Caregivers' health literacy and management of presumptive malaria in children under five: A cross-sectional study from Ghana

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Research Article

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Abstract

Background: Low health literacy is associated with poor health status, poor self-management, and poor use of healthcare. This study assessed the associations of caregivers' health literacy, incidence of malaria in children, use of healthcare and associated household costs in the management of malaria in children under five years.

Method: This is a cross-sectional study with data (N=1270) collected in November - December 2017. We used hierarchical cluster analysis to generate health literacy profiles of caregivers based on responses to the Health Literacy Questionnaire (HLQ). We run logistic regression models and generalized linear models with incidence of malaria, desirable use of healthcare and household costs as dependent variables, and health literacy profiles and other socio-demographic and access variables as covariates.

Results: We generated 7 caregiver health literacy profiles with Profile 1 characterised by overall high scores, Profile 4 by overall moderate scores and Profile 7 by overall low scores on nine health literacy dimensions. With Profile 4 as reference, children of caregivers in Profile 7 had 69% increased odds of an incident of malaria and no difference in odds for those of Profile 1. Profiles 1 and 7 both had reduced odds of desirable use of healthcare, 26% and 58% respectively. Caregivers in Profile 1 incurred higher spending, while caregivers in Profile 7 incurred lower spending on management of malaria in children as compared to Profile 4.

Conclusions: Our findings suggest that general health literacy of caregivers as measured by the HLQ may not be influential in incidence of malaria, desirable use of healthcare and household costs in the management of malaria in children under five years in Ghana where malaria is highly prevalent. The use of hierarchical cluster analysis was feasible in the analysis of comprehensive health literacy and facilitated analysis on use of healthcare and associated costs.

Background

Health literacy has become a topic of interest for researchers, health practitioners and policy makers in diverse disciplines. This is because the concept serves as a guide to identify, understand, explain and address individual as well as group differences in various health outcomes(1). Health literacy is the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and apply information in ways which promote and maintain good health(2). Health literacy is influenced by personal, situational and societal determinants, and in turn influences the use of healthcare and related costs(1). It impacts health behaviour and health status, as well as empowerment, sustainability and equity(1). Regarding health behaviour, Maindal et al showed that among diabetic patients, there were higher odds of physical inactivity and unhealthy dietary habits among patients with challenges in health literacy than otherwise(3). Another study showed that among patients with cardiovascular diseases, there was a positive association between health literacy and self-reported health and the association was stronger for physical health than mental health(4).

In general, inadequate health literacy is associated with higher needs for assistance in disease management(3), higher use of medical service among the aged(5, 6) and other minority population groups (7). Inadequate health literacy is likely to result in higher medical costs due to poorer health and frequent use of services, such as visits at the emergency unit(8). Haun et al showed that a group of veterans with marginal and inadequate health literacy incurred $143 million dollars more on medical and pharmacy expenses over a three-year period than a comparable group of veterans with adequate health literacy(9). In addressing challenges in health literacy, the focus is often on how patients manage a particular health issue.

This study focused on malaria in children under five years in a peri-urban setting of a malaria endemic country. Over the years, there has been a global reduction in the malaria burden yet, malaria remains a global public health problem. In 2018, the estimated malaria cases worldwide was 228 million compared to 251 million in 2010(10). The scourge of malaria strikes hardest in Sub-Saharan Africa and in 2018 about 93% of the malaria cases were traceable to this region(10). Children under five years accounted for 67% of global malaria deaths (405,000) in 2018(10). The World Health Organization

(WHO) recommends testing and confirmation of all suspected malaria cases before treatment with anti-malaria drugs for appropriate treatment and to avoid spread of drug resistance (11) yet presumptive treatment of malaria is still common especially in rural underserved areas.

Not only is malaria a public health problem, it also poses a significant economic burden at individual, household, and societal levels especially in developing countries (12–16). It is estimated that malaria is accountable for a 'growth penalty' of 1.3% per annum in some African countries and, when compounded, this penalty results in considerable difference in the GDP between countries with or without malaria(17). In the long run, this may severely retard the economic growth of the entire region(17). A study on economic costs of malaria in children under five years in three Sub-Saharan African countries reported the costs for an episode of malaria to range from US$7.99 to US$229.24 in Ghana, from US$5.2 to US$137.74 in Tanzania and from US$11.24 to US$287.81 in Kenya(18).

In Ghana, malaria spurs on as one of the leading causes of morbidity and mortality and in 2018, the country recorded the highest absolute annual increase in malaria cases in the Sub-Saharan African region(10). In 2018, malaria in Ghana accounted for 4% of the global disease burden of malaria and 7% of malaria disease burden in West Africa(19). Despite progress, malaria remains a problem; in 2018 13% of deaths in children under five years was due to malaria(20).

The economic burden of malaria may also result in catastrophic costs to households. For instance, a study in Ghana showed that about 5% of respondents spent more than 5% of their annual income on the treatment of malaria, which was described as catastrophic cost(15). Tawiah et. al reported average cost to households in Ghana to be US$14.61 per episode of malaria(21). Although the National Health Insurance Scheme (NHIS) was introduced in 2003 to alleviate the economic burden of healthcare including malaria treatments especially for poorer households(22) other factors such as low levels of active subscription and lack of proximity to health facilities reduces the functionality of this insurance coverage. For example, Fenny et al reported that about 15% of insured patients chose to use informal health care over formal health care as a result of lack of proximity to health facilities(14). In addition, it is reported that unfamiliarity with insurance validity and renewable times also contribute to low active enrolment of the Ghana NHIS(23), and thus low protection against financial costs of malaria.

Health literacy may impact on health behaviour, thus influences preventive measures against malaria as well as appropriate treatment seeking choices, which could consequently affect malaria incidence, care seeking pathways and associated treatment costs. However, not much research has been conducted on how health literacy levels influence incidence of disease, health behaviours and associated costs in disease management in Sub-Saharan Africa. Specifically, no study has been done on health literacy, management of malaria and associated costs. We set to explore the relationship between health literacy levels of caregivers with children under five years, the incidence of presumptive malaria in their children, their use of health care and total household cost of presumptive malaria in their children under-fives in peri-urban Kumasi, Ghana

Method

Study Area

This study was conducted in two districts: Ejisu-Juaben and Kwabre-East, in the Ashanti Region, Ghana. Both districts are farming communities with most of the women engaged in trading of farm products.

Study Design and Sampling strategy

Cross sectional survey data was collected in November - December 2017 for 1270 caregivers. However, we lost responses for 36 caregivers while synchronizing data from the data collection software. The study adopted multi-stage random sampling (sub-districts, communities, households) to select caregivers and details of the sampling strategy is explained in another paper on the cultural adaptation of the Health Literacy Questionnaire in Asante-Twi(24). The sampling process

resulted in the selection of 18 communities, 9 from each of the selected districts. One of the communities was excluded from Kwabre-East district for logistic reasons.

Data Material (or Data Collection)

We used two questionnaires, the Health Literacy Questionnaire (HLQ) and a malaria specific questionnaire, both in the local language (Asante-Twi)(24). The HLQ covers nine conceptually distinct areas (scales) of health literacy including:

1. Feeling understood and supported by healthcare providers
2. Having sufficient information to manage health
3. Actively managing my health
4. Social support for health
5. Appraisal of health information
6. Ability to actively engage with healthcare providers
7. Navigating the healthcare system
8. Ability to find good health information
9. Understand health information well enough to know what to do.

The scales are based on 44 question items. The question items of the first part (scales 1–5) are scored on a 4-point Likert scale (Strongly disagree, Disagree, Agree, Strongly agree), while a 5-point Likert scale is used for the second part (scales 6–9), which rates the ability to perform various tasks (cannot do, very difficult, difficult, easy and very easy).

The malaria questionnaire included questions on recent episode of malaria in under five-year olds within 6 months, choice of treatment pathway and associated household costs. Other questions covered socio-demographic characteristics of the respondents.

Variables of Interest

Three dependent variables were of interest in this study; incidence of presumptive malaria in children under five, caregivers' desirable use of health care and total household costs of malaria in children under five years. Associations of each of the dependent variable was measured in relation to the independent variable of primary interest; health literacy of caregivers (see more details in the analysis section) and other covariates.

Dependent variables

Incidents of presumptive malaria were self-reported by the caregivers and here, we asked respondents to report on an episode of presumptive malaria within the past 6 months from the data collection date.

We categorised use of health care as resorting to either a desirable or an undesirable health seeking pathway. In the malaria questionnaire, caregivers were asked their sequence of choice of health care on an incident of presumptive malaria. Thus, on an incident of malaria, "what was your first treatment source", then, "what next did you do if your child did not get better". This line of question ended on the fourth treatment choice, which mapped out a 4-sequence health seeking pathway as shown in the supplementary Fig. 1. We defined a desirable pathway as resorting to the use of formal health care as at least second treatment choice, and otherwise undesirable. Formal health care in this study refers to both public and private health facilities. The definition for desirable pathway was based on the Ministry of Health guideline for treating malaria which recommends using formal health care as the first source of healthcare(25). We assumed that most respondents used some form of first aid as first treatment choice when a child had fever which is a common symptom of malaria, thus our definition of a desirable approach rested on the first two treatment choices. We further divided undesirable care seeking into two groups: Undesirable 1 where caregivers resorted to late use (third or fourth choice) of formal healthcare in the treatment

seeking pathway and Undesirable 2 where caregivers resorted only to informal treatment including over the counter medication. We did this to assess the difference in costs for the two types of undesirable care pathways.

Total household cost was the accumulation of costs across the 4-sequence health seeking pathway and it included both direct and indirect cost per episode for managing malaria in children under five years. The direct costs included consultation and medication costs. The indirect costs consisted of the value of days lost to care. Reported days lost to care was valued using the respondents' self-reported income.

We collected cost data in Ghana Cedis and converted to US Dollars based on 2017 currency conversion rate (GH 1,00 = USD 0,22).

Independent Variable of interest

Our primary variable of interest was health literacy. First we calculated the mean score for each of the nine health literacy dimensions, details are provided in another paper (24). To have a combined measure of health literacy, we used hierarchical cluster analysis, to create health literacy profiles of respondents, see details in the data analysis section below. The health literacy profiles were presented as dichotomous variables indicative of whether a caregiver is within a particular profile or not. We used these as independent variables.

Covariates

Paasche Orlow and Wolf's causal model on health literacy(26) guided the selection of covariates which were grouped into socio-demographic and access variables. The socio-demographic variables included age of the child, sex of respondent, years of schooling, respondents' reported income, and employment status (both indicative of ability to pay). Access variables included reported National Health Insurance Scheme (NHIS) membership and distance to health facility.

Data Analysis

Data was analysed using STATA version 15. Using hierarchical cluster analysis, with Ward's linkage as the clustering method and the Squared Euclidean distance as distance measure, health literacy profiles were created based on the nine health literacy scales. The cluster analysis was performed on the standardized health literacy scores for each scale using z-scores to account for the differences in score ranges among scales. The analysis yielded seven distinct profiles where each respondent could only be identified in one profile. These profiles were described based on their average scores for each health literacy scale and later, a description of their socio-demographic characteristics. Representing the most dominant profile among respondents, and with moderate scores across the nine scales, Profile 4 was selected as the reference group throughout the analysis.

Using logistic regression, we analysed the associations between caregivers' health literacy profiles and the incidence of malaria in their children under five, while adjusting for the socio-demographic covariates. This analysis included the total study sample (n = 1234).

The subsequent analysis focused on caregivers of children with an incident of malaria (n = 588), their use of healthcare and total household costs for malaria given their health literacy profiles. Use of health care and mean total household costs by respondent characteristics are presented using descriptive statistics. For binary variables, we tested for equal means using the t-test statistic and for ordinal or categorical variables, we used the ANOVA test. We used Spearman's correlation coefficient to assess the correlation between the health literacy scales and desirable use of healthcare. To minimize the effect of outliers on the estimated relationships, we trimmed the cost data at the 5 percent tails.

We used a logistic regression model to assess the association between desirable use of health care and health literacy profiles, while adjusting for socio-demographic covariates as well as access covariates.

We applied generalized linear model procedures with a log link function and Gamma distribution to measure the association between total household cost and health literacy profiles, as total cost (dependent variable) is not normally distributed. We

adjusted for socio-demographic covariates as well as reported NHIS membership and whether the chosen treatment strategy was desirable.

P-values less than 0.05 was used as threshold for statistical significance.

Findings

Respondent characteristics

Most respondents (98%) were female caregivers and the majority (77%) of respondents were within the ages of 25–44 years. Three of four (75%) had less than 9 years of education and 60% of respondents were employed. About 9% of respondents spoke English at home and otherwise a local language. Valid subscription to the National Health Insurance Scheme (NHIS) was reported by 82% of respondents.

Health literacy profiles

In Table 1, we described the average mean scores of the 9 health literacy scales across the 7 health literacy profiles.

Table 1 Average health literacy scales mean scores among health literacy profiles

		Part 1 (4-point Likert scale response)					Part 2 (5-point Likert scale response)			
Profiles	N (%)	1. Healthcare provider support	2. Having sufficient information	3. Actively managing health	4. Having social support	5. Critical appraisal of information	6. Actively engaging with providers	7. Navigating the health system	8. Finding health information	9. Understanding health information
Profile 1	34 (2.8%)	3.26	3.18	3.25	3.11	3.18	4.42	4.23	4.15	4.31
Profile 2	330 (26.7%)	2.87	2.98	3.00	2.92	2.94	4.01	3.87	3.88	3.66
Profile 3	198 (16.0%)	2.56	2.76	2.85	2.77	2.73	3.65	3.53	3.50	3.51
Profile 4	394 (31.9%)	2.26	2.51	2.62	2.57	2.45	3.23	3.18	3.24	3.28
Profile 5	132 (10.7%)	2.08	2.30	2.44	2.38	2.25	2.89	2.84	2.97	3.07
Profile 6	117 (9.5%)	1.94	2.14	2.20	2.33	2.08	2.65	2.61	2.64	2.76
Profile 7	29 (2.4%)	1.78	1.81	1.71	2.23	1.65	2.38	2.10	2.02	2.34

Health literacy scale scores are colour coded from highest (blue) to lowest (red) within each part of the HLQ.

The hierarchical cluster analysis produced seven distinct clusters and after discussions on the analysis between two of the authors, all the clusters were kept because each covered a good number of respondents for the analysis. Caregivers within profile 1 (3%) scored high across all nine scales and Profile 7 (2%) scored relatively low across all scales. In between these profiles, are profiles with moderate to high scores or moderate to low scores. Most respondents (32%) fell within profile 4 with moderate scores across scales but better at actively managing their health. Profile 5 had moderate to low scores with least average score in health provider support. Profiles 4, 5, 6, and 7 all had major challenges with health provider support. A detailed description of profiles and their socio-demographic characteristics are presented in the supplementary table 1 in the appendix.

Association between caregivers' health literacy profiles and incidence of malaria in children

Table 2 presents the adjusted and unadjusted results of the logistic regression analysis on the associations between the health literacy profiles and incidence of malaria in children under five years. After adjusting for covariates, caregivers in profile 7 had increased odds of 69%, thus there is 69% higher likelihood for a child of a caregiver within this profile, to have

an incident of malaria compared to Profile 4. Similarly, caregivers in Profile 6 had 44% increased odds for their children to have an incident of malaria as compared to those in Profile 4. Profile 3 and 5 showed decreased odds of 12% and 10% respectively as compared to Profile 4. However, none of the associations were statistically significant. Supplementary Table 2 in the appendix is a descriptive table on caregivers' health literacy profiles and the incidence of malaria in children.

Table 2 Logistic regression analysis on the associations between incidence of presumptive malaria in children and caregivers' health literacy profiles

	Unadjusted analysis		Adjusted analysis (all covariates)	
Profiles	OR	[95% Conf.Interval]	AOR	[95% Conf.Interval]
1.	1.12	0.55 ; 2.25	1.00	0.44 ;2.28
2.	1.12	0.83 ; 1.50	1.04	0.75 ;1.43
3.	0.88	0.62 ; 1.24	0.88	0.60 ;1.29
4.	Ref.		Ref.	
5.	0.88	0.59 ; 1.30	0.90	0.57 ;1.43
6.	1.14	0.75 ; 1.72	1.44	0.88 ;2.38
7.	1.38	0.64 ; 2.94	1.69	0.70 ;4.11

Note: all covariates here include socio-demographic variables: age of the child, sex of respondent, years of schooling, employment status and reported income.

Associations between health literacy profiles and desirable use of health care

Table 3 shows the use of healthcare by characteristics of caregivers with children who had an incident of malaria. Overall, 58% of caregivers resorted to a desirable treatment seeking pathway. In summary, female caregivers from Ejisu-Juaben, who spoke English at home, within the ages of 45-69 years, employed, with no long term illness, with a child between 37 to 48 months and reported having a valid NHIS subscription had a higher chance of choosing desirable pathway to seeking treatment. Desirable use of healthcare increased with increase in years of schooling and was most frequent for health literacy Profiles 3 (66%) and 1 (65%) and least frequent for Profile 7 (31%).

Table 3 Use of health care by caregivers' characteristics

Variables	All	Use of Health Care *Desirable	%	*Undesirable	%	p-value
All	588	343	58	245	42	
District				0.012		
Ejisu_Juaben	312	197	63.1		115	36.9
Kwabre_East	276	146	52.9		130	47.1
Gender				0.234		
Female	570	334	58.6		236	41.4
Male	18	9	50.0		9	50.0
Age				0.707		
15-24 years	126	77	61.1		49	38.9
25-44 years	443	254	57.3		189	42.7
45-69 years	16	10	62.5		6	37.5
Education				0.171		
≤ 9years	441	249	56.5		192	43.5
>9 ≤ 12 years	134	84	62.7		50	37.3
Above 12 years	13	10	76.9		3	23.1
Employment				0.201		
Employed	355	212	59.7		143	40.3
Unemployed	233	131	56.2		102	43.8
Longterm illness				0.394		
Yes	59	33	55.9		26	44.1
No	529	310	58.6		219	41.4
Language				0.038		
English	53	37	69.8		16	30.2
Local	535	306	57.2		229	42.8
Age of child (months)				0.251		
0-12 months	95	56	58.9		39	41.0
13-24 months	143	86	60.1		57	39.9
25-36 months	121	66	54.5		55	45.4
37-48 months	99	65	65.7		34	34.3
49-60 months	85	51	60.0		34	40.0
61-71 months	31	13	41.9		18	58.1
NHIS				<0.01		
Yes	481	297	61.7		184	38.2
No	107	46	43.0		61	57.0
Health literacy profiles						0.288
Profile 1	17	11	64.7	6	35.3	

Profile 2	165	97	58.8	68	41.2
Profile 3	87	57	65.5	30	34.5
Profile 4	186	106	57.0	80	43.0
Profile 5	58	32	55.2	26	44.8
Profile 6	59	35	59.3	24	40.7
Profile 7	16	5	31.2	11	68.7

Note: Desirable Healthcare refers to the timely use of formal healthcare as at least the second treatment option for treatment of malaria in children under five years, otherwise, undesirable.

Prior to assessing the associations between the seven profiles and desirable use of healthcare, we investigated the association between the nine health literacy scales and desirable use of healthcare. Spearman's correlation showed a positive association between the nine health literacy scales and desirable use of health care, as desirable use of healthcare increased with increasing levels of health literacy. However, the correlation coefficients were small and only statistically significant for scale 9, Understanding health information (ρ= 0.08; p-value=0.04).

Table 4 shows the results from the logistic regression analysis that assessed the association between health literacy profiles and use of health care. From the bivariate analysis, caregivers in profile 7 had reduced odds of using desirable healthcare (odds ratio (OR) 0.34 (0.11; 1.03)), with reference to profile 4. Thus, respondents with health literacy profile 7 were 66% less likely to choose a desirable treatment strategy than the most common profile (Profile 4). Profile 3 had the highest increased odds of using desirable healthcare (1.43 (0.84; 2.43)). The first adjusted model included socio-demographic covariates and the second included both socio-demographic and access covariates. Both adjustments decreased the odds of using desirable healthcare among the profiles except for Profiles 6 (1.17 (0.60, 2.31)) and Profiles 7 (0.42 (0.13; 1.41). All other things being equal, both Profile 1 and 7 had decreased odds of using desirable healthcare as compared to Profile 4, with greater decreased odds in Profile 7 (58%) than Profile 1 (26%). Profile 3 maintained increased odds of using desirable healthcare across the three models, although the increased odds declined in both adjustments. Yet, the association was not statistically significant for any Profile.

Table 4 Relationship between health literacy profiles and desirable use of healthcare for treating malaria in children under 5

	Unadjusted analysis		Adjusted analysis (socio-demographic covariates)		Adjusted analysis (all covariates)	
Profiles	OR	[95% Conf.Interval]	AOR	[95% Conf.Interval]	AOR	[95% Conf.Interval]
1.	1.38	0.49 ; 3.90	1.01	0.34 ; 2.96	0.74	0.23 ; 2.40
2.	1.08	0.70 ; 1.65	1.08	0.70 ; 1.66	0.99	0.62 ; 1.58
3.	1.43	0.84 ; 2.43	1.34	0.78 ; 2.28	1.10	0.62 ; 1.96
4.	Ref.		Ref.		Ref.	
5.	0.93	0.51 ; 1.68	0.83	0.45 ; 1.51	0.88	0.45 ; 1.70
6.	1.10	0.61 ; 2.00	1.08	0.58 ; 2.00	1.17	0.60 ; 2.31
7.	0.34	0.11 ; 1.03	0.34	0.11 ; 1.01	0.42	0.13 ; 1.41

Note: socio-demographic covariates include age of the child, sex of respondent, years of schooling, employment status and reported income. All covariates include reported NHIS subscription and distance to health facilities in addition to the socio-demographic covariates.

Association between health literacy and total household cost of treatment

On average total household cost associated with malaria treatment was USD 20.29 with an average direct cost of USD 9.54 and indirect cost of USD 11.10. Table 5 shows the mean total household cost for malaria in children under five years by the socio-demographic characteristics and health literacy profiles of their caregivers.

Total household costs were higher among older caregivers, caregivers with more than 12 years of schooling, unemployed caregivers, caregivers without long term illness, caregivers who spoke English at home, caregivers with children within 25-36 months age group, caregivers who chose desirable treatment pathway and caregivers without National health insurance. With regard to the health literacy profiles, total household cost for caregivers in Profile 1 (USD 24.77) was higher than all other profiles with least cost in Profile 6 (USD 17.93). The mean difference in the total household costs for all the groups were not statistically significant except for use of health care (desirable and undesirable).

Table 5 Mean household costs (USD) by respondent characteristics and health literacy profiles

Variables	N	Direct Cost Mean (SD)	Indirect Cost Mean (SD)	Total cost Mean (SD)	p-value
Total sample	**588**	**9.54 (10.12)**	**11.10 (17.42)**	**20.29(20.63)**	
District					0.137
Ejisu_Juaben	312	9.20 (9.99)	10.44 (16.47)	19.41 (19.37)	
Kwabre_East	276	9.95 (10.27)	11.84 (18.44)	21.33 (22.02)	
Gender					0.426
Female	570	9.43 (9.98)	11.18 (17.54)	20.26 (20.72)	
Male	18	13.43 (14.16)	8.36 (13.23)	21.27 (17.59)	
Age					0.683
15-24 years	126	9.93 (10.48)	12.59 (22.42)	21.65 (26.35)	
25-44 years	443	9.29 (9.85)	10.74 (15.96)	19.80 (18.79)	
45-69 years	16	10.94 (14,29)	9.44 (12.44)	21.17 (21.15)	
Education					0.408
≤ 9 years	441	10.08 (10.29)	11.14 (18.25)	20.92 (21.48)	
>9 ≤ 12 years	134	7.72 (9.37)	10.68 (14.39)	18.13 (17.59)	
Above 12 years	13	9.66 (10.10)	14.13 (17.93)	21.16 (19.69)	
Employment					0.026
Employed	355	9.23 (10.00)	9.67 (14.54)	18.96 (19.05)	
Unemployed	233	10.03 (10.21)	13.27 (20.92)	22.43 (22.83)	
Longterm illness					0.222
Yes	59	9.57 (9.52)	8.48 (12.95)	18,30 (15,58)	
No	529	9.53 (10.19)	11.39 (17.84)	20,51 (21,12)	
Language					0.221
English	53	10.65 (9.33)	11.29 (16.22)	22.43 (19.73)	
Local	535	9.43 (10.19)	11.08 (17.55)	20.08 (20.72)	
Age of child (months)					0.557
0-12	95	8.91 (10.73)	12.07 (16.62)	20.20 (20.69)	
13-24	143	9.63 (9.83)	11.66 (17.02)	21.18 (19.81)	
25-36	121	10.30 (10.64)	11.00 (17.58)	21.37 (22.42)	
37-48	99	9.43 (9.64)	11.27 (20.26)	20.70 (23.23)	
49-60	85	10.00 (10.96)	11.02 (18.74)	19.93 (19.76)	
61-71	31	7.08 (6.74)	6.40 (7.74)	13.49 (9.61)	
Use of health care					<0.01
Desirable	343	11.70 (11.04)	10.48 (17.32)	22.76 (21.33)	
Undesirable	245	6.62 (7.84)	11.54 (17.51)	16.96 (19.18)	
NHIS membership					0.069
Yes	481	9.68 (9.89)	10.46 (16.66)	19.66 (19.80)	
No	107	8.94 (11.05)	13.98 (20.34)	22.96 (23.76)	
Health Literacy Profiles					0.843
Profile 1	17	11.04 (10.50)	12.53 (18.43)	24.77 (21.63)	
Profile 2	165	10.26 (9.73)	9.78 (12.70)	20.10 (16.87)	
Profile 3	87	10.17 (10.89)	9.77 (13.99)	19.27 (19.16)	
Profile 4	186	9.78 (10.48)	12.76 (19.45)	21.74 (22.62)	
Profile 5	58	6.77 (9.56)	12.89 (26.59)	19.37 (28.26)	
Profile 6	59	8,36 (9,90)	9,66 (15,52)	17,93 (17,55)	
Profile 7	16	8,97 (7,42)	9,85 (16,03)	18,81 (18,20)	

Note: Direct cost covers consultation and medical costs while indirect cost includes the value for days lost to care.

*shows statistically significant difference between total cost incurred by users of desirable healthcare and undesirable healthcare users.

Table 6 shows the association between health literacy profiles and total household cost using the generalized linear model. After adjusting for all covariates, caregivers from all profiles incurred less household cost on malaria as compared to Profile 4 except for Profile 1 ($0.24). Caregivers in Profiles 6 incurred least cost ($-0.30), then Profile 7 ($-0.14) as compared to Profile 4. Profile 3 incurred less ($-0.11) total household cost on malaria in children than Profile 4.

Table 6 Relationship between health literacy profiles of caregivers and total household cost of malaria in children under five

Unadjusted analysis		Adjusted analysis (socio-demographic covariates)		Adjusted analysis (all covariates)		
Profile	Coeff	[95% Conf.Interval]	Coeff	[95% Conf.Interval]	Coeff	[95% Conf.Interval]
Profile 1	0.13	-0.41 ; 0.67	0.25	-0.31 ; 0.81	0.24	-0.32 ; 0.80
Profile 2	-0.08	-0.30 ; 0.14	-0.02	-0.25 ; 0.20	-0.01	-0.23 ; 0.21
Profile 3	-0.12	-0.39 ; 0.15	-0.10	-0.37 ; 0.17	-0.11	-0.38 ; 0.16
Profile 4	Ref.	Ref.		Ref.		
Profile 5	-0.12	-0.42 ; 0.19	-0.13	-0.44 ; 0.18	-0.11	-0.42 ; 0.20
Profile 6	-0.19	-0.50 ; 0.11	-0.26	-0.57 ; 0.05	-0.30	-0.61 ; 0.01
Profile 7	-0.14	-0.67 ; 0.38	-0.21	-0.73 ; 0.32	-0.14	-0.67 ; 0.39

Note: socio-demographic covariates include age of the child, sex of respondent, years of schooling, employment status and reported income. All covariates include reported NHIS subscription and desirable use of healthcare in addition to the socio-demographic covariates.

Table 7 Average treatment costs for desirable and two groups of undesirable healthcare users

Use of health care	Direct costs	Indirect cost	Total cost USD (CI)	P-value
Desirable treatment pathway	11.70 (11.04)	11.54 (17.51)	22.75 (20.42; 25.09)	P≤0.001
Undesirable 1(only informal care)	4.60 (4.97)	9.95 (18.46)	14.60 (11.85; 17.35)	
Undesirable 2 (delayed use of formal care)	13.84 (11.32)	12.20 (12.95)	25.40 (20.73; 30.08)	

Table 7 shows that caregivers who used a desirable treatment pathway on the average incurred significantly higher costs (US$ 22.76) than those who used solely informal treatment options (US$ 14.60). However, caregivers who started with informal care and ended with formal treatments incurred significantly higher total household cost (US$ 25.40) than those who chose to use a desirable treatment pathway (US$ 22.76). The difference was particularly large for the direct costs, but also the indirect costs was lower.

In summary, the findings suggest that the identified health literacy profiles 6 and 7 had considerable higher odds of experiencing a child with malaria. Profile 7 individuals were less likely to use desirable healthcare and as well incurred less on total household costs as compared to caregivers who had moderate scores (Profile 4) across the nine scales. As compared to Profile 4, caregivers in Profile 1 were also less likely to use desirable healthcare, yet, incurred higher total household costs. Caregivers in Profile 3, however, had reduced odds of an incident of malaria in children, more frequent use of desirable healthcare and in addition, incurred less total household costs on malaria in children as compared to Profile 4. None of the associations were, however, statistically significant. Although desirable use of healthcare was associated with higher costs, table 7 showed that a caregiver would pay much more for delayed use of formal healthcare.

Discussion

In this section, we discuss the analytical approach, definitions and measurements of outcome variables and relate the study findings to existing studies on the same or similar associations. Therefore, our discussions centre on the use of health literacy profiles, the meaning, and implications of desirable use of healthcare, then, the association between health literacy and use of healthcare. We follow up with discussions on our cost estimates and the associations between health literacy and costs. Finally, we present strengths and limitations of this study.

We generated seven health literacy profiles which mapped out the combined strengths and weaknesses of caregivers in terms of the nine health literacy dimensions (27-29). The profile descriptions coupled with respondents' socio-demographic characteristics may provide useful information for policies and intervention design(30) . For example, almost all health literacy profiles in our study had challenges with health provider support, so this dimension could generally be addressed. On the other hand, some profiles scored low on almost all dimensions. While it is difficult to target interventions based on intangible characteristics such as health literacy, the identification of socio-demographic characteristics of the least scoring profile, improves the ability to reach the group with the greatest need(30). Thus, the use of this multi-dimensional health literacy questionnaire (HLQ) is essential in identification of health literacy needs, still, the use of the profiling approach could contribute to equitable health literacy interventions(30).

In this study, use of health care was categorized into desirable and undesirable healthcare. Use of health care is usually defined as either use of formal healthcare (public or private health facilities) or informal healthcare which includes drug stores, herbal and traditional medicine or other therapies acquired outside the hospital for the treatment of a particular disease(14, 31-33). We found that 42% of caregivers used an undesirable treatment pathway, either not seeking formal care or doing so only as 3rd or 4th choice. Other studies in Ghana also suggest a high use of informal care for malaria treatment(15, 21, 34), with a recent study reporting 28% choosing informal over formal care among caregivers of children under 5 years in Upper West Region(15). This is in line with our finding of a high percentage of undesirable practices as we include late use of formal care. Based on the recommendations by WHO and Ghana's Ministry of Health's malaria treatment guidelines(10, 25) which encourages seeking early treatment for malaria from health facilities, we defined desirable healthcare as timely use (at least second treatment option) of health facilities in treatment of malaria in children under five years.

However, in malaria prone areas, presumptive malaria is mostly defined by the presence of fever(35), and in children, several illnesses could present with fever(36) which may or may not necessarily require a visit to the hospital. Thus, in this study, some caregivers may have used informal treatment as the first or second option and did not seek further treatments because the child recovered. Such caregivers were categorized as using an undesirable approach, which could be questionable if the child recovered from the illness. Although, our definition is in line with appropriate and accurate timely diagnosis and treatment of malaria(10), the desirable use as defined may also result in an influx of patients at health facilities which yields unnecessary pressure on the limited resources in the Ghanaian health system. In other words, there may be scope for management of some of these presumptive malaria cases at lower level than the health facilities; indeed, this was the basis for programmes like the community case management of malaria in Ghana(35). For countries with limited resources, the proliferated use of informal sources of healthcare in the treatment of malaria could be channelled into an advantage by training and equipping such sources to promote test prior to treatment(37, 38). This could serve as a form of screening of mild and severe cases for treatment, thereby making it a desirable treatment option which would likely imply less cost to the individual as well as the health system.

Although health literacy is associated with proper management of health conditions and engagement in healthy behaviours(1, 3, 4, 39), the associations between health literacy levels of caregivers and the use of health care for their children has been mixed(31, 40, 41). For example, a study conducted in Wisconsin USA, by May et al reports that, certain capabilities including good assessment of severity of illness, navigating the health system, relationship between caregiver and health providers as well as perception of care, could positively influence the behaviour of caregivers in managing their

child's health in mild or acute illnesses with possibilities of waiting for longer appointments(42). Thus, such caregivers are less frequent users of formal health facilities. In a similar study setting in the United States, Sanders et al reported that there was no statistically significant association in health care use and costs for children of caregivers with low health literacy or otherwise(31).

In the present study, we found that caregivers in both Profile 1 (high scores) and Profile 7 (low scores) were associated with reduced odds of using desirable healthcare. This could be driven by different factors. Given the high health literacy scores and high level of education, caregivers in Profile 1 may assume to have better judgement of health conditions and only use formal healthcare when necessary as reported in the study by May et al (42). Again, with over 80% of caregivers in Profile 1 employed, the high indirect costs which in this study comprises value of time spent in care, could possibly also influence their decisions. However, characterized with low health literacy scores coupled with low education and socio-economic status, cost could be a more influential determinant in the decisions of caregivers in Profile 7 in their choice of informal treatments. Other studies also show that caregivers with low socio-economic status use more informal healthcare due to the low cost of care(43, 44). However, none of the associations in our study were statistically significant as Sanders et al(31) also reported. As we find high total costs associated with the desirable use of health care, much effort will be needed to stimulate the practice of desirable healthcare by such groups.

With cost being a barrier as mentioned above, we could expect National Health Insurance Scheme (NHIS) membership to be a mediating factor. The mediating effect was evident as we observed a reduction in the differences in the odds ratios after we adjusted for NHIS covariate. Caregivers in Profile 3 subscribed (94%) to the NHIS more often than all other profiles including Profile 1 (82%). Thus, it seems that high subscription to NHIS emphasizes the strength of caregivers in Profile 3 in the active management of health and in their high (57%) use of public health facilities as compared to the 47% use by caregivers in Profile 1. Agbanyo et al. reports that among expectant mothers' subscribers of the NHIS have 29.4% higher likelihood to use public health facilities and clinics with 2.3% higher likelihood of using private facilities(45). It is also reported that the positive effect of the NHIS is predominant in lower-educated than otherwise(46). Several other factors could also account for the differences in the use of healthcare and cost among the Profiles. These could include, but not be limited to, trust in healthcare providers, the perceptions on various curative measures, birth parity, and the perception of the disease of interest(43, 47).

In the present study, household costs per an episode of malaria on the average amounted to $20.29 of which $9.54 in direct treatment costs and $11.10 due to lost income. This appears to be slightly above estimates in other studies that also measured costs for malaria in children under five. Using a model-based analysis Sicuri et. al, report an expected average direct treatment cost per case of US$7.85 in 2013(18) and two studies report direct and indirect costs in 2011 around US$14.00 (US$ 13.90, US$14.6) (21, 34). In comparison with costs reported from other studies in Ghana, (18, 21), the differences in costs estimates could be attributable to the differences in study population, increasing costs over the years, inclusion of expenditures for informal care in our study, valuation of indirect costs and differences in recall period. Out of the identified studies on costs estimates on malaria, some focus on estimates for malaria in children (15, 18) while others report on cost estimates for the general population(21, 34, 48). In terms of differences in years of cost estimates, most studies were based on almost 10 years old data (18, 34).

Comparison of cost estimates across studies is also challenged by different cost components included in the studies, for example one study reports on only direct costs (15), others report on both direct and indirect costs (18, 21, 34); some studies report on both informal and formal treatment costs (15, 21, 34), and others report on only formal treatment costs (18). However, where possible, we compared relevant sub-results from the studies. Generally, compared to the other cost studies with 2 weeks (21) and 1 month recall period(15), our study had a longer recall period of 6 months and this could have influenced the cost reported by respondents. The cost level apart, our study reports the indirect cost as a greater share of the total costs which is in line with other studies which reports 71% (48), 80% (21) and 74% (34) of costs as indirect expenditure in management of Malaria.

With respect to associations between health literacy and cost of healthcare, the direction did not follow previously reported associations between health literacy and cost of health care (8, 9). We found that costs tended to be higher among caregivers within profiles with relatively good health literacy compared to those with relatively poor health literacy. This could reflect that caregivers with high health literacy value health and health care and thus are willing to pay more for appropriate care, but it could of course also reflect a higher ability to pay. Another possible reason could be a difference in the type of undesirable healthcare used between Profiles 1 and 7. Although both high and low scoring caregivers were associated with reduced odds of using desirable healthcare, the use of undesirable healthcare differs between the two extreme profiles. Caregivers in Profile 1 were dominant in the late use of formal healthcare, which was the most costly use of healthcare, while caregivers in Profile 7 dominated in sole use of informal healthcare, the least costly use of healthcare.

We found that resorting to an undesirable treatment pathway, on average, costs less than seeking early treatment from a formal source of healthcare. This is because caregivers who chose an undesirable pathway (highly informal), were likely to incur lower direct cost due to the absence of consultation costs and other possible informal payments, including motivations for health staff at health facilities (15). However, the lower cost should be assessed against health outcomes forgone. According to Sumba et al(33), on an episode of malaria in Kenya, children who are sent to health facilities as first source of treatment are significantly more likely to recover and would not need further treatment as compared to those who use informal treatments(33). Thus, resorting to informal treatments could likely lead to failed treatments, hence require further treatment possibly from formal sources of health care, which could in sum result in higher costs of treatment.

Strengths and Limitations

This study used a standardised health literacy questionnaire(24) in measuring health literacy levels. The translation and cultural adaptation of the Health Literacy Questionnaire reports of an acceptable fit for the overall nine factor model with less model fit for the ninth scale on understanding of health information(24). However, the less model fit had no influence on the profile groups. This is the first study to use this tool validated for use in a local language in Ghana and thus assesses the usefulness of the questionnaire.

The cross-sectional design is a limitation as it does not permit close monitoring on costs from the onset of malaria till the child recovered. It also does not allow firm conclusions on causal inference. Our study values work time loss based on self-reported income and a detailed measure of income could have improved this estimate. Due to long time recall period of six months, it is likely that some caregivers did not report the accurate costs they incurred when their child had malaria. This study used six-months recall period because, it has been reported that children are likely to have an episode of malaria within a six months period (33). However, the recall bias may have influenced the results in this study. We, however, have no reason to believe that this inaccuracy would differ by health literacy level. In terms of the overall relationship between health literacy, incidence of malaria, use of healthcare, and costs, malaria may not have been the best health condition for the assessment considering the familiarity of the disease in this context. A more complex health issue like a non-communicable disease may have shown different associations.

Conclusion

We sought to assess the association between general health literacy levels of caregivers, incidence of malaria in children, use of healthcare and related total household cost of malaria in children under five years. Our finding showed that caregivers with low health literacy levels more frequently experienced incidence of malaria in their child, less frequently used desirable healthcare and likely incurred less cost on management of malaria in a child. On the other hand, caregivers with higher health literacy levels less frequently experienced an incident of malaria in a child, less frequently used desirable healthcare and likely incurred more cost on management of malaria in a child. However, none of these associations were statistically significant. Thus, general health literacy levels of caregivers may not be a significant factor in an incident, the use of healthcare and associated costs on malaria in children under five years. Further studies on health literacy and costs could focus on more complex health conditions like non-communicable diseases.

In this study, the use of hierarchical cluster analysis helped to describe our study population based on their comprehensive health literacy scores from the HLQ, their demographic characteristics, and again facilitated the analysis on use of health care and costs. Such analytical methods appear feasible in the identification of vulnerable groups towards equity in healthcare.

List Of Abbreviations

HLQ - HEALTH LITERACY QUESTIONNAIRE

WHO - WORLD HEALTH ORGANIZATION

NHIS - NATIONAL HEALTH INSURANCE SCHEME

ANOVA - ANALYSIS OF VARIANCE

Declarations

Ethics approval and consent to participate:

We received ethical approval from the Committee for Human Research and Publication Ethics, an institutional review board of the Kwame Nkrumah University of Science and Technology (CHRPE/AP/506/17). All methods were carried out in accordance with relevant guidelines and regulations. We obtained written informed consent from all respondents and parents or legal guardian of respondents under 18 as approved by the ethics committee.

Consent to publish: Not applicable

Availability of data and material: The datasets used and analysed during the current study are available from the corresponding author upon reasonable request.

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Authors' contributions: MAB is the corresponding author. She worked on the study design, data analysis and drafted the manuscript.

UE contributed to study design, analysis, and review of the paper.

PAB contributed to the design and review of the paper.

DA contributed to the analysis and review of the paper.

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References

1. Okan O, Bauer U, Levin-Zamir D, Pinheiro P, Sørensen K. International Handbook of Health Literacy. Bristol, UK: Policy Press University; 2019.
2. Dodson S, Good S, Osborne R. Health literacy toolkit for low-and middle-income countries: a series of information sheets to empower communities and strengthen health systems. New Delhi: World Health Organization, Regional Office for South-East Asia. 2015.

3. Friis K, Vind BD, Simmons RK, Maindal HT. The relationship between health literacy and health behaviour in people with diabetes: a Danish population-based study. Journal of diabetes research. 2016;2016.
4. Aaby A, Friis K, Christensen B, Rowlands G, Maindal HT. Health literacy is associated with health behaviour and self-reported health: A large population-based study in individuals with cardiovascular disease. European journal of preventive cardiology. 2017;24(17):1880-8.
5. Sudore RL, Mehta KM, Simonsick EM, Harris TB, Newman AB, Satterfield S, et al. Limited literacy in older people and disparities in health and healthcare access. Journal of the American Geriatrics Society. 2006;54(5):770-6.
6. Sudore RL, Yaffe K, Satterfield S, Harris TB, Mehta KM, Simonsick EM, et al. Limited literacy and mortality in the elderly. Journal of general internal medicine. 2006;21(8):806-12.
7. Howard DH, Sentell T, Gazmararian JA. Impact of health literacy on socioeconomic and racial differences in health in an elderly population. Journal of general internal medicine. 2006;21(8):857-61.
8. Howard DH, Gazmararian J, Parker RM. The impact of low health literacy on the medical costs of Medicare managed care enrollees. The American journal of medicine. 2005;118(4):371-7.
9. Haun JN, Patel NR, French DD, Campbell RR, Bradham DD, Lapcevic WA. Association between health literacy and medical care costs in an integrated healthcare system: a regional population based study. BMC health services research. 2015;15(1):249.
10. Organization WH. World Malaria Report 2019. 2019. Reference Source.
11. WHO. Guidelines for the Treatment of Malaria. Geneva: World Health Organization 2015.; 2015.
12. Maka DE, Chiabi A, Obadeyi B, Mah E, Nguefack S, Nana P, et al. Economic evaluation of artesunate and three quinine regimens in the treatment of severe malaria in children at the Ebolowa Regional Hospital-Cameroon: a cost analysis. Malaria journal. 2016;15(1):587.
13. Akazili J, McIntyre D, Kanmiki EW, Gyapong J, Oduro A, Sankoh O, et al. Assessing the catastrophic effects of out-of-pocket healthcare payments prior to the uptake of a nationwide health insurance scheme in Ghana. Global health action. 2017;10(1):1289735.
14. Fenny AP, Asante FA, Enemark U, Hansen KS. Malaria care seeking behavior of individuals in Ghana under the NHIS: Are we back to the use of informal care? BMC Public Health. 2015;15(1):370.
15. Dalaba MA, Welaga P, Oduro A, Danchaka LL, Matsubara C. Cost of malaria treatment and health seeking behaviour of children under-five years in the Upper West Region of Ghana. PLoS One. 2018;13(4):e0195533.
16. Matovu F, Nanyiti A, Rutebemberwa E. Household health care-seeking costs: experiences from a randomized, controlled trial of community-based malaria and pneumonia treatment among under-fives in eastern Uganda. Malaria journal. 2014;13(1):222.
17. Malaria RB. Economic costs of malaria. World Health Organization. 2011;20.
18. Sicuri E, Vieta A, Lindner L, Constenla D, Sauboin C. The economic costs of malaria in children in three sub-Saharan countries: Ghana, Tanzania and Kenya. Malaria journal. 2013;12(1):307.
19. Organization WH. World malaria report 2018. 2018. World Health Organization: Geneva.
20. UNICEF. GHANA, Malaria status update on children. 2020.
21. Tawiah T, Asante KP, Dwommoh RA, Kwarteng A, Gyaase S, Mahama E, et al. Economic costs of fever to households in the middle belt of Ghana. Malaria journal. 2016;15(1):68.
22. Jehu-Appiah C, Aryeetey G, Spaan E, De Hoop T, Agyepong I, Baltussen R. Equity aspects of the National Health Insurance Scheme in Ghana: Who is enrolling, who is not and why? Social science & medicine. 2011;72(2):157-65.
23. Kanmiki EW, Bawah AA, Akazili J, Agorinyah I, Awoonor-Williams JK, Phillips JF, et al. Unawareness of health insurance expiration status among women of reproductive age in Northern Ghana: implications for achieving universal health coverage. Journal of Health, Population and Nutrition. 2019;38(1):1-12.

24. Boateng M, Agyei-Baffour P, Angel S, Enemark U. Translation, Cultural Adaptation and Psychometric Properties of the Ghanaian language (Akan; Asante Twi) version of the Health Literacy Questionnaire. 2020.
25. Ministry of Health G. Strategic Plan for Malaria Control in Ghana 2008–2015. . In: MOH/GHS, editor. 2008.
26. Paasche-Orlow MK, Wolf MS. The causal pathways linking health literacy to health outcomes. American journal of health behavior. 2007;31(1):S19-S26.
27. Aaby A, Beauchamp A, O'Hara J, Maindal HT. Large diversity in Danish health literacy profiles: perspectives for care of long-term illness and multimorbidity. European Journal of Public Health. 2020;30(1):75-80.
28. Batterham RW, Buchbinder R, Beauchamp A, Dodson S, Elsworth GR, Osborne RH. The OPtimising HEalth LIterAcy (Ophelia) process: study protocol for using health literacy profiling and community engagement to create and implement health reform. BMC public health. 2014;14(1):1-10.
29. Bakker MM, Putrik P, Rademakers J, van de Laar M, Vonkeman H, Kok MR, et al. Addressing health literacy needs in rheumatology–which patient health literacy profiles need the attention of health professionals? Arthritis care & research.
30. Bakker MM, Putrik P, Rademakers J, van de Laar M, Vonkeman H, Kok MR, et al. Addressing Health Literacy Needs in Rheumatology: Which Patient Health Literacy Profiles Need the Attention of Health Professionals? Arthritis care & research. 2021;73(1):100-9.
31. Sanders LM, Thompson VT, Wilkinson JD. Caregiver health literacy and the use of child health services. Pediatrics. 2007;119(1):e86-e92.
32. Sanders KC, Rundi C, Jelip J, Rashman Y, Smith Gueye C, Gosling RD. Eliminating malaria in Malaysia: the role of partnerships between the public and commercial sectors in Sabah. Malar J. 2014;13:24.
33. Sumba PO, Wong SL, Kanzaria HK, Johnson KA, John CC. Malaria treatment-seeking behaviour and recovery from malaria in a highland area of Kenya. Malaria Journal. 2008;7(1):245.
34. Dalaba MA, Akweongo P, Aborigo R, Awine T, Azongo DK, Asaana P, et al. Does the national health insurance scheme in Ghana reduce household cost of treating malaria in the Kassena-Nankana districts? Global health action. 2014;7(1):23848.
35. Ruizendaal E, Dierickx S, Peeters Grietens K, Schallig HD, Pagnoni F, Mens PF. Success or failure of critical steps in community case management of malaria with rapid diagnostic tests: a systematic review. Malar J. 2014;13:229.
36. Child WHODo, Health A, Organization WH, UNICEF. Handbook IMCI: Integrated management of childhood illness: World Health Organization; 2005.
37. Hansen KS, Pedrazzoli D, Mbonye A, Clarke S, Cundill B, Magnussen P, et al. Willingness-to-pay for a rapid malaria diagnostic test and artemisinin-based combination therapy from private drug shops in Mukono District, Uganda. Health policy and planning. 2013;28(2):185-96.
38. Mbonye AK, Lal S, Cundill B, Hansen KS, Clarke S, Magnussen P. Treatment of fevers prior to introducing rapid diagnostic tests for malaria in registered drug shops in Uganda. Malaria journal. 2013;12(1):131.
39. Kickbusch I, Wait S, Maag D. Navigating health: The role of health literacy: Alliance for Health and the Future, International Longevity Centre-UK; 2005.
40. Shone LP, Conn KM, Sanders L, Halterman JS. The role of parent health literacy among urban children with persistent asthma. Patient education and counseling. 2009;75(3):368-75.
41. DeWalt DA, Hink A. Health literacy and child health outcomes: a systematic review of the literature. Pediatrics. 2009;124(Supplement 3):S265-S74.
42. May M, Brousseau DC, Nelson DA, Flynn KE, Wolf MS, Lepley B, et al. Why parents seek care for acute illness in the clinic or the ED: the role of health literacy. Academic pediatrics. 2018;18(3):289-96.
43. Adedokun ST, Yaya S. Factors influencing mothers' health care seeking behaviour for their children: evidence from 31 countries in sub-Saharan Africa. BMC Health Services Research. 2020;20(1):1-9.

44. Visser T, Bruxvoort K, Maloney K, Leslie T, Barat LM, Allan R, et al. Introducing malaria rapid diagnostic tests in private medicine retail outlets: a systematic literature review. PloS one. 2017;12(3):e0173093.
45. Agbanyo R, Peprah JA. National health insurance and the choice of delivery facility among expectant mothers in Ghana. International Journal of Health Economics and Management. 2020:1-23.
46. Asare S. Health Insurance Provision and Women's Healthcare Utilization: Evidence from the National Health Insurance Scheme in Ghana. Available at SSRN 3641994. 2020.
47. Hooft A, Nabukalu D, Mwanga-Amumpaire J, Gardiner MA, Sundararajan R. Factors Motivating Traditional Healer versus Biomedical Facility Use for Treatment of Pediatric Febrile Illness: Results from a Qualitative Study in Southwestern Uganda. The American Journal of Tropical Medicine and Hygiene. 2020:tpmd190897.
48. Akazili J, Aikins M, Binka FN. Malaria treatment in Northern Ghana: What is the treatment cost per case to households? African Journal of Health Sciences. 2007;14(1):70-9.

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