

# Investigating unlicensed retail drug vendors' preparedness and knowledge about malaria: An exploratory study in rural Uganda



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## ABSTRACT

**Background:** Despite major efforts to increase the uptake of preventive measures and timely use of the first line antimalarial treatment artemisinin-based combination therapies (ACT), Uganda continues to fall short of meeting its national malaria control targets. One of the challenges has been scaling up effective measures in rural and remote areas where the unlicensed private retail sector remains the first point of contact and a common source of treatment. The current paper discusses unlicensed vendors' (1) training related to malaria case management for children aged five and under, and (2) knowledge related to the cause of malaria, preventive measures, common signs, and symptoms, diagnostic procedures, and best treatment options.

**Methods:** A qualitative study using semi-structured interviews was conducted in the rural district of Butaleja, Uganda in 2011. All 88 unlicensed drug outlets enumerated in the study area were visited by six locally recruited research assistants, with one vendor from each outlet invited to participate. The transcripts were analyzed using acceptable qualitative research protocols.

**Results:** About half of the 75 vendors interviewed had received some sort of formal training on malaria at a post-secondary institution, although only 6.7% had qualifications which met licensure requirements. The study found widespread misconceptions relating to the cause, as well as prevention and treatment of malaria. A large majority of the vendors relied primarily on non-specific symptoms and limited physical exams for diagnoses, with less than one-tenth of the vendors recognizing that rapid or microscopic blood testing was necessary to confirm a clinical diagnosis of malaria. While most recognized mosquitoes as the primary vector for malaria, over two-fifths of the vendors held misconceptions about the factors that could increase the risk of malaria, and nearly a third believed that malaria could not be prevented. With respect to acute case management, three-quarters viewed as the best option a medicine other than the government's first-line antimalarial, artemisinin-based combination therapies (ACT). Almost three-fifths specified quinine as their preferred option, with about one-fifth recommending quinine injection.

**Conclusion:** Findings from this study confirm significant gaps in unlicensed vendors' knowledge related to malaria. With increased utilization of unlicensed drug outlets in rural and remote settings such as Butaleja, findings from this study strongly supports the need to implement strategies to improve the quality of care delivered at these outlet.

## 1. Introduction

Malaria is one of the leading causes of morbidity and mortality in the world, posing a major public health challenge in several countries across Sub-Saharan Africa (World Health Organization (WHO), 2015c). In 2015 there were 214 million cases of malaria and 438,000 deaths reported, with 90% of the deaths occurring in Sub-Saharan Africa

(World Health Organization (WHO), 2015c). Malaria constitutes the greatest threat to children five years of age and under, contributing to the deaths of approximately 306,000 children in that age group globally in 2015 (World Health Organization (WHO), 2015c). Uganda is among the top four countries for cases of malaria, contributing to 19% of Uganda's under-five mortality, second only to pneumonia (World Health Organization (WHO), 2015b; World Health Organization

**Abbreviations:** ITN, insecticide-treated nets; IRS, indoor residual spraying; WHO, World Health Organization; ACT, artemisinin-based combination therapy; iCCM, integrated management of childhood illness; CHW, community health workers; RA, research assistant; NSAID, non-steroidal anti-inflammatory drugs; DV, drug vendor; AMFm, affordable medicines facility-malaria; RDT, rapid diagnostic testing

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(WHO, 2015c).

The strategy for malaria control in endemic countries, such as Uganda, involves prevention and prompt case management (Ministry of Health, 2005; United States Agency for International Development (USAID), 2016). For prevention, the strategy typically includes: vector control using insecticide-treated nets (ITN) alongside indoor residual spraying (IRS); the removal of breeding sites by draining pools of water, larvaciding, and clearing unnecessary vegetation around houses; and reducing the entry of mosquitoes into houses by installing mosquito-proof windows, ventilators, and open eaves and closing windows and doors during the evening (Fullman et al., 2013; Musoke et al., 2013, 2015). With respect to uncomplicated malaria management, appropriate action is defined as parasitological confirmation followed by treatment with an artemisinin-based combination therapy (ACT) started within 24-h of the appearance of initial symptoms (Ministry of Health Uganda, 2010, 2012; United States Agency for International Development (USAID), 2017). While oral quinine has been the long-standing second-line treatment option in Uganda, in keeping with the WHO treatment guidelines, more recent malaria strategic reports discourage its use except in circumstances where ACTs are not available (Ministry of Health Uganda, 2010, 2012; United States Agency for International Development (USAID), 2016, 2017). Similarly, for severe malaria, recent strategic reports support the use of parenteral artemisinin derivatives (artesunate or artemether) over parenteral quinine where available (Ministry of Health Uganda, 2010, 2012; United States Agency for International Development (USAID), 2016, 2017). Rectal artesunate remains the pre-referral treatment option for severe malaria at the community level (Ministry of Health Uganda, 2010, 2012).

Though major efforts have resulted in a gradual uptake of preventive measures and impressive gains in the use of ACTs, Uganda continues to fall short of meeting its national targets. For example, while 81%–97% of households in 2014/2015 were reported to own at least one ITN, only 78% (65.0%–87.1%) of children under five were reported to have slept under an ITN the night before the survey (Uganda Bureau of Statistics (UBOS) and ICF International, 2015). Additionally, a negligible proportion of households (4.9%) had applied IRS within the previous six months (Uganda Bureau of Statistics (UBOS) and ICF International, 2015). Similarly, Ugandan studies conducted between 2011 and 2014 estimate the use of ACTs within the same or next day of experiencing fever in children aged five and under ranged from 20.8%–49%, and the number who had blood taken for testing ranged from 21%–36% (Kassam et al., 2015, 2016b; Uganda Bureau of Statistics (UBOS) and ICF International, 2015).

If Uganda is to successfully meet its national targets, adequate knowledge about preventive and treatment measures and the uptake of this knowledge into practice by all health providers is needed. In many rural and remote regions of Uganda where formal health facilities are either difficult to reach or viewed as providing sub-optimal care, the private-for-profit drug sector is often the first point of contact and a common source of treatment (Awor et al., 2012; Kassam et al., 2016b, 2016c; Konde-Lule et al., 2010; Rutebemberwa et al., 2009). While much is now being reported about the formal (licensed) private sector in Uganda, little is known about the training, knowledge, and preferences of vendors affiliated with the unlicensed private drug sector that often dominate many remote Ugandan communities (Awor et al., 2015; Buchner and Awor, 2015; Mbonye et al., 2015; Talisuna et al., 2012). What is acknowledged, however, is that few vendors affiliated with unlicensed private drug outlets adhere to national treatment protocols (Goodman et al., 2007; Sudhinaraset et al., 2013; Wafula et al., 2012).

At the request of community leaders in the rural district of Butaleja, Uganda, a large exploratory research was undertaken to identify sustainable interventions to improve malaria care for children five years

and under (Kassam et al., 2016a, 2016b, 2016c). Household survey data from across the district revealed that only a third of the children with presumed malaria received what could be considered an appropriate antimalarial treatment, about a third were treated with something other than an antimalarial, and less than a quarter were offered a confirmatory diagnostic test (Kassam et al., 2016b). Equally important, among those who received an antimalarial, almost a third of children were treated with an antimalarial obtained from the private drug sector. With unlicensed private retail drug outlets outnumbering their licensed counterparts and the formal health facilities in Butaleja, the aim of this research was to understand the role, practices, and preparedness of unlicensed outlets as it relates to malaria. The objective of this paper is to discuss unlicensed vendors' training and knowledge as it relates to the cause of malaria, preventive measures, common signs, and symptoms, diagnostic procedures, and best treatment options. A previous paper discussed vendors' perceptions of their role, practice, and social environment as it relates to malaria management (Liow et al., 2016).

## 2. Material and methods

### 2.1. Study design

An exploratory qualitative design using semi-structured interviews was undertaken to examine unlicensed retail drug vendors' training and knowledge related to malaria in Butaleja District, Uganda. The interviews were conducted during the months of August and September 2011.

### 2.2. Setting

The study was set in the rural district of Butaleja, one of the most disadvantaged districts of Uganda. The district has been described elsewhere in more detail (Kassam et al., 2016b, 2016c). Briefly, the district is composed of 10 sub-counties and two town councils, with a projected population of about 207,300 (Uganda Bureau of Statistics (UBOS), 2009). The main source of income for most households includes subsistence farming. At the time of the study, the formal health system consisted of one hospital, 11 Health Centre IIIs (which provide a range of inpatient, outpatient, and outreach services), 11 Health Centre IIs (which provide a limited range of outpatient services, including dispensing of antimalarial medicines); and a cadre of volunteers known as community health workers (CHWs) who provided basic care but no treatment (K Mweru, District Health Officer, personal communication, April 2011). Unlike some regions of Uganda, Integrated Community Case Management (iCCM) strategy had yet to be introduced in Butaleja. While the District is also serviced by private-for-profit drug outlets, a large majority constitute unregulated drug outlets. For the purpose of this study, unlicensed retail drug outlets are defined as mobile or stationary commercial settings, such as markets and shops, which sell antimalarials but are not registered with any government regulatory body and operate outside the purview of regulation, registration, or oversight by the government or other health or professional institutions (Liow et al., 2016). The district has no pharmacies, and the few licensed private drug outlets that are present are primarily located in peri-urban and market areas.

### 2.3. Sampling process and participants

Mirroring the larger research, this study was conducted in 27 of Butaleja's 66 parishes, located across the 10 sub-counties (Kassam et al., 2016b). The whole cohort (n = 88) of unlicensed retail drug outlets located within the study parishes served as the sampling frame. All 88

outlets were first visited by the local council chairperson within each village who knew the vendors well and introduced to the study. Outlets were subsequently visited by one of the study research assistants to assess the vendors' willingness to participate, with one vendor per outlet invited to partake in the interview. Vendors were eligible to participate if they were present on-site for at least 50% of operating hours, they agreed to participate, and they were willing to sign a consent form. If an outlet was closed or the vendor absent, the outlet was visited a second time before being excluded.

#### 2.4. Data collection

Interviews were conducted by six locally recruited research assistants (RAs) who were familiar with the local context and fluent in English and the local dialect of Lunyole. The interviews were facilitated by a structured guide consisting of open-ended questions (Appendix A). The RAs used conversational prompts to clarify issues and encourage in-depth descriptions, and they employed the techniques of free listing and ranking to elicit culturally relevant responses (Weller and Romney, 1988). The interviews took 1–1½ h to complete. The vendors were interviewed at their place of work, and questions were asked in either English or Lunyole, depending upon the vendor's preference. Prior to the interviews, all RAs participated in a week-long training program that consisted of formal discussions about the study protocol, interview questions, and qualitative interviewing techniques, followed by field training. All RAs were responsible for conducting, recording, translating, and transcribing their own interviews. For quality assurance, RAs were paired with a study supervisor who monitored and supervised all aspects of data collection.

#### 2.5. Data analysis

Interview transcripts were imported into NVivo (NVivo version 9, QRS International, Doncaster, Australia) and analyzed. The transcripts were analyzed using thematic content analysis (Smith, 1992). The interview questions served as an initial frame for organizing the transcripts. As a first step, two members of the research team reviewed the transcripts and determined preliminary codes. A line-by-line analysis of the transcript was then conducted to identify both anticipated and emergent themes. Themes were then discussed and final themes reached by consensus. Where necessary, codes were relabeled or re-grouped using open and axial coding techniques. Relative frequency of thematically similar content was calculated and reported. Demographic information was entered into Microsoft Excel 2010 software to compile descriptive information about the sample. Consistent with any qualitative research, statistical representativeness was not an aim for this study.

#### 2.6. Ethical approval

Ethical approval was obtained from the University of British Columbia's Behavioural Research Ethics Board (certificate number H10-02909), the Child Health and Development Ethical Centre at Makerere University, and the Uganda National Council for Science and Technology (certificate number HS 906).

### 3. Results

A total of 75 of the 88 unlicensed outlets were represented. The study sample consisted of 65.3% females and 34.7% males. A large majority (93.3%) of the vendors were affiliated with drug shop type outfits, with less than 5% associated with general shops, market kiosks,

**Table 1**

Educational sources for acquiring knowledge about malaria and its treatment (n = 75).

	n (%)
Formal: courses/program at post-secondary institutions <sup>†, ¶</sup>	38 (50.7)
Informal: on-the-job training at public health facilities <sup>†, §</sup>	24 (30.7)
Formal: courses/program at post-secondary institution, PLUS Informal: on-the-job training at public health facilities <sup>†, ¶, §</sup>	9 (12.0)
Formal: workshop/seminars <sup>†, ¶</sup>	8 (10.7)
Informal: self-learned—on-the-job experience as shop attendant	8 (10.7)
Informal: self-learned—using print materials (books, brochures, charts)	5 (6.7)
No training	5 (6.7)

<sup>†</sup> Vendors gave more than one response.

<sup>¶</sup> 36 of the 38 vendors obtained a health-related qualification.

<sup>§</sup> Considers on-the-job training only; excludes practicums associated with formal, post-secondary training.

<sup>¶</sup> Considers those who first obtained formal training at a post-secondary institution and later went on to receive on-the-job training.

<sup>¶</sup> 4.0% had no formal training, and 6.7% attended a workshop in addition to their formal training.

or mobile stalls (Liow et al., 2016). The official hours of operation ranged from 3 to 15 h, although most served their communities seven days a week and were available at all hours of the day.

#### 3.1. Training on malaria case management

Overall, the vendors' training in malaria ranged from formal training to no training (Table 1). The two most common sources of education were some form of formal training at a post-secondary institution and informal on-the-job experience at a public health facility (hospital, Health Centers III and/or Health Centers II). While about 48.0% of the vendors had received some kind of health-related qualifications, only 6.7% had qualifications which met licensure requirements for managing ailments such as malaria within a drug shop setting (nurse n = 4; medical officer n = 1).

Additionally, a large majority (82.7%) of the vendors reported regularly interacting with health providers from public health facilities in order to learn about the best treatments for common childhood illnesses, such as malaria. Nurses were the health-care providers mentioned most often (64.4%), followed by doctors (25.8%). In contrast, less than one-tenth of the vendors mentioned interacting with midwives (8.0%), clinical officers (6.5%), nursing aides/assistants (6.5%), medical assistants (3.2%), dental assistants (1.6%), and surgical theater attendants (1.6%).

#### 3.2. Vendors' knowledge

Five areas of knowledge related to childhood malaria were evaluated: (1) causes, (2) preventive measures, (3) signs and symptoms, (4) diagnostic procedures, and (5) best treatment options.

##### 3.2.1. Causes of malaria

All 75 vendors recognized mosquitoes as the vector for malaria. In addition, 70.7% listed a variety of behavioral and environmental factors as increasing the risk of malaria infection. Table 2 summarizes the range of responses given by the vendors. With just 48% of the vendors mentioning one or more recognized behavioral and environmental factors, the interviews revealed that this knowledge was low irrespective of their training. Among those who made their beliefs known, about one-third (30.2%) had correct information, almost two-fifths (37.7%) had one or more points of misinformation alongside correct

**Table 2**  
Extent of knowledge of the cause of and risk factors for malaria in children<sup>†</sup> (n = 75).

	n (%)
Mosquitoes	75 (100)
<b>Behavioral and environmental factors associated increased risk of infection</b>	<b>53 (70.7)</b>
<b>Recognized factors</b>	<b>36 (48.0)</b>
Lack of bed nets	21 (28.0)
Stagnant water nearby	21 (28.0)
Unsanitary and unclean households (inside and surroundings)	11 (14.7)
Improper use of nets	9 (12.0)
Malnutrition	7 (9.3)
Bushes nearby home	5 (6.7)
Lack of protective coverings	3 (4.0)
Under dosing of medicines resulting in resurgence of malaria parasite	2 (2.7)
Doors and windows left opened	1 (1.3)
<b>Misconceptions</b>	<b>35 (46.7)</b>
Drinking dirty/unboiled water	18 (24.0)
Poor parenting or child rearing in general	10 (13.3)
Spread by coughing	8 (10.7)
Change in weather/seasons	6 (8.0)
Eating spoiled/dirty food	3 (4.0)
Flies	2 (2.7)
Typhoid	1 (1.3)

<sup>†</sup> Vendors gave more than one response.

**Table 3**  
Knowledge of measures that prevent malaria in children<sup>†</sup> (n = 75).

List of preventive measures	n (%)
<b>Recognized Preventive Measures<sup>†</sup></b>	<b>66 (88.0)</b>
Proper use of bed nets	57 (76.0)
Clearing of bushes	27 (36.0)
Removing stagnant water	22 (29.3)
Spraying insecticide inside homes	22 (29.3)
Cleaning the house and its surroundings	15 (20.0)
Closing doors/windows	13 (17.3)
Preventing reinfection with malaria medicines that eradicate the parasite	7 (9.3)
Providing nutritional food to children	3 (4.0)
Others (for example, mosquito coils and protective clothing/blankets.)	9 (12.0)
<b>Misconceptions<sup>†</sup></b>	<b>17 (22.7)</b>
Immunization	11 (14.7)
Drinking boiled water	11 (14.7)
Preventing infection by using prophylactic medicines	5 (6.7)
<b>No Measures Shared</b>	<b>5 (6.7)</b>

<sup>†</sup> n = 70 vendors gave more than one response.

information, and the remaining one-third (28.3%) conveyed only misinformation.

### 3.2.2. Prevention of malaria

While most (93.3%) of the vendors mentioned one or more preventive measure, less than three-quarters (69.3%) of the vendors believed that malaria could be prevented in their communities. Table 3 lists what the vendors said about prevention measures. A vast majority (88.0%) mentioned at least one recognized measure for preventing malaria in children, and about half (48.0%) spoke of two or more recognized preventive measures. While a disconcerting proportion of the vendors (22.7%) were misinformed – mentioning mainly ineffective measures, five vendors were not able to specify any preventive methods for malaria. The proper use of bed nets was the most frequently reported measure (76.0%). The management of environmental factors (such as clearing bushes, removing stagnant water, spraying houses with insecticides, cleaning houses, and closing doors and windows)

were mentioned by less than two-fifths of the vendors. However, no vendor mentioned indoor residual wall-spraying, a proven and highly effective primary preventive measure.

### 3.2.3. Signs and symptoms of malaria

When asked about the signs and symptoms of uncomplicated malaria in young children, the vendors enumerated an average of five symptoms (range: 1–9). Fig. 1 classifies the various signs/symptoms into five categories using the Bartoloni and Zammarchi classification system: (1) classical symptoms, (2) subtle warning signs/symptoms, (3) early warning signs/symptoms, (4) severe signs/symptoms, and (5) non-malaria signs/symptoms (Bartoloni and Zammarchi, 2012). The most frequently mentioned signs/symptoms fell into the classical and early-warning categories. Fever was by far the most commonly recognized sign/symptom (92.0%); chills/shivering alone or in combination with fever was less often mentioned (5.3% and 9.3%, respectively) – suggesting few vendors were knowledgeable about the classical pattern of a paroxysm of fever alternating with chills. Almost one-third of the vendors (28.0%) were misinformed, identifying signs/symptoms not typically associated with malaria, such as runny nose and non-specific cough.

Since 37.3% of the vendors incorrectly associated signs/symptoms of severe malaria with uncomplicated malaria (Fig. 1), in order to clarify their understanding of severe malaria, the vendors were subsequently asked to list signs/symptoms that would signal progression to severe malaria. A vast majority (82.7%) correctly identified one or more signs/symptoms associated with severe malaria, 36.0% correctly indicated two signs/symptoms, and 10.7% correctly provided three signs/symptoms. Despite convulsions and rapid breathing being hallmarks of severe malaria, these were mentioned by only 40.0% and 16.0%, respectively. About one-third of the vendors mentioned body weakness (32.0%), fever/high temperature (30.7%), and vomiting (28.0%); and about one-quarter mentioned diarrhea (25.3%) and loss of appetite (22.7%). Other legitimate signs/symptoms less frequently reported were anemia (20%), sunken eyes and dehydration (13.3%), and changes to the skin (4.0%). A small proportion (13.3%) also mentioned symptoms not related to malaria, such as sneezing, non-specific cough, sore throat, and restlessness. None of the vendors mentioned prostration.

### 3.2.4. Diagnosis of malaria

Most vendors said they used more than one diagnostic approach to establish if a child had uncomplicated malaria; these are illustrated in Fig. 2. The two most commonly reported methods involved observing a child for symptoms associated with malaria (77.3%) and performing a physical exam of various parts of the body (60.0%), such as testing the elasticity of the skin. Only about one-third of the vendors mentioned using a thermometer (33.3%) to confirm fever, and a similar proportion (29.3%) reported that they request a diagnosis from a health professional at a public health facility before initiating treatment. Equally important, less than 10% of the vendors (independent of their training) mentioned that malaria could only be confirmed (or excluded) with the use of rapid or microscopic blood testing, equipment that none of them stocked. This lack of awareness was present among those with and without any formal training.

As with uncomplicated malaria, a large majority of the vendors (92.0%) said they would establish the presence of severe malaria by observing a child's signs/symptoms. Additionally, about one-quarter (25.7%) said they would automatically assume severe malaria if the initial treatment for uncomplicated malaria failed. While 97.3% of the vendors indicated that they would refer the child to a public health facility, over half (46.6%) of these vendors reported that they would first attempt to treat the child themselves and only refer them to others

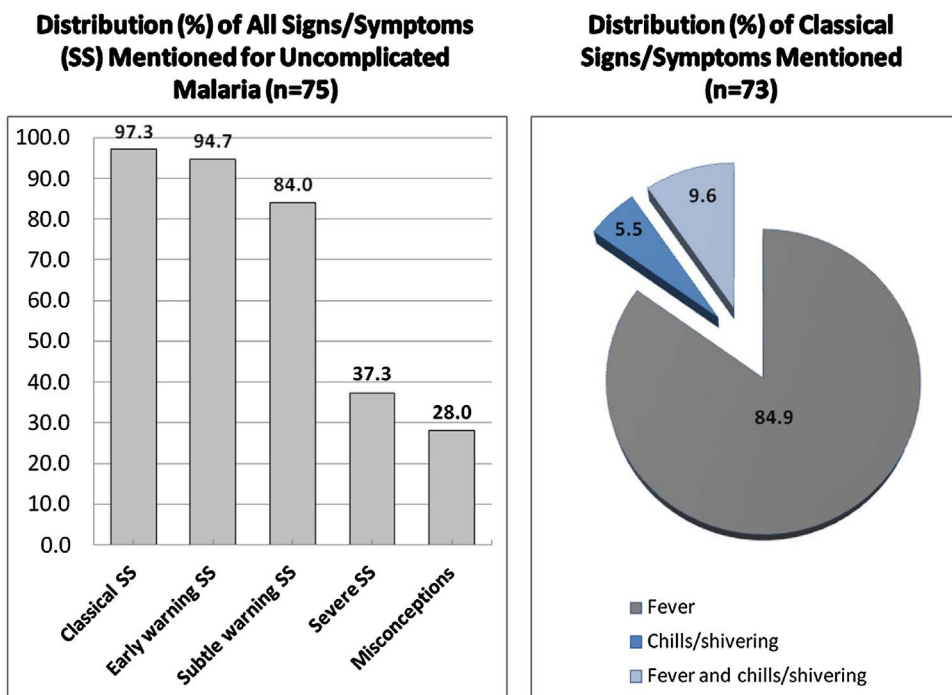


Fig. 1. Knowledge of signs/symptoms of uncomplicated malaria<sup>†,‡</sup> (n = 75).  
<sup>†</sup>Vendors gave more than one response. <sup>‡</sup>Responses categorized according to Bartolini and Zammarchi classification system: Classical symptoms—fever or chills/shivering; early warning signs/symptoms—aches, diarrhea, headache, weakness, abdominal pain, and vomiting; Subtle warning signs/symptoms—decreased appetite, crying, flu-like signs/symptoms, not playing, and pale eyes; Severe signs/symptoms—*anemia*, chest pain, respiratory problems, and convulsions; Misconceptions—runny nose and non-specific cough.

if their treatment failed. A greater proportion of vendors with informal training (78.1%) reported that they would refer a child if they suspected severe malaria compared to those with formal training from a post-secondary institution (20.0%) and those with no training (39.5%).

3.2.5. Best treatment option for managing uncomplicated malaria

Table 4 lists medicines that the vendors reported using in treating uncomplicated malaria in children five and under. Overall, knowledge was inadequate across all the vendors, irrespective of training. Of the four-fifths (82.7%) of vendors who mentioned using an actual antimalarial, about half (54.8%) recommended a single antimalarial agent, almost a third (33.3%) used an antimalarial in combination with non-antimalarials, and a small proportion (4.8%) used more than one antimalarial. Among those who prescribed antimalarials together with non-antimalarials, typical examples of the non-antimalarials included antipyretics (68.0%), antibiotics (36.0%), and cough and cold preparations (20%).

About one-quarter of the vendors (25.3%) reported ACTs as their preferred option. More vendors with formal training at a post-

secondary institution reported an ACT as their best treatment option than vendors with only informal on-the-job training at public health facilities, only informal self-learned on-the-job training, or no training at all (34.2%, 26.1%, 11.1%, and 0%, respectively). Among those who recommended an ACT in combination with other antimalarials, a vast majority (83.3%) used them with oral quinine; and a smaller percentage (16.7%) used them with an antimalarial no longer recommended, such as chloroquine and sulphadoxine-pyrimethamine. However, of the 19 vendors who initially said ACTs were their preferred option, subsequently noted that they also considered quinine as an effective antimalarial and used it when they did not stock an ACT. About four-fifths (82.6%) of the vendors who chose ACTs offered an explanation for their preference. Quotations that typify their explanations are summarized in Table 5.

In contrast to ACTs, twice as many vendors (62.7%) specified quinine (oral and/or injectable) as their best preferred option, either alone (21.3%) or in combination with other antimalarials (26.7%) and/or non-antimalarials (14.7%). While most vendors (42.7%) preferred using the oral formulations, about 20% commonly recommended

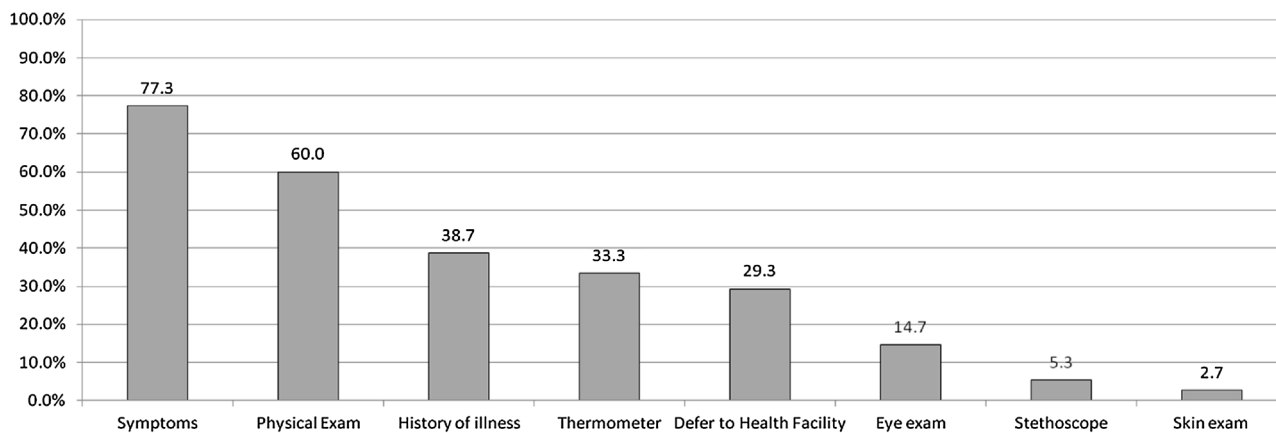


Fig. 2. Distribution (%) of approaches used by vendors to diagnose uncomplicated malaria in children<sup>†</sup> (n = 75).  
<sup>†</sup>Vendors gave more than one response.

**Table 4**  
Medicines used for treating uncomplicated malaria in children (alone or in combination)<sup>†,‡</sup> (n = 75).

	n (%)
Antimalarials	62 (82.7)
<b>ACT</b>	<b>19 (25.3)</b>
Artemether-lumefantrine	19 (25.3)
Dihydroartemisinin-piperazine	1 (1.3)
Artesunate-amodiaquine	1 (1.3)
<b>Non-artemisinin therapy</b>	<b>62 (82.7)</b>
Quinine (oral)	32 (42.7)
Quinine (injection)	15 (20.0)
Chloroquine	17 (22.7)
Sulphadoxine-pyrimethamine	1 (1.3)
<b>Artemisinin monotherapy</b>	
Artemether	1 (1.3)
<b>Non-antimalarial</b>	<b>33 (44.0)</b>
<b>Antipyretic</b>	<b>19 (25.3)</b>
Paracetamol	19 (25.3)
NSAID (Ibuprofen/indomethacin/diclofenac)	2 (2.7)
<b>Antibiotic</b>	<b>13 (17.3)</b>
<b>Cough and Cold Preparations</b>	<b>8 (10.7)</b>

<sup>†</sup> Vendors gave more than one response.

<sup>‡</sup> Abbreviations: ACT: Artemisinin-based combination therapy; NSAID: Non-steroidal anti-inflammatory drugs.

injectable ones. Table 6 provides select quotations from those vendors who chose quinine and shared their reasons for their preference.

A disconcerting 24.0% of vendors said that chloroquine and artemisinin monotherapy (alone or in combination with other medicines) was their preferred options. Table 7 provides select quotes from those who viewed chloroquine as the best option. Although one vendor said he used sulphadoxine-pyrimethamine in combination with chloroquine, none reported using sulphadoxine-pyrimethamine monotherapy.

#### 4. Discussion

This study documents significant gaps in unlicensed vendors' understanding of malaria and its management in children five and under. While several studies have evaluated malaria related practices at private not-for-profit sectors in Uganda since the introduction of ACTs as first-line treatment, few have focused exclusively on unlicensed retail drug outlets. Among those who have considered such outlets, none have undertaken a comprehensive assessment of their knowledge related to malaria (ACTwatch Group, 2014; Konde-Lule et al., 2010; Medicines for

Malaria Venture, 2008; Ndyomugenyi et al., 2007). The current study, therefore, makes a unique contribution to the understanding of unlicensed retail drug vendors' preparedness and knowledge regarding the prevention and management of uncomplicated malaria in children aged five and under in rural Uganda.

All the vendors interviewed in this study recognized mosquitoes as the primary vector for malaria. However, similar to what has been reported elsewhere, there were several misconceptions about the factors that increase the risk of malarial infection and how malaria could be prevented (Okeke et al., 2006). About two-fifths of the vendors held some form of misinformation, implicating factors such as drinking un-boiled water, eating spoiled/dirty food, and poor parenting in general as culprits. Moreover, about one-third of the vendors shared that they did not believe that malaria could be prevented. With respect to recognized preventive measures, well under half the vendors were able to point to key environmental measures that could cut down the chances of getting bitten by mosquitoes, such as slashing bushes and removing stagnant water. Equally important, no vendor mentioned indoor residual wall-spraying, which, like insecticide-treated nets, has been proven to be a highly effective primary preventive measure (Fullman et al., 2013). The lack of knowledge about the cause and transmission of malaria has been reported to pose problems when deciding which medicines to use and whether to promote preventive measures to consumers (Maslove et al., 2009; Okeke et al., 2006; Tunwikirize et al., 2004). As members of the community, drug vendors' provision of care could extend beyond dispensing of medicines to informing the community about ways to prevent disease. For this to occur, an accurate working knowledge of malaria control is necessary.

Considering that malaria is endemic to Butaleja and that all unlicensed vendors live in the communities they serve, one might expect vendors to know about the signs and symptoms of malaria. However, while a large majority did correctly identify fever and a range of early signs/symptoms (such as diarrhea, vomiting, and weakness) to malaria, only a negligible proportion of vendors mentioned chills/shivering, alone or with fever, and few knew that the paroxysm of fever, chills/shivering, and sweats is a hallmark of *Plasmodium falciparum* malaria. Additionally, about one-third of the vendors cited signs/symptoms not commonly associated with malaria. Knowledge about severe malaria was also low, with well under half of the vendors recognizing convulsions or rapid breathing as a hallmark of severe malaria. Though most vendors said they would consider referring a child with severe malaria to a public health facility, their poor ability to recognize severe malaria or to differentiate it from uncomplicated malaria makes it doubtful that enough children are being referred. Likewise, a willingness to refer

**Table 5**  
Reasons for choosing an ACT as the best option for treatment of malaria in young children<sup>†</sup>.

Themes (% spoke to each theme)	Select quotes that best reflect vendors' reasons for choosing an ACT (82.6% of vendors who chose an ACT also shared their reasons)
<b>Less side effects</b> (31.6%)	<ul style="list-style-type: none"> <li>• "Coartem, even if you give an overdose ... The reaction is not so high, like that one of quinine." (DV41)</li> <li>• "Coartem reduces malaria faster in those children and they don't feel dizzy." (DV21)</li> <li>• "For Coartem, the [health care providers] say that they don't have complications." (DV16)</li> </ul>
<b>Effective</b> (26.3%)	<ul style="list-style-type: none"> <li>• "Coartem is very effective at treating malaria when the child is sick." (DV66)</li> <li>• "I see that ... Coartem has made a difference [in treating malaria]." (DV19)</li> <li>• "If they give it [Coartem] to someone like a child, they show signs that it [ACT] is effective and they work." (DV47)</li> </ul>
<b>First-line medicine</b> (15.8%)	<ul style="list-style-type: none"> <li>• "Now Coartem has replaced choroquine. Choroquine was the first line treatment for malaria." (DV72)</li> <li>• "Coartem is the medicine to begin with..." (DV55)</li> <li>• "Coartem is the first treatment for malaria." (DV51)</li> </ul>
<b>Available for free</b> (15.8%)	<ul style="list-style-type: none"> <li>• "They give it out for free; it is not bought." (DV67)</li> <li>• "At the health centre they give it for free." (DV23)</li> <li>• They give us that Coartem. In the health unit it is there ... They give it for free." (DV42)</li> </ul>
<b>Better adherence</b> (10.5%)	<ul style="list-style-type: none"> <li>• "It [Coartem] also is easy to administer. It can be easily swallowed. It takes only three days [for full treatment]." (DV68)</li> <li>• "Coartem—it is easy to swallow; it is not bitter." (DV 20)</li> </ul>

<sup>†</sup> Abbreviations: ACT: Artemisinin-based combination therapy; DV: Drug vendor.

**Table 6**  
Reasons for viewing oral quinine as the best option for treatment of malaria in young children<sup>†</sup>.

Themes (% who spoke to the theme)	Select quotes that best reflect vendors' reasons for choosing oral quinine (66.7% of vendors who chose quinine also shared their reasons)
<b>Less side effects</b> (12.5%)	<ul style="list-style-type: none"> <li>• "I commonly use syrups because syrups, even if someone gives the child a lot, it's not too harmful like the tablet." (DV03).</li> <li>• "Difficult to give an overdose treatment." (DV05).</li> <li>• "[Quinine] syrups have measurements; now when you tell a parent that go and give 25 milliliter, she may not exceed. But with tablets, you need to crush them. She [the parent] may crush all of them at once, and can then give [an] overdose [by giving more what is recommended]." (DV63).</li> <li>• "Even though the child requires [a lot] of fluids [with quinine] ... [there are] less side effects compared to other medicines." (DV64).</li> </ul>
<b>Effective</b> (62.5%)	<ul style="list-style-type: none"> <li>• "Because if you give [quinine] tablets to a child ... within 30 min the child will be okay." (DV30).</li> <li>• "Quinine [tablets] kills or reduces malaria parasites highly." (DV49).</li> <li>• "Our Uganda [government] put it there; they saw it [to be] the most powerful. It will reduce that malaria quite a bit." (DV60).</li> </ul>
<b>First-line medicine</b> (recognize ACT is first-line but availability is restricted) (9.4%)	<ul style="list-style-type: none"> <li>• "We would be using Coartem to treat; but we are not allowed to use it. So we use Quinine." (DV23).</li> <li>• "Coartem is still expensive and still us with the drug shops here, there is no way we can sell it; but yet at the health centre they give it for free. That is why we use Quinine." (DV36).</li> <li>• "That [quinine] is what we have as malaria medicines. That is what we know. ACT is there, but it is for government. So we are not allowed to sell its in drug shops." (DV62).</li> </ul>
<b>Better adherence</b> (12.5%)	<ul style="list-style-type: none"> <li>• "Syrups [quinine] are easy for the parent to administer because they have measurements; but for tablet, when you write them take one quarter, the parents can fail to break into four equal pieces." (DV02).</li> <li>• "It [quinine syrup] is already mixed and ready to go." (DV11).</li> <li>• "That [quinine] syrup is good. It is a full dose for 7 days. You can tell a patient that the tablets are supposed to be for 7 days, but the patient only buys 2 of the 7 tablets. But if he buys syrup, a syrup is a full dose bought." (DV37).</li> </ul>
<b>Helpful for specific symptoms of malaria</b> (3.1%)	<ul style="list-style-type: none"> <li>• "Those who come coughing, they can get [quinine] syrups to easily sooth the irritation. [It] depends on the condition of the patient and other complications." (DV27).</li> </ul>

<sup>†</sup> Abbreviations: ACT: Artemisinin-based combination therapy; DV: Drug vendor.

**Table 7**  
Reasons for viewing chloroquine as the best option for treatment of malaria in young children<sup>†</sup>.

Themes (% who spoke to the theme)	Select quotes that best reflect vendors' reasons for choosing chloroquine (94.1% of vendors chose chloroquine also shared their reasons)
<b>Less side effects</b> (15.8%)	<ul style="list-style-type: none"> <li>• "Chloroquine is good to children since it has no side effects." (DV09).</li> </ul>
<b>Effective</b> (56.3%)	<ul style="list-style-type: none"> <li>• "I first treat with this chloroquine; and when things fail then I give [quinine]." (DV57).</li> <li>• "Chloroquine treats the [malaria] parasite." (DV01).</li> <li>• "These [chloroquine] are the ones that can kill the parasites caused by that malaria." (DV32).</li> <li>• "That [chloroquine] is what used to treat me and it [chloroquine] used [to] be very effective [in reference to why it continues to still be effective]." (DV08).</li> </ul>
<b>First-line medicine</b> (15.8%)	<ul style="list-style-type: none"> <li>• "These [chloroquine] tablets are the first treatment; and if they fail you go for injection and they treat the children because tablets is first treatment, they call them 'first aid'." (DV04).</li> <li>• "Chloroquine and Fansidar are the first-line. They are the first and if they fails then you go to another." (DV40).</li> </ul>
<b>Better adherence</b> (10.5%)	<ul style="list-style-type: none"> <li>• "These [chloroquine syrups], if you tell one that go and measure up to this line there it comes easy." (DV59).</li> </ul>

<sup>†</sup> Abbreviations: ACT: Artemisinin-based combination therapy; DV: Drug vendor.

urgent cases may be undermined by vendors' determination to continue their treatment with alternative medicines or approaches when initial treatment has failed.

Unlicensed drug vendors' knowledge regarding the best treatment options for managing malaria in young children was also grossly inadequate, regardless of their training background. Three-quarters of the vendors viewed a medicine other than the government's first-line antimalarial – ACT, as the best option for uncomplicated malaria. In view of how frequently the vendors in our study interacted with health providers for the purpose of learning about best treatment approaches, and considering the many reports in the literature about improved ACT accessibility at private drug outlets since the advent of the Affordable Medicines Facility-malaria (AMFm), this gives rise to the question, why is there such a low preference for ACTs (ACTwatch Group, 2014; Fink et al., 2014; Tougher et al., 2012)?

One explanation for the low preference for ACT is the prohibitive cost of carrying ACTs at the unlicensed outlets (Liow et al., 2016). The

AMFm program, managed by the Global Fund, is a financing mechanism whose aim has been to supply ACTs at highly subsidized prices to the public and licensed private drug sectors (World Health Organization (WHO), 2012). This scheme was initiated as a pilot in 2009 and scaled up nationally in spring of 2011. While the introduction of the AMFm has successfully increased the availability of subsidized ACTs at private-for-profit drug outlets, this benefit has been limited to licensed private drug outlets (Fink et al., 2014; Talisuna et al., 2012). In Butaleja District where licensed private drug outlets are scarce and primarily located in peri-urban centers, a district-wide exploratory study conducted in summer of 2011 found few ACTs provided though the AMFm reached young children suffering from malaria (Kassam et al., 2016b). Another reason for vendors' low preference for ACTs (by comparison with quinine) may be that they are emulating the practice of public health providers. Parallel studies in Butaleja District have reported ACT stock-outs to be a common occurrence at public health facilities and generally difficult to find in the private sector (Kassam

et al., 2016a, 2016b, 2016c). Consequently, health providers regularly dispense quinine and refer patients to private outlets with prescriptions for quinine. Such practices and referrals likely reinforce the notion that quinine is still a legitimate treatment for young children with malaria.

Perhaps the most unsettling findings included vendors' preference for chloroquine (despite its being banned by the Ugandan government); the use of quinine injections by untrained people (especially in light of its rare but serious side effects and the high risk of transmitting HIV and other blood-borne infections); and the tendency to select an anti-malarial based on an individual's presenting symptom (Okeke et al., 2006). The continued use of quinine injection and chloroquine suggests that many cases of uncomplicated malaria are still being inadequately managed, subjecting children to failed treatments, increased morbidity and mortality, and growing resistance (World Health Organization (WHO), 2015a).

The current strategic goal for Uganda is to have 85% of the population practice correct malaria prevention and treatment measures by 2017 (United States Agency for International Development (USAID), 2016). The Uganda's National Malaria Control Program has since 2011 introduced a number of programs to help attain this target. The implementation of integrated community case management (iCCM) (using a streamlined treatment algorithm and rapid diagnostic tests) using community health workers (CHWs) and licensed private-for-profit drug outlets has been one of the most successful strategies for improving access to rapid diagnostic testing and ACTs at the community-level (Ajayi et al., 2008; Awor et al., 2014; Bennett et al., 2014; Mbonye et al., 2015). However, despite its recognized impact, iCCM has been difficult to scale-up due to limited funding to support CHWs and limited access to licensed private drug outlets in rural and remote areas (Buchner and Awor, 2015). As a result, in rural communities such as Butaleja where iCCM is yet to be implemented, the licensed private sector is far and between, and ACT stock-outs at public health facilities remain a regular occurrence, feasible solutions to improve access to timely diagnosis and treatment with ACTs have yet to emerge (JB Matovu, District Health Officer, personal communication, June 2016). With a large majority of interventions focusing exclusively on licensed vendors and the government continuing to delegitimize the unlicensed sector, there has been little opportunity or incentive for the unlicensed sector to evolve since 2011. However, more work on this topic is needed, including a follow-up study to evaluate any possible diffusion effect from these interventions on the knowledge and practice of unregulated vendors.

Health providers can only play their critical role in controlling diseases if they inform their communities about rational measures for prevention and treatment and if they themselves offer the right treatments. The two things health providers need most, then, are correct information and the right supplies (United Nations Children's Fund (UNICEF), 2000; Watsierah and Ouma, 2014). In such contexts, the training and support of unlicensed vendors needs to take top priority. Given that community health workers, who also are lay persons, have been shown to successfully manage childhood illnesses in research studies, similar outcomes may be possible with careful selection of unlicensed drug vendors (Kalyango et al., 2012). Research is needed to determine how best to include and train the wide spectrum of unlicensed vendors that currently exist, and which incentive structures will ensure that their new knowledge is translated into a practice that is sustained over time (Hetzl et al., 2008).

The findings from our study need to be considered in the context of potential limitations. First, as with any research that uses interviews, one must consider whether reporting bias has limited the value of the data. It is not uncommon for participants to want to respond in a

manner that they perceive will cause them to be looked upon favorably. The tendency to give a response that is socially desirable may have resulted in an overestimation of the number of vendors who truly believe ACTs are the best option for malaria management in young children. While the study methodology tried to minimize this bias by asking vendors to qualify their preferences, it is still possible that some vendors gave responses because they viewed them as socially desirable rather than because they actually believed them. However, the low endorsement of ACTs as the best treatment option suggests that the influence of such a bias was minor in this study. Second, this study used just one methodological approach and one stakeholder's perspective to assess vendors' knowledge. Given that this is the first study of its kind in Butaleja, it is conceivable that our approach may have missed illuminating all the nuances and deep-seated problems associated with this topic. Hence, a more extensive inquiry about the vendors is warranted, including examining community members' experiences with the unlicensed sector, to enhance the findings from this study. Lastly, as with any qualitative method, there is a trade-off between generalizability of findings for richness and depth in data. Therefore, the results of this study need to be considered in the context of the population of vendors that were sampled. Additional research is needed to determine if these findings can be generalizable to a wider population.

## 5. Conclusions

Findings from this study confirm significant gaps in unlicensed vendors' knowledge related to malaria. National targets for reducing malaria in young children can only be met if preventive measures and effective treatments are made more widely available (World Health Organization (WHO), 2011). With increased utilization of unlicensed drug outlets in rural and remote settings such as Butaleja, findings from this study strongly supports the need to implement strategies to improve the quality of care delivered at these outlet.

## Disclosure

None of the authors has any conflict of interest to declare.

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## Appendix A

See Table A1.

**Table A1**  
Interview Questions.

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- What do you think causes malaria in children five and under? Is it preventable? How can malaria be prevented?
  - What are the common signs/symptoms of uncomplicated malaria in children five and under? What is the one main sign of malaria?
  - How do you personally decide if a child has malaria? Are you aware of other way(s) to diagnose malaria?
  - In your opinion, which is the best option to treat malaria in children five and under? Why?
  - If caregivers cannot afford the malaria medicine you have recommended for their children five and under, what usually happens?
  - Under what circumstance would you not feel comfortable recommending a malaria medicine for a child five and under? What do you then tell the caregiver?
  - What happens if the fever continues after you have recommended a western malaria medicine? What do you do for severe cases? How do you know that a child is experiencing severe malaria?
  - How, where, and when did you learn about treating children five and under with fever? How, where, and when did you learn about treating children five and under with malaria?
  - How regularly do you talk with the nearest health facility (private, public)? Nurses? Doctors? What is the common purpose of your discussions?
- 

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