**Abstract**

**Background**: Children under five years old are considered one of the most vulnerable groups affected by malaria. Of the roughly 400,000 deaths attributable to malaria in 2015, nearly 70% were in children under five years of age. Generalized trends demonstrate a relationship between socio-economic status and morbidity. With such being the case, understanding how socio-demographic traits affect how an individual may perceive the ease of accessing and utilizing malaria treatment will help to improve equitable treatment seeking conditions

**Methods:** A cross-sectional study sampling 151 mothers to children under five years of age was conducted. Respondents were sampled and interviewed in the north, east, and central zones based on the demarcation of the Navrongo Health and Demographics Surveillance System (NHDSS). The frequencies of symptom recognition and health seeking practices were calculated and logistic regressions were completed in order to determine any associations between socio-demographic characteristics and specific health-seeking behaviors. .

**Results**: Respondents with the highest level of education and from higher socio-economic status were less likely to recognize basic symptoms of malaria in their children such as fever and shaking/chills. However, these same demographics are quicker to seek treatment after symptom recognition. The vast majority of mothers that do seek treatment select the facility based on proximity. Lastly, it was also found that respondents of specific socio-economic statuses are more likely to have been reached by certain messages pertaining to malaria.

**Conclusion**: It is demonstrated that a mother’s socio-economic status education had an association with specific symptom recognition and treatment response time in the case of under-five malaria. Policymakers may seek to critically study these associations in order to ensure prompt and proper health seeking behaviors for mothers of all socio-demographics in the Kassena-Nankana districts.

**Child malaria treatment seeking practices and perceptions among mothers in the Kassena-Nankana districts of northern Ghana**

Jack Sardinia

# Background

Introduction to Ghana

The Republic of Ghana is a West African country with a population of just over 27 million people. Three French-speaking countries border Ghana: Togo, Burkina Faso and Cote d’Ivoire. The Gulf of Guinea on the southern border provides Ghana vital trade and shipping access. With a constitutional republic government led by President John Dramani Mahama, Ghana is, by a variety of standards, a stable country. The nation is currently ranked as both one of the least corrupt and least fragile states in all of Africa [1, 2].

The country has a tropical climate that is best characterized by a definitive pattern of wet and dry seasons. In the south of Ghana, there are two wet seasons, from March to July and from September to October, while in the North a single wet season lasts from May to September. The climate has a large effect on the nation’s agricultural industry, in which 45% of the economically active population is engaged [2].

Recently there has been a sharp increase in Ghana’s GDP, growing to a current value of 37.8 billion (USD) from a value at the turn of the millennium of under 5 billion (USD). The parallel growth in Ghana’s GNI per capita at this time caused the World Bank to reclassify the nation’s economic status as “lower-middle income” rather than “lower income” [2, 3].

The fertility rate has declined from 6.4 children per woman in 1988 to 4.2 children per woman in 2014. These rates are low when compared other nations in SSA, but they are rather high when compared to other countries of similar World Bank income level classification. The population of Ghana structurally resembles populations in SSA rather than countries of comparable income [3].

This age structure must be considered in any analysis of healthcare in Ghana. The number of dependents per productive person will decline from 0.72 in 2010 to 0.56 in 2030. This means that Ghana is primed to reap the benefits of a “demographic dividend” if this young population is properly employed. Governance will need to play a key role in this progression, as it will be a time when both economic and health repercussions will be tightly interwoven [4]. If the working age population of Ghana is not employed, there could be devastating impacts in terms of tax revenues, NHIS premiums, and the Ghana Health System as a whole. Furthermore, the population of people over the age of 65 is projected to increase by 90% by 2030. Subsequently, this will shift the burden of disease in Ghana to both non-communicable diseases and communicable diseases. A dual burden of disease will considerably strain a country that has not made policy adjustments to account for it [5].

Healthcare in Ghana

The GHS is administratively organized into three levels (National, Regional, and District) and functionally organized at five levels. The functional levels include sub-district and community levels in addition to the same levels used at the administrative level. At the most basic level, there are community-based programs like CHPS centers that provide basic health education and services. The health staff at the CHPS centers, known as Community Health Officers (CHOs), are equipped to provide immunizations, family planning, supervising of deliveries, antenatal/postnatal care, treatment of minor aliments and health education. An individual is able to access diagnostic tests and, if necessary, ACT treatment from a CHPS center [6, 7].

Above the community level there are sub-district health centers and clinics, district general hospitals, regional general hospitals, and specialized tertiary hospitals. The public sector accounts for 50% of health facilities and 58% of hospital beds. The non-public sector includes for-profit and not-for-profit providers. There is a significant regional disparity in terms of health facilities; the Greater Accra and Volta Regions have more than twice as many beds per 1,000 people as the Northern Region, which has 0.56 beds per 1,000 people [5].

The newly established National Health Insurance Scheme (NHIS) mandates that all Ghanaians enroll in the NHIS or with an alternative provider. NHIS membership is not automatic, and citizens are not penalized for choosing not to register. In effect enrollment into the NHIS might be alternatively considered voluntary, and in 2012 only 35% of Ghanaians were registered with the NHIS [8].

NHIS premiums take into account one’s employment sector (formal and informal) and socioeconomic status. Those that are indigent, over 70 years old, under the age of 18, pregnant women and pensioners are exempt from paying premiums [9].

The NHIS benefits package mainly covers curative healthcare. Enrollees are insured for 95% of the most common health problems in Ghana. Services include: “general out-patient and in-patient services, oral health, eye care, emergencies, maternity care (prenatal care, normal delivery and some complicated deliveries), and treatment for malaria, diarrhea, upper respiratory tract infections, skin diseases, hypertension, asthma and diabetes [10].

Global burden of malaria

According to the WHO, between 2000 and 2015, the global number of malaria cases declined by 18%, to a current number of roughly 214 million cases. The increased global effort orchestrated by the Roll Back Malaria (RBM) Partnership and the Millennium Development Goals has helped in achieving these trends. However, this progress is not ubiquitous globally. Of the estimated 214 million global cases of malaria, 80% of the cases occur in 15 countries, all but one of which are in sub-Saharan Africa (SSA) [11]. In the SSA region the transmission of malaria primarily coincides with the 3-4 month rainy season, during which 57% of all cases are estimated to be found in children under the age of five. This demographic is disproportionately burdened due to limited exposure to the *Plasmodium falciparum* parasite and their subsequent insufficient natural immunity. In addition to high morbidity, there is also a high mortality rate associated with malaria. In 2015, there were an estimated 438,000 malaria deaths worldwide, and 80% of these deaths occurred in sub-Saharan Africa [12, 13].

There are a multitude of reasons why sub-Saharan Africa in particular bears so much of the global burden for malaria, but most of the issue can be traced back to the multitude of gaps that exist in providing prevention measures, treatment, and diagnostic testing for malaria. Current estimates report only 53% of the 834 million people at risk for malaria live in households with insecticide-treated mosquito nets (ITNs) or indoor residual spraying (IRS). The WHO recommended artemisinin-based combination therapy (ACT), which is the most effective antimalarial medicines available today, has had major treatment successes in conjunction with an increased number of manufactures producing treatments. However, estimates of the current proportion of febrile children that have received ACT are still under 50% in sub-Saharan Africa. WHO policy is to perform diagnostic testing for malaria prior to treatment. Fever is commonly associated with malaria, but it is not specific to malaria, thus early administration of proper treatment prevents the disease from progressing to more severe stages [2]. However, in the SSA region there have been more reported medicines distributed than rapid diagnostic tests (RDTs) administered, thus leading to the assumption that much of the malaria medication is administered without diagnostic assurance of the disease [11].

The economic cost of malaria is staggering. In countries like Ghana with intense malaria transmission, the disease causes an average loss of 1.3% in annual economic growth, or 12 billion USD per year [14]. The average per-capita health expenditure in sub-Saharan Africa is an annual expenditure per capita of 34 USD [15]. However, the cost of inpatient care for a single severe case of malaria is estimated between 12 USD and 75 USD; a significant burden on households, even those with members enrolled in the National Health Insurance Scheme [15, 16].

A 2013 study in sub-Saharan Africa estimated a substantial increase in the number of malaria cases that could be discovered through active case detection (ACD) rather than passive case detection (PCD). ACD involves health workers surveying and reporting cases on a weekly basis, while PCD utilizes data reported at health care facilities. Thus, the projected disparity represents an underutilization of health services when it comes to malaria treatment [17]. In general, treatment-seeking behavior is often a derivative of local “access to health care providers, costs of services, attitudes towards providers, perceived severity of disease, age, sex education level, socio-economic status, and cultural beliefs about the cause and cure of illness,” all factors that must be considered in studying malaria [18]. The success of malaria interventions is contingent on an awareness of the community’s perception of the illness and their health seeking behaviors.

Ghana has a declining trend in the under-five mortality rate; reporting levels consistently lower than the sub-Saharan African region as a whole (World Bank Data, 2015). The Upper East region does have an under-five mortality rate that is even lower than this national average, but this rate has recently remained stagnant relative to the progressively decreasing national rate [19]. Malaria is in part responsible for this stagnation, as the disease accounts for 35% of all mortality in children under five [17]. On the national level, malaria accounts for more than 44% of reported outpatient visits, but national outpatient visit and mortality rates may not be reflective of the situation in Northern Ghana [12]. Prevalence rates of malaria in children under-five in the Northern Regions have been estimated to be four times as high as those found in the Greater Accra region, but in such areas of low access to health care, it is increasingly difficult to distinguish malaria from other febrile illness [20].

Literature Review

The Upper East Region (UER) of Ghana has a prevalence of malaria in children under-five of 11% when measured by microscopy, which is a significant difference to the prevalence around 40% in the adjacent Northern and Upper West Regions. However, on a national level the lowest and second lowest wealth quintiles are far more susceptible to malaria. The relatively lower rates of malaria prevalence in the UER may be the result of effectively utilized prevention measures. In 2014, 79 percent of households in the UER reported receiving IRS in the past 12 months, a figure far greater than the proportion of household in either the Northern or Upper West Regions. However, there is not the same difference between these regions when it comes to the percent of households with LLINs, for which all regions have near 70% household coverage [2].

Further understanding of the relationship between socio-demographic factors and health-seeking behavior will facilitate the delivery of prompt and proper care soon after the onset of malaria symptoms. According to the WHO, this window of opportunity is the critical time when an effective antimalarial should be delivered to prevent life threating complications [13]. The failure of mothers in rural SSA regions to utilize proper diagnostic and treatment measures from a trained health worker in this time has been extensively reported. In rural settings a large majority of mothers are inclined to treat a child with febrile illness within the household, and over 50% of mothers report that they would only seek treatment in a health center or health clinic if there was an emergency [21, 22, 23, 24].

Mothers often report cost as the most significant deterrent from seeking treatment at a health facility. Mothers alternatively are inclined to choose to treat children with febrile illness at home with plant leaves (traditional treatment) that are both cheap and often readily available in their local environment [23]. A study conducted in rural Uganda showed that mothers elect to utilize care at a health clinic if it is in close proximity, if it could offer free or cheap treatment, and if they knew they would receive quick medical attention. This decision may also have demographic influences, as the study found that child-headed households were six times less likely to seek treatment at a healthcare facility [22]. Further reports have shown that age of the mother is a significant factor in the recognition of symptoms and the subsequent administration of treatment. While the age of the mother is important, there is no significant variation in knowledge for mothers that have recently treated a febrile illness in their children and those that did not [21].

Across rural SSA, it is consistently reported that at least 70% of mothers could recognize fever and vomiting as symptoms of malaria [21, 22, 23, 24]. However, in some regions less than 10% of mothers to children under-five were found to be able to recognize sweating, nausea, and muscle aches as symptoms of malaria [22]. Ultimately, the failure to recognize multiple symptoms can result in a low sensitivity and specificity in a mother’s diagnosis. In one notable study of mothers diagnosing malaria in rural Mali, the sensitivity and specificity were 40% and 55%, respectively [21]. Knowledge has an influence on the prevention and control of malaria as well as the treatment. In a qualitative study within rural Burkina Faso, mothers rarely considered mosquitoes to be the cause of malaria, rather crediting dirty conditions, certain foods, and climate patterns to be the cause of the illness [23].

Understanding the relationship of a mother’s socio-demographics and the prevention, diagnosis and treatment of malaria is crucial to controlling malaria in the rural Kassena-Nankana region of Ghana. The early detection and treatment of malaria is critical to prevent progression into severe malaria. This study will be unique as there is a wide range of socio-demographic indicators that have shown a significant relationship with the control of malaria in rural SSA, but such a relationship has never been examined in the Kassena-Nankana districts Ghana’s UER.

## Study Aims and Objectives

Aims

This study aimed to discover the treatment seeking practices and perceptions of the mothers in the Kassena-Nankana districts of the UER of northern Ghana. The former part of the aim was performed through the assessment of a mother’s capacity for symptom recognition and health seeking behaviors (*treatment at home, time between symptom recognition and seeking treatment at health facility, etc.)* The latter part of the aim was assessed indirectly. For this study “treatment seeking perceptions” refers to the perceived accessibility of care and the perceived importance of care. Both perceptions could be assessed indirectly through analysis relative to other demographic cohorts.

The significance of this study is apparent in the high prevalence of malaria in children under five in SSA. Specifically, in the rural and low-income populations of SSA, children under five years old are considered one of the most vulnerable groups affected by malaria. Of the roughly 400,000 deaths attributable to malaria in 2015, nearly 70% of mortality was in children under five years of age. Generalized trends demonstrate a relationship between socio-economic status and malaria morbidity. With such being the case, understanding how socio-demographic affect an individual’s access to and utilization of malaria treatment is critical to improving equitable treatment seeking condition.

Objectives

This study aims to expand on the existing data representing the association between socio-demographic indicators and treatment seeking practices and perceptions in the Kassena-Nankana district of northern Ghana. Specifically, this study aims to assess the behaviors of mothers of children under the age of five that have contracted a febrile illness.

Objective #1: To assess the health seeking behaviors of caregivers to children under-five that display symptoms of a febrile illness.

Objective #2: Assess socio-demographic differentials in perception of ease of accessing and utilizing various healthcare providers.

Objective #3*:* Compare the household financial burden associated with the treatment of febrile illnesses across levels of socio-economic status.

Objective #4: Inform policy makers on how to address inequity in accessibility and utilization about healthcare services.

## Methodology

Setting

The Kassena-Nankana Districts (KNDs) is located within the Upper East region (UER) of Ghana and on the southern border of Burkina Faso. The KND was split into two districts, Kassena-Nankana East and West Districts, in 2008. This study will focus on both and refer to them both as the KND. The Navrongo Health and Demographics Surveillance System (NHDSS) separated the district into five zones for the purpose of the data collection: North, South, East, West, and Central zones. Of these five zones, people that identify as Kassena live in the North and West, and the Nankana people live in the South and the East [25].

The climate is spit into a rainy season from May/June to September/October and a dry season from November to mid-February. The population is serviced by one district hospital, seven health clinics, and 27 Community Health Compounds [26]. My a multitude of measures, the UER is considered to be the poorest region in Ghana. Economic activity in the region is dominated by farming, and just under half of the population is reported to be illiterate [27].

Sample Size

It was determined that a sample size of 166 mothers would be necessary. This calculation was based on the most recent data on the prevalence of under-five malaria (diagnosed from microscopy positive test) in the UER, which is 11% [2]. This prevalence was used to calculate the sample size of 151 with a 95% confidence interval. An additional 10% (15 mothers) were added to the sample size calculation in anticipation of a 90% response rate. Calculations were performed using OpenEpi’s sample size for a proportion or descriptive study.

Target Population

The target population of this study is mothers to children currently under five years of age who are living in the Kassena-Nankana Districts.

Sampling Strategy

Sampling was done according to the following steps. First, three zones were selected based on ethnicity. The Kassenas are located in the North and West, while the Nankanis live in the South and East. One zone from each ethnic region was selected at random. The central zone was also used since it is the only urban zone in the KND and has ethnic diversity. In each of the three zones, the NHDSS generated a list of households with at least one child under five years of age.

Eligibility Criteria

People were eligible to participate in the study if they meet all of the following criteria:

(1) The woman lives within the Kassena-Nankana Districts

(2) The mother has at least one child currently under the age of five.

Study Design

This study was a 53 question cross-sectional survey divided into 5 parts: questions on socio-demographic data about the respondent and his/her household, questions on symptom recognition, questions examining treatment-seeking behavior, questions on prevention measures, and questions relating to health awareness. These questions were modeled off of using the intellectual property of multiple studies. A Navrongo Health Research Center (NHRC) pioneered study, the PREventing Maternal and Neonatal (PREMAND) project protocol, provided questions articulated in a culturally appropriate fashion for the study population. The Ghana Demographic Health Survey (GDHS) and a study conducted seeking the relationship of socio-economic status and health seeking behavior in Nigeria were drawn from for questions assessing socio-demographic relationships with treatment seeking behaviors [28, 29].

Socio-demographics

The “socio-demographic component consisted of 23 questions pertaining to age, sex, marital status, number of children, level of education and various socio-economic indicators. These questions on socio-economic status were derived from the Navrongo Demographic Surveillance System (DSS) in order to create a principal component analysis

There was a wide range of variables that were used to determine socio-economic status. All mothers were asked if their household possessed any of the following: car, motorcycle, tractor, bicycle, electricity, refrigerator, television, radio, sewing machine, electric iron, donkey cart, kerosene stove, personal computer, mobile phone, DVD/VCD/VCR, electric/gas stove, fan, solar, and grinding mill.

The principal component analysis also took into account answers from respondents regarding household composition and lifestyle. Mothers received a positive score if they met specific superior living conditions. For example, mothers that used pipe water or sachet water as their main drinking source received a positive (a score of +1) score while mothers that used surface water, well water, or water from a borehole did not (a score of 0). In addition to drinking water, this scoring system was used for toilet source, floor composition, trash disposal, roof composition, wall composition, cooking fuel, light source and land ownership. Using these scores, STATA 14 was used to divide the mothers into 5 different wealth quintiles.

Symptom recognition

The “symptom recognition” component consisted of 5 questions pertaining to the recognition of various symptoms of malaria, as well as the certain aspects relevant to this recognition (i.e. the person responsible for noticing the first symptoms and the amount of time that transpired during recognition). Mothers were first asked to list any symptoms that they knew were associated with malaria, and then were asked which of those symptoms they would consider to be “especially severe.” These responses were open and not prompted, thus symptoms erroneously associated with malaria by the mothers were also recorded in this section. In order to comply with the closed-ended format of the questionnaire, the two field staff members conducting the interview were trained to select the answer that fit closest to the respondent’s answer. For example, the condition of being “floppy” was often cited by mothers as a symptom associated with malaria. As a local term for extreme fatigue, the field workers would know to associate this symptom accordingly.

Treatment seeking behavior

The “treatment seeking behavior” component consisted of 16 questions pertaining to the actual health seeking behaviors that the mother took in the most recent case of a fever in her child under the age of five. In the previous section, the mothers were asked if their child had a fever in the past 12 months, and only participated in this section of the survey if they gave a positive response to this question. This time frame was included as an attempt to limit recall bias.

In this section, mothers were asked if they administered any medication at home before taking their child to a healthcare facility. In part, this question was included with the intent to assess if mothers were able to properly diagnose malaria, as well as administer the proper treatment (e.g. ACT). Pre-survey focus group assessment showed that mothers might also be inclined to administer other medications that would not have a curative affect on malaria (e.g. antibiotics, Paracetamol, etc.). As such, mothers were asked to provide the name or the actual script of the drugs that they used. In practice, this question was not effective, as no mother was able to provide the name of a specific medication.

Additional questions were included for assessment of if and why the child was treated, where the child was taken, and problems associated with getting to/receiving this treatment. Again, the fieldworkers were trained to select the answer that fit closest with the respondent’s answer.

Prevention measures

The “prevention measures” component consisted of 7 questions pertaining to the attainment, use, and disposal of household bed nets and the household coverage with indoor residual spraying (IRS). In order to assess the ratio of people in the household sleeping under bed nets, mothers were asked how many people slept under nets the night before. Mothers were also asked if their IRS had been performed within the past 12 months. Both time frames were included to limit recall bias.

Health awareness

The “health awareness” component consisted of 2 questions pertaining to the reception of specific malaria awareness messages known to be circulating in Ghana. Mothers were asked to list any sources of health knowledge they had been exposed to (e.g. television, health worker, etc.). During the survey, malaria specific messages were read to the respondents, and the mothers were asked whether or not they had heard them before. These messages were taken from the Ghana Health Survey for 2014. The exact messages were read in the following order:

Message #1: *Treatment should be sought from health facilities within 24 hours of onset of fever, especially for children under the age of 5.*

Message #2: *The Ghana health service recommends ACT as medicine for malaria.*

Message #3: *The full course of the malaria medicine, ACT, should be completed.*

Message #4: *Families should sleep under insecticide treated nets (ITNs) to protect them from malaria, especially pregnant women and children under the age of 5.*

Data analysis

151 mothers were sampled over a nine-day period. The results of the questionnaires were loaded into a Microsoft Excel spreadsheet and then transferred to STATA 14.

The variables used to determine socio-economic status were derived from the NHIS DSS socio-demographic survey. The STATA code used for creating a principle component analysis from these variables was also received from the NHIS DSS. Ultimately, all respondents stratified into socio-economic quintiles and these groupings were used for analysis.

In addition to the SES quintiles, several other groupings were made. In each case this was deemed necessary to consolidate data to reflect trends, and may have been done to combine like demographics for richer data. For example, “skilled employment” was a grouping created post-survey that consisted of students in tertiary education or white collar/ office workers, and “unskilled employment” consisted of farmers, traders, craftsman, and the unemployed.

In order to determine statistical significance between socio-demographic characteristics and variables pertaining to symptom recognition and health seeking behaviors, chi2 tests were conducted. The relationship was deemed to be statistically significant if the p-value was equal to or less than 0.05. All reported values are rounded to the nearest thousandth.

Once statistical significance was determined, binomial logistic regressions were used to determine further associations. In a few instances, STATA 14 did not have a large enough data set to perform such regressions, and an exact logistical regression was performed to find a similar estimate. Such cases are noted in the tables below.

# Results: reported frequencies

Socio-demographic Characteristics

The sample population of 151 mothers is all between 18 and 59 years old, with 26% being in the 18-24 year old age group. The average age for the population was 29.43 years old. 72% of the mothers had between one and three children, and 8% of the mothers had six or more children. 40% of the respondents did not complete any school past their primary education, and 11% of the mothers had completed a tertiary degree. The vast majority of mothers, upwards of 85%, were married at the time of the survey.

All but one of the mothers was employed at the time of the survey, with 68% of all mothers working as farmers of traders. 60% of the mothers with spouses stated that their husbands worked in trading or farming. It is significant to note that just over 20% of the households surveyed had at least one person with a job that was considered to be a “white collar” or “office job.” Table 1 shows the frequencies and rates of responses for the various socio-demographic indicators that were tested for and used in later analysis.

**Table 1: Socio-demographic characteristics of parents**

|  |  |  |
| --- | --- | --- |
| Socio-demographic characteristics | Frequency | Percent |
| *Mothers marital status*  Married  Single/ divorced  Widowed | 129 | 85.43 |
| 18 | 11.92 |
| 4 | 2.65 |
| *Mother’s ethnicity*  Kassena  Nankani  Other | 81 | 53.64 |
| 64 | 42.38 |
| 6 | 3.97 |
| *Mother’s educational status*  Primary  Secondary  Tertiary  None  Don’t Know | 47 | 31.13 |
| 42 | 27.81 |
| 16 | 10.60 |
| 41 | 27.15 |
| 5 | 3.31 |
| *Father’s educational status*  Primary  Secondary  Tertiary  None  Don’t Know | 17 | 13.18 |
| 36 | 27.90 |
| 20 | 15.50 |
| 40 | 31.00 |
| 16 | 12.40 |
| *Mother’s occupation*  Farmer  Trading  Craftsmanship  Student  White collar/ Office worker  No work/Unemployed  Other | 57 | 37.75 |
| 34 | 22.52 |
| 20 | 13.25 |
| 7 | 4.64 |
| 13 | 8.61 |
| 18 | 11.92 |
| 2 | 1.32 |
| *Father’s occupation*  Farmer  Trading  Craftsmanship  Student  White collar/ Office worker  No work/Unemployed  Other | 65 | 50.39 |
| 11 | 8.53 |
| 27 | 20.93 |
| 0 | 0.00 |
| 19 | 14.73 |
| 2 | 1.55 |
| 3 | 2.33 |
| *Parent’s socioeconomic status*  Poorest  Poorer  Poor  Less Poor  Least Poor | 40 | 27.03 |
| 20 | 13.51 |
| 29 | 19.59 |
| 30 | 20.27 |
| 29 | 19.59 |

After tabulation, it was found that there was zero variance among and the ownership of kerosene stoves or grind mills, and both components were excluded from the results. Figure 1 shows the variance between wealth quintiles with regards to the mean ownership of specified components. For interpretation, the figure shows the proportion of each wealth quintile that owns the specified item. The distribution among respondents was especially distinct between the ownership of motorcycles, electricity, and television. All respondents in the “less poor” and “least poor” wealth quintiles had access to electricity, while none from the “poorest” and “poorer” quintiles had access to electricity. There was a similar trend for the ownership of television and motorcycles.

Figure 1: Household ownership of motorcycle, electricity, and television vs. SES quintile



The principal component analysis also took into account answers from respondents regarding household composition and lifestyle. After tabulation it was found that there was zero variation for roof composition, and this component was excluded from the results. Table 2 is provided to further demonstrate variance within these socio-economic quintiles. The mean score represents the distribution for each wealth quintile. Significantly, nearly all mothers in the highest wealth quintile had finished walls and floors and little to no mothers in the lowest wealth quintile had such luxuries. Additionally, among the entire sample population there was a low proportion of mothers with access to a working toilet or proper trash disposal facilities.

Table 2: Household characteristics by socio-economic quintile

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Poorest | Poorer | Poor | Less poor | Least poor |
| Toilet ownership | 0 | 0 | 0 | 0 | .172 |
| Trash disposal | 0.05 | 0.05 | 0.068 | 0.133 | 0.206 |
| Finished floor | 0.75 | 0.6 | 0.89 | 1.0 | 1.0 |
| Finished walls | 0 | 0 | 0.172 | 0.466 | 0.655 |
| Cooking fuel | 0 | 0 | 0 | 0.10 | 0.41 |
| Light source | 0 | 0 | .58 | 1.0 | 1.0 |

Symptom recognition

All mothers were asked to name the symptoms that they would most commonly associate with malaria. Table 3shows the top 5 symptoms that mothers were able to properly associate with malaria. Less than 10% of mothers properly associated sweating, muscle aches, and nausea with malaria, even though each is clinically considered a common and potentially serious symptom of malaria.

Mothers were also asked what symptoms of malaria they would consider to be the most serious and more likely to need professional attention. In terms of frequency of responses, most symptoms stayed in the same order as the symptoms that were considered to be simply associated with malaria. However, headaches went from the 2nd most frequently reported system to the 4th most serious symptom. Every symptom was less commonly reported as a serious symptom than just a symptom.

Table 3: Frequencies for recognition of selected symptoms (correct recognition)

|  |  |  |  |
| --- | --- | --- | --- |
| Symptom | N | Rate |  |
| *5 most common symptoms* |  |  |  |
| Vomiting | 101 | 66.89 |  |
| Headache | 62 | 41.06 |  |
| Fever | 56 | 37.09 |  |
| Refusal to eat | 52 | 34.44 |  |
| Diarrhea | 48 | 31.79 |  |
| *5 least common symptoms* |  |  |  |
| Sleepy “floppy” | 24 | 15.89 |  |
| Muscle pain | 8 | 5.30 |  |
| Nausea | 6 | 3.97 |  |
| Anemia | 3 | 1.99 |  |
| Sweating | 1 | 0.66 |  |

Notably, there were a significant number of mothers that made erroneous associations of certain symptoms and malaria. 16% of mothers associated a cough with malaria, and 5% of mothers associated infected wounds with malaria. In total, 58 mothers (39.19%) mistakenly associated a false symptom with malaria. The five most common symptoms to be mistakenly associated with malaria are displayed in Table 4.

Table 4: Frequencies for recognition of selected symptoms (mistaken recognition)

|  |  |  |  |
| --- | --- | --- | --- |
| Symptom | N | Rate |  |
| *5 most common symptoms* |  |  |  |
| Cough | 24 | 15.89 |  |
| Swelling on some part of the body | 10 | 6.62 |  |
| Infected wounds | 8 | 5.30 |  |
| Bloody stools | 6 | 3.97 |  |
| Breathlessness | 2 | 1.32 |  |

Treatment seeking behavior

Of the 151-person sample size, 39.07% (n=59) mothers reported that their child under the age of 5 had a fever in the past 12 months. All but one of these mothers took their child to a healthcare facility. 48.28% (n=28) went to a CHPS compound for this care. The remainder of mothers went to the Navrongo District Hospital (War Memorial District Hospital) or one of several public health centers within the surveyed area. Every mother stated that her selection was at least in part based on proximity. Table 5 shows the frequencies and rates for specific treatment behaviors of the mothers interviewed.

Table 5: Frequencies of specific treatment behaviors

|  |  |  |
| --- | --- | --- |
| Characteristics | Frequency | Percent |
| *Able to recognize ≤ 1 true symptom of* *malaria*  Yes  No | 145 | 96.03 |
| 6 | 3.97 |
| *Mistakenly associated ≤ 1 false symptom with malaria*  Yes  No | 58 | 40.56 |
| 85 | 59.44 |
| *Person to recognize first symptom*  Mother  Father  Grandma | 47 | 79.66 |
| 4 | 6.78 |
| 8 | 13.56 |
| *At-home intervention/ practice \*\**  Drugs  Herbs  None | 31 | 52.54 |
| 5 | 3.31 |
| 25 | 42.37 |
| *Place of treatment*  Hospital  Public health center or clinic  CHPS compound  Drug store | 11 | 18.97 |
| 18 | 31.03 |
| 28 | 48.28 |
| 1 | 1.72 |

61.02% (36=n) of the mothers that reported that their child did have a fever in the past 12 months treated the child at home after recognizing symptoms thought to be malaria. 8.47% (n=5) treated their child with plants or herbs and 52.54% (n=31) treated the child with a drug they thought to malaria medication. None of the mothers that used drugs for treatment could remember the name of the drug or had the medication on hand for verification.

On average, the 58 mothers that did seek treatment at one of these healthcare facilities took 2.45 days to take their child to get treatment after they recognized the first symptom that they associated with the illness. The distribution of days spent before seeking treatment can be found in Figure 2**.**

Figure 2: Number of days before seeking treatment by frequency of response

****

Mothers were prompted to discuss any problems that they faced when taking their child to the health facility. 18 mothers did report problems associated with finding transport and having money for transport. Although these issues do have significance for the purposes of descriptive analysis, they are not used in any of the following sections for statistical analysis for association. This is because during data collection it was found that there was inconsistency in between field workers in the method of administering this question to the mothers.

Prevention measures

As is shown in Figure 3**,** 18% of households reported that their home had received indoor residual spraying (IRS) in the past 12 months. Of the total number of people (n=796) that slept the night before in the surveyed households, 88% (n=700) slept under an insecticide treated net. 59% (n=89) of households used their nets for between 2-4 years before they disposed of them. Furthermore, 89% (n=133) of respondents reported that they disposed of their nets when they did because it had been torn.

Figure 3: Household coverage with IRS in study population

It is important to note that virtually all nets that were used in the sample population were handed out for free. According to the WHO, the current standard for ITNs (which is assumed to be the form publically handed out in Ghana) last for three to five years. The vast majority of nets used in the sample population were torn before that time period.

Figure 4: ITN usage in study population

Health awareness

72% of mothers recalled receiving a malaria-specific message from a health worker in the past 6 months, and 17% heard something from a relative. These were the two most significant sources of awareness. Other sources included television, radio the newspaper, and the radio. The composition of exposure from these sources is shown in Figure 4.

Figure 5: Source of malaria-awareness message

Figure 6 shows the frequency of exposure to the specified malaria messages within the study population. The vast majority (87%) of all mothers had been exposed to the message on ITN usage, and only 5% of mothers had not been exposed to any message. Roughly a third of mothers were exposed to the messages on ACT, and there was virtually complete overlap with the same mothers being exposed to both messages.

Figure 6: Rate of exposure for specific malaria messages

# Results: logistical regressions

Associations between socio-demographic variables and symptom recognition, health seeking behaviors, prevention measures, and general awareness

The results of the individual chi2 tests can be found in Table 6**.** Statistically significant relationships are highlighted. The logistic regressions in the following sections were only conducted in these cases when statistical significance was found.

Table 6: Significance of socio-demographic characteristics and symptom recognition, health seeking behaviors, prevention measures, and general awareness (p-values)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |  |
| **Perception** | **Age** | **Marital Status** | **Mother’s educational status** | **Father’s educational s** | **Mother’s Occupation** | **Father’s occupation** | **SES** |
| **Symptom recognition** |  |  |  |  |  |  |  |
| Shaking/Chills | **0.005** | 0.345 | 0.269 | 0.126 | 0.393 | 0.125 | **0.010** |
| Fever | **0.010** | 0.131 | **0.002** | **0.027** | **0.020** | **0.016** | **0.000** |
| Profuse sweating | **0.001** | 0.679 | 0.461 | 0.606 | 0.673 | 0.671 | 0.168 |
| Headache | **0.020** | 0.650 | **0.003** | **0.012** | **0.001** | 0.070 | **0.000** |
| Nausea | 0.310 | 0.302 | 0.563 | 0.836 | 0.909 | 0.918 | 0.420 |
| Vomiting | 0.606 | 0.726 | 0.761 | 0.755 | 0.379 | 0.142 | 0.795 |
| Diarrhea | 0.272 | 0.136 | 0.283 | 0.311 | **0.034** | 0.336 | 0.250 |
| Anemia | 0.590 | 0.470 | 0.436 | 0.226 | **0.017** | 0.458 | 0.229 |
| Infected wounds | 0.706 | 0.557 | 0.234 | 0.801 | 0.549 | 0.546 | 0.672 |
| Refusal to eat | **0.018** | **0.032** | 0.140 | 0.196 | 0.853 | **0.008** | 0.085 |
| Muscle pain | 0.702 | 0.865 | 0.727 | 0.101 | 0.243 | 0.310 | 0.750 |
| Bloody stools | 0.295 | **0.012** | 0.798 | 0.226 | 0.338 | 0.458 | 0.735 |
| Swelling on some part of the body | 0.675 | 0.177 | 0.246 | 0.328 | 0.532 | 0.633 | 0.573 |
| Breathlessness | 0.713 | 0.155 | 0.712 | 0.596 | 0.547 | 0.669 | 0.469 |
| Cough | 0.811 | 0.751 | 0.923 | 0.370 | 0.769 | 0.538 | 0.428 |
| Sleeping all the time/ floppy | 0.436 | 0.345 | **0.005** | 0.095 | **0.027** | **0.029** | **0.044** |
| False symptom recognition | 0.847 | 0.325 | 0.171 | 0.184 | 0.472 | 0.277 | 0.111 |
| **Health seeking behaviors** |  |  |  |  |  |  |  |
| Fever prevalence | 0.206 | 0.591 | **0.003** | **0.031** | **0.039** | **0.012** | **0.001** |
| Treatment with drugs | 0.634 | 0.818 | 0.565 | 0.923 | 0.299 | 0.977 | 0.486 |
| Treatment with herbs | 0.415 | 0.652 | 0.950 | 0.157 | 0.516 | 0.634 | 0.562 |
| Time before treatment | 0.076 | 0.172 | 0.095 | 0.074 | 0.231 | 0.079 | **0.015** |
| Transport method | 0.350 | 0.609 | 0.249 | 0.983 | 0.748 | 0.799 | 0.135 |
| Treatment at Hospital | 0.567 | 0.338 | 0.110 | 0.454 | 0.699 | 0.499 | **0.003** |
| Treatment at Public Health center | 0.693 | 0.189 | 0.682 | 0.348 | 0.375 | 0.345 | **0.021** |
| Treatment at CHPS | 0.482 | **0.019** | 0.234 | 0.574 | 0.299 | 0.149 | **0.025** |
| **Prevention measures** |  |  |  |  |  |  |  |
| IRS spraying | 0.149 | 0.603 | 0.080 | 0.213 | 0.072 | 0.261 | 0.484 |
| ITNs usage | 0.577 | 0.757 | 0.256 | 0.306 | 0.120 | **0.017** | 0.144 |
| Net disposal time | **0.016** | **0.047** | **0.019** | 0.156 | 0.581 | 0.369 | 0.307 |
| **General Awareness** |  |  |  |  |  |  |  |
| TV/radio | **0.001** | 0.369 | **0.002** | **0.012** | **0.014** | **0.009** | **0.001** |
| Community volunteer | 0.203 | 0.264 | 0.125 | 0.155 | **0.035** | 0.187 | **0.005** |
| Health worker | 0.600 | 0.590 | 0.320 | 0.059 | 0.137 | 0.228 | 0.193 |
| Relative | 0.725 | 0.843 | 0.107 | 0.143 | 0.129 | 0.164 | 0.736 |
| “Treatment should be sought within 24 hours…” | **0.006** | 0.265 | **0.001** | **0.006** | **0.008** | **0.009** | **0.000** |
| “The Ghana health service recommends ACT…” | **0.011** | 0.549 | 0.064 | 0.188 | 0.137 | 0.421 | 0.117 |
| “The full course of malaria should be completed…” | 0.061 | 0.111 | **0.013** | 0.364 | **0.039** | 0.240 | 0.114 |
| “Families should sleep under ITNs…” | 0.996 | 0.680 | 0.791 | 0.775 | 0.747 | 0.139 | 0.108 |
| No exposure | 0.474 | 0.186 | 0.798 | 0.801 | 0.338 | 0.458 | 0.323 |

Associations between Age and symptom recognition, health seeking behaviors, prevention measures, and general awareness

The odds of recognizing malaria-specific health symptoms in a child were tested against the younger age bracket. Recognition of shaking/chills, fever, and the refusal to eat were all statistically significant. Mothers in the 25-40 age group were 79% (odds ratio=0.207) less likely to recognize shaking or chills as a symptom of malaria. There was a similar trend for the recognition of a fever and decreased appetite. Notably, there was no statistical significant difference in symptom recognition between mothers in the youngest group (18-24) and mothers in the oldest group (41-59).

Mothers in the oldest group (41-59) were 82.9% (odds ratio=0.171) less likely to have received a message on malaria awareness from either the television or the radio. The odds ratios and the test for significance are displayed in Table 7**.** In this table and the tables that follow, data outside of the 95% confidence interval are highlighted and some cells may be omitted due to insufficient responses for that demographic cohort.

Table 7: Results of logistic regression of age groups and symptom recognition, health seeking behaviors, prevention measures, and general awareness

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **18-24 (n=25)** | | **25-40 (n=99)** | | **41-59(9)** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |  |  |
| Shaking/chills | 1 | -- | **0.207** | **0.002** | 0.429 | 0.346 |
| Fever | 1 | -- | **0.411** | **0.051** | 2.75 | 0.260 |
| Headache | 1 | -- | 1.97 | .165 | -- | -- |
| Refusal to eat | 1 | -- | **0.280** | **0.006** | 0.393 | 0.251 |
| **General awareness** |  |  |  |  |  |  |
| TV/radio | 1 | -- | 2.07 | 0.134 | **0.171** | **0.052** |
| “Treatment should be sought within 24 hours…” | 1 | -- | 0.433 | 0.067 | 5.33 | 0.141 |
| “The Ghana health service recommends ACT…” | 1 | -- | 0.494 | 0.121 | 3.79 | 0.137 |

Associations between marital status and symptom recognition, health seeking behaviors, prevention measures, and general awareness

Table 8 shows the results of a logistic regression conducted against single mothers. Married mothers were 356% (odds ratio=3.56) more likely to recognize the refusal to eat as a possible symptom of malaria. They were also 85% (odds ratio=0.151) less likely to believe bloody stools to be a symptom associated with malaria. It is noted that bloody stools is not a symptom of malaria. Married mothers were also 378% (odds ratio=3.78) more likely to dispose of their nets after using them for 4 years than their single mother counterparts.

Table 8: Results of logistic regression of marital status and symptom recognition, health seeking behaviors, prevention measures, and general awareness

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Single** | | **Married** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |
| Refusal to eat | 1 | -- | **3.56** | **0.013** |
| Bloody stools | 1 | -- | **0.151** | **0.027** |
| **Health seeking behaviors** |  | | | |
| Treatment at CHPS | 1 | -- | 1.66 | 0.514 |
| **Prevention measures** |  | | | |
| Net disposal time | 1 | -- | **3.78** | **0.020** |

Associations between mother’s education and symptom recognition, health seeking behaviors, prevention measures, and general awareness

As was shown in the descriptive data, in the vast majority of cases of under-five malaria, the mother is the first person to recognize the symptoms. Women that have completed either secondary or tertiary education are far more likely to recognize headaches as a symptom of malaria. Mothers that have completed secondary education are 294% (odds ratio=2.94) to recognize this symptom, and mothers with a tertiary degree are 1,066% (odds ratio=10.66) times more likely to show recognition. It is noted that only headaches fits this trend with a mother’s education and there is no other statistically significant positive trend in symptom recognition. Conversely, mothers with a secondary education were actually 88% (odds ratio=87.9%) less likely to recognize sleepiness or “floppy” symptoms.

Mother’s with at least a primary or secondary education were 311% (odds ratio=3.11) and 268% (odds ratio=2.68) more likely to see a malaria awareness message on the television or the radio than mothers without any education. Furthermore, mothers with the highest level of education were 91.5% less likely to hear the specific malaria message prescribing full course completion when receiving malaria treatment.

**Table 9: Results of logistic regression of mother’s education and symptom recognition, health seeking behaviors, prevention measures, and general awareness**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **No education** | | **Primary** | | **Secondary** | | **Tertiary** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |  |  |  |  |
| Fever | 1 | -- | 0.446 | 0.066 | 0.6477 | .326 | -- | -- |
| Headache | 1 | -- | 2.21 | 0.101 | **2.94** | **0.027** | **10.66** | **0.001** |
| Sleeping all the time/ floppy | 1 | -- | 0.653 | 0.389 | **0.121** | **0.008** | -- | -- |
| **Health seeking behaviors** |  | | | |  |  |  |  |
| Fever prevalence | 1 | -- | **0.401** | **0.043** | 0.788 | 0.588 | -- | -- |
| **General awareness** |  |  |  |  |  |  |  |  |
| TV/radio | 1 | -- | **3.11** | **0.017** | **2.68** | **0.040** | -- | -- |
| “Treatment should be sought within 24 hours…” | 1 | -- | 0.486 | 0.097 | 0.782 | 0.578 | -- | -- |
| “The full course of malaria should be completed…” | 1 | -- | 0.599 | 0.248 | 1.28 | 0.578 | **0.085** | **0.023** |

Associations between father’s education and symptom recognition, health seeking behaviors, prevention measures, and general awareness

Conducting the logistic regression against households that did not have a husband with an education, it was found that when the husband had a secondary or tertiary education there were similar trends in symptom recognition to the regression of a mother’s education. This is as expected given that mothers in the study often have a similar level of education as their spouses. However, it is significant to note that the level of education has an apparent and comparable affect on only specific variables. Households with higher levels of educational attainment are less inclined to associate fever with malaria, and far more likely to associate headache with malaria. When the father has completed a tertiary education, headache is 639% (odds ratio=6.39) more likely to be associated with malaria.

There is a loose trend among education and the prevalence of a household reporting a case of malaria in the past year. When the mother had a primary education, she was 60% (odds ratio= 0.401) less likely to report that her child had malaria in the past year. Following this trend, when the father in the household had a tertiary education there was an 88% (odds ratio=0.123) lower chance that the child had a fever in the past year. Lastly, fathers with a tertiary education were 89% (odds ratio=0.106) less likely to have been exposed to the specific message on seeking treatment within 24 hours of the onset of a fever.

Table 10: Results of logistic regression of father’s education and symptom recognition, health seeking behaviors, prevention measures, and general awareness

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **No education** | | **Primary** | | **Secondary** | | **Tertiary** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |  |  |  |  |
| Fever | 1 | -- | 0.446 | 0.178 | 0.654 | 0.359 | **0.144** | **0.006** |
| Headache | 1 | -- | 3.061 | 0.069 | **2.76** | **0.045** | **6.39** | **0.002** |
| **Health seeking behaviors** |  | | | |  |  |  |  |
| Fever prevalence | 1 | -- | 0.603 | 0.398 | 0.884 | 0.790 | **0.123** | **0.010** |
| **General awareness** |  |  |  |  |  |  |  |  |
| TV/radio | 1 | -- | 1.32 | 0.660 | 2.39 | 0.101 | **--** | **--** |
| “Treatment should be sought within 24 hours…” | 1 | -- | 0.533 | 0.283 | 0.429 | 0.071 | **0.106** | **0.001** |

Associations between employment and symptom recognition, health seeking behaviors, prevention measures, and general awareness

When conducting a logistic regression against mothers and fathers without skilled employment, a multitude of trends are apparent. Mothers and fathers with a skilled profession were roughly 76% (respective odds ratio=0.239, 0.227) less likely to recognize fever as a symptom of malaria, and there was a similar trend for the condition of sleeping all the time. Other symptoms such as diarrhea, and refusal to eat had a negative association when at least one of the parents had a skilled profession. When the mother had a skilled profession, they were five times (odds ratio=4.99) more likely to recognize headache as a symptom of malaria.

Mothers and fathers with a skilled profession were roughly 9 times (respective odds ratios=8.75, 9.91) to receive an awareness message from the television or the radio. These parents were less likely to receive any awareness message from a community volunteer, and less likely to receive malaria-specific messages pertaining to proper treatment within 24 hours.

Table 11: Results of logistic regression of mother’s occupation and symptom recognition, health seeking behaviors, prevention measures, and general awareness

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Unskilled** | | **Skilled** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |
| Fever | 1 | -- | **0.239** | **0.029** |
| Headache | 1 | -- | **4.99** | **0.002** |
| Diarrhea | 1 | -- | **0.219** | **0.049** |
| Anemia | 1 | -- | 5.65\* | 0.301 |
| Sleepy all the time/floppy |  |  | **0.142\*** | **0.031** |
| **General awareness** |  | | | |
| TV/radio | 1 | -- | **8.75** | **0.038** |
| Community volunteer | 1 | -- | **0.157\*** | **0.046** |
| “Treatment should be sought within 24 hours…” | 1 | -- | **0.199** | **0.014** |
| “The full course of malaria should be completed…” | 1 | -- | **0.277** | **0.050** |

\**Exact logistic regression*

Table 12: Results of logistic regression of father’s occupation and symptom recognition, health seeking behaviors, prevention measures, and general awareness

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Unskilled** | | **Skilled** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |
| Fever | 1 | -- | **0.227** | **0.024** |
| Refusal to eat | 1 | -- | **0.099** | **0.027** |
| Sleepy all the time/floppy | 18 | -- | **0.146\*** | **0.036** |
| **Health seeking behaviors** |  | | | |
| Fever prevalence | 1 | -- | **0.172** | **0.023** |
| **Prevention measures** |  |  |  |  |
| ITN usage | 1 | -- | **0.139** | **0.004** |
| **General awareness** |  | | | |
| TV/radio | 1 | -- | **9.91\*** | **0.008** |
| “Treatment should be sought within 24 hours…” | 1 | -- | **0.202** | **0.015** |

Associations between socio-economic status and symptom recognition, health seeking behaviors, prevention measures, and general awareness

The logistic regressions performed for the five socio-economic quintiles against the poorest wealth group showed notable trends. The odds ratios of a mother in the least poor wealth quintile recognizing shaking, fever, and sleeping all the time were 0.123, 0.188, and 0.255, respectively. This same wealth quintile had an odds ratio or 8.89 for recognizing headache as a symptom of malaria. There were similar, yet often less extreme trends for mothers in the less poor wealth quintile when they were compared to the poorest wealth quintile.

Mothers in the highest wealth quintile were 98% (odds ratio=0.016) less likely to report that their child under the age of 5 had a fever in the past year. These mothers were also 24 times more likely to use the hospital for care than mothers of the lowest wealth quintile.

With regards to general awareness, mothers from the less poor and least poor were far more likely to receive a message from the television or the radio than mothers of the poorest wealth quintile (respective odds ratios=9.74, 9.04). Furthermore, a mother in the less poor wealth quintile was 97% (odds ratio=0.033) less likely to hear a message from a community volunteer than a mother in the poorest wealth quintile. The only specific message with a statistically significant odds ratio among SES quintiles was the one regarding the prompt treatment within 24 hours of the onset of fever. Mothers in the less poor and least poor wealth quintiles were 86% and 76% (respective odds ratios=0.139, 0.236) to hear this message.

Table 13: Results of logistic regression of socio-economic status and symptom recognition, health seeking behaviors, prevention measures, and general awareness

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Poorest** | | **Poorer** | | **Poor** | | **Less poor** | | **Least poor** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Symptom recognition** |  |  |  |  |  |  |  |  |  |  |
| Shaking | 1 | -- | 0.861 | 0.825 | 1.55 | 0.427 | **0.119** | **0.050** | **0.123** | **0.054** | |
| Fever | 1 | -- | 0.905 | 0.855 | 0.969 | 0.949 | **0.139** | **0.002** | **0.188** | **0.004** |
| Headache | 1 | -- | 1.33 | 0.658 | 2.11 | 0.180 | **6** | **0.001** | **8.89** | **0.000** |
| Sleepy all the time/floppy | 1 | -- | 1.85 | 0.305 | 0.397 | 0.199 | 0.383 | 0.180 | **0.255** | **0.038** |
| **Health seeking behaviors** |  | | | |  |  |  |  |  |  |
| Fever prevalence | 1 | -- | 0.667 | 0.465 | 0.933 | 0.888 | **0.154** | **0.003** | **0.016** | **0.003** |
| Time before treatment | 1 | -- | 0.667 | 0.707 | 0.229 | 0.097 | -- | -- | **0.033** | **0.012** |
| Treatment at hospital | 1 | -- | 1.45 | 0.798 | 3.0 | 0.363 | **48.0** | **0.012** | **24.0** | **0.021** |
| Treatment at CHPS | 1 | -- | 2.1 | 0.371 | **0.250** | **0.053** | 0.233 | 0.246 | 0.467 | 0.463 |
| **General awareness** |  |  |  |  |  |  |  |  |  |  |
| TV/radio | 1 | -- | 1.04 | 0.939 | 1.32 | 0.583 | **9.74** | **0.004** | **9.04** | **0.006** |
| Community volunteer | 1 | -- | 0.967 | 0.957 | 0.923 | 0.887 | **0.100** | **0.033** | -- | -- |
| “Treatment should be sought within 24 hours…” | 1 | -- | 2.11 | 0.199 | 1.11 | 0.826 | **0.139** | **0.002** | **0.236** | **0.010** |

Associations between message type and source of message

A logistical regression was performed in order to show the odds ratios for seeing the various malaria-specific messages from the different sources present. Each odds ratio in effect represents the “risk factor” of receiving a specific message from television/radio, a community volunteer, a health worker, or a relative. Table 14 shows the results of logistic regressions for each message and source against mothers that didn’t receive a single message from that source. In other words, against mothers that were not exposed to television or radio messages, mothers that received any malaria messages on the television or the radio were 77% less likely to have exposure to the message: “treatment should be sought from health facilities within 24 hours of onset of fever, especially for children under the age of 5.”

Here, the data represents where mothers are receiving specific messages. It is apparent that the television and radio ads are more likely (odds ratio=5.33) to discuss the importance of sleeping under bed nets. Mothers that had received a message from community volunteers were more likely to be informed on the first three messages than those that did not hear from a community volunteer. Ultimately, relatives were found to be a significant and the often the most effective sources of awareness. It is important to note that this was not an anticipated result, and that the option “relatives” was not included in the original question (modeled off of the 2014 Ghana Health Survey). 17% (n=26) of all mothers added the option “relative” as a source of awareness.

Table 14: Results of logistic regression of message type and source of message

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **TV/radio** | | **Community volunteer** | | **Health worker** | | **Relative** | |
|  | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** | **OR** | **P > | z |** |
| **Message** |  |  |  |  |  |  |  |  |
| “Treatment should be sought within 24 hours…” | **0.232** | **0.002** | **7.56** | **0.004** | 1.07 | 0.902 | **7.51** | **0.00** |
| “The Ghana health service recommends ACT…” | 0.990 | 0.984 | **2.97** | **0.053** | 1.95 | 0.258 | **12.69** | **0.00** |
| “The full course of malaria should be completed…” | 1.39 | 0.494 | **2.95** | **0.052** | 1.19 | 0.736 | **7.66** | **0.00** |
| “Families should sleep under ITNs…” | **5.33** | **0.035** | -- | -- | 2.21 | 0.187 | 0.787 | 0.738 |

## Discussion

The study has uncovered numerous interesting findings concerning symptom recognition, health seeking behaviors, prevention measures, and general awareness and the factors socio-demographic factors that influence them. As was mentioned previously, similar studies have not specifically studied the population of the Kassena-Nankana Districts. This study found a multitude of trends distinct from those demonstrated in both the rural/low-income populations of SSA and the Ghana population as a whole.

The literature review showed a well-established link between socio-economic status and malaria symptom recognition. In this study, socio-demographic indicators that are known to influence socio-economic status (i.e. age, marriage status, education, type of employment) were found to have similar trends of association on symptom recognition. Socio-economic status is not a function of a single socio-demographic characteristic; rather it is a composite of the various factors tested for and many others. However, none of these socio-demographic characteristics presented a trend entirely unique from the others tested. Ultimately, it is possible to say that there is an association between socio-economic status and the symptom recognition, but it is not possible to narrow that statement. To elaborate, the results from this study do not support the notion that an intervention specifically on single women or on women without primary education would have the potential to target a problematic demographic.

In both the literature and within this study population mothers commonly associate fever with malaria. In this study, fever was the second most commonly associated symptom of malaria. However, mothers in higher wealth quintiles were significantly less likely to know that fever was a symptom. There were similar trends with the less commonly known symptoms of “shaking” and “sleeping all the time.” Despite this trend, mothers in the highest wealth quintile were nearly 9 times more likely to associate headache with malaria. This was the only statistically significant trend aligned with the literature.

Additional research is also necessary to understand the disparities in symptom recognition. This study does offer credence to some theory that may be tested further. The CHPS program is lauded for the more intimate relationships between CHOs and the mothers they serve, and the dispersal of health-awareness that results from this relationship. This health-awareness has been crucial in antenatal and postnatal care that CHPS centers offer. Although hospitals in the region do offer more professional staff and healthcare capacity, they do lack the intimacy of a CHPS center. As this study demonstrated, mothers from low-income households were far more likely to utilize a CHPS center for the treatment of malaria than mothers of other SES quintiles, as well as have had exposure to a message from a healthcare worker on the proper treatment with ACT.

A crude measurement of fever prevalence (measured by a mother’s response to whether or not their child had a fever in the past 12 months) shows that mothers in the highest wealth quintile were the least likely to have had a febrile child. As such, this study supports the notion that there is an association between experience treating febrile illness and recognizing the symptoms of malaria. Although this result may seem intuitive, the finding is especially interesting as it directly contradicts associations found in the literature between symptom recognition and experience treating malaria.

One plausible explanation for the apparent low sensitivity and specificity of the mother’s diagnosis of malaria was proposed by Théra et al. in the 2000 study of child malaria in the Yanfolila, Sikasso region of Mali. This study proposes that when children received anti-malarial treatment within 24 hours, their parasitaemia likely decreased under [the study’s] threshold of 2000 parasites/micro liter. With regards to the study population of the KND, mothers that treated their children within 24 hours did perform the worst at general symptom recognition. Prompt treatment may hinder the display of fever in some cases and the subsequent association of malaria as a febrile illness by the mothers.

Another significant result was the difference in time before recognition of the first suspected symptom of malaria and the administration of the proper treatment. As shown in the literature, treatment within the first 24 hours of the first display of symptoms is crucial for preventing the progression of severe malaria. This is especially the case in children under the age of five that have yet to develop any natural immunity to malaria, and as a result are more susceptible to the disease. In the study population, mothers in the highest socio-economic quintile were 96% more likely than those of the lowest wealth quintile to take their child to a treatment facility within this 24-hour window. There is no statistically significant difference between SES in regards to which mothers treat their children at home or even what type of treatment is administered at home.

These “least poor” mothers were 24 times more likely to seek treatment at a hospital, while the “poorest” mothers were 55% more likely to use a CHPS center if they sought treatment. With the relatively recent introduction of the National Health Insurance Scheme in Ghana, the whole population is technically provided with healthcare package that includes malaria. Although current enrollment rates hover around 36% of the population, it does appear that the financial relief inherent to the mission of the NHIS is in part effective. Direct cost of treatment was rarely a point of consideration for mothers when bringing their child in for treatment. Rather, all mothers stated that proximity to the treatment facility was a factor that they considered when choosing where to seek treatment, and it was often the only factor that went into the decision.

Another statistically significant trend between socio-economic statuses was present in the source of malaria messages. Given that ownership of television and radio were components taken into account for the principal component analysis used to determine SES, it would be assumed that more mothers from the highest wealth quintile received messages from these sources. This assumption proves to be correct, and mothers in the highest wealth quintile were nearly 10 times more likely to receive a message from television or radio. The only message from this source that respondents were more likely to hear was on the usage of ITNs; the remaining messages were less likely to be received. Despite this exposure, there was a high rate (88%) of the study population that regularly slept under ITNs and there was no statistically significant association between exposures to this message and ITN usage.

Interestingly, mothers from this study in the highest wealth quintile are the least likely to hear the message informing them to take their children to receive treatment within 24 hours, yet they are the most likely to actually perform that task. Mothers in this demographic are also the least likely to associate the most common symptom of malaria, a fever, with the illness.

The CHPS policy in Ghana was adopted nationally after the model developed by the Navrongo Health Research Center showed promising results. The model found that relocating a nurse to communities could outperform an entire sub-district health center and increase the volume of health service encounters eight-fold. This study supports the notion that lower-income populations in the KND still delay beyond the 24-hour window of time recommended for treatment of under-five malaria. This is despite this population demonstrating an increased accessibility to CHPS centers, a higher exposure to awareness messages on malaria, and better rates of symptom recognition for more symptoms of malaria when compared to the highest wealth income population of the KND. Further research is necessary to uncover why the disparity in time before treatment still exists between members of different SES quintile.

Limitations and Biases

One of the main limitations for this study was time. 14 weeks were allotted for the creation and the implementation of this study. This meant that drafting of the proposal, waiting for institutional review board approval, training of field staff, and data collection fit into this window of time. During the final synthesis of data and the comparisons by socio-demographic characteristics, it was found that some demographic indicators had insufficient response rates. When this was the case, the program STATA 14 failed to perform logistical regressions.

An important aim of the study was to explore the various aspects of treatment for malaria within the household. In many regards this aim was successful, however no mothers were able to recall the exact drugs that they administered during home treatment. It may have been more effective to provide the mothers with a list of drugs they may have used in order to help recall. The addition of this data would make for richer synthesis.

Another limitation was the way in which certain questions were phrased. An objective and significant portion of the study was intended to investigate the issues that mothers face when trying to receive treatment for their children. This aim was hindered as the two field workers asked the question differently. This problem was only realized towards the end of data collection and could not be remedied in the allotted time.

Conclusions

Numerous studies on rural and low-income populations across sub-Saharan Africa have supported the notion that these demographics are the most burdened when accessing healthcare. The health-seeking behaviors of mothers treating malaria in their children under the age of five in settings such as the Kassena-Nankana West and Kassena-Nankana East Municipality was an ideal way to assess an aspect of access to health care for such populations. The study setting and objectives are optimal on account of three key factors: malaria rarely progresses in severity when properly diagnosed and promptly treated; all citizens of Ghana have access to free malaria treatment under the NHIS; and the introduction of the CHPS program allows for increased access to care for rural populations. In theory, with limitations on barriers that would otherwise limit access to healthcare (e.g. cost and distance), the population demonstrated other factors for consideration in the management of a potentially fatal health condition.

Many of the findings in this study were not consistent with the literature. A key exhibition of this was that in this study mothers of higher socio-economic status performed worse than mothers of the lower socio-economic status in most categories of symptom recognition. Further research is necessary to understand why this disparity exists, and by what means policy recommendations could affect it.

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