Healthcare Utilization for Acute Febrile Illness, Knowledge of Malaria and Trust in Informational Resources among Clinic Attendees in Port-au-Prince and Artibonite Département: A Cross-sectional Survey

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ABSTRACT

Objective: The overall aim of the project was to understand healthcare utilization patterns and access to and trust in resources regarding malaria and other febrile illness in two regions (Port-au-Prince and Artibonite Département) differentially affected by the 2010 earthquake.

Methods: In 2012-2013, a cross-sectional survey was conducted with clinic patients regarding local perceptions of febrile illnesses, treatment patterns, malaria knowledge, information sources for malaria, and perceived trustworthiness of these sources.

Results: Overall, hospitals, pharmacies, and clinics were commonly used facilities for treatment of febrile illness; however, over 72% of respondents also used traditional medication. Respondents with higher education were more likely to use pharmacies and biomedical and traditional medications than those with lower education. Respondents reported that children were more vulnerable to fever than adults. Respondents were knowledgeable about malaria; however, numbers and types of sources of information used about malaria varied significantly by demographic characteristics including gender, education, region, and residency. Trust in resources varied by types of resources, respondent demographics, and health utilization patterns.

Conclusion: Healthcare utilization practices and access to reliable and trusted health information resources are significant factors in prevention and treatment of infectious diseases including malaria and other acute febrile illnesses. Differential use of health facilities and resources can result in health disparities between demographic and socio-economic groups. These preliminary data suggest the need for community-based research on perceived access to healthcare facilities and resources and trust in those resources to facilitate development of targeted sustainable education and intervention programs.

Keywords: Acute Febrile Illness, Haiti, Healthcare Utilization, Malaria

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INTRODUCTION

Haiti, an island nation with a population of 10 million, is the poorest country in the Western Hemisphere. The 2010 GNI was US$700 – compared to an average of US$534 across low-income countries (LIC). Total health expenditure is US$76, a figure comparable to the global average for LIC. The under-5 year mortality rate is 165/1000 compared to 18/1000 regionally and 57/1000 globally. In addition, Haitians experience significant health disparities both between urban and rural regions and by socio-economic status.

Similar to other LIC, Haiti has experienced a history of political turmoil and reconstruction efforts after natural disasters, most recently the 2010 earthquake. Evidence suggests that improvements in maternal and child health services accomplished before the earthquake have been substantially reversed and there is decreased likelihood of meeting 2015 Millennium Development Goals (MDG) (1). Since the earthquake, infectious diseases have experienced resurgence and Haitians throughout the country remain at risk for a variety of agents including bacterial, viral and parasitic pathogens (2).

Hispaniola (Dominican Republic and Haiti) is the only Caribbean island on which malaria persists (3). Annually, there are approximately 30,000 reported cases of malaria in Haiti with estimates of occurrence as high as 200,000 (4, 5). Surveillance in Southeast Haiti in 2010 revealed a 9.5% overall rate (201/2126) caused by *Plasmodium falciparum*; however, within the surveillance region, rates varied markedly from 0% to 34%. Four regions were designated as highly infected (6). In a study in the Ouest Département over a seven month period (2010 to 2011), 255 patients presented at a primary health clinic with undifferentiated fever. Nearly 30% of these patients were diagnosed with *P. falciparum* (2).

In a 2006 household survey in Arbonite Département, a region with high rates of malaria and a data collection site for the current study, more knowledge regarding malaria transmission was associated with higher household assets and younger age (< 60 years). Overall, approximately 68% of respondents correctly identified mosquitos as transmitters of malaria. Only 7.0% and 3.6% of households possessed one or more bed nets or ITN (insecticide treated nets) respectively (7).

These studies demonstrate the need for more information on malaria in Haiti, to impact diagnosis, treatment, and prevention procedures, particularly as Hispaniola has been targeted for malaria eradication by 2020. However, existing monies (e.g. Global Fund) and the Haitian health system infrastructure are insufficient to meet this goal (3, 8). Efforts have been compromised by the effects of the 2010 earthquake and the subsequent cholera outbreak including homelessness, lack of sanitation, a fragile public health infrastructure, and distrust of relief efforts (6, 9, 10).

Data analyzed for this paper includes 152 surveys. The objectives for the following analysis include assessments of: 1) Healthcare utilization and treatment for fever in relation to socio-demographic characteristics of respondents including proximity to the 2010 earthquake; 2) Knowledge regarding malaria transmission, symptoms, prevention, and treatment; and, 3) Utilization of information sources about malaria and level of trust in those sources in relation to socio-demographic characteristics and healthcare utilization patterns.

METHODS

Research Sites**.** The research was conducted between June 2012 and January 2013 at healthcare facilities in seven sites in Port-au-Prince and the northwest Artibonite Département. Port-au-Prince is the capital and commercial center of Haiti and has an estimated population of

over 900,000. As of September 2014, over 85,000 individuals in Port-au-Prince and the surrounding region still live in internally displaced persons (IDP) camps as a result of the earthquake (11). Artibonite Département is a rice growing region and has a population of approximately 1,070,000. While the 2010 earthquake epicenter occurred in the immediate region of Port-au-Prince, the Artibonite Département experienced minimal impact.

Research Population and Recruitment**.** The research population included individuals aged 16+ years attending healthcare facilities in the research sites. A convenience sampling strategy was utilized. Individuals waiting for service at the health facilities were approached by research team members and asked to participate in the survey. Verbal informed consent was obtained from all research participants. The research protocol was approved by the Institutional Review Board at Henry Ford Health System, Detroit, Michigan.

Survey Development and Outcome Measures**.** The cross-sectional survey was adapted from a healthcare utilization instrument developed and implemented by members of the research team in Nha Trang, Viet Nam (12). Modifications were made to the survey to address areas of interest (e.g., acute febrile illness, malaria) and the instrument was piloted in Haiti prior to implementation. After the pilot, additional changes were made to address item clarity and local conditions (e.g., types of health facilities). Outcome measures are described in Table 1. INSERT TABLE 1.

Data Collection**.** Data were collected at healthcare facilities by research teams including U.S. visiting medical students from Wayne State University and Haitian collaborators. The items and response choices were read to the respondents in Haitian Creole. The data collector marked the respondent's answers on a survey sheet. Each survey took approximately 30 minutes.

Data Management and Analysis**.** Survey data were entered into SPSS (Version 21.0, IBM Corporation, Armonk NY) at Henry Ford Health System Division of Infectious Diseases. Raw data were reviewed and corrections made. Data analysis was conducted using SPSS and frequencies and means were run for further data cleaning. Variables were created including a binary education variable (lower/higher education) and two binary residency (urban/rural) and region variables (Port-au-Prince/Artibonite Département). Disease severity items were re-categorized from five to three age-based variables (0-5 years, 6-15 years, 16+ years). The malaria knowledge items were summed to calculate a score for correct responses (range 0-4). Total number of information resources for malaria were summed (range 0-14) and reclassified as institutional (government, NGOs), radio-TV, written materials, social network (family, friends), traditional medicine, non-healthcare professionals (religious leaders, teachers), and healthcare professionals. Based on mean scores for levels of trust in sources of information, a dichotomous (lower/higher trust) variable was established. [see Table 1] Univariate analysis including frequencies and means with standard deviations provided descriptive data. Bivariate analysis including Pearson's chi square (categorical) and student t-tests (continuous) were used to assess significant differences between dependent (healthcare utilization, treatment, knowledge of malaria, and information sources) and independent variables (gender, residency, region, education, healthcare utilization). Multinomial logistic analysis was conducted for trustworthiness. Independent variables included gender, residency (rural/urban), region (Port-au-Prince/Artibonite Déparetment), education (lower/higher), use of services for fever (pharmacy, clinic, hospital), malaria knowledge, and number of reported sources of information.

RESULTS

Demographics**.** Overall, 62.9% respondents were female, 65.8% resided in urban areas and 66% lived in the Artibonite Département. Less than 10% of respondents were employed and 47.4% had a primary school education or less. Nearly 80% of households included children 15 years and younger. Analysis indicates a larger proportion of male respondents (80.4%) compared to female respondents (56.8%) lived in urban areas [X^2=8.63, df 1: p=.003]. Respondents in Port-au-Prince lived in smaller households than those from Artibonite Département [t=4.34, df 149: p<.001] [Table 2]. INSERT TABLE 2.

Healthcare Utilization and Treatment of Fever**.** Respondents were asked about types of health facilities and treatments used the *most recent time someone in their household had a fever.* Data indicate 78.9%, 76.3% and 64.2% of respondents used hospitals, pharmacies, and clinics respectively. Respondents with higher education were significantly more likely to use a pharmacy than respondents with lower education [X^2=8.21, df 1: p=.004]. Under 10% of respondents used neither a hospital, pharmacy nor a clinic and Port-au-Prince residents were more likely (19.6%) to not use any of these services than Artibonite Département residents (5.0%) [X^2=8.06, df 1: p=.005]. Over 59% of respondents used a biomedical fever reducing medication, 46.5% used antibiotics, and 72.9% used local traditional teas, leaves, and/or herbs. Specific traditional medicines included cayman fruit (*kachiman*), and potato (*pom*), orange (*zoranj*) and squash (*kalbas*) leaves. Over 65% of respondents reported growing medicinal plants at home. By residency, urban residents were more likely than rural residents to use antibiotics [X^2=4.64, df 1: p=.031]. Respondents with a lower level of education were less likely to use both biomedical fever reducing medicines [X^2=5.18, df1: p=.023] and teas, leaves, and/or herbs [X^2=4.36, df 1: p=.037]. Residents of Artibonite Département were more likely to use biomedical fever reducing

medication [X^2=10.72, df1: p=.001], antibiotics [X^2=5.53, df1: p=.019, and teas, leaves and/or herbs [X^2=5.89, df1: p=.015]. [Table 3] Respondents were more likely to have used teas, leaves, and/or herbs for adults (82.6%) compared to children (61.1%) [X^2=8.00, df 1: p=.005].

INSERT TABLE 3.

Knowledge of Malaria and Use of Information Resources. A 4 point scale was used to assess malaria knowledge. The mean score was 3.36 (SD .85) with no differences in scores by residency, region, education level, or gender. In terms of utilization of sources of information about malaria, data indicate significant differences by demographic characteristics. Overall, mean number of previously used information resources regarding malaria was 11 (SD 3.89: range 1 to 14). Males reported using more sources of information than female respondents [t-2.43, df 148: p=.016], and respondents with higher education reported more sources than those with lower education [t=-2.05, df 144: p=.042]. Male respondents were more likely to use institutional resources (government, NGOs) [t=2.022, df 148: p=.045) and TV/radio [t=3.555, df 148: p=.001]. Respondents with higher education were more likely to use institutional resources [t= -2.107, df 144: p=.037], written materials [t= -2.525, df 143: p=.013], and social networks (family, friends) [t= -2.490, df 144: p=.014]. Rural respondents compared to urban respondents were more likely to use non-healthcare professionals (teachers, religious leaders) as sources of information [t= -3.887, df 149: p<.001]. Residents of Artibonite Département compared to those in Port-au-Prince were more likely to use written information [t=2.089, df 148: p=.038] and advice from traditional practitioners [t=2.794, df 149: p=.006] (Table 4). INSERT TABLE 4.

Trust in Information Sources**.** Respondents were asked to rate the level of trust they have in the sources of information which they reported to utilize. Using multinomial logistic regression analysis data indicate individuals who used fewer informational resources had less trust in institutional sources [OR 1.57 (CI 1.22-2.01): p<.001], TV/radio [OR 1.33 (CI95 1.09-

1.63):p=.006], written materials [OR1.66 (CI95 1.18-2.32): p=.003], non-healthcare professionals (religious leaders, teachers) [OR 2.07 (CI95 1.50-2.88): p<.001], healthcare providers [OR 2.00 (CI95 1.47-2.73): p<.001], and traditional practitioners [OR2.22 (CI95 1.39-3.56): p=.001]. Rural respondents had less trust in institutional resources than urban respondents [OR 4.56 (CI95 1.65-12.65): p=.004] and those reporting use of local clinics for fever had less trust in written information [OR 6.67 (CI95 1.57-28.39) p=.010]. Individuals with lower malaria knowledge reported less trust in healthcare providers [OR 2.54 (CI95 1.42-4.56): p=.002].

DISCUSSION

At a global level, a vast majority of populations engage in pluralistic health systems which can include a combination of traditional and western pharmaceutical self-care, use of traditional and/or religious practitioners, and homeopathic and biomedical treatments (13, 14). These "blended" healthcare systems are both reinforced through local culture, social norms and individuals' experiences and beliefs regarding effective prevention and treatment modalities for symptoms and diseases. In these findings from Haiti, respondents with higher education report more use of pharmacies and greater likelihood of using both western fever reducing medications and traditional medications. Individuals with higher education may feel more confident in their ability to care for and self-treat household members. There is also indication of more self-treatment for adults than children. These data may indicate that households conserve scarce resources for children's health needs. This is consistent with data from Thailand regarding dengue fever, in which adults are reported to be more likely to delay seeking treatment from biomedical facilities for themselves than for their children (15).

Our data indicate that Port-au-Prince residents use public health facilities less than Artibonite Département residents. Less use of these facilities in Port-au-Prince should be considered in the context of a health system which suffered severe disruption in the aftermath of the 2010 earthquake including thousands of health workers killed and injured, 8 hospitals, 9 clinics, and 19 university and training facilities destroyed, and another 38 facilities seriously damaged. Several years later, healthcare in Port-au-Prince remains fragile (16, 17).

Urban residents were more likely to use antibiotics than rural residents. This might be associated with ease of availability through pharmacies and 'boutique' shops which sell medications. Misuse of antibiotics in LMIC has contributed to multidrug resistance (MDR) in a wide range of pathogens and increasing morbidities and mortalities. To date, we are aware of no published research regarding antibiotic prescription practices or use by consumers in Haiti.

Across demographic groups, data indicate a high level of knowledge about causes of malaria and prevention, symptoms, and treatment. Respondents reported a wide range of malaria information sources. Women and individuals with lower levels of education used less sources of information. Since data do not indicate an association between gender or education and trust in sources, these differences might be attributed to accessibility, literacy, and/or knowledge of the sources. This interpretation is supported by types of information used – men were more likely to use institutional resources (NGO/government) and TV/radio, and respondents with higher education were more likely to use institutional resources, written material, and social networks.

Rural residents were more likely to report use of non-healthcare professionals as information resources. In these smaller community networks, individuals with higher education may provide and interpret a variety of information including health-related messages and materials. In Port-au-Prince compared to Artibonite Département, respondents more often

reported traditional practitioners as sources of information which again could be attributable to the continued disruption of many services in the earthquake damaged regions of the country.

Overall, individuals who used more resources of information about malaria also reported higher trust in those resources and individuals with higher levels of trust in healthcare providers scored higher on the malaria information scale. Further research is needed to increase understanding of the relationship between trustworthiness of resources and health literacy and access and use of available information. Such research is particularly important in a post-disaster context to further develop disaster preparedness and recovery strategies at the individual, community, and national levels.

Almost five years after a major earthquake in Haiti, collaborative efforts are needed to develop and implement community-based sustainable applied research and health programming to reduce levels of morbidity and mortality from malaria and other infectious diseases. This cross-sectional healthcare utilization survey provides some preliminary data which can be a platform for such efforts. Accurate knowledge of disease prevalence across regions and populations is an integral component of disease eradication efforts and introduction of prophylactic and treatment modalities. Such data are primarily dependent on passive surveillance efforts conducted through local health facilities. Information on where, when, and who goes to these health facilities can increase the accuracy of surveillance data (18). Furthermore, regional and demographic variations in facility and treatment utilization and socio-economic barriers can lead to treatment delay, misuse of pharmaceuticals, and health disparities and poor health outcomes.

Our data indicate relationships between knowledge of malaria, number of utilized health information resources, and trust in health providers as sources of information. Socio-demographic characteristics including gender and rural and urban residency were also associated with access to

certain types of information. Organizations and health providers developing and implementing social mobilization and communication campaigns about malaria need to know the best ways to reach various population groups and where a need exists to engender greater trust in available resources. These data also suggest the importance of engaging and training non-biomedical human resources (e.g., teachers and priests) in dissemination of accurate health information.

Study limitations include the use of convenience sampling and recruitment at healthcare facilities. Future research needs to be community based and include a larger range of sites (e.g., remote mountainous areas). Our data also do not include information on living situations, e.g., whether respondents were living in Internally Displaced Persons (IDP) camps. Such data are important to understanding the extent of disruption of social networks, access to resources and healthcare experienced by respondents in post-earthquake Haiti. We are currently in the process of implementing a supplemental survey regarding healthcare utilization, social networks, and access to and trust in resources with residents in IDP camps.

REFERENCES

1. Amibor P. What will it take to maintain maternal and child health gains made in Haiti prior to the 2010 earthquake? An analysis of past progress, trends, and the prospects for realization of the United Nations Millennium Development Goals 4 and 5. Matern Child Health J. 2013; **17**(8): 1339-45.
2. Neuberger A, Tenenboim S, Golos M, Pex R, Krakowsky Y, Urman M, et al. Infectious diseases seen in a primary care clinic in Leogane Haiti. Am J Trop Med Hyg. 2012; **86**(1):11-15.
3. World Health Organization. Elimination of malaria and lymphatic filariasis in Hispaniola. Weekly Epidemiological Report. 2013; **7**(88): 72-80.
4. Weppelmann TA, Carter TE, Chen Z, von Fricken ME, Victor YS, Existe A, et al. High frequency of the erythroid silent Duffy antigen genotype and lack of Plasmodium vivax infections in Haiti. Malar J. 2013; **12**:30.
5. World Health Organization. Malaria Country Report Haiti 2011 [Internet]. c2011. [cited 2014 April 9] Available from: URL: http://www.who.int/malaria/publications/country-profiles/2011/profile_hti_en.pdf
6. Raccurt CP, Ciceron M, Dossil R, Boncy J. Prevalence of *Plasmodium falciparum* during the rainy season (June-December) in the southeast district of Haiti. Med Sante Trop. 2012; **22**(4): 435-39.
7. Keating J, Eisele TP, Bennett A, Johnson D, & Macintyre K. A description of malaria-related knowledge, perceptions, and practices in the Artibonite Valley of Haiti: Implications for malaria control. Am J Trop Med Hyg. 2008; **78**(2): 262-69.
8. Roberts L. Elimination meets reality in Hispaniola. Science. 2010; **328** (5980): 850-51.
9. Neuberger A, Zaulan O, Tenenboim S, Vernet S, Pex R, Held K, et al. Malaria among patients and aid workers consulting a primary healthcare centre in Leogane Haiti, November 2010 to February 2011 – a prospective observational study. Euro Surveill Bull Eur Sur Mal Transm Eur Commun Dis Bull. 2011; **16**(13):pii=19289.

10. Global Health Sciences, University of California San Francisco. The feasibility of malaria elimination on the island of Hispaniola, with a focus on Haiti: An assessment conducted January to June 2013. [cited 2014 April 8]. Available from: URL: http://globalhealthsciences.ucsf.edu/sites/default/files/content/ghg/mei-malaria-elimination-haiti.pdf
11. International Organization for Migration. Displacement Tracking Matrix (DTM) Haiti. Round 20-September 2014. [cited 2014 December 3]. Available from URL: http://iomhaitidataportal.info/dtm/index2.aspx
12. Kaljee L, Anh DD, Minh TT, Tho LH, Batmunkh N, & Kilgore P. Rural and urban Vietnamese mothers utilization of biomedical and traditional healthcare resources for infants and young children with pneumonia and associated symptoms. J of Behav Med. 2011; **34**(4): 54-67.
13. Stoner BP. Understanding medical systems: Traditional, modern and syncretic health care alternatives in medically pluralistic societies. Med Anthropol Q. 1986; **17**(2): 44-48.
14. Green G, Bradby H, Chan A, & Lee M. "We are not completely Westernized": dual medical systems and pathways to health care among Chinese migrant women in England. Soc Sci Med. 2006; **62**(6): 1498-1509.
15. Pach A and Kaljee L. Participation in a dengue fever vaccine trial in Thailand: issues of vaccine acceptance, trial attributes, and informed consent. Presented at: Annual Meeting of the Society for Applied Anthropology; March 2010; Merida, Mexico.
16. Drobac P, Basilico M, Messac L, Walton D, Farmer P. Building an effective rural health delivery model in Haiti and Rwanda.In: Farmer P, Kim JY, Kleinman A, Basilico M, eds. Reimagining Global Health: An Introduction. Berkeley: University of California; 2013.133-83.
17. Merlin [U.K.], Is Haiti's health system any better? A report calling for a more coordinated collaborative approach to disaster response. c2011. [cited 2014 April 8]. Available from: URL: http://www.who.int/workforcealliance/knowledge/merlinhaiti_2011report.pdf
18. Kaljee L, Pach A, Thriemer K, Ley B, Ali S, Jiddawi M, Puri M, et al. Utilization and

accessibility of health care on Pemba Island, Tanzania: implications for health outcomes and surveillance for typhoid fever. Am J Trop Med Hyg. 2013;**88**(1): 144-52.

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Table 1: Outcome measures: Items, scales, and response options

Category	Items/scales (response options)
Demographics	Gender (male, female); Age (continuous); Employment Status (employed, unemployed); Education (lower [primary school or less], higher [secondary school or more]); Residency (urban, rural); Region (Port-au-Prince/Artibonite Département); Mean Number of Household Members (continuous); Households with children ≤ 15 years (continuous).
Healthcare Utilization and Treatment	Where do you usually go for healthcare for adults [16 years +]? For children [≤ 15 years]? (self-treatment, pharmacy, primary care clinic, private physician, hospital, traditional healer) Which health facilities did you use last time someone in your household had a fever? (pharmacy, primary care clinic, hospital) Do you grow medicinal plants/herbs at home? (yes, no) What type of medicine do you use for treatment of fever? (biomedical fever reducing medications, antibiotics, local traditional teas, leaves, herbs) How likely for an adult in your household to have fever? How likely for a child? (very likely, likely, not likely) Range: 1-3.
Knowledge of Malaria	Transmission: a) drinking or eating contaminated water/food; b) getting sneezed on by infected person; c) hugging/kissing; d) bitten by mosquito; Symptoms: a) bloody stool; b) vomiting, watery diarrhea, nausea, fast pulse, cramps; c) cycles of fever, sweats, elevated temperature, enlarged spleen; d) rash on entire body; Prevention: a) boiling water for 20 minutes before drinking; b) sleep with bed net, insecticides, keep arms/legs covered; c) avoid contacting infected individuals; d) eat fruits and vegetables; Treatment: a) with an antibiotic; b) ACT (artemisinin-combination therapies); c) Aspirin; d) ORT (Oral rehydration therapy) Range 1-4

Sources of information about malaria	Use of the following sources: Institutional (Government, NGOs). TV, radio, written media (flyers, posters), social networks (friends, family); non-healthcare professionals (religious leaders and teachers), health care professionals (pharmacists, nurses, doctors), traditional practitioners (traditional healers, voodoo doctors) Range for total number of sources 1-14.
Trust in information sources	How much do you trust these sources [see above sources]? (lower trust, higher trust)

Table 2: Socio-demographic characteristics by gender and residency (urban/rural) and region (Port-au-Prince [PAP]/Artibonite Département[AD])

	Gender		Residency		Region	
	Female	Male	Urban	Rural	PAP	AD
Education level [completed] (primary school or less)	53.3% (49/92)	42.6% (23/54)	50.4% (67/133)	47.0% (31/66)	50.0% (24/48)	48.5% (48/99)
Employed (yes)	8.4% (8/93)	14.3% (8/56)	16.2% (22/136)	11.8% (8/68)	5.9% (3/51)	12.9% (13/101)
Mean age (SD)	38.1 (15.4)	36.8 (15.8)	38.0 (13.9)	38.5 (17.0)	36.1 (13.0)	38.5 (16.6)
Mean # household members (SD)	6.2 (3.1)	5.6 (2.3)	5.8 (2.6)	5.8 (2.8)	**4.6** [c] **(1.8)**	**6.6 (3.0)**
Percentage of households with children	83.2% (79/95)	75.0% (42/56)	81.6% (111/136)	79.4% (54/88)	84.3% (43/51)	77.2% (78/101)

[a] p<.05; [b] p<.01; [c] p<.001; Bold text indicates significance at p<.05

Table 3: Use of healthcare facilities and treatments for fever by education level, residency (urban/rural) and region (Port-au-Prince [PAP]/Artibonite Département[AD])

	Education		Residency		Region	
	Primary school or less	Secondary school or more	Urban	Rural	PAP	AD
Hospital	81.4% (57/70)	77.3% (58/75)	82.8% (82/99)	74.5% (38/51)	**58.8% [c] (30/51)**	**90.9% (90/99)**
Clinic	55.9% (33/59)	68.6% (48/70)	68.7% (57/83)	59.9% (29/51)	**41.2% [c] (21/51)**	**78.3% (65/85)**
Pharmacy	**64.4% [b] (38/59)**	**85.9% (61/71)**	75.0% (65/84)	78.4% (40/51)	**62.7% [b] (32/51)**	**84.5% (71/84)**
Biomedical fever reducing medications	**51.5% [a] (34/66)**	**70.3% (52/74)**	62.4% (58/93)	53.8% (28/52)	**41.2% [b] (21/51)**	**69.1% (65/94)**
Antibiotics	43.9% (29/66)	52.1% (38/73)	**53.3% [a] (49/92)**	**34.6% (18/52)**	**33.3% [a] (17/51)**	**53.8% (50/93)**
Traditional teas, leaves, and/or herbs	**65.2% [a] (43/66)**	**80.8% (59/73)**	73.9% (68/92)	71.2 % (37/52)	**60.8% [a] (31/51)**	**79.6% (74/93)**

[a] p<.05; [b] p<.01; [c] p<.001; Bold text indicates significance at p<.05

Table 4: Mean number and types of sources of information about malaria by gender, education, residency (urban/rural), and region (Port-au-Prince [PAP]/Artibonite Département [AD])

	Gender		Education		Residency		Region	
	Male	Female	Primary School or Less	Secondary School or More	Urban	Rural	PAP	AD
Total	**11.84** [a] **(3.12)**	**10.27 (4.21)**	**10.20** [a] **(4.38)**	**11.51 (3.27)**	10.75 (4.35)	11.12 (2.87)	10.18 (3.29)	11.23 (4.15)
Institutional (Government/NGOs)	**1.79** [a] **(0.53)**	**1.55 (0.76)**	**1.51** [a] **(0.79)**	**1.75 (0.57)**	1.62 (0.74)	1.69 (0.58)	1.61 (0.63)	1.66 (0.71)
TV/radio	**1.88** [b] **(0.43)**	**1.45 (0.84)**	1.48 (0.84)	1.72 (0.62)	1.60 (0.74)	1.63 (.74)	1.49 (0.76)	1.67 (0.73)
Written media	0.79 (0.41)	0.69 (0.47)	**0.63** [a] **(0.49)**	**0.81 (0.39)**	0.74 (0.44)	0.71 (0.46)	**0.62** [a] **(0.49)**	**0.78 (0.42)**
Social network (friends/family)	1.79 (0.56)	1.61 (0.70)	**1.55** [a] **(0.75)**	**1.81 (0.51)**	1.69 (0.69)	1.65 (0.59)	1.59 (0.67)	1.72 (0.65)
Professional (non-healthcare providers)	1.77 (0.57)	1.68 (0.68)	1.63 (0.70)	1.80 (0.55)	**1.58** [c] **(0.74)**	**1.98 (0.14)**	1.84 (0.46)	1.65 (0.70)
Healthcare providers	2.70 (0.69)	2.40 (1.02)	2.41 (1.00)	2.63 (0.78)	2.48 (0.98)	2.58 (0.89)	2.31 (1.07)	2.62 (0.81)
Traditional providers	1.14 (0.84)	0.89 (0.86)	1.00 (0.89)	0.98 (0.83)	1.05 (0.88)	0.88 (0.81)	**0.73** [b] **(0.72)**	**1.13 (0.90)**

[a] p<.05; [b] p<.01; [c] p<.001; Bold text indicates significance at p<.05