STUDY PROTOCOL

Effectiveness of Malaria Free Zone Program on the Knowledge, Attitude and Practice of Malaria Prevention among university students in Conakry, Guinea: Protocol of a Randomized Controlled Trial

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ABSTRACT

Introduction: Malaria is a vector-borne disease caused by the bites of infected female mosquitoes that transmit the parasite to humans. In Guinea, the entire population is at risk of malaria infection. The objective of this study is to develop, implement and evaluate the effectiveness of the Malaria Free Zone program using the Health Belief Model (HBM) to improve malaria prevention knowledge, attitudes, and practices among university students in Conakry, Guinea. **Methods:** The study design is a clustered randomized controlled trial (RCT). Students are selected using the clustered sampling method, with each university representing one group, either the intervention or control group. The sample size is 113 university students from each group. The content of the Malaria Free Zone program includes eight sessions, which are based on the HBM constructs. This program takes approximately 6 hours and 30 minutes to complete. Respondents are required to complete a questionnaire over four time points. Generalized Estimating Equation (GEE) will be used to determine the effectiveness of the Malaria Free Zone program on malaria prevention knowledge, attitudes, and practices, adjusted with covariates. **Conclusion:** It is expected that there will be a significant difference in knowledge, attitude, and practice of malaria prevention in the post-test, 2-week and 2-month follow up of the intervention group after the Malaria Free Zone program. Students in the intervention group will have significant higher knowledge, attitude and practice of malaria prevention compared to students in the control group.
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INTRODUCTION

Malaria is an alarming public health problem in Guinea, with 100% of the population at risk. Between 2019 and 2020, the number of malaria cases increased by 2.6%, from 3, 334,355 cases to 3, 422, 309 cases (1). Due to the high number of malaria cases, the economic costs of treating the disease also increased. From 2005 to 2012, they increased from $2.9 million to $6.77 million. The President's Malaria Initiative (PMI) funding increased from $10 million to $15 million between 2011 and 2017 (2).

In Guinea, there were two studies that investigated knowledge, attitude and practice (KAP) on malaria (3-4) meanwhile another study only focused on factors associated with malaria prevention practice (5). A cross-sectional study among 2248 pregnant women highlighted that the factors associated with malaria prevention practice included age, marital status, length of residence, place of residence, level of education, distance between home and health center, health status, occupation, occupation of the household head, the presence of garbage and standing water in the neighborhood, and source of running water (5).

Sociodemographic characteristics at the individual level, namely gender (6), age (7), parental status, primary caregiver and family income (8), education (7), socioeconomic factors (9), household factors (10) and

behavioural factors (11), have been reported as factors associated with KAP on malaria.

It is important to have the correct knowledge towards malaria because it helps individuals understand the ways in which malaria is transmitted, the cause of malaria, the source of malaria and the signs and symptoms towards malaria so that they may know how to prevent contracting the disease. As author aware, there have been several intervention studies to improve KAP of malaria in other African countries, including Nigeria (12), South Africa (13), North Sudan (14), Ethiopia (15), Niger (16), Mali (17), and Malawi (18). In Guinea, however, there has yet to be an intervention study conducted on the KAP of malaria.

Several theories have been used for the previous studies on malaria including Protection Motivation Theory (PMT) (19), Health Belief Model (HBM) (20-21), Information, Motivation and Behaviour (IMB) skills (12) and theory of planned behaviour (22). HBM will be used in current intervention program. HBM has 6 constructs include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, and cues to action (23). HBM is one of the well-known used model on developing health promotion intervention as this could aid to understand and predict health behaviours well (24).

The specific objectives of this study are; 1) To develop and implement Malaria Free Zone using Health Belief Model (HBM) to improve the knowledge, attitude and practice of malaria prevention among university students in Conakry, Guinea. 2) To compare the changes on the knowledge, attitude, practice, perceived severity, perceived susceptibility, perceived benefits, perceived barriers, perceived self-efficacy of malaria prevention and cues to action at baseline to post intervention to 2 weeks and 2 months follow up of the intervention, (between and within) the intervention and control groups among university students in Conakry, Guinea.

METHODOLOGY

The study design to be used is clustered randomized controlled trial (RCT). Randomization and single blinding will be performed, where two universities (Université Gamal Abdel Nasser de Conakry and Université Général Lansana Conté de Sonfonia) were randomly assigned to either intervention or control group. The data collection will take approximately four months. Approval of this study was obtained from the Ethics Committee for Medical Research Involving Human Subjects, Universiti Putra Malaysia (JKEUPM-2020-265) and Pan African Clinical Trial Registry (PACTR202102614259601). Permission will be obtained from the universities with additional written consent from participants before study.

Figure 1 shows a CONSORT flow for the Malaria Free Zone Program on malaria prevention knowledge, attitudes, and practices among university students in Conakry, Guinea.
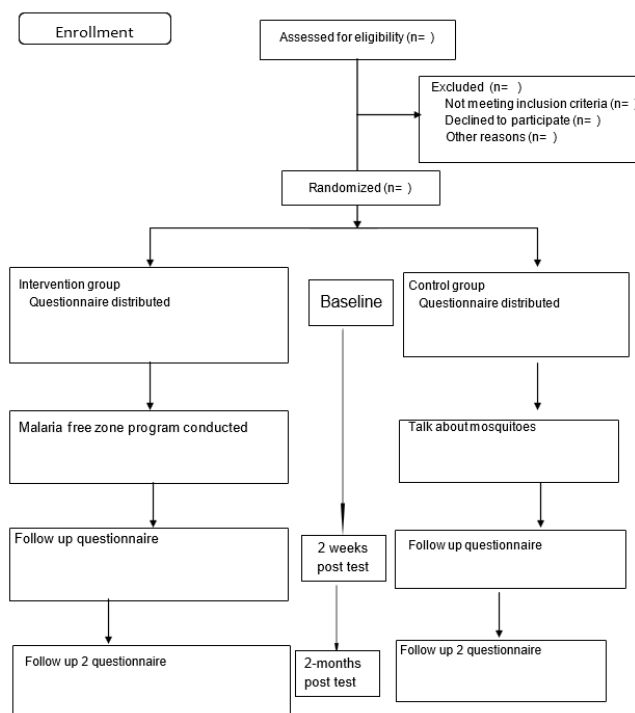

Figure I: CONSORT flow for the Malaria Zone Program on knowledge, attitude and practice of malaria prevention among university students in Conakry, Guinea

Due to there is limited intervention studies in Guinea, the sample size was calculated from a study conducted in Nigeria, using the mean of knowledge in the intervention (3.94) and control (3.18) groups (12) with two-mean sample size formula (25).
The formula is as follows:

$$n = \frac{2\sigma^2 \left[z_{1-\frac{\alpha}{2}} + z_{1-\beta} \right]^2}{(\mu_1 - \mu_2)^2}$$

n= sample size estimate
$Z_{1-\alpha/2}$=standard error with 95% confidence interval= 1.96
$Z_{1-\beta}$= standard error associated with 80% power= 0.842
μ_1= mean value of knowledge in intervention group (3.94) (12)
μ_2= mean value of knowledge in control group (3.18) (12)
α= Estimated standard deviation (1.496) (12)

Calculation:
$$\frac{2(1.496)^2 \ [1.96+0.842]^2}{(3.94-3.18)^2}$$

Considering the comparison between two groups (intervention and control)

$n_1 = 61$

The design effect has been proposed as inflation for cluster randomization control trials to achieve statistical power with cluster randomization (Donner, Birkett and Buck, 1981).

Adding the design effect:
$n_2 = n_1 \times DE$
$= 61 \times (1.3) = 79$

Addition of 30% is added due to attrition rate:
$n_3 = 79/0.7 = 112$
$= 113$ per group

Therefore, sample size of each group is 113, with total is 226.

Inclusion criteria are university students residing in Conakry and exclusion criteria are university students who are absent, not from Guinea, part-time students or studying in the Faculty of Medicine and Health Sciences. The target population that meets the inclusion and exclusion criteria will be identified and invited to participate in the introductory session. After a brief introduction, each student will be asked to voluntarily raise their hand if they are interested in participating in the study. Slips of papers are then distributed, 113 of which are numbered in advance (the size of the study sample) and the others are left blank, divided equally according to the number of classes involved. Among the volunteers of each class, a random selection will be made by drawing slips and those who drew a number participate in the study. The samples will be selected based on the number they drew in the random selection.

Participants in the intervention group will join Malaria Free Zone program with 8 sessions (6 hours 30 minutes in total). In the control group, they will attend seminar related with mosquitoes without detailed explanation of the various mosquito-borne diseases. The Malaria Free Zone program was derived from the We Control Malaria program (26) and guided by 6 HBM constructs. Table I shows the content of the Malaria Free Zone program modules.

The questionnaire consists of 9 sections (Table II); Sections 1 to 4 and 9 were adapted from previous the literature titled, "Knowledge, attitude and practice on malaria control and prevention in Uganda" (27). Sections 5 to 8 were adapted from an article titled "Caregivers perception of malaria and treatment-seeking behaviour for under 5 children in Mandura district, West Ethiopia: a cross-sectional study" (20).

Section 1 contains 15 questions about participants' sociodemographic characteristics, including age, sex, year of study, major, faculty, marital status, type of residence, religion, occupation, and educational level of father and mother, family size, monthly income of breadwinner, malaria experience of participant and family in the past 12 months, and ownership and use of a mosquito net, mosquito repellent and mosquito coil.

Section 2 contains 8 questions about malaria knowledge, with 3 options (Yes, No and I do not know). If the respondent chooses the wrong answer, zero score is recorded while one score is recorded for the correct answer. The total score for knowledge ranged from 0 to 36. Section 3 contains 14 questions on attitude toward malaria with a 5-point Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, and 5: strongly agree), with the total attitude score ranged from 14 to 70.

Section 4 to section 8 will use the same Likert scale, with section 4 on perceived severity (5 questions, total score ranged from 5 to 25), section 5 on perceived susceptibility (6 questions, total score ranged from 6 to 30), section 6 on perceived benefits (5 questions, total score ranged from 5 to 25), section 7 on perceived barriers (8 questions, total score ranged from 8 to 40), section 8 on perceived self-efficacy (3 questions, total score ranged from 3 to 15).

Section 9 contains 9 questions on practice related to malaria with a 3-point Likert scale (1: always, 2: sometimes, and 3: never), with the total score for practice ranged from 9 to 21. The same questionnaire will be distributed at four different time points (12,13,28). This self-administered questionnaire will be distributed by a research assistant. The research assistant will be trained before the study.

The intervention program content was validated by public health experts. A total of 30 students will be included in the pilot study. In this study, an intention-to-treat (ITT) analysis will be conducted, which means that even if participants do not participate after the intervention, they will be included in the final analysis.

As part of the quality control of the questionnaire, the content validity the questions were validated by public health experts. Face validity will be conducted to ensure the questionnaire is understandable. Cronbach's alpha value will be calculated to ensure the questionnaire is reliable.

Data analyses will be conducted using SPSS version 27.0. Table III shows the comparison of knowledge, attitude, and practice of malaria between intervention and control groups (Table III). Descriptive analysis will be performed, using mean and standard deviation to describe continuous data and frequencies and percentages for categorical data. A histogram with normal curve will be used to determine the normality of the distribution. There are dependent variables (total scores for knowledge, attitude, and practice respectively). Paired t-test will be use to compare the

Table I: Content of Malaria Free Zone program

Session (Title)	Content	6 HBM Construct	Content of program
Session 1 (Introduction to the guide)	Participants will have an overview of the knowledge, attitude and practice towards malaria	Knowledge, attitude and practice	Facilitator will give a welcoming note, ice breaking session, distribute the informed consent and questionnaire. Facilitator will also explain the goals, learning objectives, and timeline of the program. Facilitator will give a brief background on malaria, including the vector causing malaria, mode of transmission, signs and symptoms, and prevention and control of malaria.
Session 2 (Malaria impact)	Participants will understand the malaria impact in their community using the signs and symptoms and how we they are all negatively affected	Perceived severity	Facilitator will introduce the session by addressing the status quo of malaria in community, malaria experience, family member malaria experience. Facilitator will divide the participants into groups and make them act out a scenario related to malaria impact. After the activity, facilitator will discuss about; • Malaria impact in the community, signs and symptoms; Negative impact, Signs and symptoms, Importance of malaria test • Issues of malaria importance in community
Session 3 (Malaria transmission)	Participants will learn and discuss how malaria is transmitted by mosquitoes and their misconceptions about how malaria is spread	Perceived susceptibility	Facilitator will divide participants into groups. Each group will have pictures related to malaria transmission routes and they would have to paste the pictures in a chart called transmission chart which will have 3 columns including; this causes malaria, doesn't cause malaria and not sure. After the activity, facilitator will discuss; • Why do people believe these ideas? • How do people catch malaria?
Session 4 (Malaria prevention)	Participants will become aware of the few key barriers to the transmission of malaria through a clear visual representation of how various barriers disrupt the malaria transmission route	Perceived barriers	Facilitators will divide participants into groups. Each group will be given pictures of those at risk of malaria. Then each group would have to paste those at risk of malaria on a large paper. After the activity, facilitator will discuss; • Misconceptions of how people catch malaria • Factors that can aggravate existing malaria and cause of malaria
Session 5 (Malaria barriers)	Participants attain a clear understanding of a few measures to stop malaria by deciding which barriers are more effective and practical and how they can apply them for themselves	Perceived barriers	Facilitators will divide the participants into groups. Each group will be given a malaria transmission chart and pictures. After the activity, the facilitator will discuss; • Why these are barriers?
Session 6 (Malaria breeding site)	Participants will know where mosquitoes are breeding in the community to develop an action plan in the future	Percieved benefits	Facilitators will divide participants into groups. Each group will create a community map which represents one neighborhood. After the activity, the facilitator will discuss; • How mosquito breeding sites need to be attacked?
Session 7 (Malaria treatment)	Participants will evaluate and learn different traditional and modern treatments for malaria and value of modern medical treatment. The importance of seeking early treatment of malaria for all infected people to break the cycle of malaria	Perceived Self-efficacy	Facilitator will divide the participants into groups. Each group will be given a treatment chart and pictures of malaria preventive measures. Participants will have to paste on the chart the preventive measure that is easy to do, in between and hard to do. After the activity, the facilitator will discuss about; • Does community need to convince everyone to use modern medical treatment? • How can community achieve treatment for all?
Session 8 (Malaria solution plan)	Participants will make a community action plan to break the cycle of malaria	Cues to action	Facilitator will divide the respondents into groups. Each group will be given a picture, then each group would have to make a story on how a sick person could turn into a healthy person. After the activity, facilitator will discuss; • How can all the the stories can become one action plan

dependent variable, before and after the intervention. Generalized estimating equation (GEE) will be used to determine the effectiveness of the Malaria Free Zone program on malaria prevention knowledge, attitudes, and practices, adjusted with covariates. Variable with a p-value < of 0.05 are considered statistically significant.

DISCUSSION

In Guinea, the entire population of the country (12.7 million), is at risk of contracting malaria. There were two cross-sectional studies investigated thee KAP of malaria prevention (3-4) and another cross-sectional study focused on the factors associated with the practice of malaria prevention (5). Results showed that age, marital status, length of residence, place of residence, level of education, distance from home to health center, health status, occupation of head of household, presence of garbage and standing water in the neighborhood, source of running water and number of pregnancies were associated with practice of malaria (5). Malaria is a serious disease and harmful to all residents. Therefore, it is vital to raise the awareness about the dangerous of malaria, regardless general community nor students.

In West Africa, a KAP study on malaria was conducted in

Table II: Content of Malaria Free Zone questionnaire

Section	Theme	Items	Remarks
1	Sociodemographic characteristics of the respondents on malaria (1)	15	Age, gender, year of study, major of study, faculty of study, marital status, type of residence, religion, father and mothers' occupation and educational level and family size, monthly income of the breadwinner, participant and participants' family history of malaria in the last 12 months and own and use bed net, own a mosquito repellent and coil
2	Knowledge towards malaria prevention(1)	8	Options (Yes, No, I don't know) Total score will range from 0 to 36
3	Attitude towards malaria prevention(1)	14	Likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree) Total score is range from 14 to 70
4	Perceived severity towards malaria prevention(1)	5	Likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree) Total score is range from 5 to 25
5	Perceived susceptibility towards malaria prevention(2)	6	Likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree) Total score is range from 6 to 30
6	Perceived benefits towards malaria prevention(2)	5	Likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree) Total score is range from 5 to 25
7	Perceived barriers towards malaria prevention(2)	8	Likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree) Total score is range from 8 to 40
8	Perceived self-efficacy towards malaria prevention(2)	3	Likert scale (1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree) Total score is range from 3 to 15
9	Practice towards malaria(1)	9	Likert scale (1- Always, 2- Sometimes, 3- Never). Total score is range from 9 to 21

4 public university institutions in The Gambia(29). The results showed that educational level had a statistically significant impact on students' perception of malaria and practice of sleeping under an ITN (29). Another cross-sectional study among French-speaking university students in Canada showed that correct knowledge of malaria symptoms was significantly associated with respondents high perceived risk of malaria infection (30).

The Malaria Free Zone program was derived from the We control malaria program (26) and guided by HBM. The "We control malaria" program was developed by Catholic Relief Services (CRS), a regional office for East Africa and a country office for Ethiopia. The role of this program is to use six participatory activities around malaria as a whole package of activities to teach participants about malaria prevention.

Through Malaria Free Zone program, participants learn the correct information about malaria. In addition, some misconceptions will be cleared and corrected. This program will help to improve the knowledge, attitude, and practice towards malaria prevention, eventually university students will be able to educate in their communities about the KAP of malaria prevention in the near future. Community health organizations can collaborate with university students to disseminate the message about malaria prevention to community, enhancing healthy behaviours in household levels eventually reducing the malaria infection. Malaria

burden such as cost treatment will be reduced if this Malaria Free Zone program is implemented.

CONCLUSION

In conclusion, this study is expected that the students in the intervention group have significant improvement on knowledge, attitude, and practice regarding malaria prevention after the intervention program at baseline to post intervention to 2 weeks and 2 months follow up of the intervention, (between and within) the intervention and control groups among university students in Conakry, Guinea.

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Table III: Comparison of knowledge, attitude and practice on malaria between intervention and control group

Variable	Intervention group Mean±SD	Control group Mean±SD
Group		
Intervention		
Control		
Age group		
17-21		
22 and above		
Gender		
Male		
Female		
Year of study group		
1st year		
2nd year and above		
Type of residence group		
House with closure		
House without closure		
Student's marital status group		
Single		
Married and divorced		
Religion group		
Muslim		
Christian and others		
Father's occupation group		
Government and private sector work		
Retired and others		
Mother's occupation group		
Government and private sector workers		
Homemakers and others		
Father's education group		
Primary school and below		
Secondary school and above		
Mother's education group		
Primary school and below		
Secondary school and above		
No. of person's in student's bedroom group		
> 2		
<2 and others		
Ethnicity group		
Three major ethnic groups (Malinke, Peuhl and Sousou)		
Minor ethnic group and others		
Average monthly income of breadwinner group		
Below 3000 000 GNF		
Above 3000 000 GNF		

Table III: Comparison of knowledge, attitude and practice on malaria between intervention and control group (continued)

Variable	Intervention group Mean±SD	Control group Mean±SD
Had malaria last 12 months		
No		
Yes		
Family member had malaria last 12months		
No		
Yes		
Have a bed net		
No		
Yes		
Sleep under a bed net		
No		
Yes		
Have a mosquito repellent		
No		
Yes		
Have a mosquito coil		
No		
Yes		
Perceived severity		
Good		
Poor		
Perceived benefits		
Good		
Poor		
Perceived barriers		
Good		
Poor		
Perceived self- efficacy		
Good		
Poor		
Cues to action		
Good		
Poor		
Knowledge		
Good		
Poor		
Attitude		
Positive		
Negative		
Practice		
Good		
Poor		

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