Predictors of patients' knowledge, attitudes and practices (KAP) regarding uncomplicated malaria in the primary healthcare facilities of Plateau state, Nigeria

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Abstract

Purpose – This study determined factors that influenced patients' knowledge, attitudes and practices (KAP) regarding uncomplicated malaria in primary healthcare (PHC) facilities of Plateau state, Nigeria.

Design/methodology/approach – The data of 956 patients treated for uncomplicated malaria in PHC facilities of Plateau state were used for the study. Inferential statistical analyses were conducted to identify factors that influenced patients' KAP on the disease and its management.

Findings – The study revealed age ($p < 0.001$), level of education ($p = 0.012$), attitudes ($p = 0.007$) and practices ($p < 0.001$) as significant predictors of knowledge outcomes on uncomplicated malaria, while their attitudes towards the disease and its management was predicted by their gender ($p = 0.011$), occupation ($p = 0.049$), monthly income ($p = 0.018$), knowledge ($p < 0.001$) and practices ($p < 0.001$). Furthermore, their practices were significantly predicted by monthly incomes ($p = 0.043$), knowledge ($p < 0.001$), attitudes ($p < 0.001$) and number of anti-malarial and adjunct drugs administered to them ($p = 0.041$).

Originality/value – The study revealed a mixed influence of patients' characteristics on their KAP outcomes. This calls for appropriate intervention measures towards achieving the desired patients' therapeutic outcomes.

Keywords Knowledge attitudes and practices, Patients, Plasmodium falciparum, Predictors, Primary healthcare facilities, Uncomplicated malaria

Paper type Research paper

Introduction

Uncomplicated malaria is a prevalent disease in Nigeria caused mainly through a parasitic infection, *Plasmodium falciparum,* with resulting symptoms including fever, headache, joint pain, malaise, vomiting, body ache, poor appetite and body weakness, without signs of severity or evidence of vital organ dysfunction [1, 2]. According to the malaria treatment guideline for Nigeria, case management of the disease involves early diagnosis and prompt

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treatment with effective and recommended anti-malarial drugs [1, 2]. The guideline states clearly the use of artemether-lumefantrine as the recommended anti-malarial drug for the case management of uncomplicated malaria treatment after diagnosis, using either microscopy or RDTs approach in identifying the parasite, or the use of artesunate-amodiaquine if artemether-lumefantrine is unavailable [1]. In some cases, antipyretics such as paracetamol could be added to the regimen when a patient's temperature reaches 38.5 C [1].

The appropriate use of drugs based on treatment guidelines is essential in the management of ailments for the purpose of achieving the required treatment success rate [3, 4]. When such medication practices are appropriately carried out based on treatment guidelines, it will result in the cure of the malarial disease, relieve symptoms and alleviate patient suffering [2].

Inappropriate use of anti-malarial drugs has been reported in Nigeria, with their consequences including a reduction in quality of drug therapy leading to drug resistance and treatment failure, unwanted side effects and increased cost of medications [5–9]. This might not be unconnected with the reported poor use of public healthcare (PHC) facilities in the country [10–15].

Although previous studies had linked poorer patients' medication practices with many factors including patients' lack of knowledge, health beliefs and treatment-seeking behaviours, in addition to how they use their medicines [7, 8, 16], there was scant information on studies from the rural areas of the country, especially in Plateau state. Hence, there was a need to assess factors that might have influenced patients' knowledge, attitudes and practices (KAP) among rural communities who are most affected by the disease. For these rural communities, the PHC facilities had been their main source when seeking treatment. The study is important because it could provide a comprehensive picture of the determinants of treatment and management of uncomplicated malaria among patients. The outcomes of the study could also be useful in helping advise health policymakers, as well as healthcare workers and patients themselves, with any necessary changes and interventions in finding realistic solutions to any sub-standard treatment and management practices in the PHC settings.

Methods

Data for this study were from two sources titled 'patients' knowledge, attitudes and practices (KAP) on uncomplicated malaria management in Plateau state, north-central Nigeria' [17] and 'assessment of primary healthcare workers' knowledge, attitudes, and practices on uncomplicated malaria management in Plateau state, Nigeria' [18]. Besides logistic preference and the availability of a residing researcher, the disease prevalence justified the choice of Plateau state as the study area. Noland and others had earlier reported that malaria transmission was most widespread between the months of May and November each year [19] in Plateau state, which was not unconnected with the climatic geographical nature of the state [20].

The dependent variables included patients' KAP on uncomplicated malaria. The independent variables for patients' knowledge score included their socio-demographic characteristics (gender, age, marital status, highest completed education level, occupation and monthly income), practices, attitudes, number of anti-malarial and adjunct drugs administered to them and healthcare workers' management practices. The influence of these independent variables on their practice and attitude outcomes was also assessed by including knowledge and practices as independent variables for attitudes outcomes, and knowledge and attitudes were included as independent variables for predicting practice outcomes. The levels of patients' knowledge were classified as good, moderate or poor based on their correct responses to the knowledge-related items which were assessed using three options of 'yes', 'not sure' or 'no'; while their levels of attitudes and practices, in addition to healthcare workers' practices, were categorized based on their respective levels of agreements to the

attitude- and practice-related statements which were scored on a five-point Likert scale [17, 18].

Ethical consideration

This study was approved by the Joint Research Review and Ethics Committee, Research Management Centre (RMC), MAHSA University, Malaysia, through an approval letter reference RMC/EC01/2016, dated 25 November 2016. This approval was subsequently used to obtain permission from the Plateau State Ministry of Health, Jos, Nigeria, and the Directors of PHC facilities of the various selected local government areas (LGAs) prior to data collection.

Data analysis

The quantitative data generated were manually sorted and entered into Microsoft Excel software based on coded format and transferred into the International Business Machines Corporation Statistical Package for Social Sciences (IBM-SPSS®) version 23 software. The distribution pattern of the data was tested by the Kolmogorov–Smirnov test, and the outcomes indicated non-normal distribution based on the recommendation of Ghasemi and Zahediasl [21].

The descriptive statistics test for healthcare workers and patients had been reported [17, 18]. Tests for statistically significant differences and relationships for respondents' KAP on uncomplicated malaria management across their independent variables were conducted through inferential statistics. The Mann–Whitney test was used to test for any significant differences in respondents' KAP scores on uncomplicated malaria treatment and management across their independent variables that were presented in two subgroups, while the Kruskal–Wallis test was applied on categorical variables which had three or more subgroups. Association assessment between categorical variables and different levels of KAP towards uncomplicated malaria among patients was conducted using a chi-square (χ^2) test for independence. Spearman's rank correlation coefficient (rho) test was also performed on the data to describe the strength and direction of relationships between continuous variables at $p < 0.05$ probability level of significance. Based on the rules of thumb set out by Cohen [22], the strength of correlations was interpreted as 0 = no relationship, 0.10–0.29 = small/low correlation, 0.30–0.49 = medium/moderate correlation, and 0.50–1.00 = large/high correlation.

Furthermore, multinomial logistic regression analysis was conducted to determine predictors of the outcome variables. During the regression analysis, the respondents who scored less than 50% were categorized as having poor KAP and were encoded as '0', while those that scored more than 50% were categorized as having good KAP towards the disease and were encoded as 1 [23]. The statistical significance of each of the predictor variables on the outcome variables was presented by their odds ratio (OR) values with a 95% confidence interval (95% CI) at $p < 0.05$.

Results

The outcomes of the Mann–Whitney and Kruskal–Wallis tests that had been conducted to assess the differences in patients' KAP based on their independent characteristics showed various significant differences, as presented in Table I**.** The tests indicated significant differences in their knowledge based on gender, age differences, attitudes, and practices. There were significant differences in median attitude scores across the respondents' independent variables including gender, age, marital status, highest education level, occupation, monthly salary, knowledge and practices. The Kruskal–Wallis test also indicated significant differences between patients' median practice scores with their marital status, knowledge and attitudes (Table I).

Table I.
Differences in patients' median KAP scores across independent variables ($N = 956$)

Variables	n (%)	Median knowledge scores		Median attitudes scores		Median practices scores	
		Mean rank	Median (IQR)	Mean rank	Median (IQR)	Mean rank	Median (IQR)
Gender		($Z = -2.11$, $p =$ **0.035***)		($Z = -3.50$, $p <$ **0.001***)		($Z = -0.15$, $p = 0.881$)	
Male	433 (45.29)	458.34	5.00 (1.00)	444.25	34.00 (10.00)	477.05	15.00 (4.00)
Female	523 (54.71)	495.19	5.00 (2.00)	506.85	37.00 (9.00)	479.70	15.00 (3.00)
Age (years)		($\chi^2 = 28.72$, df $= 3$ $p <$ **0.001***)		($\chi^2 = 29.46$, df $= 3$ $p <$ **0.001***)		($\chi^2 = 0.53$, df $= 3$ $p = 0.913$)	
<18	142 (14.85)	584.21	5.00 (2.00)	588.85	39.00 (6.00)	483.17	15.00 (2.00)
18–29	266 (27.82)	481.61	5.00 (1.00)	476.12	34.00 (8.25)	485.35	16.00 (3.00)
30–41	321 (33.58)	444.38	4.00 (1.00)	462.18	35.00 (9.00)	469.95	15.00 (4.00)
>41	227 (23.75)	456.98	5.00 (1.00)	435.34	34.00 (10.00)	479.65	16.00 (4.00)
Marital status		($\chi^2 = 2.48$, df $= 2$ $p = 0.290$)		($\chi^2 = 10.04$, df $= 2$ $p =$ **0.007***)		($\chi^2 = 8.12$, df $= 2$ $p =$ **0.017***)	
Never married	343 (35.88)	496.69	5.00 (2.00)	511.36	37.00 (8.00)	466.83	15.00 (2.00)
Married	407 (42.57)	469.36	5.00 (1.00)	447.73	35.00 (10.00)	464.03	15.00 (4.00)
Divorced/widowed	206 (21.55)	466.27	5.00 (2.00)	484.58	34.00 (10.00)	526.53	16.00 (6.00)
Education level		($\chi^2 = 4.57$, df $= 3$ $p = 0.207$)		($\chi^2 = 18.07$, df $= 3$ $p <$ **0.001***)		($\chi^2 = 0.88$, df $= 3$ $p = 0.831$)	
No formal education	137 (14.33)	503.59	5.00 (2.00)	566.95	38.00 (7.00)	462.89	15.00 (5.00)
Primary	268 (28.03)	457.55	5.00 (1.00)	460.84	34.00 (9.00)	473.05	15.00 (2.00)
Secondary	358 (37.45)	471.78	5.00 (1.00)	475.87	35.00 (10.00)	484.11	16.00 (4.00)
Higher education	193 (20.19)	502.23	5.00 (2.00)	445.11	34.00 (8.00)	486.74	16.00 (4.00)
Occupation		($\chi^2 = 2.55$, df $= 2$ $p = 0.280$)		($\chi^2 = 17.11$, df $= 2$ $p <$ **0.001***)		($\chi^2 = 0.41$, df $= 2$ $p = 0.816$)	
Student	287 (30.02)	479.86	5.00 (1.00)	489.85	36.00 (10.00)	480.15	15.00 (2.00)
Employed	335 (35.04)	461.42	5.00 (1.00)	430.52	34.00 (9.00)	471.18	15.00 (3.00)
Farmer/business	334 (34.94)	494.46	5.00 (2.00)	516.88	37.00 (9.00)	484.43	16.00 (6.00)
Monthly income (naira)		($\chi^2 = 7.35$, df $= 3$ $p = 0.062$)		($\chi^2 = 15.89$, df $= 3$ $p =$ **0.001***)		($\chi^2 = 1.67$ df $= 3$ $p = 0.644$)	
None	481 (50.31)	496.71	5.00 (2.00)	504.93	37.00 (10.00)	473.16	15.00 (4.00)
<18,000	165 (17.26)	482.39	5.00 (2.00)	497.39	37.00 (10.00)	466.22	15.00 (2.00)
18,000–40,000	200 (20.92)	436.13	4.50 (1.00)	424.59	33.00 (8.75)	487.64	16.00 (5.00)
>40,000	110 (11.51)	470.07	5.00 (1.00)	432.62	34.00 (8.00)	503.66	16.00 (3.00)

(*continued*)

Table I.

Variables	*n* (%)	Median knowledge scores		Median attitudes scores		Median practices scores	
		Mean rank	Median (IQR)	Mean rank	Median (IQR)	Mean rank	Median (IQR)
Knowledge				($\chi^2 = 86.79$, df = 2 $p < \mathbf{0.001}$*)		($\chi^2 = 58.23$, df = 2 $p < \mathbf{0.001}$*)	
Poor	164 (17.15)		3.00 (1.00)	381.00	33.00 (8.00)	391.55	15.00 (4.00)
Moderate	556 (58.16)		5.00 (1.00)	448.42	34.00 (9.00)	457.36	15.00 (3.00)
Good	236 (24.69)		6.00 (1.00)	617.12	39.00 (9.00)	588.74	16.00 (4.75)
Attitudes		($\chi^2 = 63.08$, df = 2 $p < \mathbf{0.001}$*)				($\chi^2 = 20.72$, df = 2 $p < \mathbf{0.001}$*)	
Poor	83 (8.68)	464.18	5.00 (1.00)	–	20.00 (5.00)	474.07	16.00 (4.00)
Moderate	438 (45.82)	408.12	4.00 (2.00)	–	32.00 (5.00)	436.95	15.00 (4.00)
Good	435 (45.50)	552.09	5.00 (2.00)	–	40.00 (3.00)	521.18	16.00 (2.00)
Practices		($\chi^2 = 46.92$ df = 2 $p < \mathbf{0.001}$*)		($\chi^2 = 46$, df = 2 $p < \mathbf{0.001}$*)			
Poor	94 (9.83)	413.44	4.00 (1.00)	391.51	33.00 (10.00)	–	8.00 (2.00)
Moderate	221 (23.12)	386.18	4.00 (2.00)	392.30	33.00 (8.50)	–	13.00 (2.00)
Good	641 (67.05)	519.87	5.00 (2.00)	520.98	37.00 (9.00)	–	16.00 (3.00)
Number of anti-malarial and adjunct drugs administered		($\chi^2 = 3.41$, df = 2 $p = 0.182$)		($\chi^2 = 5.41$, df = 2 $p = 0.067$)		($\chi^2 = 4.24$, df = 2 $p = 0.120$)	
≤3	178 (18.62)	480.48	5.00 (1.25)	471.32	34.00 (11.00)	492.61	16.00 (6.00)
4–5	567 (59.31)	467.23	5.00 (1.00)	466.31	35.00 (9.00)	463.84	15.00 (4.00)
≥6	211 (22.07)	507.13	5.00 (2.00)	517.32	37.00 (8.00)	506.00	16.00 (2.00)
Healthcare workers' practices		($\chi^2 = 0.13$, df = 2 $p = 0.977$)		($\chi^2 = 2.57$df = 2 $p = 0.276$)		($\chi^2 = 0.30$, df = 2 $p = 0.860$)	
Poor	47 (4.92)	491.20	5.00 (2.00)	481.54	35.00 (9.00)	461.20	15.00 (5.00)
Moderate	66 (6.90)	473.49	5.00 (1.00)	425.98	35.00 (13.50)	489.90	15.00 (4.00)
Good	843 (88.18)	478.18	5.00 (1.00)	482.44	35.00 (10.00)	478.57	15.00 (3.00)

Note: * = statistically significant at $p < 0.05$; df = degree of freedom; Z = Z-statistics; $\chi 2$ = chi-square; IQR = interquartile range

Associating patients' KAP scores on uncomplicated malaria to their characteristics using the chi-square test showed significant associations between knowledge score and gender, age and marital status (Table II). Interestingly, with respect to attitudes, there were significant associations between all the ten independent variables included in the analysis. The associations between practices and gender, marital status, occupation, knowledge, attitudes and the number of anti-malarial and adjunct drugs administered were also significant.

The outcomes of bivariate analysis using Spearman's rank-order correlation coefficient (rho) revealed statistically significant positive and negative low and moderate correlations between patients' KAP scores with the continuous independent variables, except knowledge–monthly income, and KAP with the number of anti-malarial and adjunct drugs administered (Table III).

Similarly, the correlations between the dependent variables were all positive with statistically significant moderate strength between knowledge–attitudes (K–A) and knowledge–practices (K–P), while the strength of correlation between attitudes–practices (A–P) was statistically significant but low (Table IV).

Multinomial logistic regression was used to assess whether the independent variables (potential predictors) significantly predict patients' KAP scores. Conducting a likelihood ratio test helps in understanding if the significant predictors give a real contribution to the models, that is, maximum likelihood is significantly higher in the full models rather than in the null ones [24]. The −2 log-likelihood (−2LL) values of 1069.3 ($\chi^2 = 84.96$, df = 22, $p < 0.001$), 994.73 ($\chi^2 = 129.24$, df = 22, $p < 0.001$) and 992.44 ($\chi^2 = 91.31$, df = 22, $p < 0.001$) for the final regression model for knowledge, attitudes and practices, respectively, containing their respective predictors were statistically significant, indicating that the full model with the predictors in them could significantly predict the outcome variables [25]. Similarly, the high and insignificant p-value of chi-square goodness-of-fit test at $p < 0.05$ for the three models, that is, knowledge ($\chi^2 = 750.12$, $p = 0.132$), attitudes ($\chi^2 = 740.91$, $p = 0.156$) and practices ($\chi^2 = 757.27$, $p = 0.163$), confirmed the acceptability of the models which were able to correctly classify the outcome variables of 63.0%, 68.1% and 69.2% of the patients as good (75.5%) or poor (47.4%) knowledge, as good (49.4%) or poor (80.8%) attitudes and as good (90.0%) or poor (27.0%) practices. Table V showed that age (years), education level, attitudes and practices significantly predicted knowledge of the patients on uncomplicated malaria, while gender, occupation, monthly salary, knowledge and practices predicted their attitudes on the disease and its management, and monthly salary, knowledge, attitudes and number of prescribed anti-malarial and adjunct drugs as predictors of the patients' practices towards uncomplicated malaria.

Table VI showed the overall level of significance and details strengths of prediction of the outcome variables by the various independent variables as indicated by their odds ratios (ORs) at 95% confidence interval (95% CI).

Discussion

Jimam and Ismail [11] reported that patients' knowledge and attitudes towards uncomplicated malaria were moderate, with borderline good practices towards the disease and its management. The main purpose of the present study was to determine predictors that influenced patients' KAP on the disease in PHC facilities of Plateau state, Nigeria.

To the best of our current knowledge, no other published studies discussed the relation to outcomes of a test of differences in patients' median KAP scores across independent variables. With respect to associations studies, better KAP of women regarding the disease (Table II) was expected because they are at higher risk of contracting the disease, which can help them become more familiar with it. They are also more often responsible for taking care of children who have been reported to be at higher risk of being infected by the disease

Table II.
Patients' KAP scores categorization and association with independent variables ($N = 956$)

Variables	Knowledge scores: Poor *n* (%)	Moderate *n* (%)	Good *n* (%)	Attitudes scores: Poor *n* (%)	Moderate *n* (%)	Good *n* (%)	Practices scores: Poor *n* (%)	Moderate *n* (%)	Good *n* (%)
Gender	(Chi-square (χ^2) = 15.62, df = 8 p = **0.048***)			(χ^2 = 59.22, df = 37 p = **0.012***)			(χ^2 = 29.40, df = 16 p = **0.021***)		
Male	93 (9.73)	111 (11.61)	229 (23.95)	46 (4.81)	236 (24.69)	151 (15.80)	48 (5.02)	97 (10.15)	288 (30.13)
Female	71 (7.43)	153 (16.00)	299 (31.28)	37 (3.87)	250 (26.15)	236 (24.69)	46 (4.81)	124 (12.97)	353 (36.92)
Age (years old)	(χ^2 = 53.23, df = 24 p = **0.002***)			(χ^2 = 170.06, df = 111 p < **0.001***)			(χ^2 = 56.99, df = 48 p = 0.574)		
<18	11 (1.15)	34 (3.56)	97 (10.15)	8 (0.84)	48 (5.00)	86 (9.00)	12 (1.26)	25 (2.62)	105 (10.98)
18–29	41 (4.29)	68 (7.11)	157 (16.42)	25 (2.62)	135 (14.12)	106 (11.09)	26 (2.72)	60 (6.28)	180 (18.83)
30–41	68 (7.11)	95 (9.94)	158 (16.53)	32 (3.35)	168 (17.57)	121 (12.66)	35 (3.66)	80 (8.37)	206 (21.55)
>41	44 (4.60)	67 (7.00)	116 (12.13)	18 (1.88)	135 (14.12)	74 (7.74)	21 (2.20)	56 (5.86)	150 (15.69)
Marital status	(χ^2 = 33.13, df = 16 p = **0.007***)			(χ^2 = 120.83, df = 74 p = **0.003***)			(χ^2 = 108.16, df = 32 p = **0.014***)		
Never married	50 (5.23)	93 (9.73)	200 (20.92)	29 (3.03)	150 (15.69)	164 (17.16)	23 (2.41)	76 (7.95)	244 (25.52)
Married	75 (7.85)	111 (11.61)	221 (23.12)	42 (4.39)	222 (23.22)	143 (14.96)	45 (4.71)	108 (11.30)	254 (26.57)
Divorced/widowed	39 (4.08)	60 (6.28)	107 (11.19)	12 (1.26)	114 (11.92)	80 (8.37)	26 (2.72)	37 (3.87)	143 (14.96)
Education level	(χ^2 = 43.31, df = 24 p = 0.059)			(χ^2 = 140.09, df = 111 p = **0.001***)			(χ^2 = 45.9, df = 48 p = 0.250)		
No formal education	29 (3.03)	26 (2.72)	82 (8.58)	8 (0.84)	52 (5.44)	77 (8.05)	20 (2.09)	27 (2.82)	90 (9.41)
Primary	46 (4.81)	83 (8.68)	139 (14.54)	23 (2.41)	144 (15.06)	101 (10.57)	18 (1.88)	69 (7.22)	181 (18.93)
Secondary	58 (6.07)	108 (11.30)	192 (20.08)	31 (3.24)	178 (18.62)	149 (15.59)	38 (3.97)	79 (8.26)	241 (25.21)
Higher education	31 (3.24)	47 (4.92)	115 (12.03)	21 (2.20)	112 (11.72)	60 (6.28)	18 (1.88)	46 (4.81)	129 (13.49)
Occupation	(χ^2 = 27.40, df = 16 p = 0.052)			(χ^2 = 105.09, df = 74 p < **0.001***)			(χ^2 = 55.47, df = 32 p = **0.008***)		
Student	42 (4.39)	88 (9.21)	157 (16.42)	28 (2.93)	134 (14.02)	125 (13.08)	25 (2.62)	59 (6.17)	203 (21.23)
Employed	68 (7.11)	86 (9.00)	181 (18.93)	24 (2.51)	209 (21.86)	102 (10.67)	23 (2.41)	92 (9.62)	220 (23.01)
Farmer/business	54 (5.65)	90 (9.41)	190 (19.87)	31 (3.24)	143 (14.96)	160 (16.74)	46 (4.81)	70 (7.32)	218 (22.80)
Monthly income (naira)	(χ^2 = 24.75, df = 24 p = 0.333)			(χ^2 = 162.71, df = 111 p < **0.001***)			(χ^2 = 62.01, df = 48 p = 0.078)		
None	77 (8.05)	124 (12.97)	280 (29.29)	45 (4.71)	216 (22.59)	220 (23.01)	60 (6.28)	103 (10.77)	318 (33.26)
<18,000	28 (2.93)	46 (4.81)	91 (9.52)	11 (1.15)	76 (7.95)	78 (8.16)	9 (0.94)	41 (4.29)	115 (12.03)

(*continued*)

Table II.

Variables	Knowledge scores			Attitudes scores			Practices scores		
	Poor *n* (%)	Moderate *n* (%)	Good *n* (%)	Poor *n* (%)	Moderate *n* (%)	Good *n* (%)	Poor *n* (%)	Moderate *n* (%)	Good *n* (%)
18,000–40,000	43 (4.50)	58 (6.07)	99 (10.36)	20 (2.09)	121 (12.66)	59 (6.17)	16 (1.67)	55 (5.75)	129 (13.49)
>40,000	16 (1.67)	36 (3.77)	58 (6.07)	7 (0.73)	73 (7.64)	30 (3.14)	9 (0.94)	22 (2.30)	79 (8.26)
Knowledge				($\chi^2 = 97.54$, df = 4 $p < \mathbf{0.001}$*)			($\chi^2 = 48.90$, df = 4 $p < \mathbf{0.001}$*)		
Poor	–	–	–	11 (1.15)	111 (11.61)	42 (4.39)	19 (1.99	62 (6.49)	83 (8.68)
Moderate	–	–	–	61 (6.38)	268 (28.03)	227 (23.75)	64 (6.69)	128 (13.39)	364 (38.08)
Good	–	–	–	11 (1.15)	59 (6.17)	166 (17.37)	11 (1.15)	31 (3.24)	194 (20.29)
Attitudes	($\chi^2 = 97.54$, df = 4 $p < \mathbf{0.001}$*)						($\chi^2 = 44.20$, df = 4 $p < \mathbf{0.001}$*)		
Poor	11 (1.15)	61 (6.38)	11 (1.15)	–	–	–	10 (1.05)	22 (2.30)	51 (5.33)
Moderate	111 (11.61)	268 (28.03)	59 (6.17)	–	–	–	52 (5.44)	135 (14.12)	251 (26.26)
Good	42 (4.39)	227 (23.75)	166 (17.37)	–	–	–	32 (3.35)	64 (6.69)	339 (35.46)
Practices	($\chi^2 = 48.90$, df = 4 $p < \mathbf{0.001}$*)			($\chi^2 = 44.20$, df = 4 $p < \mathbf{0.001}$*)					
Poor	19 (1.99)	64 (6.69)	11 (1.15)	10 (1.05)	52 (5.44)	32 (3.35)	–	–	–
Moderate	62 (6.49)	128 (13.39)	31 (3.24)	22 (2.30)	135 (14.12)	64 (6.69)	–	–	–
Good	83 (8.68)	364 (38.08)	194 (20.29)	51 (5.33)	251 (26.26)	339 (35.46)	–	–	–
Number of anti-malarial and adjunct drugs administered	($\chi^2 = 9.55$, df = 4 $p = \mathbf{0.049}$*)			($\chi^2 = 12.76$, df = 4 $p = \mathbf{0.012}$*)			($\chi^2 = 21.42$, df = 4 $p < \mathbf{0.001}$*)		
≤3	35 (3.66)	100 (10.46)	43 (4.50)	15 (1.57)	86 (9.00)	77 (8.05)	25 (2.62)	38 (3.97)	115 (12.03)
4–5	107 (11.19)	328 (34.31)	132 (13.80)	60 (6.28)	262 (27.41)	245 (25.62)	65 (6.80)	135 (14.12)	367 (38.39)
≥6	22 (2.30)	128 (13.40)	61 (6.38)	8 (0.84)	90 (9.41)	113 (11.82)	4 (0.42)	48 (5.02)	159 (16.63)
Healthcare workers' practices	($\chi^2 = 3.46$, df = 4 $p = 0.484$)			($\chi^2 = 15.44$, df = 4 $p = \mathbf{0.004}$*)			($\chi^2 = 5.10$, df = 4 $p = 0.277$)		
Poor	5 (0.52)	30 (3.14)	12 (1.26)	2 (0.21)	25 (2.62)	20 (2.09)	9 (0.94)	9 (0.94)	29 (3.03)
Moderate	8 (0.84)	43 (4.50)	15 (1.57)	14 (1.46)	25 (2.62)	27 (2.82)	7 (0.73)	16 (1.67)	43 (4.51)
Good	151 (15.79)	483 (50.52)	209 (21.86)	67 (7.00)	388 (40.59)	388 (40.59)	78 (8.16)	196 (20.50)	569 (59.52)

Note: * = statistically significant at $p < 0.05$; χ^2 = Pearson's chi-square; df = degree of freedom

[26, 27]. Combinations of all these factors help enable females to gain more understanding through better practices on appropriate management of the disease from healthcare workers who counselled them when they visited the PHC facilities for medications or as caregivers for children when ill. This was consistent with the findings of a study conducted in Ghana by Appiah-Darkwah and Badu-Nyarko [28]. The significant associations in the respondents' knowledge and attitudes based on their age categories were similar to the outcomes of a related study conducted in Tanzania [29]. Furthermore, the significant associations in attitudes of respondents based on their levels of education, occupation and monthly income were consistent with the results of a study reported by Kigodi and Komanya [29]. These further confirmed the disease was more common among rural settlers, as the majority of them were peasant farmers with less financial strength compared to those in the urban areas who were mostly salary earners as reported by Oyindamola *et al.* [30]. However, to the best of our current knowledge, no further comparison can be made to present significant associations between study variables due to a lack of published related data and analysis.

The significant low negative correlations between patients' age and KAP scores on uncomplicated malaria showed a likely decrease in KAP with increased age of the patients. However, this was not the same as a study conducted by Vodouhe *et al.* [31] that reported respondents <19 years old were more likely not to adhere to medications. Furthermore, the negative correlations between respondents' knowledge and attitudes with monthly earnings implied that increased earnings had negative impacts on the respondents' knowledge and attitudes. However, the reported positive correlations between practices with financial strength signified the possibility that the respondents could afford to pay for their medications during disease management time with ease compared to those earning less, or those not on any sources of income [32, 33]. On a general note, the observed strength of correlation within patients' KAP scores (Table IV) might help explain the interdependency of the variables on each other in achieving the desired therapeutic outcomes during disease management, as supported by another study conducted in Zambia [34], although Gumucio *et al.* [35] reported low or no connection between attitudes and practices.

The outcomes of multinomial logistic regression were in agreement with similar previous studies that reported socio-demographic characteristics of respondents as likely predictors of

Independent variables	Knowledge		Attitudes		Practices	
	Rho	*p*-value	Rho	*p*-value	Rho	*p*-value
Age (years old)	−0.29	**<0.001****	−0.23	**<0.001****	−0.25	**0.030***
Monthly income (naira)	−0.16	0.068	−0.36	**<0.001****	0.28	**0.036***
Number of anti-malarial and adjunct drugs administered	0.04	0.271	0.06	0.077	0.02	0.520

Note: Rho = Spearman's rank correlation coefficient; * = statistically significant at $p < 0.05$; ** = statistically significant at $p < 0.001$

Table III. Correlations between patients' continuous independent variables with KAP scores ($N = 956$)

Variables	Knowledge	Attitudes	Practices
Knowledge	1	0.34[a*]	0.39[b*]
Attitudes	0.34[a*]	1	0.29[c*]
Practices	0.39[b*]	0.29[c*]	1

Note: [a] p-value < 0.001*; [b] p-value < 0.001*; [c] p-value < 0.001*; * correlation was significant at the $p < 0.001$ level

Table IV. Correlations between dependent variables scores ($N = 956$)

Table V.
Multinomial logistic regression between patients' independent variables and KAP scores ($N = 956$)

Effect	Knowledge scores				Attitudes scores				Practices scores			
	MFC	LRT			MFC	LRT			MFC	LRT		
	−2LL	χ^2	df	*p*-value	−2LL	χ^2	df	*p*-value	−2LL	χ^2	df	*p*-value
Intercept	1069.30	0	0	–	994.73	0	0	–	992.44	0	0	–
Gender	1070.70	1.40	1	0.237	1001.19	6.46	1	**0.011***	992.52	0.09	1	0.771
Age (years)	1091.51	22.21	3	**<0.001****	1001.00	6.26	3	0.099	992.88	0.45	3	0.930
Marital status	1070.53	1.23	2	0.542	995.13	0.40	2	0.821	996.04	3.60	2	0.165
Education level	1080.25	10.95	3	0.012*	1000.31	5.58	3	0.134	993.01	0.58	3	0.902
Occupation	1072.92	3.62	2	0.164	999.80	5.07	2	**0.049***	993.25	0.81	2	0.668
Monthly income (naira)	1071.60	2.30	3	0.512	1004.81	10.08	3	**0.018***	997.72	5.28	3	**0.043***
Knowledge					1011.29	16.56	2	**<0.001****	1020.26	27.82	2	**<0.001****
Attitudes	1079.22	9.92	2	**0.007***	–	–	–	–	1021.73	29.29	2	**<0.001****
Practices	1094.04	24.74	2	**<0.001****	1023.94	29.21	2	**<0.001****	–	–	–	–
Number of anti-malarial and adjunct drugs administered	1072.11	2.80	2	0.246	996.20	1.47	2	0.480	997.72	5.29	2	**0.041***
Healthcare workers' practices	1070.77	1.46	2	0.481	995.83	1.10	2	0.578	993.08	0.64	2	0.726

Note: − 2LL = −2 log-likelihood of reduced model; χ^2 = chi-square; LRT = likelihood ratio tests; MFC = model fitting criteria; df = degree of freedom; * = statistically significant at $p < 0.05$; ** = statistically significant at $p < 0.001$

Table VI.
Details of multinomial logistic regression between patients' independent variables and KAP categories (N = 956)

Variables	Knowledge scores Exp(β) (95% CI)	*p*-values	Attitudes scores Exp(β) (95% CI)	*p*-values	Practices scores Exp(β) (95% CI)	*p*-values
Intercept	–	0.133		0.781		**<0.001****
Gender						
Male	0.80 (0.45–1.55)	0.251	0.96 (0.71–1.28)	**0.006***	0.97 (0.56–1.48)	0.771
Female	Reference	–	–	–	–	–
Age (years)						
<18	0.31 (0.17–0.57)	**<0.001****	0.57 (0.31–1.06)	0.076	0.97 (0.50–1.87)	0.930
18–29	0.46 (0.28–0.70)	**0.002****	1.10 (0.66–1.85)	0.712	1.14 (0.67–1.92)	0.631
30–41	1.03 (0.70–1.49)	0.898	0.98 (0.66–1.47)	0.934	1.08 (0.73–1.60)	0.701
>41	Reference	–	–	–	–	–
Marital status						
Never married	1.02 (0.63–1.64)	0.948	1.02 (0.69–1.50)	0.589	0.98 (0.59–1.61)	0.926
Married	0.83 (0.57–1.20)	0.324	0.88 (0.54–1.42)	0.938	1.40 (0.95–2.10)	0.093
Divorced/widowed	Reference	–	–	–	–	–
Education level						
No formal education	2.36 (1.24 – 4.48)	**0.009***	0.76 (0.39 –1.47)	0.409	1.13 (0.58 – 2.21)	0.719
Primary education	2.11 (1.32–37.00)	**0.002****	1.25 (0.76–2.05)	0.375	0.92 (0.57–1.50)	0.743
Secondary education	1.58 (1.04–2.40)	**0.032***	0.88 (0.57–1.37)	0.575	0.96 (0.62–1.48)	0.839
Higher education	Reference	–	–	–	–	–
Occupation						
Student	1.51 (0.93–2.45)	0.096	1.15 (0.70–1.88)	0.586	0.84 (0.51–1.40)	0.509
Employed	0.93 (0.62–1.40)	0.731	1.63 (1.06–2.50)	**0.025***	1.09 (0.71–1.68)	0.703
Farmer/business	Reference	–	–	–	–	–

(*continued*)

Table VI.

Variables	Knowledge scores Exp(β) (95% CI)	*p*-values	Attitudes scores Exp(β) (95% CI)	*p*-values	Practices scores Exp(β) (95% CI)	*p*-values
Monthly income (naira)						
None	0.74 (0.41–1.32)	0.305	0.70 (0.38–1.30)	0.260	1.42 (0.83–2.45)	0.201
<18,000	0.76 (0.43–1.34)	0.334	0.46 (0.25–0.84)	**0.012***	1.42 (0.78–2.61)	0.255
18,000–40,000	1.00 (0.60–1.65)	0.985	0.92 (0.53–1.60)	0.764	2.00 (1.08–3.72)	**0.028***
>40,000	Reference	–	–	–	–	–
Knowledge						
Poor	–	–	2.40 (1.55–3.73)	**<0.001****	2.47 (1.67–3.64)	**<0.001****
Moderate			1.14 (0.83–1.58)	0.419	1.96 (1.40–2.74)	**<0.001****
Good	–	–	Reference	–	–	–
Attitudes						
Poor	1.00 (0.60–1.68)	0.989	–	–	2.09 (1.23–3.57)	**0.007***
Moderate	1.56 (1.16–2.11)	**0.003****	–	–	2.38 (1.72–3.29)	**<0.001****
Good	Reference	–	–	–	–	–
Practices						
Poor	2.04 (1.28–3.26)	**0.003****	2.14 (1.29–3.55)	**0.003****	–	–
Moderate	2.10 (1.52 – 2.91)	**<0.001****	2.43 (1.69–3.49)	**<0.001****	–	–
Good	Reference	–	–	–	–	–
Number of anti-malarial and adjunct drugs administered						
≤3	0.84 (0.60–1.18)	0.320	1.24 (0.87–1.76)	0.238	1.55 (1.06–2.27)	**0.025***
4–5	0.69 0.44–1.07)	0.095	1.11 (0.71–1.74)	0.653	1.49 (0.93–2.40)	0.097
≥6	Reference	–	–	–	–	–
Healthcare workers' practices						
Poor	0.81 (0.43–1.52)	0.508	1.19 (0.68–2.07)	0.547	1.09 (0.62–1.92)	0.767
Moderate	1.30 (0.77–2.20)	0.334	1.35 (0.70–2.6)	0.375	1.29 (0.68–2.45)	0.443
Good	Reference	–	–	–	–	–

Note: * = statistically significant at $p < 0.05$; ** = statistically significant at $p < 0.005$

their KAPs [36], but they were in contrast with a report of Simsek and Kurcer [37]. The details of the result showed that male patients were less likely to possess good attitudes on uncomplicated malaria and its management compared to females. Moreover, although the effects on knowledge and practices were insignificant (Table VI), they were in agreement with previous studies conducted in the southern part of Nigeria which indicated the likelihood of females taking better care of their health than their male counterparts [38]; this, however, contrasted with another study conducted in Ethiopia and India, which reported males were more likely to be knowledgeable than females [39, 40]. The positive influence of age on respondents' knowledge on the disease and its management agreed with other studies conducted among community members in Ethiopia which reported age as a factor that influenced respondents' knowledge on malaria and on mosquito-biting behaviours [40]. The education level of the respondents was also a predictor of their knowledge on the disease and its management, and this was consistent with previous studies [40, 41], but in contrast with reports of Das and Ravindran [39]. Furthermore, the employed had been more likely to exhibit positive attitudes during the management of the ailments, which might be linked to the possible influence of a monthly income. This study showed that higher salary earners were likely to possess better attitudes and practices with regard to the disease. This might be linked to the issue of affordability, because poor people who are the most affected by the disease [32, 33, 42] tend to spend less money during treatment because they cannot afford the high cost of medication based on their financial strengths compared to those with a better source of income who tend to seek better treatment when sick, as cost implications are not an issue as they can afford to pay. Poor practices by respondents who were prescribed and dispensed a large number of drugs were not unexpected, as it could be the case that they may not be able to understand all the information given such as about the drugs and when to take them, as they had not had any form of medical training [43, 44]. This implied that prescribing fewer drugs, in addition to appropriate patients' education, might help in shaping their behavioural activities which might further influence their attitudes and how they carry out medication practices for a desired therapeutic outcome.

Conclusion

The overall outcomes of the study showed significant differences and relationships between the variables, and the overall outcomes of multinomial logistic regression analysis indicated that patients' knowledge on uncomplicated malaria was predicted from age, highest level of education, attitudes and practices, while their attitudes were predicted by gender, occupation, monthly income, knowledge and practices. Their practice with regard to the treatment of malaria was significantly predicted by their monthly incomes, knowledge, attitudes and number of anti-malarial and adjunct drugs administered.

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