conducted in 2011 UMkhanyakude district (about 12 800 km² in size) has a population of 625 846 people and is bordered by uThungulu District, Zululand District, the Indian Ocean, the Republic of Mozambique and the Republic of Swaziland (UMkhanyakude District Municipality, 2011).

The study site within the Jozini Local Municipality (Fig. 1), Mgedula Village (*isiGodi*), is located in the low-lands of the municipality in close proximity to the borders of the Republics of Swaziland and Mozambique.

2.2. Study design and data collection

An observational cross-sectional survey was conducted between May and August 2014 among 121 randomly selected women aged between 18 and 45 years who had been residents for five years or more. This sample size was calculated at the 95% confidence level, with a $\pm 9\%$ estimated precision and a 0.5 expected odds of occurrence. One hundred and twenty one households were randomly selected (using the software package Stata/IC, version 13.0) from a sample frame (irrespective of the gender of the household head). Of the 121 selected households, 23 were headed by women and 98 by men. One woman was recruited from each of the 121 randomly selected households for inclusion in the study. From households headed by women, the household heads were recruited, and a female household head proxy was recruited from

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