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Asymptomatic Malaria Prevalence and Health Facility Influence on the Attitude of Facility Users in Malaria Meso-Endemic Districts in Ghana

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Abstract

Asymptomatic adults are a regular pool for malaria transmission because of their roles as parasite reservoirs of infection. This study aimed to assess activities at various healthcare facilities that could influence the health seeking attitudes of facility users and to determine malaria infection status of 'healthy' adults who accompanied ill relations to selected health facilities. The descriptive, cross-sectional study employed cluster-probability sampling technique to recruit 849 participants from seven districts in malaria meso-endemic forest zone of Ghana. Questionnaires were administered and capillary blood samples were taken for malaria diagnostic tests. While 51.6% had their expectations fully met, 48.4% were dissatisfied because of delays, poor attitude of healthcare staff and hidden charges. Asymptomatic malaria prevalence was 13.1% (111 out of 849). Facility-related challenges can impede access and affect the health-seeking behaviour of potential clients to a health facility. Client satisfaction may not only be limited to clinical effectiveness, so healthcare facilities should consider socio-psychological acceptability and perceptions as well as proactive screening to reduce the menace of malaria infection reservoir.

Keywords: Malaria; Parasitaemia; Client satisfaction; Asymptomatic; *Plasmodium.*

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1. Introduction

Malaria has been recognized as a serious health threat to the populace in tropical and sub-tropical regions of the world. The disease affects all age groups and social classes, but those that bear the brunt of the infection are infants, the poor and the marginalised [1]. The adult population is not spared in malaria infection [2]. Until recently, the adult population was not given the requisite attention probably because they presumably possessed transient immunity and tended to be asymptomatic and sub-microscopic [3]. Despite the strategies adopted by policy makers, delays in seeking healthcare, myths and misconceptions surrounding medications and attitudes of some healthcare staff appear to be reversing the gains being made in the fight against the malady [4]. Malaria eradication is a multi-sectoral venture; hence, socio-cultural factors have their roles in malaria management [5]. In Ghana, policy makers and managers of healthcare facilities are focusing on meeting client expectations, and malaria disease burden reduction by 75% [6, 7]. The end result will be a satisfied patient whose evaluation of service delivery is positive because of the fulfilment of expectations (8). The present study had the double aim of assessing the experiences of asymptomatic facility users at selected healthcare facilities in Ghana and also determining the prevalence of asymptomatic parasitaemia.

2. Materials and methods

2.1 Study areas and sites

This study was conducted in June, 2018. The study sites were: Eastern Region: Holy Family Hospital, Nkawkaw and Presbyterian Hospital, Donkorkrom; Central Region: St. Francis Xavier Hospital, Assin Fosu; Ashanti Region: St. Patrick's Hospital, Offinso and Mankranso Government Hospital; Bono East Region: Holy Family Hospital, Techiman; Volta Region: St. Anthony's Hospital, Dzodze.

The study areas (Figure 1) lie within the malaria meso-endemic zone of the tropical rainforest [9]. In this zone, malaria disease incidence and fatalities are more pronounced in the rainy seasons than in the dry season especially where adult mosquito population exists [10, 11]. This happens around the month of June, the same time when heavy parasitaemia prevails [12]. Vector bites are high in Ghana [13] and in this zone, the annual entomological inoculation rate (AEIR) can be as high as 630 to 866 infectious bites per individual per annum [14].

Figure 1: Map of Ghana showing the study areas

2.2 Study design and study population

A descriptive, cross-sectional health facility-based study was carried out. Cluster-probability sampling method was employed. Normal residents of the study districts, aged 18 - 64, were enrolled on to the study. Individuals considered in this study were those who accompanied sick relatives to the health facilities. A total of 849 adults participated.

2.3 Subject recruitment

To meet the eligibility inclusion criteria, each participant had to accompany a sick relation to the hospital, must not have fever or headache, must not have taken any anti-malarials in a fortnight and needed to be Ghanaian and a normal resident of the district. Those who were unwilling to partake in the study were excluded.

2.4 Sample size

The very active section of the Ghanaian populace charged with family responsibilities are from 18 - 64 years. The percentage in this group altogether sum up to 56.9% of the total Ghanaian population [15]. From a total population of 978,483 for the seven districts [15], 56.9% translated to 556,757. By calculation using Slovin's formula [16], the appropriate sample size was approximately 400. For reliable data collection, the number of respondents must not be lower than 400. Any number greater than 400 was very appropriate and representative [17]. As cluster-probability sampling technique was adopted, all 849 respondents who met the inclusion criteria were enrolled on to the study.

2.5 Sample collection

Unique codes which were generated on the questionnaires were used to label the malaria RDT kits and microscope slides. Capillary blood samples were taken from the fingers via sterile blood lancets. Malaria RDTs were performed. Thick and thin blood smears were prepared.

2.6 Test procedure

2.6.1 Rapid diagnostic testing

CareStart^{TM} HRP-2/pan pLDH test kit was used to qualitatively detect parasites of *Plasmodium* species in the blood of subjects. This screening test, based on immunochromatographic technique, has both histidine-rich protein 2 (HRP-2) and parasite lactate dehydrogenase (pLDH) as antigens [18]. These antigens are produced by the parasites in the course of their development in humans [19]. Known malaria positive and negative blood samples were included in each test kit batch and run to serve as controls.

2.6.2 Malaria microscopy

Thick and thin blood smears were prepared on the same glass slide for each subject using the method described by Norgan and his colleagues [20]. Known malaria positive and negative blood samples were included in each test batch to serve as controls. After air-drying, the slides were stained with Giemsa (10%v/v) for 10 minutes. After washing off the stains with buffered water (pH 7.2) and air drying, the stained slides were examined under the microscope by trained, experienced Medical Laboratory Scientists blinded to the RDT results. Species were identified on positive slides whilst negative slides were declared negative if no *Plasmodium* asexual forms or gametocytes were found in 100 thick film fields.

2.7 Questionnaire administration

Details of each participant were collected on questionnaires which were administered after written voluntary consent for participation had been obtained. The local Akan/Eʋe translations of the wordings of the questionnaires were utilized for communication. Multiple choice and open-ended responses were sought for and where relevant, Likert scale format was adopted in questionnaire construction to measure attitudes and opinions

about malaria, measuring levels of agreement or disagreement [21].

2.8 Data analysis

Data generated were stored in MS Excel and analysed using same. Categorical data were expressed in numbers and percentages. Bar chart was used to illustrate the malaria prevalence of asymptomatic subjects in the study districts.

2.9 Ethical approval and consent to participate

Approval (CHRPE/KNUST/KATH/AP/433/17) was obtained from the Committee on Human Research Publications and Ethics of the Kwame Nkrumah University of Science and Technology, Kumasi and Komfo Anokye Teaching Hospital, Kumasi, Ghana, before the commencement of the study. Written permission was obtained, the study aims, objectives as well as risks and benefits were explained (in the Akan and Eʋe languages). Informed consent was obtained from each participant before commencement of the study. The data collected from subjects were coded and placed in a secured cabinet for confidentiality.

3. Results

Table 1: Background characteristics of respondents

	N (849) %
Gender	
Male	61 (7.2%)
Female	788 (92.8%)
Age	
≤ 19	118 (13.9%)
20 – 29	210 (24.7%)
30 – 39	302 (35.6%)
40 – 49	119 (14.0%)
50 – 59	75 (8.8%)
≥ 60	25 (3.0%)
Educational Level	
Tertiary	160 (18.9%)
SHS	175 (20.6%)
JHS/MSLC	201 (23.7%)
Primary	53 (6.2%)
None	260 (30.6%)
Religion	
Christianity	537 (63.3%)
Islam	256 (30.1%)
ATR	41 (4.8%)
Others	15 (1.8%)
Marital Status	

Married	669 (78.8%)
Single	127 (15.0%)
Widowed	23 (2.7%)
Divorced/separated	30 (3.5%)
Occupation	
Education	117 (13.8%)
Healthcare	32 (3.8%)
Trading	248 (29.2%)
Farming	264 (31.0%)
Religious	30 (3.5%)
Fishing	8 (1.0%)
Housewife	53 (6.2%)
Artisan	21 (2.5%)
Office work	34 (4.0%)
Unemployed	42 (5.0%)
Daily Turn out	
Sunday	46 (5.4%)
Monday	154 (18.1%)
Tuesday	162 (19.1%)
Wednesday	121 (14.3%)
Thursday	174 (20.5%)
Friday	107 (12.6%)
Saturday	85 (10.0%)
Respondents by District	
Techiman	111 (13.1%)
Offinso	191 (22.5%)
Mankranso	86 (10.1%)
Assin Fosu	113 (13.3%)
Dzodze	93 (11.0%)
Donkorkrom	118 (13.9%)
Nkawkaw	137 (16.1%)

Table 2: Respondents' views on malaria-health facility-related issues

	N (849) %
Signed up for health insurance?	
Yes	733 (86.3%)
No	116 (13.7%)
Health insurance type preference	
National/Public	820 (96.6%)
Private	29 (3.4%)
Malaria treatment point preference	
Hospital	619 (72.9%)
Home	230 (27.1%)
Malaria review date communicated (based on those who chose hospital treatment)?	
Yes	806 (94.9%)
No	43 (5.1%)
Malaria diagnosis communicated?	
Yes	811 (95.5%)
No	38 (4.5%)
Hospital delay points during malaria visits	
Records	232 (27.3%)
Nurses' station	38 (4.5%)
Consulting Room queue	97 (11.4%)
Laboratory	301 (35.5%)
Dispensary	181 (21.3%)
Satisfied with health facility malaria-related services?	
Satisfied	438 (51.6%)
Dissatisfied (Staff poor attitude)	161 (19.0%)
Dissatisfied (Delays)	217 (25.6%)
Dissatisfied (Hidden charges)	33 (3.8%)

Table 3: Respondents' views on malaria medication

	N (849) %
Medication (given when child is sick)	
Orthodox	706 (83.2%)
Herbal	143 (16.8%)
Personal treatment preference for malaria	
Orthodox only	506 (59.6%)
Herbal only	75 (8.8%)
Combined (Orthodox + Herbal)	268 (31.6%)
Medication habit in malaria treatment	
Expert prescription	411 (48.4%)
Self-medication	438 (51.6%)
Child malaria medication administration route preference	
Oral	235 (27.7%)
Injectable	483 (56.9%)
Suppository	131 (15.4%)
Hospital medication counselling given?	
Yes	838 (98.7%)
No	11 (1.3%)
Hospital medication counselling understood?	
Yes	565 (66.5%)
No	284 (33.5%)
Malaria medication source	
Hospital dispensaries	223 (26.3%)
Drug stores	418 (49.2%)
Herbal outlets	208 (24.5%)
Malaria medication with ease of adherence	
Orthodox	391 (46.1%)
Herbal	458 (53.9%)
Malaria medication ease of accessibility	
Orthodox	316 (37.2%)
Herbal	533 (62.8%)
Malaria medication affordability	
Orthodox	302 (35.6%)
Herbal	547 (64.4%)
Malaria medication reliability	
Orthodox	464 (54.7%)
Herbal	385 (45.3%)
Malaria medication with superior quality	
Orthodox	556 (65.5%)
Herbal	293 (34.5%)
Malaria medication perceived to be efficacious	
Orthodox	389 (45.8%)
Herbal	460 (54.2%)

Table 4: Asymptomatic respondents' malaria test

	N (849) %	
Malaria Microscopy		
Positive	111 (13.1%)	
Negative	738 (86.9%)	
Microscopy Results by District	**Positive**	**Negative**
Techiman	8 (7.2%)	103 (92.8%)
Offinso	20 (10.5%)	171 (89.5%)
Mankranso	9 (10.5%)	77 (89.5%)
Assin Fosu	14 (12.4%)	99 (87.6%)
Dzodze	22 (23.7%)	71 (76.3%)
Donkorkrom	31 (26.3%)	87 (73.7%)
Nkawkaw	7 (5.1%)	130 (94.9%)
Malaria RDT		
Positive		104 (12.2%)
Negative		745 (87.8%)
RDT Results by District	**Positive**	**Negative**
Techiman	8 (7.2%)	103 (92.8%)
Offinso	18 (9.4%)	173 (90.6%)
Mankranso	8 (9.3%)	78 (90.7%)
Assin Fosu	13 (11.5%)	100 (88.5%)
Dzodze	22 (23.7%)	71 (76.3%)
Donkorkrom	29 (24.6%)	89 (75.4%)
Nkawkaw	6 (4.4%)	131 (95.6%)

Table 5: Comparison of RDTs and microscopy results

	No of positive identification							**No. Neg**	**FP**	**FN**	**Total**	**Sens. %**	**Spec. %**	**PPV %**	**NPV %**
	Pf	**Ppan**	**Po**	**Pv**	**Pm**	**Pf + Ppan**	**Pf + Po**								
RDT	100	2	N/A	N/A	N/A	2	N/A	745	2	7	849	94.1	99.7	98.2	99.1
Microscopy	107	N/A	2	0	0	N/A	2	738	-	-	849	-		-	-

Pf (*Plasmodium falciparum*); Ppan (non-*falciparum* plasmodia); Po (*Plasmodium ovale*); Pv (*Plasmodium vivax*); Pm (*Plasmodium malariae*); FP (False positive); FN (False negative); PPV (Positive Predictive Value); NPV (Negative Predictive Value); N/A (Not Applicable).

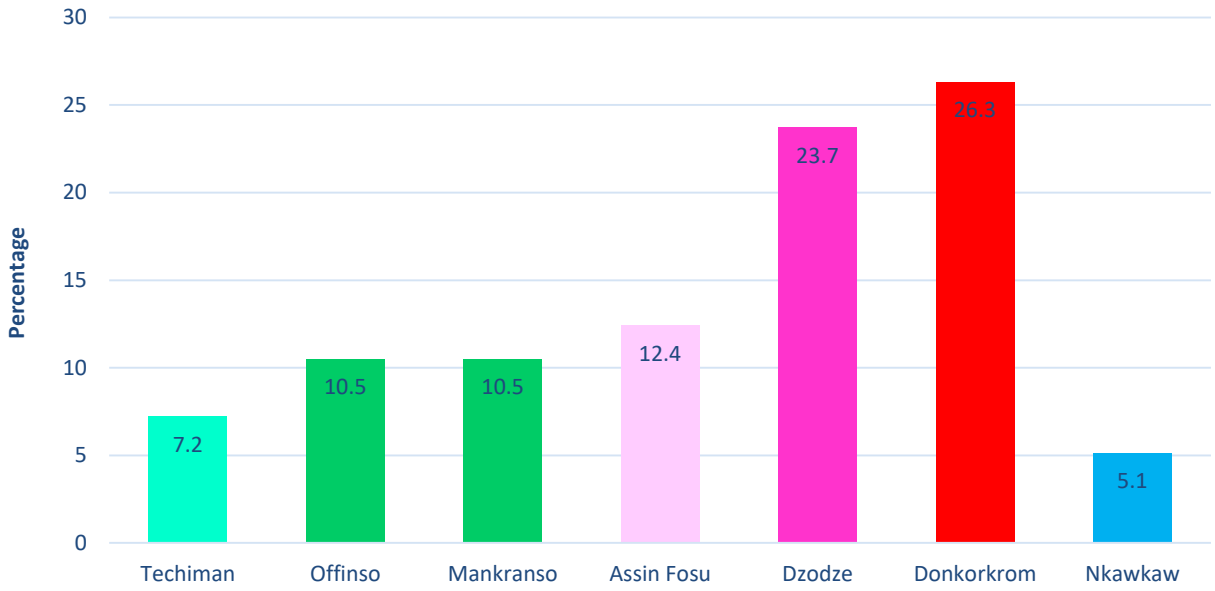

Figure 2: Bar chart showing the prevalence of asymptomatic malaria by study districts

4. Discussion

4.1 General

Majority of the respondents were female (92.8%) (Table 1). The present study observed that few males (7.2%) accompanied their sick relatives to hospitals. This finding confirmed similar finding in another Ghanaian study which observed a low male turnout and found that the role of the male gender in family-member healthcare was limited to provision of financial support [22]. The role of the male gender in family healthcare is crucial because of its positive bearing on well-being and reduction in diseases and mortality, especially in children. The United Nations had been advocating for male involvement in healthcare [23]. The present study also observed that majority (31.0%) of the respondents engaged in agrarian business which dominated Ghana's economy accounting for 39.3% of the Gross Domestic Product [24]. To boost agriculture, irrigation projects have been established, but irrigation-related malaria transmission must be pre-empted as a link has been established between poorly managed irrigation facilities and malaria outbreaks [11, 25]. The present study observed that turnout at selected health facilities was highest on Thursday (20.5%) followed by Tuesday (19.1%) with Sunday recording the lowest attendance (5.4%). The low attendance could be due to the fact that the study population were mostly Christians (63.3%) and would be in church on Sundays (Table 1). The explanation for the high turnout on Thursday and Tuesday may be socio-cultural. Among the Akan ethnic group of Ghana, there are days (especially Tuesdays and Thursdays) on which fishing/farming may not be carried out. Although there are cultural reasons for this, the practice frees the inhabitants to seek healthcare on those days [26, 27].

4.2 Health facility-based challenges

A number of considerations go into the decision to seek health care from one facility and not the other. The present study assessed affordability, communication and healthcare staff attitude as predictors of satisfaction for

seeking healthcare. Majority (86.3%) of respondents subscribed to the National Health Insurance Scheme (NHIS) (Table 2). Premium for private schemes were higher than was applicable to the public scheme, hence it was not surprising that the private insurance scheme had not been able to make much incursion in the rural area where poverty bites and pertains. The high subscription for the NHIS was in agreement with earlier studies (in Ghana) with subscription ranging from 71% to 73% [28]. The high patronage of the scheme may also be due to the fact that 95% of diseases (including malaria) were covered by the NHIS [29] reducing the chances of out-of-pocket payment. Respondents' high level of subscription may be due to their socio-economic status as pertains in rural settings of Ghana. This assertion confirmed the pro-poor perception of the NHIS [28] although other studies had asserted that the policy was not pro-poor [30]. Most (72.9%) respondents preferred healthcare at hospitals (Table 2). Oreagba and his colleagues [31] also found that majority of the participants in a study in south-western Nigeria preferred hospital to home when sick which they attributed to professional care that assured better clinical outcomes. Most (94.9%) respondents in the present study affirmed that clinical staff communicated diagnosis to them. However, 33.5% of the respondents admitted not understanding the diagnosis communication. In their study, Wong and his colleagues [32] also found that a third of hospital clients did not correctly follow dosing instructions due to lack of understanding. Another study opined that because some clients find it embarrassing to disclose their difficulty in understanding both written and oral dosing instructions, mis-dosing prevails [33]. There is therefore the need for health workers to ask probing questions to assess and verify communication success. Skilled communication of diagnosis and other relevant issues to the patient or their caretakers have been found to improve treatment outcomes [34]. With regards to delays in the health facilities, most (35.5%) of the respondents complained that the turn-around-times at the Laboratory Departments were rather high (Table 2). Other delay points included Records Unit (27.3%), Dispensary (21.3%), Consulting Room Queue (11.4%) and Nurses' Station (4.5%). Clinical and technical procedures that may warrant delays needed to be communicated timely to the client as delay may be relative and subjective. About 52% of respondents were satisfied with the facilities (Table 2). A satisfied patient has a fulfilled expectation because of positive evaluation of service delivered [35]. Of those who were dissatisfied, the factors were delays (25.6%), poor attitude of staff (19.0%) and hidden charges (3.8%). The hidden charges component may be quite problematic for the rural folk because, the introduction of the NHIS was to eliminate out-of-pocket health expenditure (OOPHE) which from the present study still persisted [36]. There is a positive relationship between patient satisfaction and better treatment outcomes [37]. Probably, half of patients seeking healthcare in the health facilities may have deficit in prognosis because satisfaction had been directly linked to better clinical outcomes.

4.3 Malaria therapeutic challenges

Most (83.2%) of the respondents administered orthodox malaria medication to sick children and other members of their families (Table 3). Respondents preferred orthodox (allopathic) treatment (59.6%) themselves when indisposed as against herbal treatment only (8.8%) or a combination of both (31.6%). This affirmed the findings from a similar Ghanaian study which showed that 31% of participants sought orthodox treatment as their first response to malaria with 8% opting for traditional/herbal treatment [38]. Preference for medications in the present study may be related to financial prowess because only those unable to afford modern medical services depend entirely on herbal decoctions for malaria treatment [38]. From the present study, approximately two out

of every ten children (16.8%) receive herbal remedies when febrile (Table 3). This may be disturbing. On the continent, the use of herbal preparations for childhood ailments have been documented [39, 40]. The debate on whether young children should be given herbal decoctions has been on-going. Although there are benefits in the use of herbal products in childhood sicknesses, Asase and Kadera [41] had called for more scientific research on these products. However, a study discouraged the practice of giving children herbal decoctions because of adverse effects [42]. This, the study attributed to immaturity of children's metabolic systems as well as unsubstantiated efficacy and safety claims. Another finding was the preference for injectables (56.9%) for children relative to oral (27.7%) and suppository (15.4%) (Table 3). The respondents claimed that injectables acted faster (quick relief) and as such would not patronize health facilities that did not frequently administer medication intravenously or intramuscularly. Oyewole and Ibidapo [43] reported a similar finding in Nigeria. The implication was that participants were oblivious of the scientific and clinical indications for drug administration and may intentionally refuse to use oral medications if their expectation of cure is injectable [44]. The present study found that most (51.6%) respondents admitted they self-medicate when they have malaria (Table 3), a finding consistent with other studies in Ghana and elsewhere on the continent [45, 46]. Many respondents (49.2%) in the present study obtained their malaria medications from drug stores, an indication that the drug stores may have informal environment, may be geographically and proximally convenient and were queueless, relative to hospitals [47, 48]. On allopathic-herbal medication preference, respondents admitted that herbal preparations have ease of adherence (53.9%), were accessible (62.8%), were affordable (64.4%) and were perceived to be more efficacious (54.2%). On the other hand, other respondents, supporting their preference for orthodox medicines mentioned reliability (54.7%) and superior quality (65.5%) as factors. The tussle over herbal preparations against orthodox medicines identified in the present study may be a matter of individual choice, which may have been emphasized by misconceptions, past experiences and socio-cultural factors. Some studies had findings that agreed with the present study regarding orthodox-herbal medication preference and dichotomy which had economic, psycho-social and parochial underpinnings [43, 38].

4.4 Asymptomatic malaria

Asymptomatic carriers of malaria parasites are a possible reservoir of infection. The present study found that a parasitaemia prevalence of 13.1% may exist across the study population (Table 4). The prevalence by study districts is shown in Figure 2. Donkorkrom had the highest prevalence (26.3%) whereas Nkawkaw had the lowest (5.1%), with a range of 5.1% - 26.3%. Other studies have found similar prevalence, ranging from 10% - 35% [49, 2]. This could be due to the low-lying terrain as against the hilly landscape of Donkorkrom and Nkawkaw, respectively. Parasitaemia among subjects in the present study may be due to endemicity and irrigation farming [50] which must be consciously considered if the fight against malaria is to be wholistically subdued. Consideration, again, should also be given to regular screening because, the panacea to reducing malaria parasite reservoir among the asymptomatic populace may be mass screening and treatment (MSAT) [51]. Though RDTs are able to detect parasites as soon as the clinical symptoms of malaria set in, discordance existed between RDT and microscopy results in the present study (Table 5). Some studies have reported such discrepancies [52, 53] which may either be due to parasite gene deletions or low parasitaemia. Furthermore, the number of false RDT positives were two. This may be due to PfHRP-2 antibodies which may continue to be positive for as long as 28 days after parasite clearance from peripheral blood [54]. Amoah and his colleagues

[55] and Osei-Yeboah and his colleagues [56] have reported false-negative and false-positive RDT results in Ghana. The present study identified *Plasmodium falciparum* in 107 (96.4% of positives) subjects, *Plasmodium ovale* in two (1.8% of positives) and mixed *Plasmodium falciparum* - *Plasmodium ovale* infection in another two (1.8% of positives) subjects (Table 5). Related findings of *P. falciparum* and *P. ovale* had been made in Ghana and elsewhere on the continent [2, 57]. Again, it is not uncommon to encounter *P. falciparum* and *P. ovale* as the only species among the Ghanaian populace in the forest zone [58].

5. Limitations

We utilised microscopy for the diagnosis of asymptomatic infections. This second-line diagnostic tool, though the gold standard, is convenient and affordable but less sensitive when compared to molecular testing and therefore a limitation to evaluating RDT performance. Nonetheless, the synergetic advantage of microscopy by expert microscopists and highly sensitive and specific HRP-2/pan pLDH RDT kits ameliorated this limitation.

6. Conclusion

We observed that facility-related challenges can impede access and affect the health-seeking behaviour of potential clients to a health facility, and found an asymptomatic malaria prevalence of 13.1%. We conclude that client satisfaction may not only be limited to clinical effectiveness, so healthcare facilities should consider socio-psychological acceptability and perceptions as well as proactive screening to reduce the menace of malaria infection reservoir.

7. Recommendations

It will be worthwhile to screen more asymptomatic adults in other malaria meso-endemic districts in Ghana because such exercise might generate a more extrapolatable view of malaria prevalence among this group. Policy makers and civil society in health should support in-depth study on the impact of health facility staff behaviour on potential clients as this may yield more discussions that could improve and revolutionize healthcare service delivery. It is also recommended that mass screening and treatment of asymptomatic adults in meso-endemic areas should be proactively implemented as this could help reduce disease burden that impinge on infection reservoir.

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9. Conflicts of interest/Competing interests

The authors declare that they have no competing interests.

10. Availability of data and material

On request.

11. Authors' contributions

Raymond Charles Ehiem: Performed experiments. Wrote the paper

John Asiedu Larbi: Conceived and designed the study. Wrote the paper

Bernard Walter L. Lawson: Analysed and interpreted the data. Wrote the paper

All three authors reviewed the manuscript

12. Ethics approval

Approval (CHRPE/KNUST/KATH/AP/433/17) was obtained from the Committee on Human Research Publications and Ethics of the Kwame Nkrumah University of Science and Technology, Kumasi and Komfo Anokye Teaching Hospital, Kumasi, Ghana

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