ORIGINAL RESEARCH

KNOWLEDGE-PRACTICE DISCONNECT IN MALARIA PREVENTION: A CROSS-SECTIONAL STUDY OF FUTURE HEALTHCARE PROVIDERS IN NIGERIA

https://doi.org/10.71921/ajrmhs.vol3no2.87

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Abstract

Background: Malaria remains a significant public health challenge in Nigeria. Translating knowledge into preventive practice remains a persistent barrier, even among healthcare trainees. This study assessed the knowledge, attitudes, and practices (KAP) of malaria prevention among clinical medical students at Rivers State University, Nigeria, with a focus on the gap between knowledge and practice.

Methods: A descriptive cross-sectional study was conducted among clinical medical students (400–600 level) at Rivers State University using a whole-population sampling approach. Data were collected using a pretested, self-administered questionnaire adapted from WHO malaria prevention indicators. Variables included socio-demographic characteristics, knowledge, attitudes, and practices related to malaria prevention. Data were analyzed using SPSS version 25. Associations between knowledge and practice were assessed using the Chi-square test, with $p < 0.05$ considered statistically significant.

Results: Out of 208 respondents, 48.6% had good knowledge of malaria prevention strategies, and 88.0% demonstrated positive attitudes. However, only 9.6% reported consistent preventive practices. Use of long-lasting insecticide-treated nets (LLINs) every night was reported by 37% of students. Knowledge scores were not significantly associated with good practice ($p=0.12$), indicating a substantial knowledge-practice gap.

Conclusion: Despite moderate knowledge and highly positive attitudes toward malaria prevention among clinical medical students, preventive practices remain suboptimal. Strategies should focus on behavior-change interventions, structured malaria-prevention modules in medical curricula, and the provision of enabling resources to facilitate consistent practice.

Key words: Malaria prevention, Knowledge-practice gap, Medical students, Public health, Nigeria

Cite as: ***Nwadiuto IC,Aruoture GP, Briggs N, Mberekpe PO, Onyekwere NV, Owhonda G, Etiga DR, Adoo DP. Knowledge-Practice Disconnect in Malaria Prevention: A Cross-Sectional Study of Future Healthcare Providers in Nigeria. AJRMHS. 2025;3(2):87-94***

INTRODUCTION

Malaria remains one of the most pressing public health challenges globally, with the burden disproportionately borne by sub-Saharan Africa, where over 94% of global malaria cases and deaths occur [1]. Nigeria continues to rank among the highest-burden countries, accounting for nearly one-third of global malaria deaths in 2023, according to the latest WHO World Malaria Report [1,2]. The disease is caused by Plasmodium parasites transmitted to humans through the bites of infected female Anopheles mosquitoes, with P. falciparum being the predominant and most lethal species in Africa [1,3]. Despite decades of control efforts—including the widespread distribution of insecticide-treated nets (ITNs), implementation of indoor residual spraying (IRS), improved diagnostics, and the availability of effective artemisinin-based combination therapies (ACTs)—malaria remains a leading cause of morbidity and mortality in Nigeria [1,2,4].

Medical students, as future healthcare providers, occupy a pivotal role in shaping health behaviors within their communities. Their knowledge, attitudes, and practices (KAP) towards malaria prevention are critical, both for their own protection and for the credibility of health promotion messages they will deliver in their professional careers [5,6]. However, studies have shown a persistent gap between knowledge and consistent preventive practice, even among health-educated populations [7,8,9]. This 'knowledge-practice disconnect' may undermine malaria control efforts, as healthcare providers who do not personally adhere to preventive measures may be less persuasive in encouraging their patients to do so [10,11].

University environments in Nigeria often present unique malaria risk factors, including crowded hostels, inadequate screening of windows and doors, limited access to ITNs, and proximity to mosquito breeding sites such as stagnant water and blocked drains [12,13]. Consequently, understanding the extent to which medical students translate their knowledge into effective malaria prevention practices is essential for designing interventions that target both structural and behavioral barriers. This study, therefore, aims to assess the knowledge, attitudes, and practices related to malaria prevention among clinical medical students at Rivers State University, Nigeria, with a particular focus on identifying gaps between knowledge and practice.

METHODOLOGY

Study Design and Setting

This study was a descriptive cross-sectional survey carried out at Rivers State University (RSU) in Port Harcourt, Nigeria. RSU is a public tertiary institution located in an urban setting of southern Nigeria. The study focused on clinical medical students in their 4th, 5th, and 6th years of study (400, 500, and 600 levels). These students have completed foundational biomedical coursework and are currently undertaking clinical rotations, making them well-suited to assess applied knowledge and practices related to health issues such as malaria.

Study Population and Sample

The target population comprised all clinical medical students (400–600 levels) in the Faculty of Clinical Sciences at RSU. According to university records, the total number of eligible clinical students was 286 (112 in 400-level, 126 in 500-level, 48 in 600-level). We aimed to recruit the entire population for participation (whole-population sampling), given the manageable sample size. A minimum sample size of 168 was calculated using Cochran's formula for cross-sectional studies, assuming 50% prevalence of good knowledge (to maximize sample size), 95% confidence, 5% precision, a finite population correction for N=286, and a 10% allowance for non-response. Ultimately, 208 students responded, yielding a response rate of approximately 72.7%. This sample exceeded the minimum requirement and represented all class levels of interest.

Data Collection Instrument

Data were collected using a semi-structured, self-administered questionnaire designed in English. The questionnaire was developed by the researchers, based on WHO malaria prevention indicators and existing literature on malaria KAP [14], and was reviewed by public health experts for content validity. It consisted of four sections: (1) Sociodemographic information (age, gender, marital status, and academic level/year of study), (2) Knowledge of malaria and its control measures, (3) Attitude towards malaria prevention and treatment, and (4) Practice of malaria preventive measures. Most knowledge questions were closed-ended (multiple-choice or true/false) items covering malaria transmission, symptoms, treatment, and prevention methods (e.g., ITNs, IRS, and environmental management). Attitude was assessed using statements about

the seriousness and prevention of malaria, to which students indicated agreement on a Likert scale. Practice was evaluated by asking participants about their personal behaviors, including sleeping under bed nets, using mosquito repellents or sprays, environmental sanitation, and seeking healthcare for malaria symptoms.

The questionnaire was administered electronically via Google Forms. A link to the form was distributed to students through their class WhatsApp and email groups, along with an explanation of the study's purpose and instructions. Participation was voluntary and anonymous. Two reminder messages were sent over two weeks to improve response rates. Only one submission was allowed per student. At the start of the questionnaire, an informed consent section explained the study and obtained consent before proceeding.

Scoring and Definitions of KAP Levels

Respondents' answers were scored to categorize their overall knowledge, attitudes, and practices. A scoring rubric was developed prior to the study: Knowledge questions were assigned points for correct responses (0 for incorrect or "don't know" responses). Attitude items on the Likert scale (e.g., willingness to use preventive measures, perceived importance of malaria control) were assigned scores, with higher scores indicating positive attitudes. Practice behaviors were scored based on recommended malaria prevention practices (with higher scores for consistent use of protective measures). For each domain (knowledge, attitude, practice), a percentage score was calculated for each participant. We then defined good, fair, and poor categories using threshold criteria commonly applied in KAP studies:

- **Good knowledge/attitude/practice:** Score ≥ 70% of the maximum.
- **Fair knowledge/attitude/practice:** Score 50–69%.
- **Poor knowledge/attitude/practice:** Score < 50%.

Data Analysis

All responses were exported from Google Forms to Microsoft Excel and then analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Data cleaning was performed to check for completeness and consistency; fourteen respondents did not indicate their class level (recorded as missing for that variable), but all questionnaires were otherwise sufficiently completed to be included in the analysis. No imputation was performed for missing data.

Descriptive statistics were computed for all variables. Categorical data (e.g., gender, KAP levels) were summarized as frequencies and percentages. Continuous data, such as age, were categorized because most respondents fell into a narrow age range.

The KAP outcome variables were treated as categorical (good/fair/poor). Associations between participants' sociodemographic factors (gender, age group, marital status, class level) and their knowledge, attitudes, and practices were assessed using chi-square (χ^2) tests. For these analyses, some categories were collapsed where necessary to ensure adequate cell counts (e.g., marital status was treated as binary because very few were married). A p-value of < 0.05 was considered statistically significant for all tests.

Ethical Considerations

The study protocol was reviewed and approved by the Ethics Committee of Rivers State University Teaching Hospital, Port Harcourt (Approval No. RSUTH/RSU/2022/081). Permission was also obtained from the Department of Community Medicine, RSU. Participation was entirely voluntary. Informed consent was obtained from each participant via the online form; the first section of the questionnaire included an information sheet about the study and a consent declaration, which students had to agree to before proceeding. Confidentiality and anonymity were strictly maintained, no personal identifiers were collected beyond general demographic information, and responses were accessible only to the research team. All data were stored securely in password-protected electronic files. Participants were assured that declining or withdrawing would not affect their academic standing. The study was conducted in accordance with the principles of the Declaration of Helsinki.

RESULTS

Sociodemographic Characteristics

A total of 208 clinical medical students participated in the survey. Of these, 64.4% were female (n = 134) and 35.6% male (n = 74). Participants' ages ranged from 18 to 30, with a mean age of approximately 22 years. The largest age group was 21–23 years, accounting for 40.9% (n = 85) of respondents, followed by the 24–26-year group (27.9%, n = 58). Younger students aged 18–20 accounted for 25.0% (n = 52), while a small minority (6.3%, n = 13) were older than 26 years. Most students were single (90.9%, n = 189); only

3.4% (n = 7) were married, and 5.3% (n = 11) indicated "other" (including engaged or in a relationship but not married). One respondent did not report marital status. In terms of academic level, the respondents were distributed across 400, 500, and 600 levels: the 400 level had the highest representation at 41.8% (n = 87). Fifth year (500-level) students accounted for 27.9% (n = 58), and final-year (600-level) students accounted for 23.6% (n = 48). Fourteen students (6.7%) did not specify their class level. This distribution indicates that all clinical years were well represented in the sample.

Knowledge of Malaria Control Measures

Overall knowledge about malaria and its prevention was moderate to high among the clinical students. Of 208 respondents, 101 students (48.6%) demonstrated "good" knowledge of malaria control measures, answering at least 70% of the knowledge questions correctly. Seventy-four students (35.6%) had "fair" knowledge, and 33 students (15.9%) had "poor" knowledge, meaning they answered less than half of the knowledge questions correctly. Thus, nearly half of the future healthcare providers surveyed were well informed about malaria, whereas a substantial proportion had knowledge gaps.

Key strengths in knowledge included awareness of malaria transmission and its symptoms. Most students (92%) correctly identified the bite of infected Anopheles mosquitoes as the cause of malaria and recognized common symptoms such as fever, chills, and headache. More than 95% knew that malaria is preventable and curable with appropriate measures, and a similar proportion recognized that prompt treatment with effective antimalarials (such as ACTs) is critical. Knowledge gaps were noted in several areas; for instance, some students were unclear about specific preventive strategies—approximately 20% did not know that indoor residual spraying (IRS) is a malaria control method. A quarter were unsure of the recommended timing/coverage for intermittent preventive therapy in pregnancy (IPTp). Additionally, a minority held misconceptions (around 15% believed, incorrectly, that staying in air-conditioned rooms eliminates malaria risk, or that herbal remedies alone can cure malaria).

Table 1: Sociodemographic Characteristics of Participants (N=208)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Female	134	64.4
	Male	74	35.6
Age Group	18-20 years	52	25.0
	21-23 years	85	40.9
	24-26 years	58	27.9
	≥27 years	13	6.3
Marital Status	Single	189	90.9
	Married	7	3.4
	Other	11	5.3
	Missing	1	0.5
Academic Level	400 Level	87	41.8
	500 Level	58	27.9
	600 Level	48	23.1
	Missing	14	6.7

Table 2: Knowledge of Malaria Transmission, Symptoms, and Prevention (N=208)

Knowledge Item	Correct Response n (%)	Incorrect/ Don't Know n (%)
Malaria is caused by a parasite	201 (96.6)	7 (3.4)
Transmitted by bite of infected *Anopheles* mosq uito	191 (91.8)	17 (8.2)
Fever is a common symptom	205 (98.6)	3 (1.4)
Can be prevented by using ITNs	198 (95.2)	10 (4.8)
Indoor Residual Spraying (IRS) is a control method	166 (79.8)	42 (20.2)
Prompt treatment with ACTs is critical	200 (96.2)	8 (3.8)
Malaria can be fatal if untreated	195 (93.8)	13 (6.2)

Attitudes Toward Malaria Control

Attitudinally, most of the students held positive views and dispositions toward malaria control and prevention. As shown in Table 3, 183 students (88.0%) had a positive attitude toward malaria preventive measures, 5 (2.4%) had a fair attitude, and 20 (9.6%) had a negative attitude. In this context, a "good attitude" means the student consistently holds or practices positive beliefs: for example, believing that malaria is a serious disease worth preventing, expressing a willingness to use personal protection like bed nets, supporting community spraying programs, and preferring prompt treatment-seeking at a health facility for fever.

Table 3: Attitudes Toward Malaria Prevention (N=208)

Attitude Statement	Agree n (%)	Neutral n (%)	Disagree n (%)
Malaria is a serious disease that deserves attention.	192 (92.3)	10 (4.8)	6 (2.9)
I am willing to sleep under an ITN every night.	178 (85.6)	20 (9.6)	10 (4.8)
Using preventive measures is a personal responsibility.	185 (88.9)	15 (7.2)	8 (3.8)
I would support IRS in my community/hostel.	175 (84.1)	25 (12.0)	8 (3.8)
It is important to seek formal treatment for malaria symptoms.	195 (93.8)	8 (3.8)	5 (2.4)

Practice of Malaria Preventive Measures

In stark contrast to their high levels of knowledge and positive attitudes, students' malaria prevention practices were largely inadequate. When asked about their own behaviors to prevent malaria, only 20 respondents (9.6%) were categorized as having good practice, meaning they consistently engaged in most recommended measures. Eighty-two students (39.4%) had fair malaria prevention practices, and the majority—106 students (51.0%)—had poor practices. These classifications were based on a composite of behaviors, including sleeping under ITNs every night, using mosquito repellents or coils, ensuring that no standing water is present around living areas, and promptly seeking treatment when febrile.

Drilling down into specific practices provides insight into these numbers. While nearly all students owned an ITN, the actual usage rate was much lower. Only 37% of respondents

reported sleeping under a bed net "every night" during the high-transmission season. Another ~30% used nets occasionally, and one-third reported rarely or never using a mosquito net. The most common personal protection reported was the use of aerosol insecticide sprays or mosquito coils—about 60% reported frequently using them in their residences. However, repellents (topical creams) were used by under 20% of students regularly. Notably, a large proportion (over 70%) reported attempting to avoid outdoor exposure to mosquitoes in the evenings, suggesting behavioral caution.

Environmental management practices were also suboptimal: fewer than half of the students reported checking and draining stagnant water around their residences weekly. Only 15% had participated in community sanitation or larval source reduction activities targeting mosquitoes.

Association Between Demographic Factors and KAP

We examined whether any subgroup of students was more likely to demonstrate good knowledge, attitudes, or practices. Chi-square tests revealed no statistically significant association between gender and any of the KAP outcomes. For example, although a slightly higher proportion of female students (31.3%) than male students (17.3%) achieved a good knowledge status, this difference was not statistically significant ($p = 0.174$). Similarly, females had slightly higher rates of good attitude and good practice than males, but the differences were not statistically significant.

Age showed a notable but mixed influence. There was no significant association between age group and knowledge ($p = 0.082$) or attitude ($p = 0.563$). However, age was significantly associated with preventive practice ($p < 0.001$). Students in the youngest age bracket (18–20 years) had the lowest proportion of good practice and the highest proportion of poor practice. In contrast, among students aged 24–26, a larger fraction reported good or fair practices. Academic level (400 vs 500 vs 600) was not significantly associated with knowledge ($p = 0.078$), attitude ($p = 0.127$), or practice ($p = 0.968$). The rates of poor practice were above 50% in each class year.

Association Between Knowledge Level and Practice Level

A chi-square test was performed to assess the relationship between knowledge level (good vs. fair/poor) and practice level (good vs. fair/poor). No statistically significant association was found ($\chi^2 = 2.39$, $p = 0.12$) despite the knowledge-practice gap identified in this population.

Table 4: Self-Reported Malaria Preventive Practices (N=208)

Preventive Practice	Always/ Often n (%)	Sometimes n (%)	Rarely/ Never n (%)
Sleep under an ITN every night	77 (37.0)	62 (29.8)	69 (33.2)
Use mosquito repellent (cream/spray)	39 (18.8)	71 (34.1)	98 (47.1)
Use mosquito coils/aerosol sprays indoors	125 (60.1)	55 (26.4)	28 (13.5)
Drain stagnant water around residence	89 (42.8)	67 (32.2)	52 (25.0)
Seek treatment at clinic/hospital for fever	166 (79.8)	31 (14.9)	11 (5.3)
Self-medicate with leftover drugs/herbs for suspected malaria	52 (25.0)	73 (35.1)	83 (39.9)

DISCUSSION

This study confirms a persistent knowledge-practice disconnect in malaria prevention among clinical medical students in Nigeria. Despite moderate knowledge (48.6% good) and highly positive attitudes (88% good), self-reported preventive behaviors were suboptimal, with only 9.6% demonstrating good practice. Our findings align with recent studies among Nigerian university students, which consistently report high ITN ownership but utilization rates below 50% [12, 15, 16]. The significant gap highlights that awareness and positive disposition alone are insufficient to drive consistent protective behavior.

The lack of a significant association between knowledge and practice ($p=0.12$) indicates that this disconnect is not attributable to a deficit in information. Instead, barriers likely include environmental and structural factors (e.g., inadequate hostel infrastructure [lack of net-hanging points, poor window screening]), perceptual factors (e.g., low perceived susceptibility among young adults, discomfort from heat while using nets), and behavioral inertia [17, 18, 19]. Our finding that younger students (18-20 years of age) had significantly poorer practice suggests that interventions should target students early in their clinical training to instill lifelong preventive habits.

Comparison with existing literature: Our results are consistent with the broader literature on the knowledge-practice gap in malaria prevention. Studies among health trainees in similar settings report comparable disparities, often attributing them to the normalization of malaria as a 'routine' illness and reliance on easy access to treatment [20, 21]. The high attitude scores in our study mirror findings from other Nigerian institutions, where health education fosters positive beliefs that are not translated into action [12, 15].

Implications for training and public health: The fact that future doctors are not consistently protecting themselves is a concern for both their personal health and their future credibility as health educators. Medical curricula should move beyond theoretical teaching to include practical, behavior-change modules. This could involve hands-on sessions on proper use of nets, peer-led prevention campaigns, and the integration of malaria prevention into clinical rotations. Universities should also partner with public health programs to improve the enabling environment—ensuring access to free LLINs, installing window screens, and conducting periodic IRS in hostels.

Strengths and Limitations

This study benefited from a high response rate and a detailed KAP assessment among a defined population of clinical medical students. However, limitations must be acknowledged. The study relied on self-reported practices, which may be subject to social desirability bias. The cross-sectional design cannot establish causality. The study was conducted in a single urban university, which may limit generalizability to other regions or non-university populations. Additionally, the study focused solely on medical students; including other health science students (e.g., nursing, pharmacy) would have provided a broader perspective. Future research should employ mixed-methods approaches to examine the qualitative reasons for the practice gap and to evaluate targeted interventions.

CONCLUSION

In conclusion, this study reveals a significant knowledge-practice disconnect in malaria prevention among clinical medical students in Nigeria. While knowledge is moderate and attitudes are highly positive, preventive practices remain worryingly low. This discordance highlights the need for multi-faceted strategies that address not only knowledge but also the structural, environmental, and behavioral barriers to consistent prevention. By embedding practical prevention training and fostering enabling environments within medical education, we can better equip future healthcare providers to protect themselves and serve as effective advocates for malaria control in their communities.

Author Contributions: D.R.E. and D.P.A. conceived and designed the study. G.P.A. and N.B. supervised data collection and entry. P.O.M. and N.B. performed the statistical analysis. I.C.N. and N.V.O. authors contributed to the interpretation of the results. G.O. and I.C.N. drafted the manuscript, and G.P.A. critically revised it for intellectual content. All authors read and approved the final manuscript.

Conflicts of Interest: The authors declare no conflicts of interest.

Funding: This research received no external funding.

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