



RESEARCH ARTICLE



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Barriers to the Usage of Topical Mosquito Repellents in Young Adults at Risk of Mosquito Bites in an Inter-epidemic Period in Mauritius

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Abstract

Topical mosquito repellents are useful in preventing mosquito bites in countries vulnerable to mosquito-borne diseases. In the island of Mauritius, recent years have seen 2 outbreaks of chikungunya fever and 2 outbreaks of dengue fever. Previously, these mosquito-borne diseases were absent in the island. In this context, a study was carried out in a young university student population to study topical mosquito repellent usage in an inter-epidemic period. Findings showed that usage of topical mosquito repellents was low as only 21% of the sample regularly used these despite an average mosquito bite rate of 1.88/day. Usage of topical repellents was also more frequent in females and did not have a statistically significant linear relationship to previous experience of mosquito-borne infections or to the rate of mosquito bites. Barriers to topical mosquito repellent usage included a lack of concern to mosquito bites, the use of alternative methods to prevent mosquito bites, concerns about topical repellent side-effects, the high cost of these products and the perception that these were ineffective in preventing mosquito bites. Individual preventive measures in society, such as the usage of topical mosquito repellents, should be regularly monitored by health authorities to gauge the state of preparedness against mosquito-borne diseases.

Keywords: Mosquito-borne diseases, mosquito bites, topical mosquito repellents, DEET, inter-epidemic period

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INTRODUCTION

Topical mosquito repellent (TMR) usage is commonly advocated as an important preventive measure against mosquito bites in human populations. For instance, TMR use is advised in children to protect against serious mosquito-borne diseases such as malaria [1]. However, actual TMR usage amongst populations is not known precisely. Although travelers and tourists to tropical countries are believed to use TMRs frequently, local usage amongst the local population in countries at risk of mosquito bites is less well established. In many such countries, prevention of mosquito bites centres on mosquito source reduction activities e.g. eradication of mosquito breeding sites and methods which target mosquito populations e.g. use of insecticides. These measures are easier to adopt in communities when compared to measures which focus on minimizing human contacts with the mosquito vectors such as the use of topical mosquito repellents as these measures require more individual motivation and effort.

Topical mosquito repellents act by inducing mosquito avoidance of the host, thus preventing mosquito bites. DEET (N,N-diethyl-3-methylbenzamide) is a widely used topical synthetic mosquito repellent. It has been shown that DEET's mode of action relies on interference with the normal functioning of insect odorant receptors [2]. Although use of DEET is widely accepted, it has recently been reported that some mosquitoes may become more insensitive to DEET as a result of pre-exposure [3] thus implying a reduced efficacy. Also, whilst DEET is safe if used as recommended, there have been concerns about its toxic effects in adults, children, pregnant and lactating women [4]; these side effects are reported to be related to absorption of the product from the skin into blood and this is influenced by its concentration and frequency of application. Other mosquito repellents include Picaridine and IR3535 (ethyl 3-[acetyl (butyl) amino] propanoate) which are also synthetic mosquito repellents which disrupt mosquito odorant activity by acting on mosquito olfactory sensory neurons [5]. In addition to synthetic repellents, plant based "natural" repellents are also used either in commercial preparations or in traditional ways. These repellents include lemon eucalyptus, citronella extracts, neem based preparations and other natural and essential oils [6].

In the island of Mauritius, past outbreaks of malaria, chikungunya fever and dengue fever have highlighted the vulnerability of population to mosquito-borne diseases. Recent outbreaks of chikungunya fever in 2005 and 2006 and dengue fever in 2009 have emphasized the need to maintain public health vigilance towards mosquitoes [7]. A new outbreak of dengue fever in 2014 has re-emphasized the continuing threat posed by mosquitoes. Health authorities consistently encourage the public to carry out source

reduction activities and to adopt appropriate preventive measures to avoid mosquito bites especially in the rainy months. Preventive measures include minimizing potential contact with mosquitoes, for instance by avoiding mosquito-abundant areas or using personal physical barriers such as wearing long sleeved clothes and the use of chemical barriers in the form of mosquito repellents; using physical barriers in the house to avoid mosquito entry and sleeping under mosquito nets at night. Although the combination of such preventive measures has been useful, the specific role of topical mosquito repellents as an effective public health measure in Mauritius has not been clearly defined.

METHODS

A. Study population:

The study population comprises 9,000 university students of the University of Mauritius and a sample size of 368 was targeted at 95% confidence level and 5% confidence interval.

B. Questionnaire design:

An online electronic questionnaire was designed and administered to provide the most convenient access to students. This questionnaire sought to obtain information on whether the participants made regular use of TMR either in the lotion, cream or spray formulation. Information sought also included the brand of TMR used. Non users of TMRs were requested to provide further information on reasons for not using TMR. Additional information included any past history of mosquito-borne diseases and the daily number of mosquito bites.

C. Data collection and analysis:

The online survey was carried in April 2013 amongst university students in Mauritius. At the time of the survey, there were no ongoing mosquito-borne diseases. However mosquito numbers are high during this month. The survey lasted 10 days after which participation diminished. It was aimed to recruit 368 participants. At the end of the study, 350 participants had completed the questionnaire. Analysis of data was made using the statistical software Stata 12.0 and Microsoft Excel software 2007 version

RESULTS

The sample comprised 350 participants. The average number of mosquito bites in the sample was 1.88/day. 35 participants had suffered from a previous mosquito borne disease (dengue fever: 1 and chikungunya fever: 34).

Out of 350 participants, 74 (21%) used TMR regularly (Figure 1). Amongst users of TMR, 85% were females and 15% were males.

Characteristics of TMR users were compared to those participants not using TMR (Figure 2).

TMR products used included Odomos (containing N, N-diethyl benzamide), Moustidose (containing DEET),

Mousticologne (containing IR3535), citronella oil, Florame (containing citronella, peppermint and other organic essential oils), Repulcide (containing paramenthane and other natural ingredients) and other DEET containing products.

Usage of mosquito repellents did not have a significant linear relationship with respect to previous mosquito-borne infections nor to the daily number of mosquito bites. As for gender, there was a mild linear correlation, and from the regression coefficient it was concluded that use of repellents was lower for male by around 0.14 points.

Barriers to the usage of topical mosquito repellents in non users of TMR are shown in Figure 3. Amongst the 276 participants who were not using TMR, the main barriers to TMR usage included a lack of concern to mosquito bites, the use of other methods to prevent mosquito bites, concerns about side effects of TMR, the high cost of TMR and the perception that these were ineffective in preventing mosquito bites.

DISCUSSION

Participants in this study were a young group of university students aged 18 to 25. They were healthy, well informed and came from an average socio-economic background. Usage of TMR was 21% in the sample at a time when there was no mosquito-borne disease in the island but mosquito bite rate was at 1.88/day. This sample may not representative of the population as usage of TMR in this young, mobile and well informed group is likely to be higher than in the general population. In addition, participants in this study are more likely to be concerned about mosquito bites as compared to non participants. There was clearly a gender bias in this study as the number of female participants exceeded male participants by a large amount. Hence, we believe that population usage of TMR is likely to be lower than 21% in an inter-epidemic period in Mauritius.

This study has a few limitations. It does not take into account the following factors: the frequency or sites of application of TMR. In addition, the efficacy of the specific TMR used is not assessed. If these factors were taken into account, it is probable that the effectiveness of TMR use, in those participants using TMR, would be less than optimal. In addition, the concurrent use of other topical preparations e.g. sunscreens, moisturizers and other emollients and its effect on TMR efficacy was not investigated.

The results demonstrate that the most common barrier to non usage of TMR is a lack of concern to mosquito bites. This is surprising since Mauritius had suffered from 2 outbreaks of chikungunya fever and 2 outbreaks of dengue fever in recent years causing significant morbidity. Previously these diseases had been absent in the island. The participants of the study, being well informed, are aware of these outbreaks and of their consequences on human health. In addition there are regular public health campaigns emphasizing measures to be taken against mosquito bites both in the press and on national television to maintain a high state of awareness and alertness in the population. However these public education campaigns in an inter-epidemic

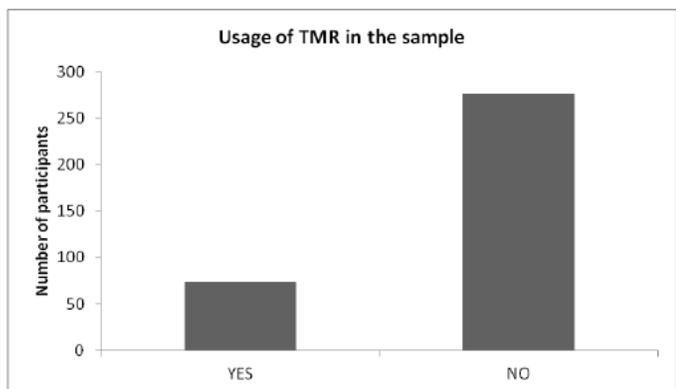


Figure 1: Usage of TMR amongst participants

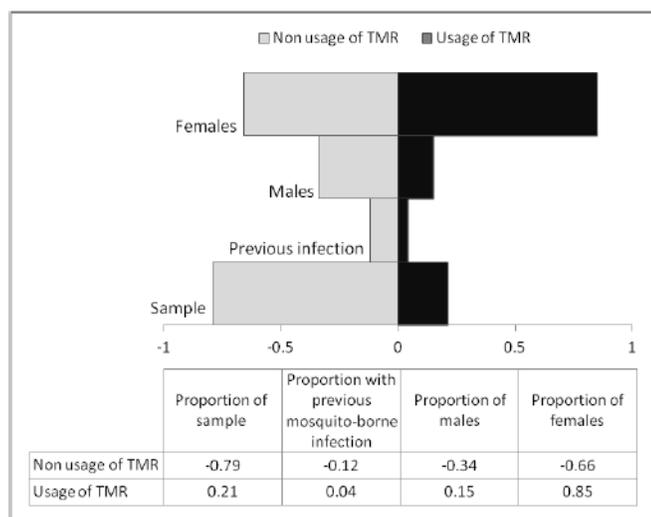


Figure 2: Characteristics of the sample

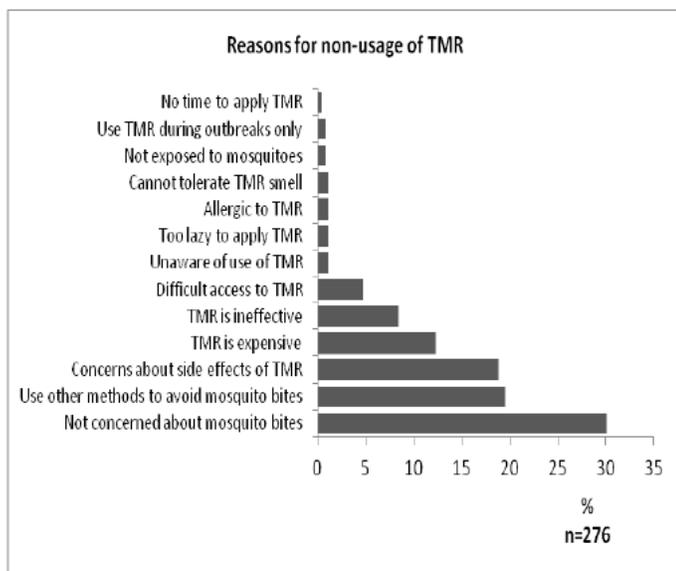


Figure 3: Reasons for non-usage of TMR

do not appear to be translated into practice where TMRs are concerned. Furthermore, it is noteworthy that TMR usage remained low even during an outbreak period in a recent study carried out in a specific locality in Mauritius [7].

Results also showed that other barriers to TMR usage were the use of alternative methods to avoid mosquito bites as well as concerns about the side effects of TMRs. Alternative methods used included personal barrier methods such as the use of protective clothing with long sleeves and trousers and physical household barrier methods to prevent and repel mosquito entry. It would be useful to compare the effectiveness of TMR use to the effectiveness of alternative methods in preventing mosquito bites to better inform public health promotion campaigns.

Concerns about the side effects of TMR also contributed to low TMR usage. TMRs are usually considered to be safe if used as recommended and thus disproportionate concerns regarding their side effects should be balanced against the detrimental health effects of a mosquito-borne disease.

This study has provided useful information on the usage of TMR amongst young people in Mauritius. Unfortunately there are few published studies on TMR usage in other countries in inter-epidemic periods and our data could not be compared to those of other countries. People have an individual responsibility to prevent mosquito bites in both inter-epidemic and outbreak periods. This contributes to prevent an outbreak of a mosquito-borne disease and also its spread in the community. Individual preventive measures should be regularly monitored to maintain a high state of preparedness against mosquito-borne diseases in vulnerable countries.

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