Co-Developing with the Victims: a Persuasion System to Address the Behavioural Delinquencies of Africans Towards Malaria

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Abstract. Malaria is one of the most common causes of illness and death in Africa as a whole, and in Nigeria in particular, particularly among pregnant women and children under the age of five. Despite the fact that the concerned authorities have deployed numerous intervention methods in the fight against these death-causing vectors—mosquitoes—the mortality toll has continued to rise. Through observations, interviews, and a review of policy documents, we discovered that while the government has done a good job of providing the majority of the requisite interventions to contain the vector, the people have refused to fully adopt those intervention mechanisms to protect themselves. Further investigation into the causes of people's negative attitudes revealed a lack of motivation due to the passive nature of those intervention systems. The Rollback Malaria (RBM) programme is one example. Secondly, existing systems lacked basic monitoring features to assess users' responsiveness and determine their compliance rate. To drive the research, we created three research questions and primary hypotheses based on them. We used Participatory System Design (PSD) and User Centered Design (UCD) techniques in our system design methodologies to avoid a one-size-fits-all design approach. Information was gathered from relevant subjects using well-structured questionnaires. The findings of the research survey were assessed in accordance with the study's objectives. The variables that restrict people from taking positive malaria preventative and control measures were discovered, as well as persuasive strategies that could be leveraged to encourage people to adopt these behaviors. We harmonized and integrated those factors to create a mobile intervention system: Malaria Prevention and Control Support System (MPCSS).

Contribution Statement. This study contributed to research through the identification of the factors that were hindering Africans from adopting positive malaria preventive behaviours and the subsequent persuasive strategies that could motivate them to engage in those preventive techniques. These findings were integrated in the Malaria Prevention and Control Support System (MPCSS) which was developed during the course of this research. This intervention system was used to engage the participants during the course of the study. Report from the participants' feedbacks indicated improvement and progress in their prevention and control behaviours. This was validated using baseline and validation studies.

Keywords: Malaria, Persuasive Strategies, Behavior Change, Persuasive Technology, Malaria Prevention and Control Support System (MPCSS), Behavioural Delinquencies

1 Introduction

Studies have shown that persuasive apps for behavior change encourage individual and communal actions in various sustainability domains like water, energy, mobility, and waste management [2]. Recent studies have also shown that amongst these health and wellness application domains, persuasive technology (PT) interventions to improve sustainable health behaviors are actually gaining momentum because of the effect of persuasion [7]. Berkovsky et al. [1] opined that tailoring persuasive strategies has "huge untapped potential to maximize the impact of persuasive applications".

Our research findings showed that the existing malaria preventive and control measures are faced with many lapses hence the increased cases of malaria being recorded [18],[19]. These lapses includes: wrong perceptions on malaria sickness as some people see it as normal sickness, low level knowledge on malaria preventive techniques, lack of interest in applying mosquito preventive techniques, forgetfulness, personal reasons and lack of motivation. Our research findings also revealed that efforts by the government to nip this menace in the board have largely proved abortive due to lack of cooperation from the people as it relates to adoption and usage of these preventive kits provided either free of charge or subsidized prices. Some of these eradication programmes include RollBack Malaria Programme, free distributions of insecticide treated nets (ITN), free distribution of malaria drugs, introduction of genetically modified mosquitoes (GMM), environmental fumigation and release of mosquitocidal fungi into the mosquito habitats [8],[3]. Most importantly, our research revealed that none of the existing eradication programmes targeted the behaviours of the users, hence the incessant failures always recorded. This animated our research, to develop a solution that combined the powers of emerging technology and persuasion. Therefore the purpose of this study is to develop a personalized mobile persuasive system for malaria prevention and control which have the capacity to motivate and nudge people to engage in malaria preventive and control behaviors. The study is guided by the following specific objectives: (i) to uncover the factors hindering people from engaging in malaria preventive and control measures (ii) to determine the persuasive strategies that could be used to motivate people to adopt positive behaviors towards malaria prevention and control (iii) to develop a personalized mobile persuasive system that could be used to inculcate positive malaria preventive and control behaviours in people and (iv) to establish whether there is relationship between mobile phone intervention system and malaria prevention and control.

2   Method

The study adopted methodological triangulation, which is a hybrid of three (3) key methodologies that include: User Centered Design (involving user studies), Object-Oriented Analysis and Design (OOAD) Methodology, and Participatory System Design (PSD) model. This hybridized method were chosen to optimize the benefits of each component methods in analyzing the existing system in order to discover the problem areas and design an enhanced intervention system for malaria prevention and control. An initial (baseline) user study was conducted to uncover the factors hindering people from engaging in malaria preventive behaviours and also to uncover the persuasive strategies that could be used to motivate them to do the right thing. The findings from that study was mapped to their corresponding persuasive strategies as described in the participatory system design (PSD) model by [6], and then we used them to develop a novel mobile persuasive system known as malaria prevention and control support system (MPCSS). This support system was used to engage the people to make them adopt the positive malaria preventive attitudes. The support system employed text notifications including audio, video and pictures made in English, pidgin, Igbo and Abakaliki dialects. To determine the effectiveness of the developed system, an evaluation study was further conducted using the system.

To achieve the research objectives, we engaged design thinking approach. We considered the desires of our target audiences by subjecting them to feasibility analysis to determine their workability.

2.1   Study Area

Our study area is Ebonyi state. Ebonyi State is in the South-eastern region of Nigeria and consists of 13 local government areas (LGAs) classified under three senatorial zones. Health service delivery in the state is structured into three tiers, with primary health care at the base, supported by secondary and tertiary healthcare services. Of the three zones, two towns in two senatorial zones are urban (Abakaliki and Afikpo LGAs). The rest are rural. However, two local government areas

was randomly selected for the study based on three inclusion criteria: highest number of malaria related deaths; nearness to river and availability of mobile phone network coverage.

This research was conducted in 3 main stages and the methodology for each stage is as follows:

- i. Pre-evaluation stage to obtain our measurable outcome –Baseline study
- ii. Implementation of the measurable outcomes in a developed interventions system that was used to plug the observations made in pre-evaluation phase-using prototype.
- iii. Evaluation stage that was used to evaluate relationship between our intervention and the measurable outcomes we set out at stage one in order to determine the efficiency of our system.

2.2 Measurable Outcomes

The measurable outcomes of the study include:

1. There should be increased adherence of people to positive malaria preventive measures such as (correct and consistent sleeping under Insecticide Treated Net (ITN), keeping of clean environment, use of chemical mosquito repellents such as sheltox, etc.)
2. There should be reduction in the number of times people fall sick or die of malaria
3. Establish if there is relationship between mobile phone intervention system and malaria prevention and control.

3 Results, Discussion and Design Implications

The results of the study revealed thus: (i) that factors such as wrong perception of people on the causes of malaria, low level knowledge on malaria preventive techniques, lack of interest in applying mosquito preventive techniques, forgetfulness, personal reasons, religious belief and lack of motivation hinders people from engaging in malaria preventive and control measures. (ii) That persuasive strategies such as customization, personalization/tailoring, praise/reward, reminder/persuasion, social influence, petting and public recognition can be used to motivate people to change their negative attitudes towards malaria prevention and control (iii) we developed a personalized mobile persuasive system known as Malaria Prevention and Control Support System (MPCSS) that is used to inculcate positive malaria preventive and control behaviours in people and (iv) we established that there is a relationship between mobile phone intervention system and malaria prevention and control measures when we compared the results of our baseline and evaluation studies respectively on malaria preventive and control factors such as rate of sickness, ownership of mosquito nets, number of people that sleep under their Insecticide Treated Net (ITN), number of people that net-proof their doors and windows, general environmental cleanliness (clearing of gutters, sweeping of rooms and compound and clearing of bushes around their compounds.
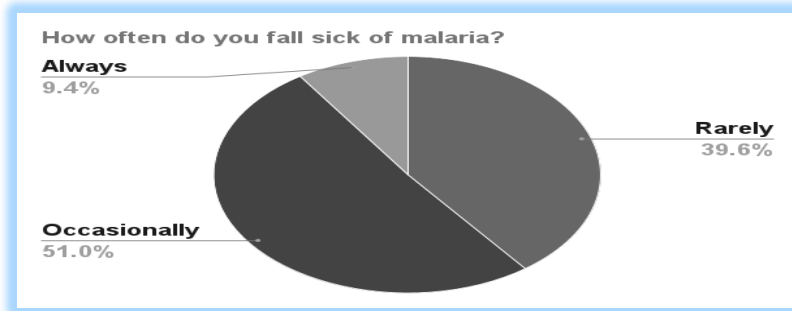
3.1   Discussions

Fig.1a. Number of people that fall sick of malaria recorded during our baseline study
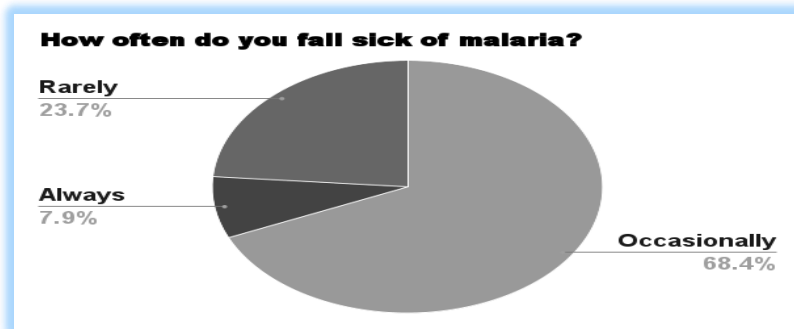

Fig.1b. Number of people that fall sick of malaria recorded during our evaluation study

When **figure 1a** is compared with **figure 1b**, you observe that there is sigificant inprovement in the rate at which the participants fall sick of malaria. During the baseline study, the participants were not yet exposed to the knowledge and strategies of malaria prevention nd control. The evaluation study was conducted after three months the participants were exposed to our study
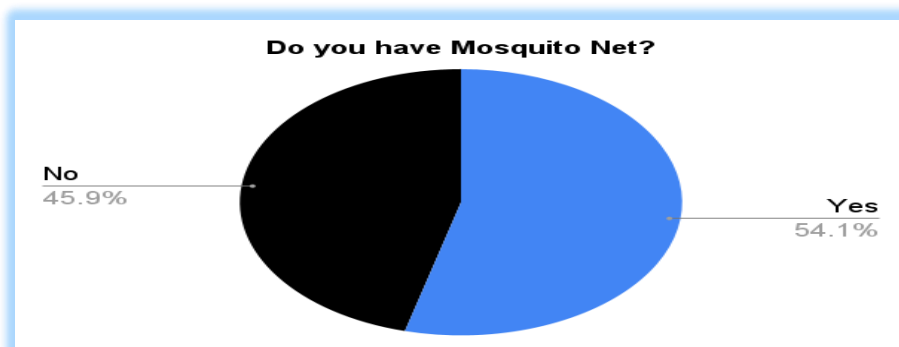

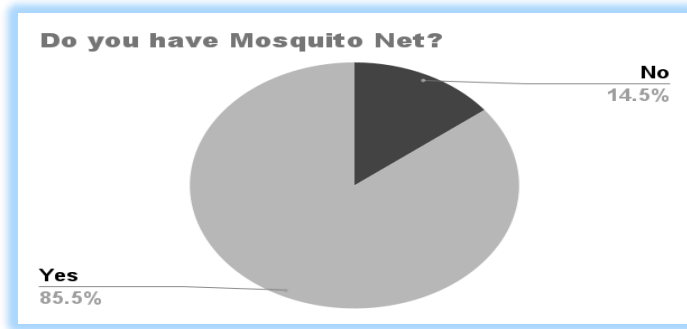**Fig.2a**: Number of people who owned mosquito net during baseline study

Fig.2b: Number of people who owned mosquito net during evaluation study

Figure 2a and figure 2b compared the people's ownership of mosquito treated net. During our baseline study, it was only 54% of the participants that had mosquito net but after three months of exposure to our study the number increased to 86%. This is a clear evidence that emerging technology moves people into action, either directly or indirectly.
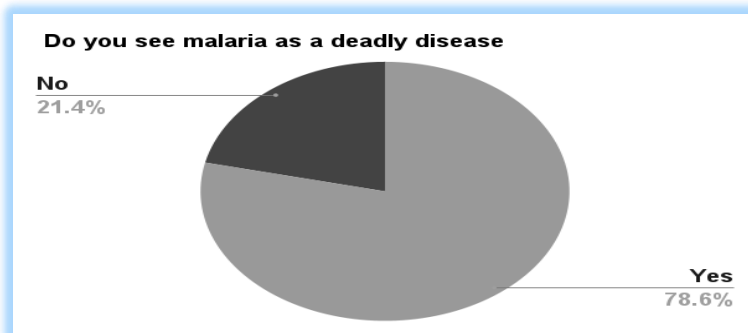

Fig.3a: people's perception of Malaria during our Baseline study
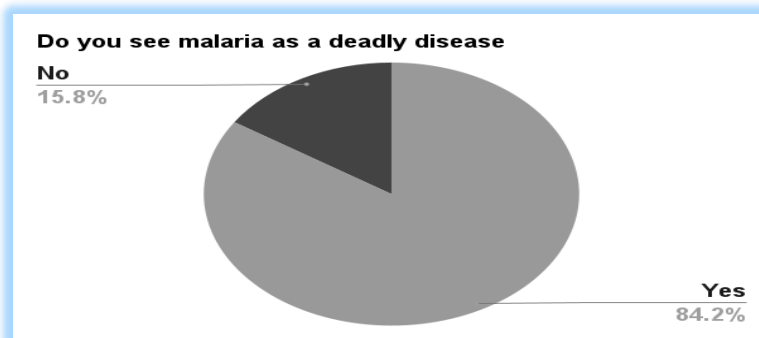

Fig.3b: people's perception of Malaria during our evaluation study

Our study equally looked at people's perceptions of malaria. This is to enable us understand the reason for the increase in malaria related deaths. From figure 3a, you observe that 21% of the participants saw malaria as normal sickness but during evaluation, 16% was recorded as those who still take malaria as normal sickness.
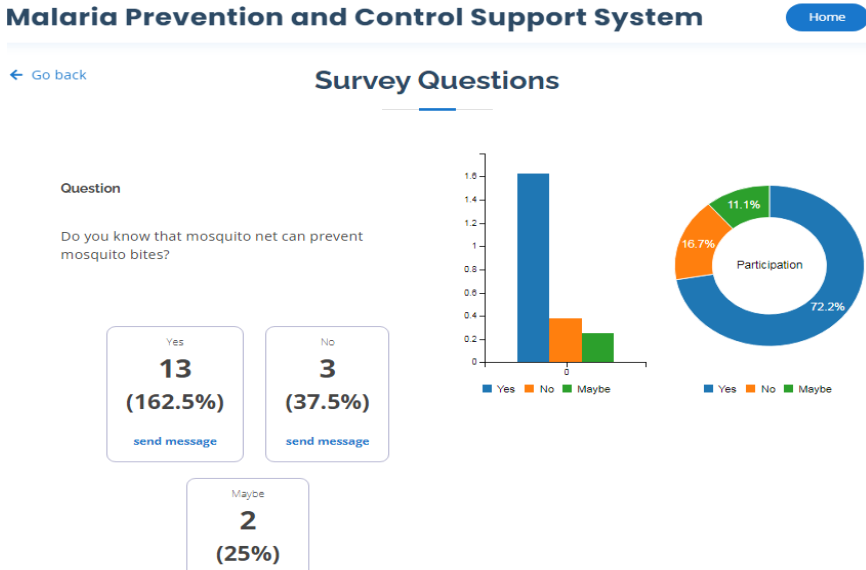

Fig.4: The interface of our MPCSS intervention system developed during the course of this research

The Figure 4 above is used to illustrate the interface of our intervention system. The above interface contained the result of the survey carried out on the participants. The graphical illustration of the result is generated in both bar chat and pies chart. The left hand side contained the question asked while below it is the distribution of the respondent according to their answers. The user response could be *Yes, No* and *Maybe*. The three boxes contained the number of respondent and their percentage while below is a message button. This button enables the system administrator to extract the details of people that responded in a particular for follow-up purposes. The follow-up are usually personalized where the respondents engage with the admin one-on-one in closed group. There is also provision for public forum where the participants interact with each other under the moderation of the administrator. This provide room for social learning and public recognition. The admin can public acknowledge those that have achieved milestones in their target behaviours and also encourage others to imitate brace up.

3.1   Design Implications

Finding from this study showed that a properly tailored mobile-phone intervention system can be very effective in addressing health and wellness issues, especially in the area of disease control. In contrast to passive participation recorded during the baseline study, the implemented system was purposely designed to stimulate active participation of participants to achieve communal objectives [9].

Specifically, the ***Social Learning*** strategy provides means for users to see the outcome of other user's behaviors. It is implemented in the form of discussion forum with other users which can be liked, shared or commented; this is similar to what is obtainable in social media applications. In addition, new users could also look up the comments from other users and get an understanding of what to expect from a system. Topics for discussion are generated from users' feedbacks on the media items they accessed on the system. This is consistent with the findings of Nkwo which suggests that social learning helps people to learn new ideas from their peers [5]. The design implication for this is that developers of MPCSS could integrate feature such as *task monitor* which will help people to monitor their progress as they perform their assigned task.

The ***Normative Influence*** strategy allows users to share their issues, thoughts, emotions with others to find support [5],[6]. They were implemented via the "public forum" platform that encourages people to share ideas with other users on the platform. The implication for this design on MPCSS for malaria prevention and control is that providing opportunities for users and groups to interact amongst themselves and feel norm will increase engagement and inspire them to adopt communally beneficial and sustainable behaviors.

The ***Recognition*** *strategy* shows public commendation of people for achieving a milestone. There is *wall of fame* to display exceptional performers in terms of consistent use of net, environmental cleanliness, least malaria treatment (LMT) and valuable contributions to discussions in the forum. These findings are significant and agree with the research of [6] because by providing public recognition to exceptional performers, other users could be motivated to perform target behaviors. The implication for the design of MPCSS for malaria prevention is that integrating features which offer public recognition to users and groups will be effective in encouraging healthy behaviors amongst users. Such features include a public display of praised and/or awarded user/group which is published on a conspicuous location on the system window. Success stories of individuals and groups who have successfully performed target behaviors could also be published as a means of recognizing their efforts and inspiring other users/groups to perform similar target behaviors.

The **Personalisation/Customisation** strategy provides for one-on-one interactions between user and the expert. The system provide for this feature through follow-up feature. This is activated based on particular responses from participants. This makes the participant to know that they are being monitored. This was implemented through the response sorting and classifications feature of the system. The implication of this design on MPCSS for malaria prevention is that it provides an opportunity for the system administrator to have direct interactions with the participants.

5   Conclusion

Malaria Prevention and Control Support System (MPCSS) resulted from the fallout of an extensive research in the domain of health and wellness with interest in malaria preventive behaviours. The research first of all addressed the root causes of high malaria cases among the people and the possible strategies that could be used to motivate them to imbibe malaria consciousness. In the nutshell, the research was able to uncover the factors that hindered people from engaging in positive malaria preventive techniques. Secondly, the research uncovered the relevant strategies that could be used to motivate people to engage in malaria preventive actions. These findings were integrated to arrive at an intervention system MPCSS which was deployed after implementation during the cause of the research. Report from the deployment enabled the researchers to establish that a well-developed mobile phone intervention can be applied in controlling health epidemic; hence there is an established relationship.

8

References

1. Berkovsky, S. et al: Influencing Individually. ACM Trans. Interact. Intell. Syst. 2, 2, 1–8 (2012).
2. Gustafsson, A.: Positive Persuasion Designing enjoyable energy feedback experiences in the home.
3. Nicoletta, Release of genetically modified mosquitoes into the wild mosquito habitat to attack and predate on them. www.livescience.com[accessed 05/05/2021]2021
4. Nkwo, M.: Mobile persuasive technology: Promoting positive waste management behaviors in developing African nations. Conf. Hum. Factors Comput. Syst. - Proc. CHI'19 Ext. Abstr. (2019). https://doi.org/10.1145/3290607.3299071.
5. Nkwo, M., Orji, R.: Persuasive technology in African context deconstructing persuasive techniques in an African online marketplace. In: ACM International Conference Proceeding Series. pp. 89–98 Association for Computing Machinery (2018). https://doi.org/10.1145/3283458.3283479.
6. Oinas-Kukkonen, H., Harjumaa, M.: Persuasive systems design: Key issues, process model, and system features. Commun. Assoc. Inf. Syst. 24, 1, 485–500 (2009). https://doi.org/https://doi.org/10.17705/1cais.02428.
7. Orji, R.: Why Are Persuasive Strategies Effective ? Exploring the Strengths and Weaknesses of Socially-Oriented Persuasive Strategies Why Are Persuasive Strategies Effective ? Exploring the Strengths and Weaknesses of Socially-Oriented Persuasive Strategies. October, (2017). https://doi.org/10.1007/978-3-319-55134-0.
8. Oyedeji, O., Elemile, P., Adepoju, A., and Oyedeji, G. "An evaluation of the use of insecticide treated bed nets among children preventing with malaria at a Nigeria health Facility. *International Journal of Medicine and Medical Sciences*. Vol. 1 (11) pp. **501**-504, November (2009)
9. Stibe, A., Oinas-kukkonen, H.: USER ENGAGEMENT IN COLLABORATIVE. In: European Conference on Information Systems (ECIS) 2014, Tel Aviv. (2014).
10. WHO World malaria report 2018. Geneva: World Health Organization, (2019)
11. WHO World malaria report 2020: 20 years of global progress and challenge ISBN978-92-4-001579-1 (electronic version) ISBN 978-92-4-001580-7 (print version) © World Health Organization (2020)