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Supply chain management of anti-malarials in the district hospitals in Kumasi Metropolitan Area, Ashanti region of Ghana

Charlotte Sena Agyare[1], Newman Osafo[2], Christian Agyare[3]*, Kwame Ohene Buabeng[4] and Akua Afriyie Abruquah[5]

[1]Pharmacy Department, Tafo Government Hospital, Kumasi, Ghana.
[2]Department of Pharmacology, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
[3]Department of Pharmaceutics, Faculty of Pharmacy and Pharmaceutical Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
[4]Department of Clinical and Social Pharmacy, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
[5]Department of Pharmaceutical Sciences, Kumasi Polytechnic, Kumasi, Ghana.

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The aim of the study was to assess the supply chain management of anti-malarials in the five district hospitals in the Kumasi Metropolitan Area (KMA) including the Regional Medical Store (RMS) and also to assess the level of knowledge of respondents on malaria in these facilities. Cross sectional study was conducted at the facilities and purposeful sampling technique was applied to select the clients and interviewed. All the hospitals sourced their anti-malarials from the regional medical store (RMS) with tablet artemether-lumefantrine, tablet artesunate-amodiaquine, injection artesunate and sulphadoxinepyrimethamine (SP) being dispensed by all the hospitals from January to December 2015. All health facilities transport their anti-malarials from RMS by vans. The commonly known anti-malarials by respondents were tablet artemether-lumefantrine (84.08%, n=169) and tablet artesunate-amodiaquine (81.09%, n =163), with 5.47% (n =11) of respondents not knowing any type of anti-malarial. Antimalarials used for the treatment of malaria was given to 65.67% (n=132) of the clients at the hospital. Most of these anti-malarials were available at the hospitals though some facilities encountered periodic shortages and also had stocks expiring within the studied period. Respondents had fair knowledge of the side effects of a few of the anti-malarials. There is a need to ensure proper and effective supply chain management of these anti-malarials in these hospitals to maintain adequate quantities of these medications in these hospitals and RMS.

Key words: Malaria, anti-malarial, supply chain management, plasmodia, female anopheles mosquito.

INTRODUCTION

Malaria is a major global problem and has devastating effects on health and development, especially on the poor and marginalized in most low-income countries. WHO estimated that in 2010, there were 219 million

cases of malaria resulting in 660,000 deaths. For most of the estimated cases, 80% occurred in sub-Saharan Africa (WHO, 2011). Malaria is one of the leading causes of illness in Ghana and the major cause of morbidity and mortality, especially among the under 5 years and pregnant women. It accounts for over 3 million outpatient visits to public health facilities annually (Steketee et al., 2001).

Due to the financial and health importance of malaria as a major public health problem, a good supply chain management system should be the key to ensuring that, anti-malarials are actually available at the point of care (Williams et al., 2004; Amin et al., 2007; Hussain et al., 2013). Supply chain management includes all the activities that must take place to get the right product to the right consumers hand in the right quantity at the right time. Simply, the chain of events is from the raw materials to the end user. To realize this, a highly managed and functioning supply chain system should be in place to help deliver quality products on time to end users (Croxton et al., 2002).

One major health challenge confronting Africa is the effective treatment of malaria, bearing in mind the fact that it claims the lives of more than one million people each year, mostly pregnant women and children under the age of five (Gelband and Stansfield, 2001; Creel, 2002). In addition to its potential mortality, malaria places a heavy economic burden on many endemic countries. Africa alone makes a yearly direct loss of approximately US$12 billion due to malaria from such indicators as the illness itself, treatment and premature death. Also, more than that is lost in economic growth due to malaria prevalence (Malaria No More, 2009).

There is a major socio-economic challenge to African countries due to malaria and this challenge needs to be curtailed since good health is not only a basic human need but also a fundamental human right and a compulsion for economic growth (Streeten, 1981; Asante and Asenso-Okyere, 2003). In line with this, artemisinin-based combination therapy (ACT) has been adopted by over 40 countries in Africa as the first line treatment recommendation for uncomplicated malaria (Cohen et al., 2005).

Ensuring high standards for medicines as well as medical treatment will be essential in preserving the efficacy of the current first line treatment, that is, ACT. Although, funding in the public sector has increased remarkably over the years, Paterson and Obileye (2002) reported that most treatments are administered over-the-counter through hospital and community pharmacies, chemical shops and hawkers. Because these outlets are not adequately regulated, there are substantial variations in the distribution, quality, price and administration of these anti-malaria drugs (Amin and Kokwaro, 2007). There is no doubt that resistance to artemisinin has already been established in places like South East Asia and this could spread to Africa (Ashley et al., 2014; Tun et al., 2015). Likewise, there is a reported high level resistance to sulphadoxine-pyrimethamine (SP) in South America, South Asia (Wongsrichanalai et al., 2002; Lin et al., 2010), East and South Africa (Lin et al., 2010; Ringwald, 2014). The problem of drug resistance could be attributed to inappropriate use of drugs, lack of medical supervision, weak public health system, shortage at government clinics or even lack of access, and all these could be linked to the supply chain system for the ACT (Asamoah et al., 2011).

All of these factors can be identified with the supply chain system of ACT in Ghana and by implication, the potential high-risk of drug resistance in the country. In Ghana, essential medicines are defined within the National Drugs Policy framework (2004) and procured through the public procurement arrangements, which are regulated by various acts and legislations. They are received by the publicly owned Central Medical Stores (CMS) for warehousing and distribution to the various regional medical stores (RMS) and health facilities in the public and private sectors. Under this procurement arrangement, all health facilities are also allowed to procure outside the CMS within an agreed threshold value (MOH, 2006).

A supply chain is that network of organizations that are involved, through downstream associations, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer (Christopher, 2005). The three primary components of supply chain management (SCM) are information, logistics and finance (Lyson and Farrington, 2006).

The unique nature of the supply chain for pharmaceuticals makes managing complex information for supply chain effectiveness challenging, but clearly the rewards for doing so are significant. Lack of proper information mechanism may lead to poor inventory control methods, which tend to affect transportation costs (Mustaffa and Potter, 2009). Supply chain vulnerability is due to five main factors- delays, disruptions, price increases, operations and legislation. Ranking these factors against standard criteria of occurrence, controls and impact, will help to identify the factor which most identifies with the vulnerability.

Delays in the supply chain have a direct impact on a company's profit (Li et al., 2006). Product discontinuity, product shortages, poor performance, patient safety/

*Corresponding author. E-mail: cagyare.pharm@knust.edu.gh or chrisagyare@yahoo.com. Tel: +233 24 636 9803.

dispensing and technological errors (causing stock shortages in pharmacies) are identified as risks associated with pharmaceutical supply chain at the basic level (Breen, 2008). These risks cause delays in the system and eventually dissatisfy the final consumers or patients. All these incur risk through disruption to the supply chain system (Breen, 2008).

The main aim of this study is to assess the supply chain management system of anti-malarials in five district hospitals in the Kumasi Metropolitan Area (KMA) of Ashanti region, Ghana; and also to assess the level of knowledge of respondents on malaria in these facilities.

METHODOLOGY

Study design

A cross-sectional study was conducted at the Ashanti Regional Medical Store (RMS) and all the district hospitals in Kumasi Metropolis, Ghana. The ethical approval for the study was approved by the Faculty of Pharmacy. Ethical Review Committee (approval number: Pharm/EthC/X812015), Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Setting

The study involved six (6) health facilities (the Regional Medical Store (RMS) and the five (5) district hospitals) and a total of two hundred and one (201) clients representing 20% of the total number of clients coming from each of the five district hospitals (Maternal and Child Hospital (MCH), Tafo Hospital, Suntreso Hospital, Kumasi South Hospital (KSH) and Manhyia Hospital). Participants included in the study were all pharmacists practicing in the selected facilities and clients (aged 18 years and above) seeking health care in the selected district hospitals. The purposeful sampling technique was applied to select the clients and interviewed. Permission to conduct the study in the selected health facilities was sought from the respective medical superintendents/directors and their management teams of the hospitals.

Data collection

The data collector/interviewer explained the purpose of the survey to the respondents and made clear that it was optional or voluntary and the respondent was assured of anonymity and confidentiality and informed consent form signed by the respondent. The sampling method used for the survey among the respondents was purposive technique. The trained interviewer also carried a copy of the printed document shown to each interviewee and his identification (ID) card. The interviews were conducted during the period of 25th May to 9th July, 2016. A validated, semi-structured questionnaire was employed to solicit information from the respondents. The data was collected from the respondents via face-to-face interviews in the selected health facilities. The average length of time taken to complete each interview was 40 min for the pharmacists and 10 min for the clients. The respondents were presented with show card for the questions.

Data analysis

Data was coded, entered into MS Excel software (Microsoft Inc., Redmond, WA, USA) and analyzed.

RESULTS

Facilities stocking pattern and sourcing

All facilities stocked tablet artemether-lumefantrine, injection artesunate and SP. Eighty three percent (83%, n = 5) and 33% (n = 2) of the facilities stock dihydroartemisinin-piperaquine and tab quinine, respectively. Suspension quinine and injection quinine were stocked by 50% (n = 3) of the facilities. However, only Manhyia stocked suspension artesunate-amodiaquine. All the hospitals sourced their anti-malarials from the regional medical store. MCH however procured from the open market in addition. The Regional Medical Store sources its anti-malarials from central medical store.

Quantities of anti-malarials dispensed from facilities

Tablet artemether-lumefantrine, tablet artesunate-amodiaquine, injection artesunate and SP were dispensed by all the facilities in the year under review. In addition, injection quinine and tab quinine were dispensed at MCH while suspension artemether-lumefantrine and suspension quinine were also dispensed at Tafo Hospital (Table 1).

Stock Levels of anti-malarials

The quantities of the various anti-malarial drugs present at the health facilities considered in the study at the end of December, 2015 were determined (Figure 1).

Prescription pattern

The most prescribed anti-malaria by all the facilities was tab artemether-lumefantrine. The least prescribed by Tafo and Suntreso were amodiaquine suspension and tablet, respectively. Tab Quinine, SP and inj Quinine were the least prescribed at MSH, KSH and Manhyia, respectively.

Stock run out documentation

Suntreso and KSH ran out of tab artesunate-amodiaquine within the year. Manhyia ran out of injection Quinine. Also, there was a run-out of suspension artesunate-amodiaquine at Tafo and susp artemether-lumefantrine at Manhyia and KSH in 2015. There was also a run out of SP at suntreso and Tafo and tab quinine at suntreso and Manhyia. KSH and Manhyia reportedly ran out of susp quinine. The RMS also ran out of inj Quinine, inj Artesunate and SP in 2015.

Table 1. Quantities of the various anti-malarials dispensed at the facilities

	KSH	MCH	Manhyia	Tafo	Suntreso
Tab A/L	24190	5015	13586	4535	7845
Susp A/L	-	-	-	7701	-
Tab A/A	1078	365	1345	1745	1403
Inj Quinine	-	60	-	-	-
Tab Quinine	-	2000	-	-	-
Susp Quinine	-	-	-	31	-
Inj Artesunate	9180	1985	8654	1023	6540
SP	9600	3010	14000	14470	12207

KSH: Kumasi South Hospital; MCH: Maternal and Child Health Hospital; Tab A/L: tablet artemether-lumefantrine; Susp A/L: suspension artemether-lumefantrine; Tab A/A: tablet artesunate-amodiaquine; SP: tablet sulphadoxine-pyrimethamine

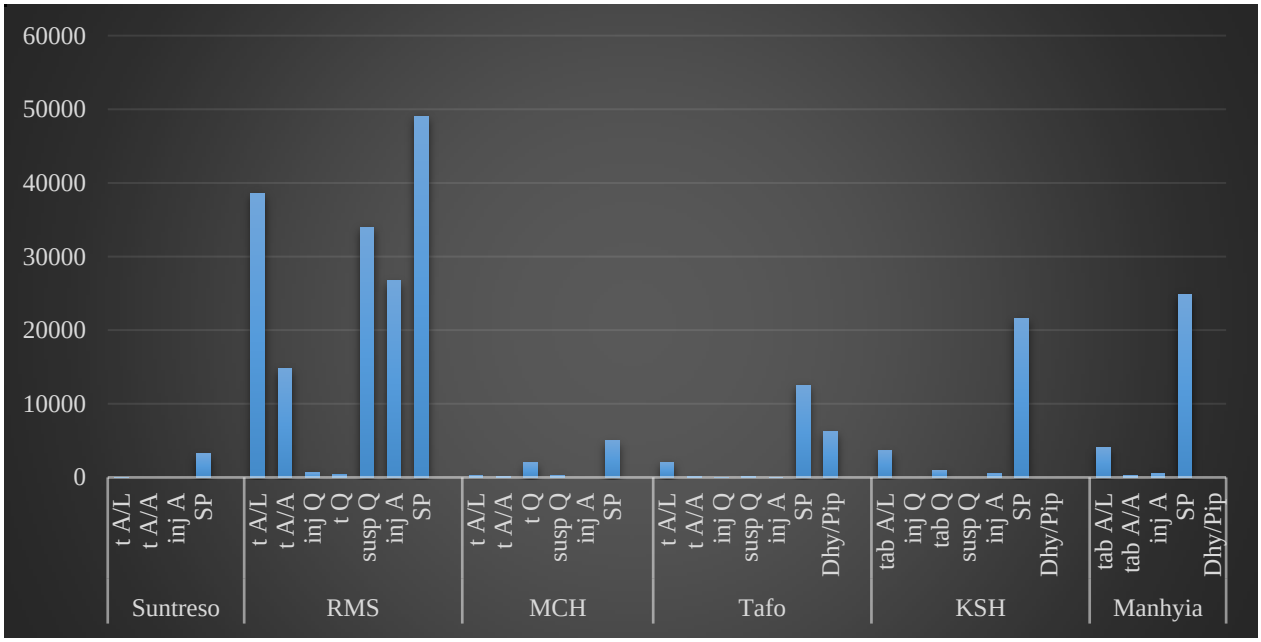

Figure 1. Stock levels of antimalarials. RMS: Regional Medical Store; KSH: Kumasi South Hospital; MCH: Maternal and Child Health Hospital; Tab A/L: tablet artemether-lumefantrine; Susp A/L: suspension artemether-lumefantrine; Tab A/A: tablet artesunate-amodiaquine; SP: tablet sulphadoxinepyrimethamine.

Suntreso ran out of these anti-malarials for a period exceeding 3 months. While Manhyia, KSH and Tafo experienced these shortages for up to 3 months.

Expiration of anti-malarials

RMS, MCH and Tafo had cases of anti-malarials expiring within 2015. All three facilities had stocks of tab artesunate-amodiaquine expiring with the study period. With Tafo also recording expirations for inj Quinine and tab Quinine, Manhyia had Dihydroartemisinin-piperaquine expiring with the study period.

Means of transport and storage of anti-malarials

All health facilities transported their anti-malarials from RMS by van. The RMS likewise received anti-malarials from CMS by van. Anti-malarials were stored in temperature-regulated rooms by all health facilities considered in the study. Only KSH and RMS however did have softwares for managing anti-malarials in and out-flow at their facilities.

Regional medical store's distribution pattern

RMS distributed range of anti-malarials to health facilities

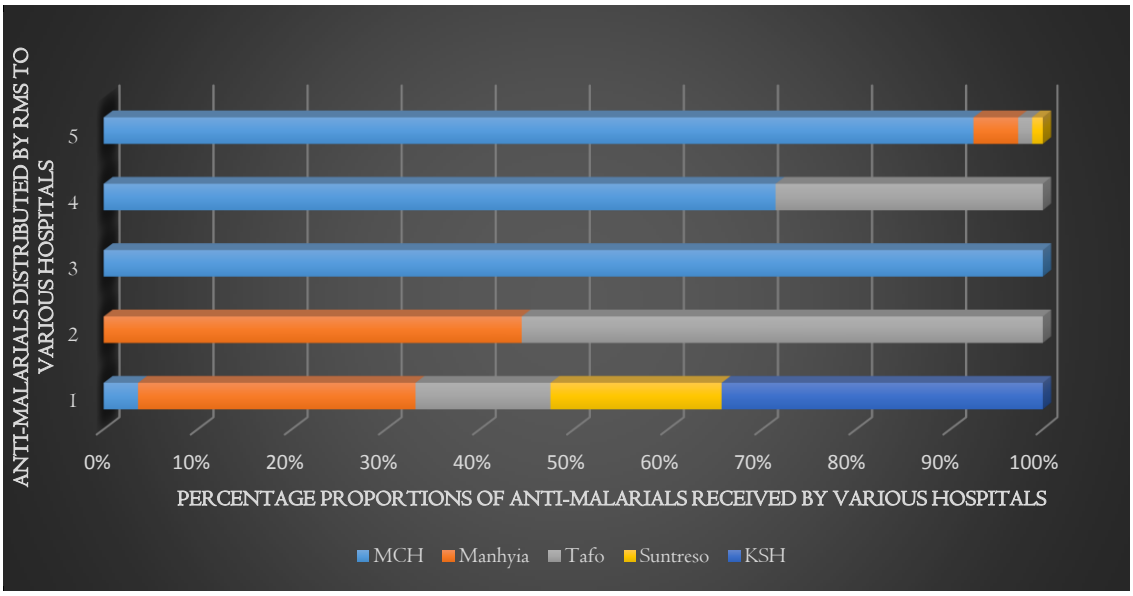

Figure 2. Distribution pattern of anti-malarials from Regional Medical Store (RMS) to hospitals. 1: Tablet artemether-lumefantrine; 2: Tablet artesunate-amodiaquine; 3: Tablet quinine; 4: Suspension quinine; 5: Injection artesunate; KSH: Kumasi South Hospital; MCH: Maternal and Child Health Hospital.

considered in the study, with the respective quantities documented in Figure 2.

Respondents' knowledge on malaria

Eighty percent (n = 161) of the respondents defined malaria as just a condition marked by fever. Sixteen percent (n = 33) however defined it as a disease caused by mosquito bite. Malaria was defined as a condition marked by headache and body pains by 1% (n = 1) of the respondents. One percent (n = 1) of the respondents also believed malaria is caused by contaminated food; with 1% (n = 1) also believing malaria to be caused by both mosquitoes and contaminated food (Figure 3).

Classification of malaria

About ninety-six percent (n = 192) of the respondents did not know the various classifications of malaria (uncomplicated or complicated). However, one respondent knew of simple malaria (Figure 4).

Symptoms of malaria as reported by respondents

Fever was the most known symptom of malaria, being reported by 78.11% (n = 157) of the respondents. About seventy-two percent (n = 144) of the respondents also knew that bodily pains is associated with malaria. Some of the symptoms of malaria respondents gave included chills, anorexia, body weakness, abdominal pains and diarrheoa (Figure 5).

Types of anti-malarials

The commonly known anti-malarial drugs by respondents were tab artemether-lumefantrine (84.08%, n = 169) and tab artesunate-amodiaquine (81.09%, n = 163). However, susp artemether-lumefantrine, susp artesunate-amodiaquine, inj quinine, tab quinine, inj artesunate and SP were known by respondents. About two percent (n = 4) of the respondents knew of herbal anti-malarials as well with 5.47% (n = 11) of respondents not knowing any type of anti-malarial (Figure 6).

Side effects of anti-malarials as known by respondents

The commonest side effects of anti-malaria drugs were vomiting and nausea, reported by 28.36% (n = 57) and 21.89% (n = 44) of the respondents, respectively. Other side effects known by respondents include anorexia, dizziness, weakness, itchiness and sleep disturbances. About twenty-three percent (n = 46) of respondents, however, did not know any side effects of anti-malaria drugs (Figure 7).

How often do respondents get malaria

Seventy-nine of the 201 respondents did get malaria once in the past three months with 35 respondents getting it twice within that period. However, 54 respondents did not get malaria within the past three months (Figure 8).

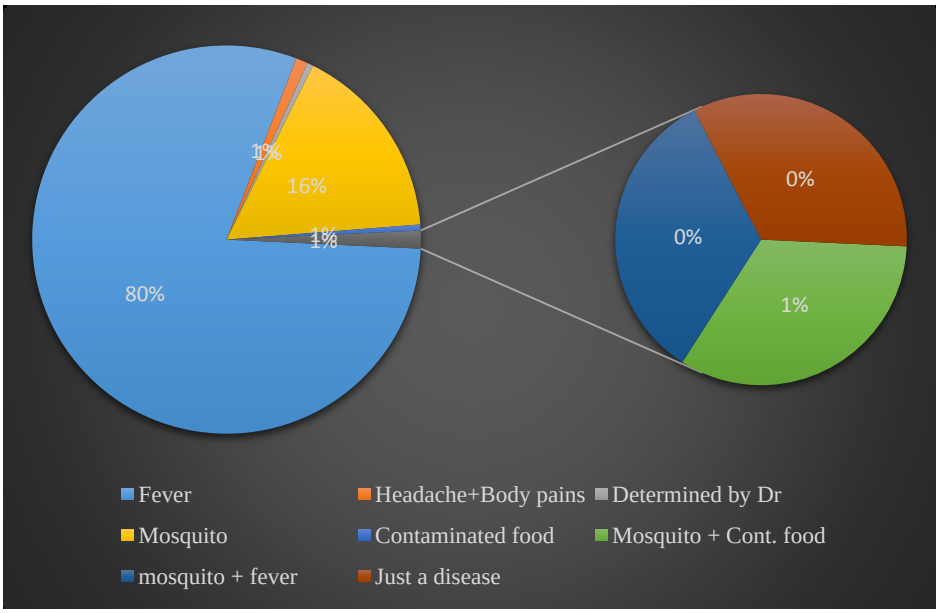

Figure 3. Respondents' knowledge on malaria. Dr: Medical officer; Cont. food: contaminated food

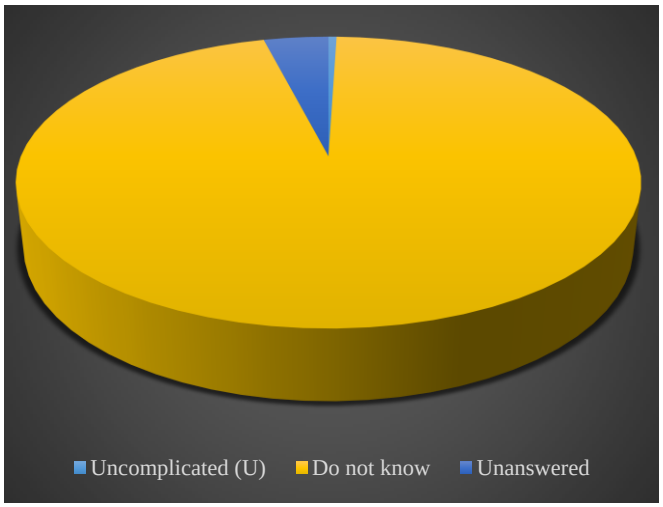

Figure 4. Classification of malaria.

Anti-malarials taken by respondents

About sixty percent (n = 121) of respondents who got malaria within the past three months took tab artemether-lumefantrine, at least once, within that period. The second most used anti-malarial by respondents was tab artesunate-amodiaquine by 24.39% (n = 49) of respondents.

However, 6.97% (n = 14) of respondents did not remember the anti-malarial they took within that period. Herbal preparation (0.50%, n = 1) and SP (0.50%, n = 1) were also taken by some respondents with the study period (Figure 9).

Source of anti-malarials used within the past three months by respondents

Anti-malaria drugs used for the treatment of malarial was given to 65.67% (n = 132) of the clients at the hospital. About thirty-four percent (n = 69) of clients also purchased these anti-malaria drugs from the pharmacy with 4.48% (n = 9) obtaining them from the chemical shop (Figure 10).

DISCUSSION

The procurement and supply directorate is mandated to formulate policies on procurement and supply chain. It coordinates central procurement and supervises the management of the central medical stores. The central medical stores, which is one of the three units of the procurement and supply directorate, receives, stores and distributes goods meant for agencies of the ministry of health. Again, they monitor the supply chain to ascertain timeliness and quality of goods (MOH, 2012). It comes with no surprise from this survey that the regional medical store procures its anti-malarials from the central medical store. Periodic shortages of anti-malarials in the supply chain mechanism of the ministry of health can, however, account for the procurement of anti-malarials by some hospitals from the open market.

With a lot of reports on the untoward side effects of artesunate-amodiaquine (Adjei et al., 2009), the first line

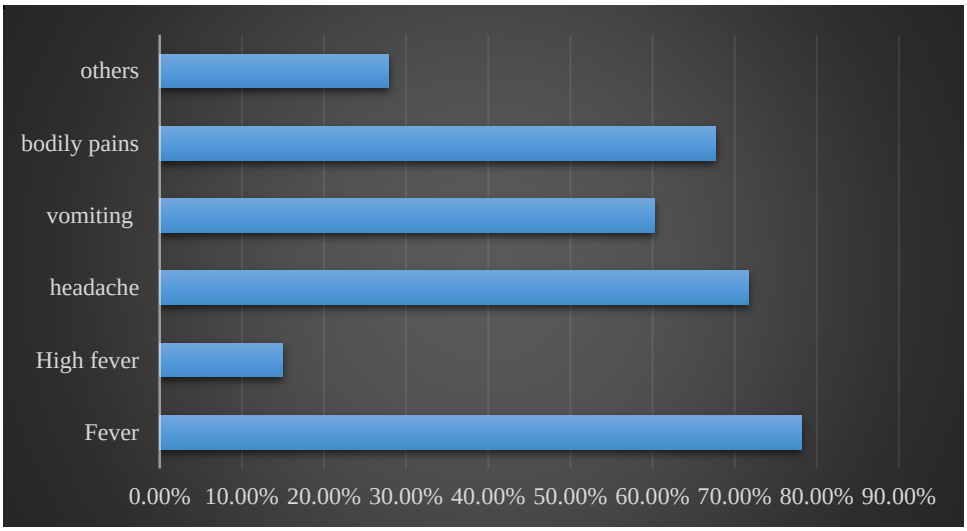

Figure 5. Symptoms of malaria as provided by respondents.

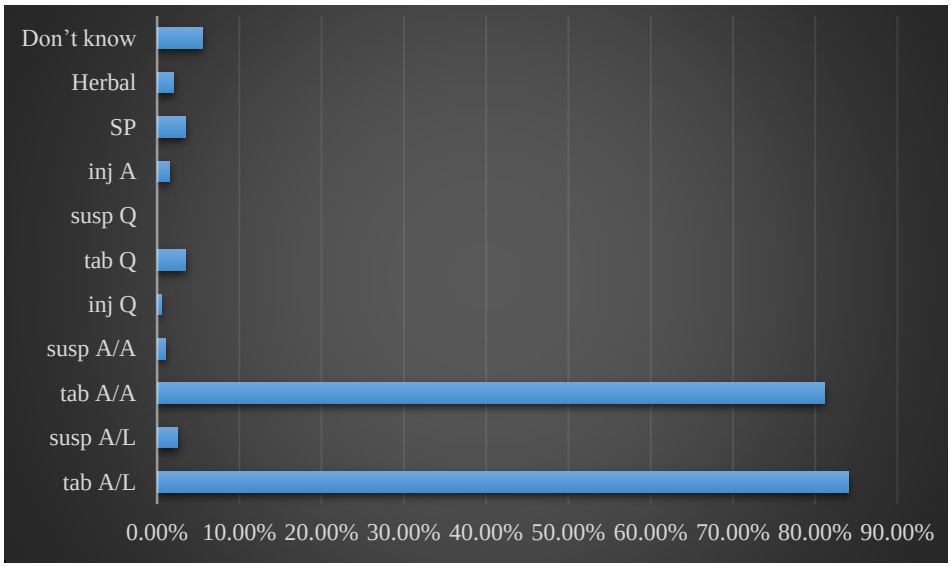

Figure 6. Types of anti-malarials as reported by respondents. Tab A/L: tablet artemether-lumefantrine; Susp A/L: suspension artemether-lumefantrine; Tab A/A: tablet artesunate-amodiaquine; inj A: injection arthemether; SP: tablet sulphadoxine-pyrimethamine; inj Q: injection quinine; tab Q: tablet quinine

treatment, it came with no surprise that artemether-lumefantrine was the most prescribed anti-malarial by the health facilities. This is because most individuals do find the side effects of artemether-lumefantrine to be tolerable (Chatio et al., 2015).

Distribution pattern for anti-malarials by regional medical stores to the various hospitals shows that Manhyia and Kumasi South Hospital may have higher cases of malaria within the period of study. Worryingly, a very high supply pattern of supply of suspension and tablet quinine and inj artesunate to MCH may be an indication of continual incidence of severe malaria in pregnancy and children. This is a public health concern and attempt to reduce malaria in pregnancy and in infants should be intensified.

There were observed and recorded cases of drug expiration before stock run-outs. This is a public health concern since the ideal target for annual expired product value would be \$0.00 or 0% (USAID/DELIVER PROJECT, 2003). This may be difficult to achieve,

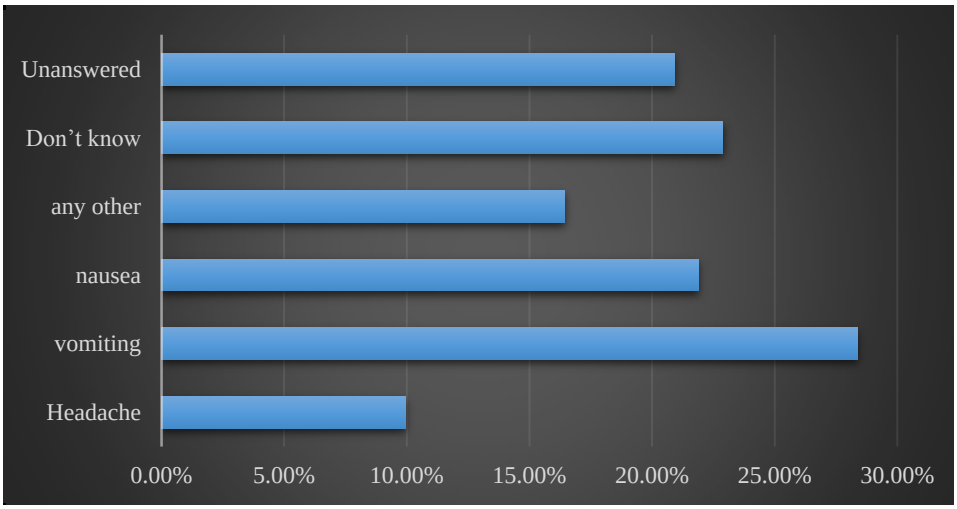

Figure 7. Side effects of anti-malarials as reported by respondents.

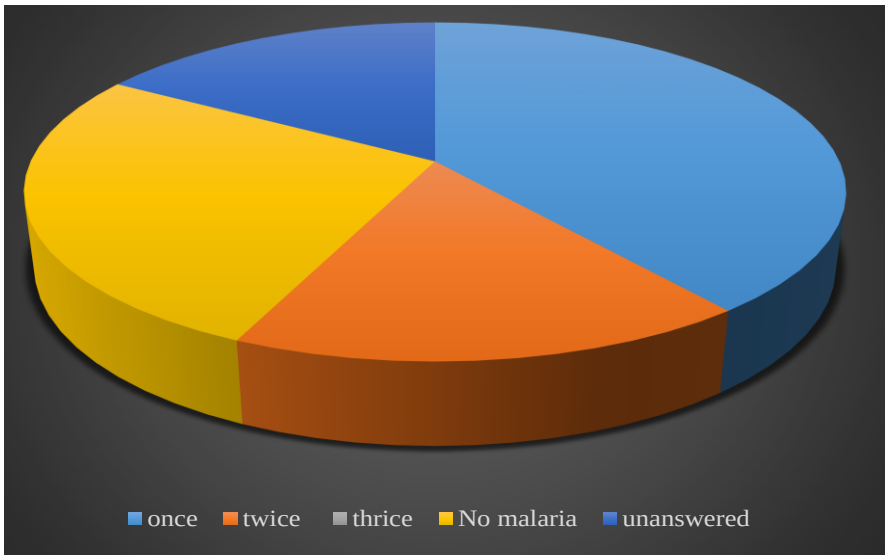

Figure 8. How often did respondents get malaria in the past three months.

however, given the various factors that contribute to product expiration. The inventory management unit should review historical information on annual product expiration values and establish a relevant target value for annual product expiration (USAID/DELIVER PROJECT, 2003).

With observed stock run-out in some facilities, the root cause may be ineffective supplier performance and poor forecasting by procurement teams of the hospitals. The ideal target for supplier product performance is 100%. However, some suppliers may not be achieving this target. In these cases, the procurement unit should review past performance and establish a baseline target rate for the supplier's performance. This rate should be set at a level above the current performance level so that it raises the supplier's performance expectations and encourages a process of continuous improvement. The target level should be raised appropriately as performance improves, aiming to achieve 100% over time (USAID/DELIVER PROJECT, 2003). To improve supplier performance, identify the areas of non-compliance to the supplier with a request for a corrective action plan and implementation schedule. It is worthwhile to provide positive feedback to the supplier to acknowledge the good/improving performance and encourage continued supplier commitment to providing product quality and service when there is a curb of stock run-out eventualities.

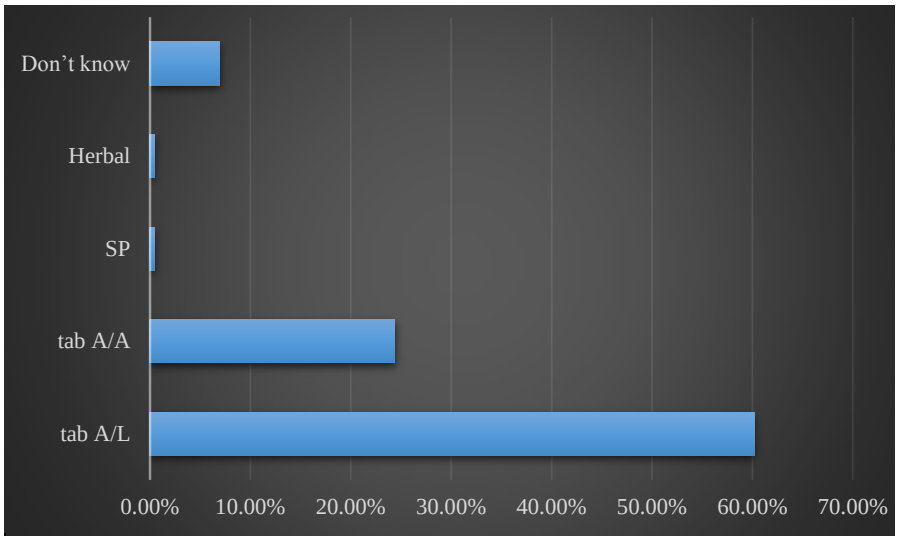

Figure 9. Anti-malarials taken by respondent within the past three months.

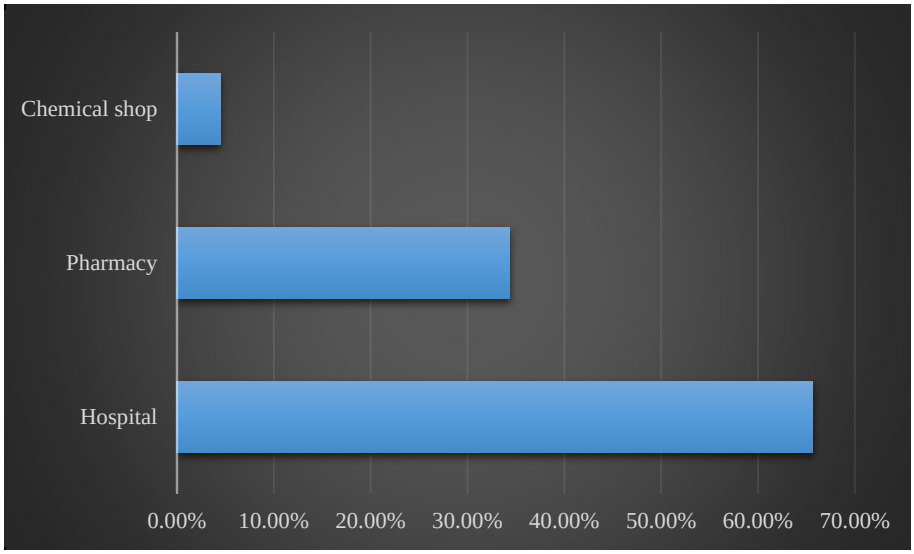

Figure 10. Sourcing of anti-malarials by respondent within the past three months.

Clients/respondents have a fair knowledge on what malaria is and some signs and symptoms of malaria.

However, the majority of the clients/patients at these health facilities had no idea of the two main types of malaria illness. It is understandable that most of the clients knew about artemether-lumefantrine and artesunate-amodiaquine, since these are the commonly prescribed anti-malarials in most health facilities for uncomplicated malaria and are actually a policy recommendation.

The side effects of these anti-malarials were observed by a significant number of clients who take them. There were also recorded cases of multiple malaria cases within three-month period. This could be attributed to number of reasons such as non-compliance with therapy regiment, failed drug therapy, breeding of mosquitoes in unsanitary conditions. In Ghana, with a failure rate of two-fifth of infected individuals, the patient has an approximately two-third chance of obtaining medicine of good quality (WHO, 2011). This shows that failed drug therapy could be a possibility.

It is however commendable that many individuals know about the prescribed anti-malarials with a high number of them obtaining these anti-malarials from the hospital pharmacies and community pharmacies where they are attended to by qualified personnel including pharmacists

and pharmacy technicians.

Working together, the planning/procurement/inventory management units of the RMS as well as the procurement teams at the various hospitals should identify activities where problems contributing to product expiration might occur. Such activities may include, the forecasting accuracy; inventory practices such as first-in first-out (FIFO); accurate stock on hand against inventory records; supplier adherence to expiration date requirements; supplier adherence to delivery dates etc. This information can be used to identify areas where improvements can be made. For effective corrective action to occur, it is important to identify the root cause of product expiration.

Conclusion

The same anti-malarials were dispensed or available in the studied facilities and they were available at the hospitals though some did encounter periodic shortages and also have some stocks expiring within the period considered in the study. Most of the facilities lacked software for efficient tracking of anti-malarial flow in the health facilities. Respondents did have considerable knowledge on malaria and its signs and symptoms. Also, they had fair knowledge on the side effects of some of the anti-malarials.

CONFLICT OF INTERESTS

Authors declare no conflict of interest.

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