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Research

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Factors associated with community engagement in areas with a high and low incidence of local malaria cases in Zanzibar

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Abstract

Introduction: *the prevalence of asymptomatic infection in the general population in Zanzibar has declined from above 25% in 2005 to less than 1% in 2010. Despite these achievements, in 2021, the number of malaria cases increased by two folds. This study aimed at understanding the levels of community engagement towards malaria elimination and factors associated with them to provide recommendations that can be used to reinforce community engagement.* ***Methods:*** *a descriptive cross-sectional survey was conducted using structured questionnaires to 431 randomly selected households. The interviewees were the heads of households or representative adults above 18 years. Univariate and multivariate analysis was done to determine the association between social demographic characteristics, malaria knowledge, practicing malaria prevention interventions and status of community engagement. Statistical significance test was declared at P- value <0.05.* ***Results:*** *of all respondents, 261 (60.6%) were not engaged in either planning or implementation of malaria interventions, of which 120 (45.9%) participants were in the high malaria transmission and 141 (54.0%) from the low malaria transmission (P=0.018). Factors significantly associated with increased odds of community engagement were the level of knowledge on malaria (P= 0.002) and factors independently associated with reduced odds of community engagement was the level of malaria burden (P= 0.01).* ***Conclusion:*** *level of malaria knowledge and malaria burden were associated with community engagement. There is a need to increase malaria knowledge in the community based on the existing gaps as this study suggests that having high malaria knowledge can significantly contribute to increased opportunity for community engagement.*

Introduction

The WHO Global technical strategy for malaria 2016-2030 was developed to provide technical guidance to countries in scaling up malaria responses to achieve high impact and move towards elimination. The strategy has set ambitious targets for attaining malaria elimination in 35 countries by 2030 [1]. Zanzibar is expected to attain malaria elimination by 2023, according to National Malaria Strategic Plan 1V [2]. Global malaria targets are off track and the World malaria report of 2021 indicates a slowing in the decline of malaria incidence, with an estimated 241 million malaria cases in 2020 in 85 malaria-endemic countries, compared to 227 million cases reported in 2019 [3,4]. In Zanzibar, the prevalence of asymptomatic infection in the general population has declined from above 25% in 2005 to less than 1% in 2010 [5]. Since 2007 the prevalence has been maintained at <1% [6].

Data from health facilities in all 11 districts, indicated that the number of confirmed malaria cases declined from 12,000 in 2005 to 4,869 in 2019 [7]. Despite the great achievement of reducing malaria prevalence through the deployment of high-coverage WHO-approved interventions, progress has stalled in recent years with an increase of malaria cases from 4,869 in 2019 to 9,290 in 2021 [7,8]. With minimized gains, the WHO framework for malaria elimination emphasizes the importance of community engagement toward malaria elimination, particularly in areas with low transmission. The required level of coverage, particularly as malaria prevalence is reduced to very low levels, can be achieved and sustained only if communities are fully supportive [9].

Community engagement has been defined by WHO as a process of developing relationships that enable stakeholders to work together to address health-related issues and promote well-being to achieve positive health impact and outcomes [10]. If communities feel that they “own” programs and are actively involved in their implementation, activities will be easier to implement, and coverage targets will more likely be reached [9]. According to WHO´s Community Engagement Health Promotion Guide for universal health coverage, there are four approaches to community engagement which are

informed, consult, involve, collaborate and empower [11]. Under these approaches, communities are informed and mobilized to participate in addressing key issues. The community is consulted and involved to improve access to health services, there is collaboration with leaders of the community to enable priority settings and decisions from the people themselves with or without external support, and community assets are fully mobilized and empowered to develop systems for self-governance, establish and set priorities, implement interventions and develop sustainable mechanisms for health promotions [11].

CDC and other literature have also defined community engagement as the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people. It is direct or indirect process of involving communities in decision-making and/or in the planning, design, governance, and delivery of services using methods of consultation, collaboration, and/or community control [12-14]. In order for Zanzibar to achieve "the zero-malaria goal", substantial research evidence on the contribution of grassroots-level participation is highly needed. Current interventions, such as the distribution of long-lasting insecticide-treated bed nets (LLINs), indoor residual spraying (IRS), and community case management are effective only if they are accessible, acceptable, and properly used within communities [15].

According to the Malaria Program 2021 annual report, coverage of malaria interventions across the island were adequate. One hundred percent (100%) of suspected malaria cases received parasitological test and 100% of all confirmed malaria cases in public health facilities were provided with medication as per the treatment guidelines. For malaria prevention, the coverage of targeted IRS was 94% (n = 46,316), protecting a population of 230,708 (94.5%). While national mass LLIN coverage was 96% [8]. Several factors may have contributed to the increase in malaria. Therefore, it is important to also understand whether community members are actively engaged in malaria elimination interventions.

Numerous community studies have been conducted worldwide in relation to healthcare service delivery. Some studies documented a significant increase in the utilization of preventive services and access to treatment when communities were fully engaged [16,17]. However, community engagement has often played a marginal role in malaria control and elimination programs in the last 15 years [13]. The malaria community have only recently begun to consider the significance and potential impact of community engagement toward malaria elimination [18,19]. This study aimed at understanding the levels of community engagement towards malaria elimination and factors associated with them to provide recommendations that can be used to reinforce community engagement.

Methods

Study area

Zanzibar is the Tanzanian archipelago off the coast of East Africa, consisting of numerous small islands and two larger populated islands (Unguja and Pemba). Zanzibar is organized by 5 regions, 11 districts, and 387 *shehias* (the lowest administrative unit). Malaria in Zanzibar is characterized by perennial transmission due to favorable conditions for both vectors and parasites. The climate is tropical, hot all year round with two peak periods of transmission associated with seasonal rainfall patterns. The main peak of transmission being May to June and low peak in October to November. All (161) Public and (91) private health facilities are providing malaria services.

Study design

This study was a two months descriptive cross-sectional survey conducted in two districts of

Unguja Island, Kusini and Kaskazini B, using structured questionnaires from June to July 2021. Eight *shehia* out of 52 from these districts were chosen on a basis of having the highest and lowest incidence of locally acquired malaria reported in 2019. Four *shehia* were grouped with an incidence ≥1.9 per 1,000 population and four *shehia* were grouped with an incidence <1 per 1,000 population. The sample size was calculated based on Epical 2000 sample size calculation software used to estimate the minimum sample size. The sample size considered 95% confidence interval, 5% absolute precision, and accounting for 10% non-response rate, resulting in a total of 422 households. However, the random selection process resulted in 431 households that were then included in our study. Through multistage sampling, 431 study participants were selected with zero non respondent rate as indicated in Figure 1. In each household head of the household or his/her representative whom written informed consent was obtained were recruited in the study and head of household or his/her representative who was below 18 years of age was excluded in the study (Figure 1, Figure 2).

Ethics approval and consent to participate

Ethical clearance was sought and obtained from the Zanzibar Health Research Institute; reference No. ZAHREC/04/ST/APRIL/2021/26 and written informed consent was obtained from all participants involved in the study.

Data collection

Researcher administered structured questionnaires were designed to seek information on participants´ demographic information, levels of education, wealth factors, knowledge of malaria causes, symptoms and prevention, as well as practice and engagement in malaria elimination interventions. All heads of households or his/her representative aged 18 years and above were interviewed, with one person selected per household.

Study data

Malaria incidence: eight *shehia* from Kusini and Kaskazini B districts were chosen with a basis of having highest and lowest incidence (Number of newly local diagnosed malaria cases per 1,000 population reported in the year 2019) extracted from the malaria surveillance system. Four *shehia* with the lowest incidence of local transmission had an incidence of < 1 per 1,000 population and four *shehia* with the highest incidence of local transmission had an incidence of ≥ 1.9/1,000 population.

Community engagement: as independent variable was analyzed against socio-demographic characteristics, knowledge on malaria, practices towards malaria prevention interventions and wealth status as dependent variable. Completeness of the questionnaires was assessed in the field by ensuring that all questions administered and answered were properly entered in the allotted space provided in the questionnaire and certified by the Field Supervisor. Completed questionnaires were coded and entered into Statistical Package for the Social Sciences (SPSS)® version 20.

Malaria

Knowledge: there were three domains which are; causes, symptoms and prevention all with multiple responses. The Principal Component Analysis (PCA) approach was used to calculate the total score for each domain. All the knowledge-related variables were recorded to binary level such that the correct answer was coded 1 while an incorrect answer was coded 0. Overall knowledge score was calculated by summing up all the knowledge variables, with 1 recorded as the least possible score and 3 recorded as the highest possible score. Respondents who scored 3 on the knowledge score, were categorized as having good knowledge, those who scored 2 on the knowledge score were classified as having fair knowledge, and respondents who scored less than two were classified as having poor knowledge.

Malaria practice: was scored if respondents practiced one of the following, received an IRS in the past twelve months, slept under LLINs, or were involved in environmental sanitation. Community engagement was computed if the respondent had reported to have been involved in any of the following: planning, implementation, or in both planning and implementation of malaria interventions in the community. The wealth index was calculated using the standard criteria for malaria indicator survey whereby each household asset for which information was collected was assigned a weight score generated through principal components analysis. The resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. These standardized scores were then used to create the break points that define wealth quintiles.

Descriptive analyses were conducted whereby the baseline characteristics of study samples were presented as frequencies and proportion. Pearson´s chi-squared test was used to determine whether there was a statistically significant difference between expected and the observed frequencies in one or more categories. Secondly, univariate and multivariate logistic regression analyses were done to determine the association between social demographic characteristics, malaria knowledge, practicing malaria prevention interventions and status of community engagement. Odds Ratio (OR) and p-values were reported accordingly. The likelihood ratio chi-square test was used for the multivariate analysis. Statistical significance test was declared at P- value <0.05.

Funding

This study is part of FBA PhD training, conducted with personal funding. Her salary was supported by the Ministry of Health Zanzibar during the time of conducting this study.

Results

Participants

All selected eligible participants participated in the study and there was zero non-respondent rate. A total of 431respondents aged 18 years to 60+ from 8 *shehias* (4 from high incidence of local malaria cases and 4 from low incidence of local malaria cases) were interviewed. Two hundred and thirteen (213) households came from *shehias* with low incidence of local malaria, while the remaining 218 households were from *shehia* with high incidence of local malaria.

Descriptive data on social demographic characteristics of study participants by malaria transmission

The sociodemographic characteristics of the study participants by malaria transmission level are presented in Table 1. The findings showed that females 324 (75%) participated more than males 107 (25%) (P=0.0001). The majority of the participants were between the age group of 30-50 years compared to the rest of the respondents (P= 0.017). A total of 388 respondents (90%) had been living in their residence for more than five years, of which 188 (48.5%) participants were in high local malaria incidence areas, and the remaining 200 (51.5%) in low local malaria incidence area (P=0.029). Of all respondents, 216 (50.1%) had low income, of which 120 (55.6%) participants were in high local malaria incidence while 96 (44.4%) participants were in low local malaria incidence (P=0.038).

Levels of malaria knowledge

The level of malaria knowledge among the respondents showed that 246 (57.1%) had fair knowledge of malaria, of which 144 (58.5%) were in the high local malaria incidence and 102 (41.5%) were in the low local malaria incidence (P=0.001).

Practice towards malaria prevention interventions

Most of the participants, 264 (61.3%) had practiced malaria prevention intervention of which 122 (46.2%) were in the high local malaria incidence and 142 (53.8%) in the low local malaria incidence (P=0.023) (Table 1). Respondents who benefited from malaria prevention using LLINs were 177 (67%), IRS 93 (35%), practiced environmental sanitation 78 (30%) and 84 (31%) respondents used at least two prevention interventions.

Engagement of the study participants in the planning and implementation of malaria interventions

On community engagement, most of the participants, 261 (60.6%) were not engaged in either planning or implementation of malaria elimination interventions, of which 120 (45.9%) were in the high local malaria transmission and 141 (54.0%) from the low local malaria transmission (P=0.018), only 170 (39%) were either involved in planning, implementation, or both planning and implementation of malaria interventions. Of the participants from high local malaria incidence *shehias*, only 3% were involved in both planning and implementation compared to 9.8% from low local malaria incidence *shehias*. Fourty one percent (41%) of participants from high local malaria incidence *shehias* were involved in implementation compared to 20.6% of participants from low local malaria incidence *shehias* (Figure 1, Figure 3).

Factors associated with community engagement on malaria elimination interventions

Univariate analysis of social demographic characteristics, knowledge on malaria, practices towards malaria prevention interventions and wealth status as dependent factors for community engagement

Factors significantly associated with increased odds of community engagement were level of knowledge of malaria, people with high malaria knowledge were significantly associated with increased odds of community engagement (P=0.002). The findings from this study suggest that 19.9% of the participants had good malaria knowledge, 57.1% had fair knowledge and 22.9% had poor malaria knowledge. The factor significantly associated with reduced odds of community engagement was the level of malaria burden (P= 0.001). Nevertheless, there was no significant evidence suggesting that, wealth index and practices towards malaria prevention interventions influenced community engagement in malaria control efforts (Table 2).

Multivariate analysis

Adjusting for confounders, the factor independently associated with increased odds of community engagement was the level of knowledge of malaria (P= 0.004) and the factor independently associated with reduced odds of community engagement was the level of malaria burden (P= 0.01) (Table 2).

Discussion

The low level of malaria transmission was found to be associated with reduced community engagement; this study suggest that more than half of the respondents (57.1%) had fair knowledge of malaria. As the malaria transmission level in the community is low, there is a possibility of low malaria risk perception and knowledge in the community. A study conducted in Gerrissa county Kenya observed that vulnerability and people perceived to be at increased risk of malaria are the commonly mentioned factors that determined net use amongst the nomadic communities [20]. An increase in knowledge among the community members may change their perception of perceived susceptibility to malaria, majority of literature concluded that having a good knowledge regarding malaria cause, mode of transmission, signs and symptoms, and prevention of malaria can fuel the use of malaria prevention interventions and increase health-seeking behavior [21,22].

In addition, this study documented poor community engagement, only few participants were involved in the planning and implementation of malaria elimination interventions in their community. Respondents from high local malaria incidence *shehias* were more involved in the implementation of malaria elimination interventions compared with those from low incidence *shehias*. Their high involvement in the implementation might have contributed by program efforts and interventions put in place to reduce transmission in high incidence *shehias*. Experience shows that as transmission goes down, some interventions are scaled down. The definition and execution of community engagement vary greatly. In the study conducted by Kimberly, the majority of participants included in this study point to some consensus that transformative community engagement is more than providing information to the community, and that communities should be involved in the design and implementation of health interventions [15]. Community engagement is vital for the long-term success of any intervention or for the uptake of new strategies to improve health. This sentiment is echoed in various global technical strategies and resolutions [23-25].

There are different behavior change theories for community engagement, community-based system dynamics, and behavioral change ball incorporates the importance of teamwork and identifying social networks of relevant stakeholders in community engagement [26-29]. It is at the level of the household that primary decisions and actions influencing health outcomes within communities are made. This raises the question as to whether improving the health services delivery system, the 'supply side´ by itself without strengthening the 'demand side´, could improve the health status of the community [30]. Researchers have shown that addressing the demand side is critical in improving health outcomes [31]. Involving communities in assessing their own needs and developing strategies to meet those needs, can increase intervention ownership and sustainability, while responsiveness to community needs in planning and implementation of health programs, can improve health equity, service delivery, and uptake of care [32].

A systemic literature review on community engagement and population coverage in mass anti-malarial administration revealed that the success of Mass Drug Administration (MDAs) varied widely by anti-malarial regimen, study design, context, era, community engagement activities, and population coverage. The review concluded that community engagement plays a major role in achieving high population coverage in mass anti-malarial administrations. Amongst the reviewed articles, coverage was highest when community engagement involved government and community structures, such as in Nicaragua and on Aneityum island [33]. A study on promoting community participation in priority settings in district health systems conducted in Mbarali district, Tanzania it was reported that community participation is an important element in improving health service. The study further observed that community representatives have real-life experience as users of the healthcare system and other public services and can offer insight into the values and beliefs of the public at large [34].

The findings of this study suggest that level of malaria knowledge was associated with increased odds of community engagement, similar findings were documented in Vietnam were villagers who informed about the Mass Drug Administration (MDA) campaign were much more likely to participate than those who did not. Demographics also played a role in participation; village residency, older age, ethnicity, religion and literacy were associated with participation contrary to this study [35]. Community participation in malaria control in Olorunda local government area, Osun State, southwestern Nigeria documented that knowledge of respondents about malaria was high with the majority participating in malaria control measures [36]. In this study, the low level of malaria transmission was found to be associated with reduced community engagement, this might have been contributed by several factors including

individual low-risk perception, low involvement and efforts from the National Malaria Program and stakeholders, due to scaling down of interventions in areas of low transmission. Contrary to this study, community members who were relatively young (26-35) years were found to be more involved in community health care programs than those aged above 36 years in a study conducted in Kenya. Similarly, participants who had attained secondary education or higher and community members who had more experience in the community were more likely to participate in community health programs than those who had primary or no formal education [37]. Community engagement approaches have been emphasized in responses to health emergencies. A COVID-19 Risk Communication and Community Engagement Strategy has been developed to increase the uptake of protective behavior and adherence to social measures. The strategy emphasizes the importance of consistent participation and empowerment of affected communities to understand the local context and ensure an informed people centered responses and to avoid misinformation, confusion and mistrust that can undermine the uptake of life-saving services [38,39].

Study limitations

This study used malaria classification data to identify *shehia* with low and high incidence of locally acquired, confirmed malaria. Misclassification of participants living in high and low malaria transmission *shehia* might have resulted from population movement, infection of participants in a location other than the *shehia* in which they lived or wrong information on travel history. In this study only the head of the household or his or her representative were interviewed, their responses might not accurately reflect the knowledge and engagement of other household members. More women were interviewed as representatives of the heads of household; this was likely due to the absence of men in the households at the time of interviews for various social and economic activities. The survey depended on self-report that could have recall bias and there was no observation component. We addressed these limitations by constant data review of the malaria epidemiology to confirm the low and high burden areas. Participants probing and ensuring the questionnaires accounted for an accurate capture of participants history, including living quarters and the area they are permanently residing allowed us to capture the right information as far as where the participants are coming from within the study shehias. A follow up study can do a more direct comparison of adult perspective within a single household. Contrary with other studies that over represent males, this study has been able to more fully capture female perspective within a household. In future studies changing the timing of the survey can help to capture more man. Despite these limitations, the findings in this study can be generalized to Unguja Zanzibar to develop strategies for community engagement for malaria elimination.

Conclusion

To date, no studies in Zanzibar have been conducted to assess the level of community engagement in implementing malaria elimination interventions. This study is the first to evaluate the community engagement in malaria and factors associated with to advice policymakers, the Ministry of Health, the Malaria Program, and other stakeholders for efficient planning and construction of local participatory strategies towards malaria elimination. Community engagement is key for malaria elimination. In this study level of malaria knowledge and malaria burden were associated with community engagement. There is a need to increase malaria knowledge in the community based on the existing gaps as this study suggests that having high malaria knowledge can significantly contribute to increased opportunity for community engagement. Moreover, there is a need to adopt the recommended WHO approaches and incorporate a community engagement component in the existing SBC strategies to ensure community members are well-engaged form planning to implementation of

malaria interventions at the grassroots level. Strong advocacy and other enhanced initiatives are needed particularly in areas with low transmission, reflecting WHO´s emphasis on the importance of community engagement even when the disease burden goes down.

What is known about this topic

- *Global malaria targets for 2016-2030 is off track;*
- *Community engagement is key to achieve malaria elimination.*

What this study adds

- *Evidence of low Community engagement in implementing malaria elimination interventions;*
- *Level of malaria knowledge and malaria burden were factors associated with community engagement.*

Competing interests

The authors declare no competing interests.

Authors' contributions

This study was undertaken by Faiza Abbas. Emmanuel Kigadye and Fauzia Mohamed provided technical guidance to Faiza Abbas on study design, protocol development, implementation, data management and analysis, and preparation of study reports. Faiza Abbas prepared the initial draft of the manuscript with the support of Al-Mafazy Abdul-Wahid. Mwinyi Khamis, Humphrey Mkali, Bilali Kabula, Shabbir Lalji and Naomi Serbantez, supported the review and finalized the manuscript. All authors have read and approved the final manuscript.

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Tables and figures

Table 1: sociodemographic characteristics of the study participants by malaria transmission level

Table 2: factors associated with community engagement using univariate and multivariate analysis

Figure 1: participant's selection flowchart

Figure 2: sampled shehias with high and low local malaria transmission in Unguja, 2019

Figure 3: summary of the community engagement outcomes among the participants included in the study

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Table 1: sociodemographic characteristics of the study participants by malaria transmission level

	Level of malaria incidence		**Total N = 431**	**P-value***
	High, (%)	Low, (%)		
Inclusion (n=357)	218 (50.6)	213 (49.4)	431 (100.0)	
Sex				
Male	37 (34.6)	70 (65.4)	107 (24.8)	<0.0001
Female	181 (55.9)	143 (44.1)	324 (75.2)	
Male/female ratio	37/181 (20.4)	70/143 (48.9)	107/324 (33.0)	
Three age groups				
<30 years	41 (66.1)	21 (33.9)	62 (14.4)	0.017
30-50 years	88 (45.4)	106 (54.6)	194 (45.0)	
50+ years	89 (50.9)	86 (49.1)	175 (40.6)	
Marital status				
Not married	46 (48.9)	48 (51.1)	94 (21.8)	0.718
Married	172 (51.0)	165 (48.9)	337 (78.2)	
Level of education				
No formal education	35 (56.5)	27 (43.6)	62 (14.4)	0.223
Primary education	103 (53.1)	91 (46.9)	194 (45.0)	
Above secondary education	80 (45.7)	95 (54.3)	175 (40.6)	
Occupation				
Farming	120 (50.4)	118 (49.6)	238 (55.2)	0.817
Fishing	27 (46.6)	31 (53.5)	58 (13.5)	
Business	36 (51.4)	34 (48.6)	70 (16.2)	
Civil servant	8 (44.4)	10 (55.6)	18 (4.2)	
Other	27 (57.5)	20 (42.6)	47 (10.9)	
Living years				
<1	15 (68.2)	7 (31.8)	22 (5.1)	0.029
2-5	15 (71.4)	6 (28.6)	21 (4.9)	
>5	188 (48.5)	200 (51.5)	388 (90.0)	
Wealth Index				
Low income	120 (55.6)	96 (44.4)	216 (50.1)	0.038
Middle income	98 (45.6)	117 (54.4)	215 (49.9)	
Knowledge				
Poor	40 (40.4)	59 (59.6)	99 (22.9)	0.001
Fair	144 (58.5)	102 (41.5)	246 (57.1)	
Good	34 (39.5)	52 (60.5)	86 (19.9)	
Practice				
Poor	96 (57.5)	71 (42.5)	167 (38.7)	0.023
Good	122 (46.2)	142 (53.8)	264 (61.3)	
Community engagement				
Poor	120 (45.9)	141 (54.0)	261 (60.6)	0.018
Good	98 (57.6)	72 (42.4)	170 (39.4)	

* - P-value obtained from Pearson's chi-squared test

Table 2: factors associated with community engagement using univariate and multivariate analysis						
	Engaged (%)	**Not engaged (%)**	**Crude OR (95% CI)**	**p-value**	**Adjusted OR (95% CI)**	**p-value**
Inclusion (n=431)	170 (39.4.)	261 (60.6)				
Sex						
Female	124 (38.3)	200 (61.7)	1.0		1.0	
Male	46 (42.9)	61 (57.0)	0.8 (0.5-1.3)	0.387	0.7 (0.5-1.2)	0.235
Age group						
<30 years	28 (45.2)	34 (54.8)	1.0		1.0	
30-50 years	71 (36.6)	123 (63.4)	0.7 (0.4-1.3)	0.229	0.7 (0.4-1.3)	0.234
50+ years	71 (40.6)	104 (59.4)	0.8 (0.5-1.5)	0.529	0.8 (0.4-1.4)	0.383
Marital status						
No	30 (31.9)	64 (68.1)	1.0			
Yes	140 (41.5)	197 (58.5)	1.5 (0.9-2.5)	0.092	1.5 (0.9-2.5)	0.132
Level of education						
No formal education	22 (35.5)	40 (64.5)	1.0		1.0	
Primary education	73 (37.6)	121 (62.4)	1.1 (0.6-1.9)	0.204	1.1 (0.6-2.1)	0.682
Above secondary education	75 (42.9)	100 (57.1)	1.4 (0.7-2.5)	0.311	1.3 (0.7-2.5)	0.371
Occupation						
Farming	90 (37.8)	148 (62.2)	1.0			
Fishing	24 (41.4)	34 (58.6)	1.2 (0.6-2.1)	0.617		
Business	26 (37.1)	44 (62.9)	0.9 (0.6-1.7)	0.919		
Civil servant	8 (44.4)	10 (55.6)	1.3 (0.5-3.5)	0.578		
Other	22 (46.8)	25 (53.2)	1.4 (0.8-2.7)	0.250		
Level of malaria transmission						
High	98 (44.9)	120 (55.1)	1.0		1.0	
Low	72 (33.8)	141 (66.2)	0.6 (0.4-0.9)	0.018	0.6 (0.4-0.9)	0.017
Living years						
<1	9 (40.9)	13 (59.1)	1.0			
2-5	7 (33.3)	14 (66.7)	0.7 (0.2-2.5)	0.608		
>5	145 (39.7)	234 (60.3)	0.9 (0.4-2.3)	0.910		
Wealth Index						
Low Income	87 (40.3)	129 (59.7)	1.0			
Middle income	83 (38.6)	132 (61.4)	0.9 (0.6-1.4)	0.722		
Knowledge on malaria						
Poor	27 (27.3)	72 (72.7)	1.0			
Fair	100 (40.7)	146 (59.4)	1.8 (1.1-3.0)	0.021	1.6 (0.9-2.7)	0.100
Good	43 (50.0)	43 (50.0)	2.7 (1.4-4.9)	0.002	2.5 (1.3-4.8)	0.004
Practice						
Poor	67 (40.1)	100 (59.9)	1.0			
Good	103 (39.0)	161 (60.9)	0.9 (0.6-1.4)	0.819		
OR – Odds Ratio, CI – Confidence Interval						

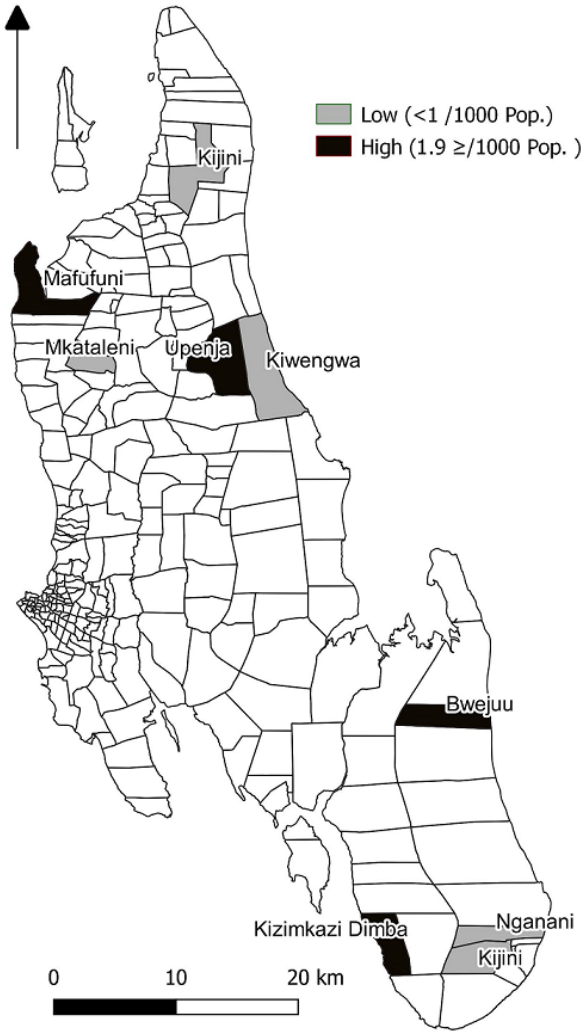

Figure 1: participant's selection flowchart

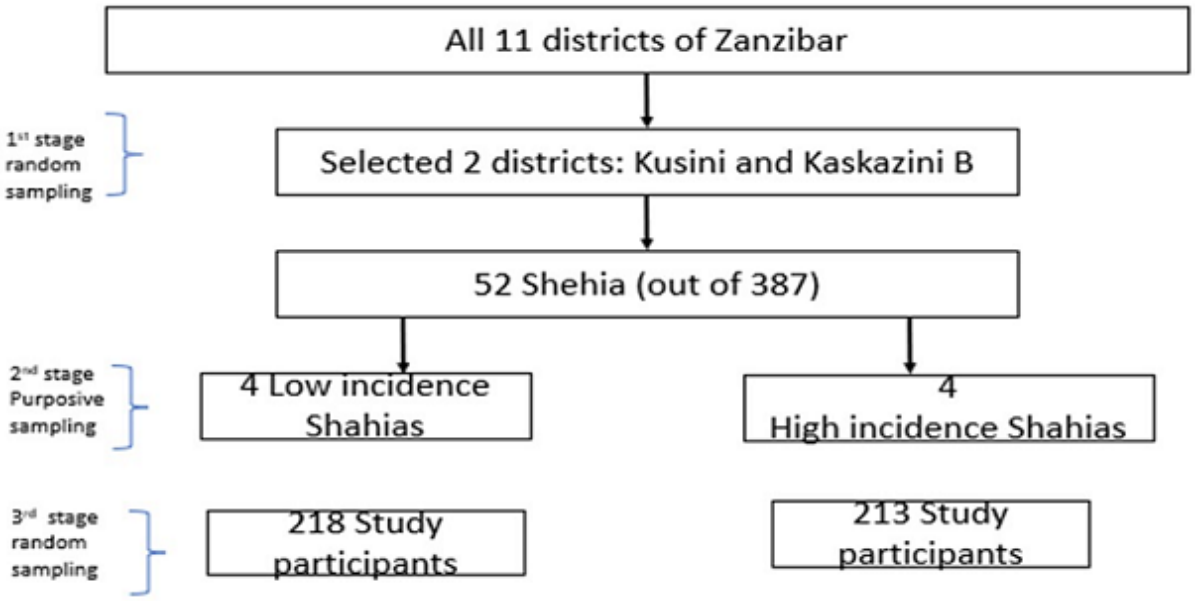

Figure 2: sampled shehias with high and low local malaria transmission in Unguja, 2019

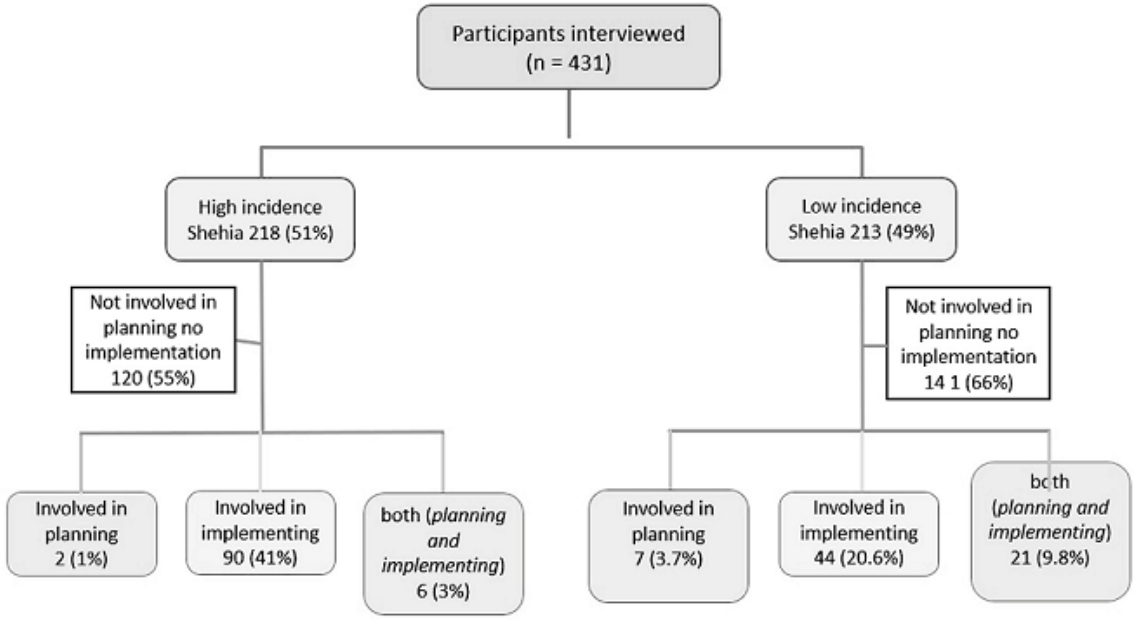

Figure 3: summary of the community engagement outcomes among the participants included in the study