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TRACKING OF MALARIA INDICATORS REPORTING SYSTEM AND DATA USAGE ON MALARIA MANAGEMENT IN AYAWASO DISTRICT

BY

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DECLARATION

I declare that with the exception of references to other people's work which have been duly acknowledged, this work is my own work. This has not been submitted neither in part nor whole anywhere for any degree.

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DEDICATION

This work is dedicated to everyone who has never had opportunity to achieve his educational goal due to social inequity.

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ABSTRACT

Background: Malaria is ranked the fourth highest cause of death in children; accounting for 10% of child deaths in sub-Saharan Africa. Global estimates peg 214 million cases of malaria, 88% of which occur in the WHO African Region. Incidence rates in sub-Saharan African is 246/ 1000 at risk. Global death rates are estimated at 19/ 100 000 at risk and majority (90%) of deaths in 2015 were in the WHO Africa Region. This burden has led to a massive international effort to increase prevention and treatment measures with main interventions as: vector control; chemoprevention and case management. To monitor program success and evaluate the impact of efforts made by different stakeholders, data generation and reporting key factors is paramount. However, documentation about the influence indicator reports have on health systems structures for malaria control practices is still unclear.

Objective: This study tracked the malaria indicators reporting system and data-use influence on malaria management in the Ayawaso sub-metro, specifically describing the system for malaria data collection, management and reporting system from health facility to the district level. It further assessed the data-use on malaria and disease management at the various levels of the health care system.

Methods: This study used exploratory mixed methods: The qualitative methods described the malaria indicators reporting system and helped to develop the basis of quantitative methods. The quantitative methods described the appearance of malaria indicators reporting situation in the Ayawaso district. Statistical data about reporting rates and malaria indicators from different sources were used to answer the study question. In depth interviews were also conducted with key informants. Record reviews of secondary data of facilities reports from 2012 to 2016 were also conducted

Results: The study showed the use of data by different stakeholders and confirmed to have influence on disease management in Ayawaso district. It showed as well improvements in coverage %, completeness % and timeliness % of reports from facilities in the 5-year period from 2012 to 2016. Timeliness was encouraging and most remarkable in 2015 among 100% of health facilities for morbidity reports and 80% for haematological and ANC/maternity malaria reports timeliness of in-patient reports however were generally low percentages. The poor reporting coverage was revealed in private health facilities and quasi-government institutions.

Conclusion: Malaria indicators data are particularly useful to various stakeholders at different levels of the Ghana Health Service and have influence on disease management. In the Ayawaso district, data are used by planners, services providers, clinicians and researchers. Coverage, completeness and timeliness over the 5-year period were excellent although certain challenges persist.

Recommendation: Coordination and governance of the reporting system between public and private sectors. Extension of DHIMS to the facility level and provision of appropriate equipment should be addressed.

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ACRONYMS

ACT: Artemisinin based Combination Therapy

CHPS: Community-based Health Planning and Services

DFID: Department for International Development

DHD: District Health Directorate

DHIMS: District Health Information Management System

FHIO: Facility Health Information Officer

GF: Global Fund for AIDS, Malaria and Tuberculosis

GHS: Ghana Health Services

GMAP: Global Malaria Action Plan

HIS: Health Information System

HSSP: Health Sector Strategic Plans

IPTp: Intermittent Preventive Treatment in pregnancy

IRS: Indoor Residual Spraying

ITNs: Insecticide-Treated mosquito Nets

LQAS: Lot Quality Assurance Sampling

MERG : Monitoring and Evaluation Reference Group

NMCP : National Malaria Control Program

PMI: President's Malaria Initiative

RBM: Roll Back Malaria

RDTs: Rapid Diagnostic Tests

SMC: Seasonal Malaria Chemoprevention

USA: United States of America

USG: United States Government

USAID: United States Agency for International Development

WHO: World Health Organization

CHAPTER ONE

INTRODUCTION

1.1. Study background

Malaria in humans is caused by five species of parasites belonging to the genus *Plasmodium* and four of these – P. *falciparum*, P. *vivax*, P. *malariae* and P. *ovale* – are human malaria species that are spread from one person to another via the bite of female mosquitoes of the genus Anopheles (David Mabey, Geoffrey Gill, Parry, Eldryd, Martin W. Weber & Whitty, 2013).

Malaria is placed as the fourth highest cause of death in children, accounting for 10% of child deaths in sub-Saharan Africa. Currently, the number of malaria cases is globally estimated to be 214 million and 88% of all cases have occurred in the WHO African Region. Incidence rate in sub-Saharan African countries is 246 per 1000 at risk of Malaria. The death rate is globally estimated at 19 per 100 000 at risk of malaria and most of those deaths in 2015 were in the WHO Africa Region representing 90% of total deaths that occurred. In children under 5 years, malaria deaths are currently estimated at 306 000 deaths with 292 000 reported in sub-Saharan Africa (WHO, 2015b).

The high burden of malaria has led to a massive international effort to increase prevention and treatment measures (Biedron et al., 2010). The main interventions are: vector control which is achieved largely through the use of insecticide-treated mosquito nets (ITNs) or indoor residual spraying (IRS); chemoprevention which suppresses blood-stage infection in humans; and case management which includes prompt diagnosis and treatment of infections (WHO, 2015).

The data from the World Malaria Report of WHO (2015) estimates the proportion with access to an ITN in most households at 56% in 2014 and 67% in 2015, specifically in sub-Saharan countries. A high proportion of up to 82% of those with access to an ITN, sleep under an ITN. As a result, ensuring access to ITNs has been critical to increasing the proportion of the population sleeping under an ITN. In the same report, the population sleeping under ITNs was estimated at 46% in 2014 and 55% in 2015; the proportion of children aged under 5 years sleeping under an ITN increased from <2% in 2000 to an estimated 68% in 2015 in sub-Saharan African countries.

As indicated by these findings above, the use of ITN as one of strategies for vector control is increasing the impact on malaria control and prevention worldwide.

Among other interventions, worldwide, 116 million people were protected by IRS in 2014 and IRS increased the proportion of population protected by vector control in sub-Saharan Africa from 2% in 2000 to 59% in 2014. The proportion of pregnant women receiving at least three doses of Intermittent Preventive Treatment in pregnancy (IPTp) as chemoprevention has increased since 2012 where 52% of eligible pregnant women received at least one dose of IPTp in 2014 versus 40% who received two or more doses, and 17% received three or more doses (WHO, 2014). In 2014, six of the 15 countries for which WHO recommended seasonal malaria chemoprevention (SMC), being Chad, the Gambia, Guinea, Mali, Niger and Senegal – had adopted chemoprevention policies for children and two additional countries outside the Sahel sub-region (Congo and Togo) reported that the policy had been adopted (WHO, 2015a).

For diagnostic testing, since 2005, the proportion of suspected malaria cases presenting for care in the public sector that receives a malaria diagnostic test has increased from 74% in 2005 to 78% in 2014. The WHO African Region has had the largest increase in levels of malaria diagnostic testing, from 36% of suspected malaria cases tested in 2005, to 41% in 2010 and 65% in 2014 thanks to an increase in the use of Rapid Diagnostic Tests (RDTs) (WHO, 2014). For treatment, the proportion of children under 5 years with P. *falciparum* malaria and who were treated with an ACT is estimated to have increased from less than 1% in 2005 to 16% in 2014 (range: 12–22%). This proportion falls substantially short of the Global Malaria Action Plan (GMAP) target of universal access for malaria case management with a primary reason being that a high proportion of children with fever are either not presented for clinical care, or use the informal private sector, where they are less likely to obtain ACTs for treatment. Nonetheless, whilst the proportion of children treated with an ACT has increased, the proportion treated with other antimalarial medicines has decreased over time.

The large reductions in the number of malaria cases and deaths between 2000 and 2015 were noticed. In this period the incidence rate of malaria, which takes into account population growth, is estimated to have decreased by 37% globally and the estimated malaria mortality rate decreased by 60% (WHO, 2015).

These large reductions were as result of investments in malaria control Global financing as this increased from an estimated US$ 960 million in 2005 to US$ 2.5 billion in 2014 which the Global Fund (estimated to US$ 7 billion cumulative budget) and the USA government have taken a lead in. Other funding including domestic funding from National Malaria Control Program (NMCP); and international funding from the World Bank as well as the UK government through Department for International Development (DFID) was also invested (GF, 2014).

With needs that are bigger than the resources available, ending epidemics and building health systems requires focused, data-driven approaches that can achieve the greatest impact (GF, 2014). Some donors like the Global Fund require countries to select programmatic output, outcome and impact indicators for monitoring programmatic performance and progress of Global Fund-supported malaria programs (Kent, 2011). The indicators are aligned with recommendations of the WHO Global Malaria Program and Roll Back Malaria M&E Reference Group (MERG). Indicator selections are suggested to minimize the reporting burden on programs, focusing on the set of the most common indicators recommended for each specific activity area (including community and health system strengthening in the context of malaria control)(Bakyaita N., 2005).

The government of Ghana had to achieve the malaria targets of at least 85% by the end of 2014, for populations at risk, with the assistance of the President's Malaria Initiative (PMI) (PMI, 2014). As in many African countries, PMI and the NMCP rely on nationally representative indicator surveys and/or on monitoring and evaluation of output and outcome indicators to track progress in coverage of malaria control interventions in Ghana. According to DHS report 2014 for Ghana by the Ghana Statistical Services (2014), 68% of households own an insecticide-treated net with a higher percentage of these households in rural than in urban areas (78% versus 60%). The night before the survey, 47% of children under age 5 slept under an insecticide-treated net in all households, an increase from 4% in 2003 and 39% in 2008. Additionally, 43% of pregnant women in all households, slept under an insecticide-treated net the night before the survey, an increase from 3% in 2003 and 27% in 2008. At the time, 85% of nets in Ghana were free to households. 10% of households reported that they had received IRS in the 12 months preceding the study with IRS being substantially higher in Upper East (79%) region, Northern and Upper West regions (37 & 32%). In the same report, it shows that in urban areas, the application of IRS is very low and or almost absent. The prevalence of malaria in children ages 6-59 months is 36% as measured by RDT and 27% measured by blood smears analysis via microscopy.

1.2. Problem statement

The fight against Malaria and its eradication has increased over the past few decades, in sub-Saharan Africa through the implementation of high impact interventions including care, treatment and prevention (WHO, 2012). Large investments and increased global prioritization of its prevention and treatment have resulted in greater emphasis on programme monitoring and evaluation (M&E) in many countries (Biedron et al., 2010).

Data generation and reporting is one of key factors in monitoring program success and evaluating impacts of efforts invested by different stakeholders in fighting malaria. For instance, malaria indicators have demonstrated a major role in programming and management among stakeholders (Boerma et al., 2009). However, the full documentation about what influence this data-flow is having on health system structure for malaria control practices is still unclear.

In Ghana, malaria burden places significant financial hardship on both households and the national economy and is a challenge to human development, manifesting itself both as a cause and consequence of under-development (Ankomah, & Asenso-okyere, 2003). Many in-country studies have been conducted on malaria prevalence, case management and economic implication (J. Chuks, Mba and K. Irene, 2012). A multiple Indicator Cluster Survey with an enhanced malaria module and Biomarker was conducted in 2011 and shows that indicators were improved across the country since 2005, through to the increased funds under a Round 4 Global Fund Malaria grant to scale up interventions (Ghana Statistical Services, 2012). Despite this, there are still very few reports from researches about influence of these indicators reporting flow on malaria management at district and primary health facility levels. However, data routinely reported by health facilities are often highly incomplete and the completeness of these data can vary significantly over time and between urban and rural facilities (JSI, 2013). According to the same publication by USAID-JSI, the completeness of monthly reporting among facilities reporting at least one month of data was 34% in the Accra Metropolitan Authority, 43% in the Kumasi Metropolitan Authority, and 35% in other communities. Among all registered facilities, the completeness of reporting was substantially lower in the Accra Metropolitan Authority (12%) and the Kumasi Metropolitan Authority (23%), than in other communities (31%).

The incompleteness of malaria indicators reports means a gap in the reporting coverage, weakness in data traceability, case reporting and most of the time in case management (J. Cox, 2013).

This study describes the system for malaria data collection, management and reporting system from the health facilities level in Ayawaso district. It also assesses the data use on malaria and disease management at the various levels of the health care system under the district health structure.

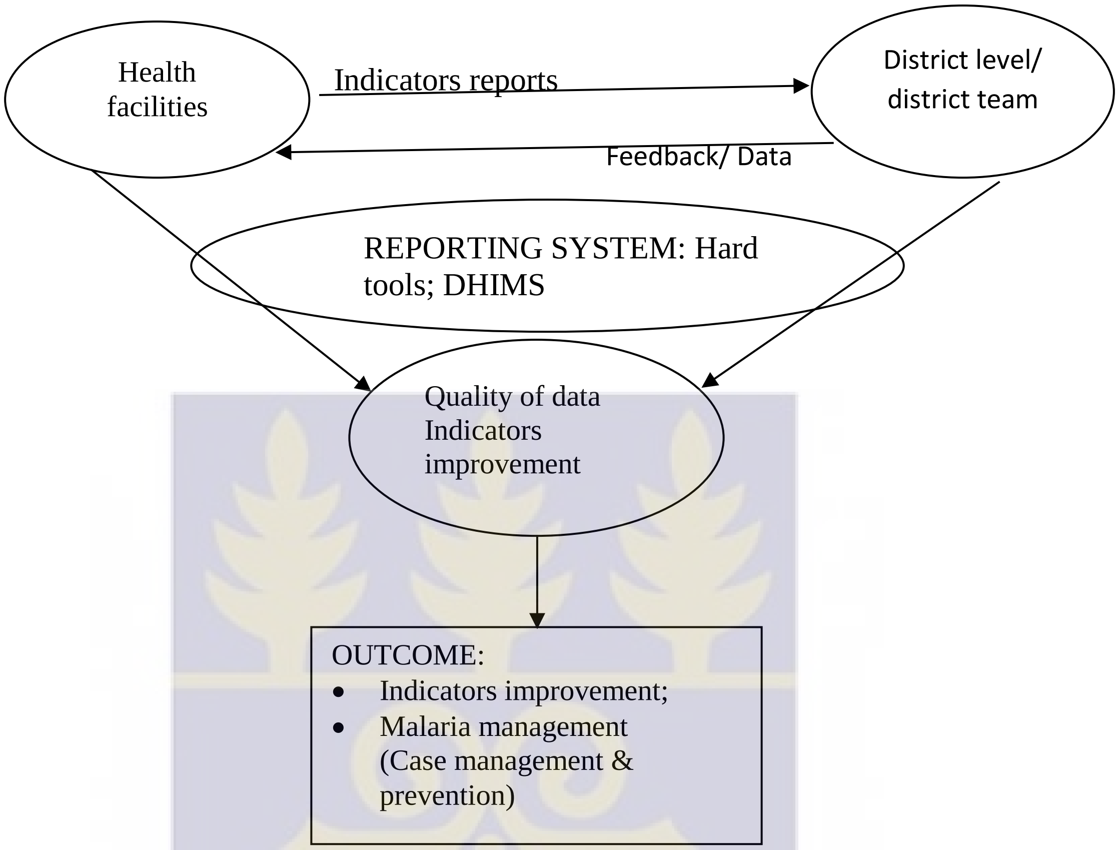


Figure 1. Conceptual framework of tracking malaria indicators reporting system in Ayawaso sub-metro

As shown in the conceptual frame work in figure 1, the health facilities report to the districts. The health district team then revises the reports, and data and feedbacks the health facilities for error corrections and data accuracy where necessary. The district then inputs the data into DHIMS software for analyses. After analysing data, any abnormal data trends are flagged to the facilities in accordance with indicators improvement. This enables health facilities enact corrections according to the feedback provided by the districts and this helps in indicators improvement and malaria management at the health facility level.

1.3. Justification of study

The national financial burden for malaria control is higher compared to the total income of malaria endemic countries. The major part of the malaria budget comes from international donors including Global Fund for Malaria, HIV/AIDS & Tuberculosis. This funding often comes with requirements to the recipient governments to produce data in the form of indicators.

This study is very important to properly understand the role of indicators reporting system and data-use on malaria control and quality improvement. For the Ministry of Health of Ghana; any other country in sub-Saharan Africa with malaria endemicity, stakeholders, and donors as well, this study will effectively contribute as a pilot study to assess the influence of national malaria indicators on malaria control, priorities and policies in the country.

1.4. Study objectives

General objective:

The general objective of the study is to analyse and track malaria indicators reporting system and data-use on malaria management in Ayawaso district of the Greater Accra Region, Ghana.

Specific objectives

The specific objectives of the study are to:

a. Describe the system for malaria data collection and management at district level;
b. Analyse reporting system from the health facility level in Ayawaso district;

c. Assess the data-use on malaria and disease management at the various levels of the health care system in Ayawaso Health District.

Questions

a. How is malaria data collected, managed and reported from health facility level to the district level?

b. Is the collected data used for malaria and disease management at facility and district level of the health care system?

CHAPTER TWO

LITERATURE REVIEW

2.1. The burden of Malaria:

In 2000, 262 million cases of malaria globally were estimated, leading to 839 000 deaths. The recent estimation by 2015 reveals a decreased number of malaria cases to 214 million (18% of declination), and the number of deaths to 438 000 (48% of declination). Specifically, most cases in 2015 are estimated to occur in the WHO African Region (88%), followed by the WHO South-East Asian Region (10%) and the WHO Eastern Mediterranean Region (2%). Similarly, it is estimated that in 2015, most deaths (90%) were in the WHO African Region, followed by the WHO South-East Asian Region (7%) and the WHO Eastern Mediterranean Region (2%) (WHO, 2015). Table 1 and table 2 below summarise estimates about malaria cases incidence, and deaths by the WHO regions from the year 2000 to 2015.

Table 1: Estimated malaria cases and deaths, by WHO region, 2000–2015

Estimated number of malaria cases (000's)					change	Estimated number of malaria deaths				change
WHO region	2000	2005	2010	2015	2000–2015	2000	2005	2010	2015	2000–2015
African	214 000	217 000	209 000	188 000	-12%	764 000	670 000	499 000	395 000	-48%
Americas	2500	1800	1100	660	-74%	1600	1200	1100	500	-69%
Eastern Mediterranean	9000	8600	4000	3900	-75%	15000	15000	7000	6800	-51%
European	36	5.5	0.2	0	-100%	0	0	0	0	
South East Asian	33000	34000	28000	20000	-39%	51000	48000	44000	32000	-37%
Western Pacific	3700	2300	1700	1500	-59%	8100	4200	3500	3200	-60%
World	**262 000**	**264 000**	**243 000**	**214 000**	**-18%**	**839 000**	**738 000**	**554 000**	**438 000**	**-48%**
Lower boundary	205 000	203 000	190 000	149 000	-	653 000	522 000	362 000	236 000	-
Upper boundary	316 000	313 000	285 000	303 000	-	1 099 000	961 000	741 000	635 000	-

Source: WHO estimates, 2015 World Malaria report

Table 2: Estimated malaria incidence and death rates, by WHO region, 2000–2015

Estimated malaria incidence rate per 1000 at risk of malaria					change	Estimated malaria death rate per 100 000 at risk of malaria				change
WHO region	2000	2005	2010	2015	2000–2015	2000	2005	2010	2015	2000–2015
African	420	378	315	246	-42%	153	117	75	52	-66%
Americas	40	26	16	9	-78%	2.6	1.9	1.5	0.7	-72%
Eastern Mediterranean	59	49	20	18	-70%	9.3	8.3	3.6	3.3	-64%
European	28	4	0.1	0	-100%	0	0	0	0	-100%
South East Asian	44	42	33	23	-49%	6.9	6.0	5.1	3.5	-49%
Western Pacific	11	6	5	4	-65%	2.4	1.2	1.0	0.9	-65%
World	**146**	**134**	**113**	**91**	**-37%**	**47**	**37**	**26**	**19**	**-60%**
Lower boundary	114	103	88	63	-	36	27	17	10	-
Upper boundary	176	159	132	129	-	61	49	34	27	-

Source: WHO estimates, 2015 World Malaria report

In Ghana, the entire population of 24.2 million is at risk of malaria infection, although specifically, children under five years of age and pregnant women are at a higher risk of severe illness due to lowered immunity (PMI, 2014). Malaria is still the number one cause of morbidity and mortality in children under five years of age, accounting for 33% of hospital deaths in children under five years and about 38% of all outpatient illnesses as well as 36% of all admissions. Between 3.1 and 3.5 million annual cases of clinical malaria are reported in public health facilities, of which 900,000 cases are in children under five years and 3,000-4,000 result in inpatient deaths (PMI, 2014).

2.2. Malaria Indicators and Monitoring programme

As malaria control expands, many programs in high-endemic settings have increased intervention coverage significantly and are reducing malaria transmission intensity and disease burden (Kent, 2011). As an addition to malaria control programmes, all countries in sub-Saharan Africa have developed Roll Back Malaria (RBM) strategic plans and health sector strategic plans (HSSP) that had set targets to be achieved between 2000 and 2015 (Bakyaita N., 2005) as it is shown in table 3.

One objective of the RBM Partnership is to develop an effective monitoring and evaluation (M&E) system to assess RBM progress towards its objectives and determine whether its goals have been met at the country, regional, and international levels (Macintyre & Hill, 2002).

Table 3: Roll Back Malaria objectives, targets for 2015 and indicators

GMAP objective or target	Key indicators
Objective 1. **Reduce global malaria deaths to near zero* by end 2015**	Inpatient malaria deaths per 1000 persons per year All-cause under-five mortality rate (5q0)
Target 1.1 Achieve universal access to case management in the public sector **Target 1.2** Achieve universal access to case management, or appropriate referral, in the private sector	%suspected malaria cases that receive a parasitological test %children aged under 5 years with fever in the last two weeks who had a finger/heel stick %confirmed malaria cases that receive first-line antimalarial treatment according to national policy
Target 1.3 Achieve universal access to community case management (CCM) of malaria	%receiving first-line treatment among children aged under 5 years with fever in the last 2 weeks who received any antimalarial drugs
Objective 2. **Reduce global malaria cases by 75% by end 2015 (from 2000 levels)**	Confirmed malaria cases (microscopy or RDT) per 1000 persons per year Parasite prevalence: proportion of children aged 6–59 months with malaria infection
Target 2.1 Achieve universal access to and utilization of prevention measures** **Target 2.2** Sustain universal access to and utilization of prevention measures	%population with access to an ITN within their household %population who slept under an ITN the previous night %population protected by IRS within the last 12 months %households with at least one ITN for every two people and/or sprayed by IRS within the last 12 months %women who received intermittent preventive treatment for malaria during ANC visits during their last pregnancy
Target 2.3 Accelerate development of surveillance systems	%districts reporting monthly number of suspected malaria cases, number of cases receiving a diagnostic test and number of confirmed malaria cases
Objective 3. Eliminate malaria by end 2015 in 10 new countries **(since 2008) and in the WHO European Region**	Number of new countries in which malaria has been eliminated

Source: Malaria world report, 2015

According to annual USAID report, (2010), a dramatic scale-up of malaria prevention and treatment measures across 15 President's Malaria Initiative (PMI)-supported countries over the past four years. Many of these countries have reported significant reductions in under-five mortality, and there is strong and growing evidence that malaria prevention and treatment efforts are a major factor in these reductions. Throughout this report, authors highlight the role of USA government in the implementation of malaria interventions, including the training of health workers and health systems strengthening. Progress in malaria control is as a result of the collective actions of African governments; international donors, including the USG, The Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), and the World Bank; as well as several nongovernmental organizations (USAID, 2010).

In Mozambique, the Malaria Indicator Survey (MIS) was conducted by the Ministry of Health in June and July 2007. It had only aimed to assess Lot Quality Assurance Sampling (LQAS) to evaluate malaria outcome indicators from extending malaria indicator surveys. It highlighted the feasibility of integrating LQAS into multi-stage cluster sampling surveys and using these results to support a comprehensive national, regional and local programme M&E system. As was shown in the study, some provinces in Mozambique achieved the 70% coverage target for household possession of bed-nets or ITNs. By applying LQAS classification rules to the data, researchers identified 266 of the 345 enumeration areas as having bed-net coverage severely below the 70% target. An additional 73 enumeration areas were identified with low ITN coverage (Biedron et al., 2010).

2.3. Malaria Data source and collection

Vital registration & and demographic surveillance:

Vital registration is the continuous collection of data on births and deaths in the country, with or without classification of the cause of death based on death certificates. Vital registration data may be collected for the entire population or in a sample of localities (Edgar, Lucas, & Mceachern, 2014).

Demographic surveillance sites are mostly preferred for several high endemic countries without functioning vital registration system. Therefore, birth and death are monitored continuously over time in a defined area. Demographic surveillance sites often rely on verbal autopsy to classify causes of death (Judith R. Glynn, et all, 2014). In countries without a fully functional vital registration system, mortality trends from these sites are a useful complement to facility-based data, but should be interpreted with caution as they carry limitations inherent in the use of verbal autopsy and may not be representative of the broader population (WHO, 2007).

Household surveys

Household surveys complement facility-based surveillance by providing data at a population level, including people who do not access health facilities (GF, 2011). They are especially relevant in rural or poorly accessible areas of endemic countries in sub-Saharan Africa, where malaria cases are commonly managed at home rather than in a health facility. Surveys are also particularly useful for collecting information on young children, an age group where the malaria burden is concentrated (Macintyre & Hill, 2002).

Key measured malaria coverage indicators are: household ownership of ITNs, use of ITNs, households receiving any form of vector control in the previous year, and women who received one or more dosages of Intermittent Preventive Treatment (IPT) during their most recent pregnancy (GF, 2011). In countries where only certain areas are malaria endemic, the national average coverage statistics may underestimate the actual coverage among populations at risk (Kent, 2011).

In addition, surveys ask about treatment-seeking behaviour by respondents and their young children, such as whether services were accessed and what medications were taken for fevers in children under 5. These data are useful in order to understand what reported facility-based cases and deaths from the HIS represent among all cases and deaths, but are not specific to confirmed malaria cases.

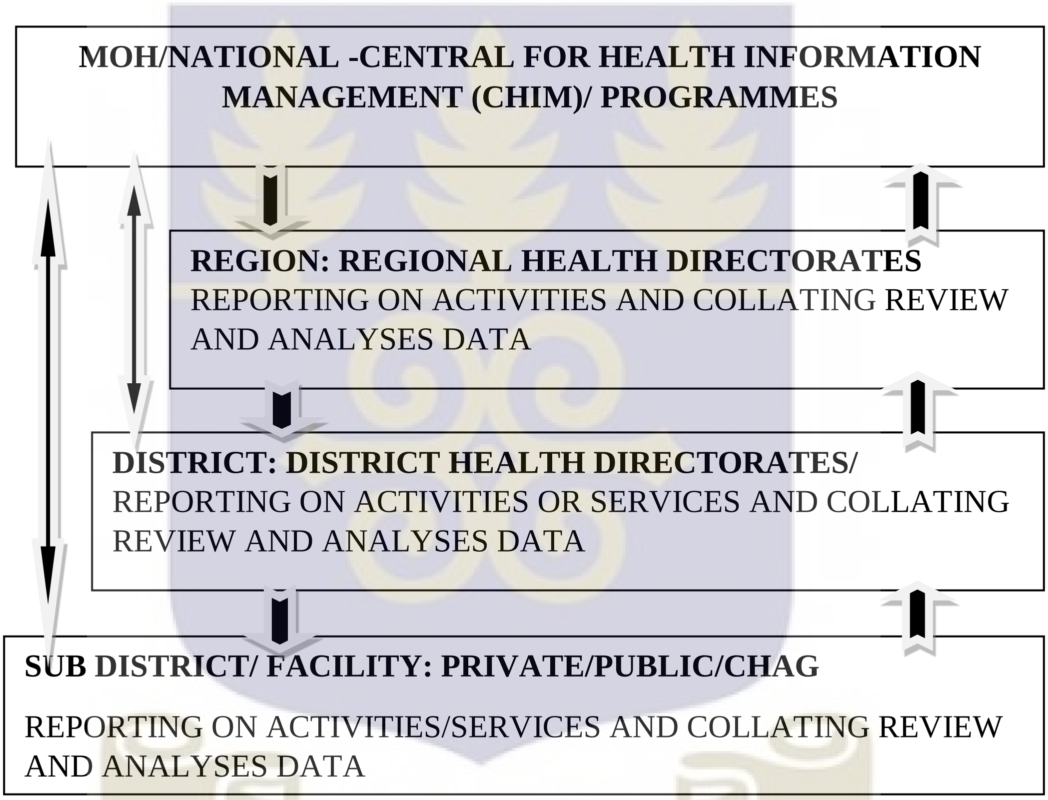
DHS, MICS and MIS are three major household surveys that are commonly used to monitor malaria indicators. The MIS is focused solely on malaria, while DHS and MICS provide information on a broader range of health and population indicators including family planning and maternal and child health (Kent, 2011).

Health information systems – facility-based recording:

Most malaria-endemic countries have an operational health information system (HIS) that serves as the main tool to monitor malaria control interventions, although this is not always fully functional (WHO, 2012a). The HIS collects information across a range of diseases and health services, which can be cost-effective and sustainable, but may not provide the full range of data required by the malaria program. A key constraint to the effectiveness of health information systems is timely and complete reporting. World health organization recommend the NMCP and other responsible authorities to monitor systematically reporting completeness over time and ensure that missing reports are actively followed up (WHO, 2015).

Ghana DHIMS 2

In the Ghanaian health sector, all health facilities are required to report on all services provided according to the agreed respective schedule. The reports flow starts from health facilities through the district, then from district to the regional and from regional to the national level. The facility health information officer (FHIO) is responsible for collecting the data from his facility and submitting to the district health information officer (DHIO) for entry into DHIMS 2. However the hospitals are supposed to enter the data into DHIMS 2 directly and the DHIO has direct access to the database in DHIMS (GHS, 2014). Figure 3 shows the reporting structure from the health facility level to National Level.



Source: SOP on Health information management II: 2014

Figure 2. Reporting structure from the health facility level to National Level

Malaria indicators report in Ghana

The total number of 51 malaria indicators are currently captured into DHIMS 2 in Ghana. All these indicator data are entered into DHIMS 2 from the district and is visible at the national level. However, national level is unable to utilise this data until it is signed off by the region or after the expiration of the official reporting date which is 25th of the following month.

The reporting deadlines at health district level

According to the SOP on health information management II, the facilities have up to the fifth day of the following month to submit their report to the Directorate of District Health (DHD). The DHD has 10 days for data verification and entry in DHIMS before signing off electronically[1] on the fifteenth day of the same month. The district reports to the regional health directorate on a quarterly basis and within the third week of the month after the quarter (GHS, 2014).

[1] Signing off electronically: This means an authorizing officer (DDHS) at the defined level fills an electronic cover sheet acknowledging ownership and approval of the data in DHIMS

CHAPTER THREE

METHODS

3.1. Study design

Study design defines the study type (descriptive, correlational, semi-experimental, experimental, review, meta-analytic) or/ and sub-type (e.g., descriptive-longitudinal case study), research question, hypotheses, independent and dependent variables, experimental design, and, if applicable, data collection methods and a statistical analysis plan (Robson, 2002).

This study design is descriptive and considered both retrospective data as qualitative data and prospective data. It used Mixed Methods to answer the study question.

Mixed methods: according to Creswell and Piano Clark, the mixed methods are a combination of quantitative and qualitative approaches in order to provide a better understanding of research problems than either approach alone. These methods would be: Triangulation; Embedded; Explanatory and Exploratory (Bowling, 2014).

Exploratory mixed methods were chosen in this descriptive study. The qualitative methods described the malaria indicators reporting system and helped to develop the basis of quantitative methods. The quantitative methods describe the appearance of malaria indicators reporting situation in the Ayawaso district. They provide the statistical data about reporting rates and malaria indicators.

To collect data, key informant interviews were conducted and records review of indicator reports were performed, considering the health facilities' reports from 2012 to 2016.

- ✓ *Qualitative primary data*: In-depth interviews with key informants

- ✓ *Record review of secondary data*: facilities reports 2012 to 2016

3.2. Study Location

The study was conducted from May to June 2016 in the Ayawaso Sub-metro. The Ayawaso Sub-metro is one of six sub-Metros which compose the Accra Metropolis. On its side, Ayawaso Sub-metro is composed of 10 communities: Mima, Pig Farm, Alajo, and Roman Ridge, Airport residential Area, Maamobi, Accra Newtown, Kotobabi, Legon and Dzorwulu.[2]

Demographic: At the 2011 census, the population of Ayawaso was 538,593 which is predominated by the Muslim community. The current projection estimates around 511,475 people. This population density is very high and this brings in its trail numerous environmental and health problems.

Boundaries: Ayawaso Sub-metro has its Northern boundary as the Ga district: Gimpa - University of Ghana Legon and the I.P.S. Road. It is bordered in the South by the Osu Klotey Sub-Metro: Ako Adjei interchange to Kwame Nkrumah circle**.** It also has on its Eastern border the Kpeshie Sub District being the Ako Adjei Interchange to Legon**.** In the West: Okaikoi South District being the Kwame Nkrumah Circle to the Apenkwa overhead Bridge.

Economy: The occupation of the people of Ayawaso sub-metro varies widely; the women are mostly petty traders, and most of the men are artisans (e.g. Masons, Carpenters, and Auto Mechanics etc.). Civil servants of lower income groups may be found in places like Nima, Maamobi, Accra New town, Alajo, and Kotobabi.

[2] Information provided by department of demographic and social services at Ayawaso Sub-metro.

The higher income populace are usually residents of places like Airport Residential Area, Roman Ridge, Kanda and Legon where the government has constructed bungalows for managerial categories of workers. Private residences owned by private individuals and real estate companies are also common in these areas. Small scale farming activities are found between Alajo and Dzorwulu where varieties of both local and exotic vegetables are cultivated. Small-scale poultry farming and sheep rearing are also undertaken in some residential homes. Cattle are occasionally found grazing in the area.

Health service structure:

This Sub-metro has the highest concentration of Health facilities among the six Sub-Metros in Accra. It has 9 hospitals; 33 health Centres/Posts and 15 other health facilities.

- ✓ 3 Government institutions: Maamobi General hospital; Nima Government Clinic and Mallam Atta clinic;
- ✓ 2 Quasi-Government institutions: 37 Military Hospital, and Legon Teaching Hospital;
- ✓ 10 Private hospitals;
- ✓ 64 private clinics including dental and maternity homes.

Management: The sub-metro health team (SDHT) is the Ghana Health service Management Team, which plans, organizes, and delivers services in a coordinated, integrated and collaborative manner within the Ayawaso sub-metro. This team meets quarterly. The team is made up of all unit heads in the Maamobi general hospital, the officer in Charge at the Nima government clinic and Medical Assistant of the Mallam Atta Market. The SDHT is supervised by the Accra Metro DHMT.

3.3. Data collection techniques and tools

The study involved in-depth interviews and record reviews. In-depth interviews were carried out among 6 personnel in the Health Directorate of Ayawaso District including:

a. Health district Director of Ayawaso sub-metro;

b. Deputy director of nursing service

c. Malaria Focal point personnel/ Pharmacist

d. Disease control officer at Ayawaso Sub-metro;

e. Public health officer at Ayawaso Sub-metro;

f. Health information officer;

Sources of secondary data were:

a. Previous reports from health facilities: from January 2012 to May 2016

b. SOP on HMIS

c. Policies and documents on malaria;

The main tools used for data collection were:

1. Data extraction tool/ excel sheet
2. Interview guide for the key informants;
3. Interview notes;

In order to effectively describe the completeness and quality of data collected through the routine reporting system, data for malaria indicators reported by health facilities were gathered and analysed. Malaria data reports for January 2012-May 2016 were provided by the Ayawaso Health Directorate.

The intensive work with staff members in Ayawaso Sub-metro was effectuated with the objective to review the malaria management and indicators reporting system at the district level. The understanding of Malaria management in terms of quality of data as well as meeting of targeted indicators was considered. Key people involved in Malaria Management were identified in order to conduct an adequate depiction of malaria management activities at any health facility level under the Ayawaso sub-metro.

Database was explored by researcher and information officer to extract data from previous reports from health facilities during a period of January 2012 to May 2016. The 6 key malaria indicators were considered for completeness and timeliness according to the information provided by key informants during in-depth interview: Malaria morbidity reports; haematological rest reports; ANC/Maternity malaria reports; Statement of in-patient reports; Malaria Returns on Anti-malarial reports and Midwife returns reports. DHIMS2 is accredited by NMCP and data from DHIMS2 at district level are quarterly validated by Regional Health Directorate.

Study limitation

In choosing the Ayawaso sub-metro, following factors were considered; among them being: study logistics, budget and time constraints given the period allocated for the academic programme.

This study did not capture nor give any information about the following data:

- The data from traditional healers and herbalists for malaria;
- Data from self-medication of malaria; and

- Data from those who never seek for any treatment.

Permission to procedures & Ethical clearance

The issued ethical clearance letter was provided by the Ghana Health Services Ethics Review Committee. The authorization to access the data was requested from the NMCP management. Data from different units and facilities were handled with assurance of all confidentiality. An ethical consent agreement was signed between the researcher and key informant interview participants or managers who provided the data and other necessary documentation. The following points were considered in the ethical consent form for participants:

- ✓ The interview data and the information which it contains were to be used solely for the purposes defined by the study;
- ✓ The compensation of interviews participants was provided as is stipulated in the research budget sheet;
- ✓ At any time, the participant had the right to refuse to answer certain questions, discuss certain topics or even culminate the interview without prejudice to him/herself;
- ✓ To facilitate the interviewer's job, note-taking was allowed. However, the notes material were devoid of both the job position and the name of the respondent and were to be destroyed as soon as the interview was transcribed;
- ✓ All interview data were handled so as to protect the confidentiality of participants. Therefore, no names were mentioned and the information was coded without any identifiers;
- ✓ All interview data collection materials were to be destroyed at the end of the study;

Training of data collectors:

Discussion with qualified and experienced public health research assistants was done in order to facilitate identification and contact with program managers and key program officers involved in malaria data management at the district level. Assistants assisted in data collection and language interpretation where necessary.

Quality control

The research assistants used were public health qualified and experienced in conducting both qualitative and quantitative studies. The data was collected by a team consisting of the researcher and the research assistants. One research assistant moderated the interview whilst the principle researcher and the second research assistant took notes from the interview in order to optimize the capture of all information provided by the respondent. The program managers and data officers who provided the key documents for secondary data and who were key elements for in-depth interviews were thoroughly briefed on the purpose of the study. The officers interviewed were familiar with health indicators and the health concepts.

3.4. Data processing and analysis

The transcription of data from the collection tools into hard copy documents were directly performed immediately after collection.

- ✓ The transcripts from the interviews were read carefully and all necessary notations indicated;
- ✓ Themes emerging from the interviews were developed into preliminary descriptive and interpretive categories based on evidence presented in the

transcripts, the researcher's literature review, and the guiding theory of this research;

- ✓ Thorough examination of the transcripts was conducted in order to identify relationships and develop outlines.

The discussion described the flow (and use) of information from health staff at the health facility level of the system to the district level and identified relevant recommendations to address some of the bottlenecks and issues identified. The discussion also included the analysis of available malaria indicator reporting data. Based on this analysis, the study was able to make recommendations aimed at maximizing the utility of the existing system.

CHAPTER FOUR

RESULTS

4.1. Malaria data collection, management and report

4.1.1. Monthly reports from Health facilities

From the information provided by interviewees, at the end of every month, every health facility is supposed to submit a monthly report of malaria data. However, few health facilities are able to submit according to the stipulated deadline. One of key informants argued that this delay or absence of reports from health facilities have been attributed to factors including the ubiquitous complaints of high workloads, the facility's usage of the hard system, or simple neglect of data collection and submission.

4.1.2. Monthly visit to the health facilities

When the informants were asked about the strategies they use to optimize data collection they said that the district team visits the health facilities on a monthly basis. One of interviewees continued to explain that team strategically also takes the opportunity as well to conduct some supervision. This is done with the help of a comprehensive malaria supervisory tool which captures all relevant and necessary data. However, this tool still has some limitations as it does not provide all the options which appear in the software. For instance, it does not have options for clinics to differentiate what type of Malaria was diagnosed.

4.1.3. Data management at District Level

At the district level, the data entry is done by a team under the district health information system office. District Health Information system has an important role in ensuring the timely completion of data. The health district has all rights and responsibilities of all data from the health facilities located under their jurisdiction.

The malaria focal point person at Ayawaso district performs regular malaria indicator data analysis in order to closely monitor indicators and quickly effect relevant actions in the event of unusual trends in data.

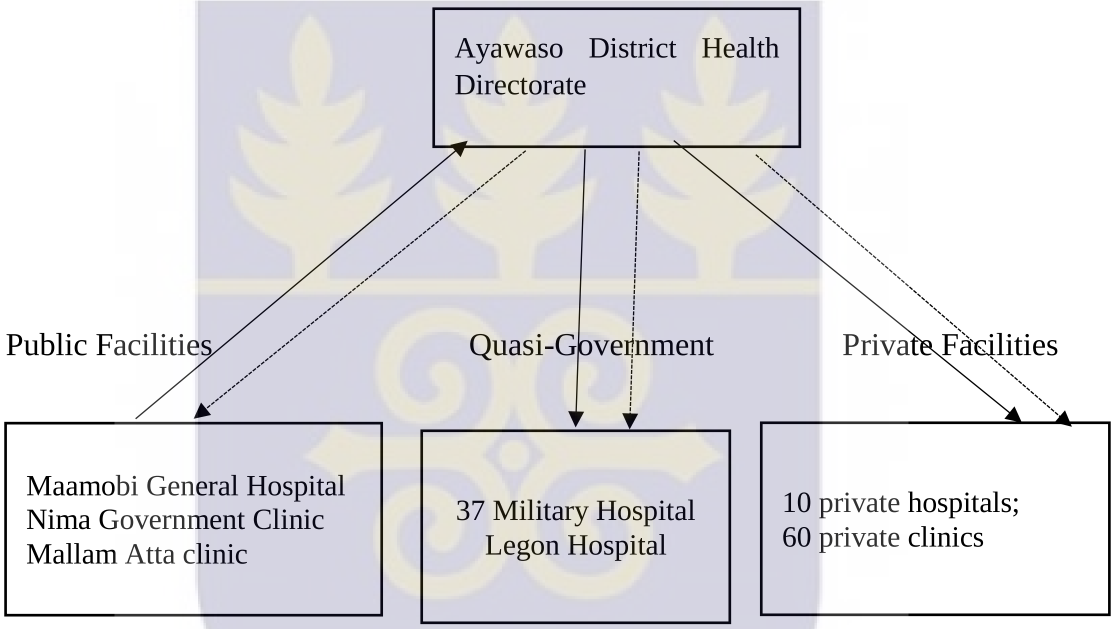
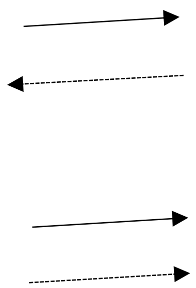


Figure 3. Malaria data collection, management and report framework in Ayawaso District



The facilities send reports and District sends a feedback

The District visits the health facilities for data collection and give them a feedback as well

Figure 3 summarises the flow of malaria indicator reports and the feedback mechanisms between the Ayawaso Health Directorate and health facilities located in its administrative boundary. Only public facilities (Maamobi General Hospital; Nima Government Clinic and Mallam Atta clinic) send the reports directly to the district health directorate themselves. The remaining health facilities (Quasi-government institutions and private facilities) provide their malaria indicators data during visits of a team from the district health directorate purposefully to collect the data. Sometimes, some of these private facilities do not even provide the data either because they do not have it or because they are unwilling to collaborate with the district directorate.

Upon receipt of reports from health facilities or data collected during their visits, the district team verifies the data before entry into DHIMS, then subsequently analyses them and sends corresponding feedback to the reporting facilities about accuracy, any relevant indicators and remarks about actions to be taken by the facility in subsequent months.

4.2. Data-use on malaria and disease management at the various levels under health district

4.2.1. Data quality and accuracy

In terms of the quality of malaria data from health facilities, the district ensures that data are accurate before any entries are done in DHIMS. Management holds data validation meetings with the health facilities each month to approve the accuracy of presented data. Different approaches are used by the DHIS team to provide feedback to health facilities:

Face- to -face feedback about reported data is done during supervision by sitting with relevant personnel and discussing how reports were filled and issues concerning any inconsistencies. Facility personnel are then taken through supervised monitoring to ensure better or more accurate data at the next visit.

Telephone feedback from districts to the health facilities is also frequently undertaken as a means of rapid communication. This helps to inform the facilities about necessary pending corrections and urgent updates on the form which need to be effected immediately so that the DHIS team can update in DHIMS as well. This is used when urgency is a high factor especially meeting the deadline of the district to send data to the regional level. Thereafter, the DHIS team routinely collects the final corrected reports from the health facilities.

The quarterly data audit involves the district team visiting the health facilities. The team scrutinizes all the periodic data registers and compares them to the previous reports received from the concerned health facility.

Late submission of reports from health facilities, inadequate computers for data entry and poor internet access are some limitations for effective DHIS to ensure the quality of data. The complexity of the reporting format, frequent transfer of experienced staff and inadequate training of the staff on how to report are also other limitations for the DHIS team in ensuring the quality of Malaria data.

4.2.2. Indicators improvement at health district managers' level

''The Malaria indicators serve to alert the us when the prescribers are deviating from the outlined policies, when there are stock outs or overstock of antimalarial drugs and

whether IPTs are being provided at ANC''. This is a quote from one of key informants at Ayawaso district when he was asked about how malaria indicators fit with his job.

The other informant continued saying that in the Ayawaso sub-metro, malaria always ranks among the top ten diseases which cause morbidity. For this reason, malaria indicators give them a much needed general picture of morbidity in this sub-metro. After analysing malaria key indicators and upon discovering any indicator trends to fall below the standards, the sub-metro notifies the district management's attention. The district management then takes action either by talking with the clinicians or by supervising indicators to know exactly the cause of changes in indicator data.

4.2.3. Impact of indicators reports on health caregivers

Malaria indicators are an alert tool which help managers to forecast for future purposes. In the Ayawaso sub-metro, malaria indicators help for example to estimate the number of people who are eligible to receive ITNs. The indicators reporting system help as well to know the right target populations for community education and sensitization on the use of ITNs.

Malaria indicator reports are important for malaria management improvement because each feedback informs health facilities and motivates them to perform better in subsequent months.

4.3. Management and coordination of reporting system on district level

The Malaria focal person at the Ayawaso sub-metro is the head pharmacist, who together with the deputy head pharmacist work closely with the Deputy Director of nursing and HMIS officer to know the real burden of disease. District staff participate in all Malaria activities to the CHPS level including health education and ITN distribution and re-treatment. The district team is coordinated by the Medical Director of the Ayawaso Health Directorate.

Nonetheless, there is no well-defined mechanism for feedback of data back down the reporting chain although there are monthly meetings at the district level and the facility level for malaria indicators reporting system. These meetings, however, almost never involve the private facilities in the malaria data discussion. It is the duty of a district delegate to attend the regional ad hoc meeting, where they can present and discuss the district's malaria situation but this meeting does not occur regularly due to budget constraints.

4.4. Reporting records and data trends

4.4.1. Overview of available data

In order to assess the completeness, timeliness and quality of routine malaria indicators data reports, case data reported by health facilities from January 2012 to May 2016 were collected and analysed. These include 6 key malaria indicator data which were reported in this given period from 3 main government clinics: Maamobi General Hospital, Nima Government Clinic and Mallam Atta Clinic. Malaria morbidity reports; haematological rest reports; ANC/Maternity malaria reports; Statement of in-patient reports; Malaria Returns on Anti-malarial reports and Midwife returns reports were selected for both completeness and timeliness. These key indicators were considered according to the information provided by key informant interviews.

4.4.2. Indicators reporting timeliness

Table 4. Reporting timeliness rate from January 2012 to May 2016

Indicator Year	Morbidity Report	Statement of In-Patient report	Haematology report	ANC/Maternity Malaria	Malaria Returns on	Midwife Returns	Overall % per
2012	10.40%	0%	0%	2.70%	0%	0%	2.18%
2013	72.90%	29.10%	0%	27.70%	2.70%	0%	22.07%
2014	75%	50%	87.50%	80.50%	50%	79.16%	70%
2015	100%	45.80%	87.50%	83.30%	61.10%	77.20%	76%
2016	65%	100%	90%	53.30%	26.60%	92.20%	71%

Aggregated data from district health information office: for January 2012 to May 2016

Table 4 shows the percentage of reporting timeliness rate from 2012 to 2016. The improvement of reporting timeliness is evident over the period for almost all indicators. The only exception is in 2016 because the data covered only 5 months from January to May 2016; data is routinely collected in the beginning of June. The major achievement in respect of reporting timeliness was more remarkable in 2015 where all expected malaria morbidity reports from 100% of health facilities were received in a timely fashion. Haematological reports and ANC/ Materiality malaria reports timeliness was achieved at over 80%. Statement of in-patients reports timeliness was always very low with the only difference in 2016. The overall indicators reports timeliness of 6 indicators was improved at 76%.

4.4.3. Indicators reporting completeness

Table 5. Reporting completeness rate from January 2012 to May 2016

Indicators year of report	Morbidity Report	Statement of In-Patient	Haematology report	ANC/Maternity Malaria report	Malaria Returns on Anti-	Midwife Returns reports	Overall reporting completene
2012	75%	45.80%	0%	88.80%	0%	0%	34.93%
2013	75%	50%	66.60%	100%	100%	0%	65%
2014	75%	50%	100%	100%	88.80%	85.20%	83%
2015	100%	50%	100%	91.60%	97.20%	85.20%	87%
2016	80%	100%	100%	73.30%	93.30%	93.10%	90%

Aggregated data from district health information office: for January 2012 to May 2016

An indication of reporting completeness was obtained by analysing the monthly breakdowns of reporting for expected health facilities for each of six considered indicators. These monthly breakdowns were extrapolated and summarized over the whole year. In table 5 the malaria indicators reports indicated that completeness was improved from 2012 to 2016 for all selected indicators. The completeness was improved at 100% for 3 malaria indicators: morbidity reports, haematological and ANC/ materiality malaria reports. The overall indicators reports completeness of 6 indicators was improved at 90%. The statement of malaria inpatient report was always very low in over 4 years for both completeness and timeliness of reports.

4.4.4. *Malaria indicators improvement: blood test indicators*

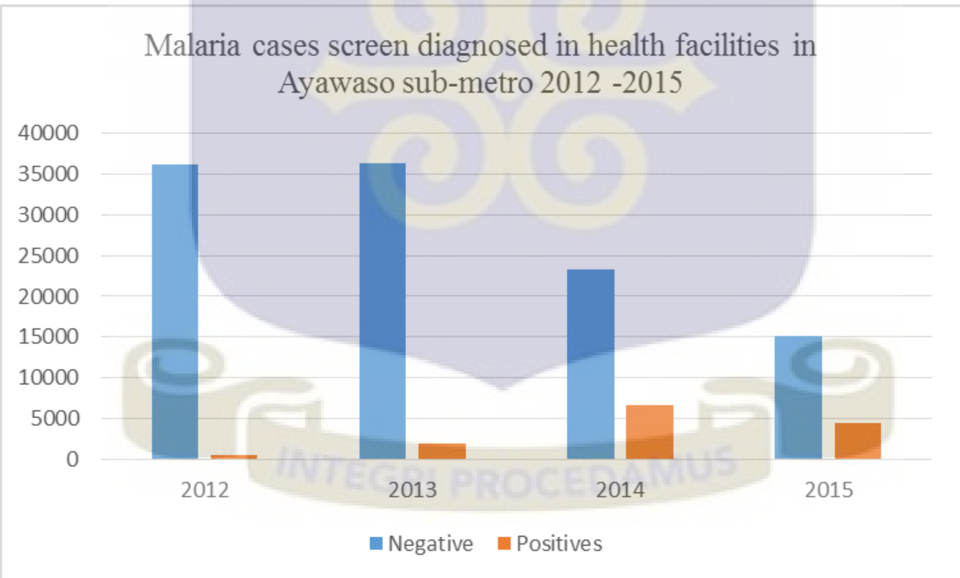


***Figure 4. The change in malaria morbidity and diagnosis improvement over 4 years in Ayawaso District*.**

Figure 4 shows the number of positively tested cases versus negatively tested cases over four years from 2012 to 2015 It shows the diminution in total cases of diseases and the increment of positive confirmed cases. During years 2014 and 2015, all suspected cases decreased significantly but the positively diagnosed cases increased.

This figure strongly demonstrates how malaria indicators were improved over the period of time; with cases generally declining and positive cases optimized.

4.5. The key success and challenges in reporting System in Ayawaso District

DHIMS as a new technology was introduced to replace the hard data management tools. Since its inception, it has made indicators reporting easier and faster; facilitating rapid data verification and easy data communication and sharing within the operating structures. The DHIMS has also minimized the workload by half at district level because the time formerly spent by the DHIS in preparing the hard reports for malaria has now reduced.

For example at the district pharmacy level, it has simplified the inventory system and malaria commodities management. The closing balance report of malaria commodities stock at the end of month needs to tally with the opening balance at the beginning of following month, the default of which may be an indication of certain problems e.g. embezzlement.

4.5.1. The challenges in malaria indicators reporting system

Malaria indicators reporting system is faced with some challenges in the Ayawaso district. These challenges are related to the lack infrastructural extension at the health facility level, indicators reporting coverage and the system design.

4.5.2. Hard data reports from health facilities

Some facilities are still reporting indicator data as hard copy reports which need manual entry at district level. Availability of IT equipment and relevant infrastructure, stable internet connection and lack of trained staff are other major problems which interfere with malaria indicators management at the district level. The malaria indicators reporting tools from health facilities also increase the workload burden because the facilities present 3 different reports: Malaria in pregnancy; malaria in children; and malaria with chronic diseases.

4.5.3. Missed data from privates health facilities

Private facilities are required to send neither monthly nor quarterly reports to the directorate of the health district. The health district team actually makes an effort to go and collect data on a monthly basis but the traceability of malaria indicators records within these private health facilities is very poor. Most of them do not have a will to track and provide all malaria indicators data to the health district.

4.5.4. DHIMS handling and report to the regional level

At the end of month, the DHIS team signs off electronically, the data to be accessed by the regional level not later than the fifteenth day of the following month. At the end of each quarter, the database closes itself and allows no modification to be done on the district level. When the DHIS team notices any error beyond this period, they are unable to make any correction. This is a major challenge in the flexibility of the data base in not allowing data correction. This consequently has a negative impact on the quality of malaria indicators data.

CHAPTER FIVE

DISCUSSION

5.1. Malaria indicators data collection, reporting and management at district level

The high workload, the facilities' usage of the hard system, and simple neglect of data collection and submission were identified among the factors of reporting delays, absence of reporting and poor coverage. In his published study conducted in Myanmar, J. Cox, (2013) states that the absence of reports and poor reporting coverage are signs of poor disease prevention and case management because it means a lack of real information about the morbidity and mortality rates of cases.

It was reported that most teams at the health facility level is understaffed and or lacking in trained staff. The personnel in charge of data and reporting at the facility level were reported to spend too much time working on different indicators data reports. For malaria alone, there are three separate indicator data reports: malaria in pregnancy, malaria in children and malaria with chronic diseases. These reports seem excessive given that there other disease reports which also require manual entry by only one person. Ultimately, the timeline and completeness of the malaria indicators reports from the health facilities cannot be met easily unless the DHIMS is extended to the health facilities level.

Despite the availability and ability of the comprehensive malaria supervisory tool for capturing all relevant necessary data is available, although hindered by some limitations as it does not provide all the options which appear in the software. For instance, it does not have options for clinics to differentiate what type of Malaria was diagnosed. This worsens as well the reporting system because it increases the workload with less information which needs to be entered into DHIMS. The hard data management and reporting system for health facilities is another factor for coverage, delay and incompleteness of data. The DHIMS is not extended to the health facilities. The organised quarterly meetings have shown efficacy in terms of diagnosing the errors and discordance in reported data from health facilities. However, a quarter is still too long a period of time to take action and correct the errors recorded in DHIMS. Furthermore, electricity shortages as well as a general lack of IT equipment and infrastructure to host DHIMS is still a problem at the facility level as reported by the district health directorate team. As at the time of the study, there were still no current plans in place from major stakeholders to extend the DHIMS to the health facility level or to provide appropriate IT equipment.

As reported by the key informants, the feedback from the district team about malaria indicators notifies the facilities of errors and helps them to perform better in the subsequent months. For Quasi-government and private facilities, the reporting coverage and completeness is perennially very low. This poor reporting coverage and absence is usually as a result of negligence from private facilities in tracking and recording malaria indicators. Ultimately, there is no enforcement policy for the reporting system of malaria indicators binding private health facilities to adhere. Moreover, there is a lack of coordination partnership between public and private sectors in malaria indicators reporting. This presents a major challenge to the NMCP in collating accurate figures of malaria morbidity in this district.

5.2. The implication of data use in malaria management

The results from the last 5 years' reports on malaria indicators from health facilities have shown overall improvement in both completeness and timeliness over the period spanning January 2012 to May 2016. For some indicators, the improvement was as striking as from 0% in 2012 to 100% in 2015 and 2016.

This improvement in reporting timeliness and completeness over the period covered by the study was reportedly influenced by continuous monitoring and mentoring by the health district team of the health facilities. The feedback from the district on the monthly reports to the health facilities, as well as the periodic monitoring and mentoring at the facility level has helped made striking improvement of this reports system over the 5 year period.

Reports on laboratory blood investigations for malaria strongly demonstrate how malaria indicators were improved over the period of time covered by the study. There was a general decrease in prevalence as well as optimisation of diagnosis of positive cases. These results are supporting evidence as well of the improvement in health facilities' capacity in the diagnosis of malaria as indicated by the increasing number of positive cases among few suspected cases.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

Conclusion:

Malaria indicators data are particularly useful to various stakeholders at different levels of the Ghana Health Service. In the Ayawaso district, data are either used by planners, services providers, clinicians and researchers. However, some observations were made:

- Assuring the accuracy of these data from Health facilities is a major challenge since the reporting system from health facilities to the district are still mostly manual and there is no appropriate tool to measure this accuracy. The quarterly meeting is efficacious in terms of diagnosing the errors and discordance in reported data from health facilities. However, a quarter is too long a period of time to take action and correct the errors recorded in DHIMS.

- The coverage, completeness and timeliness of malaria indicators reports in Ayawaso sub-metro were improved over five years covered by the study. Late submission of reports from health facilities, inadequate computers for data entry, poor internet access are common limitations for effective DHIS to ensure the quality of data. The complexity of the reporting format, frequent transfer of experienced staff and inadequate training of the staff on how to report are other limitations for the DHIS team to ensure the quality of Malaria data.

- A large proportion of the population in the Ayawaso district attend private health facilities. Unfortunately, the private facilities do not collaborate to track and provide data about malaria indicators. This impedes the quality of malaria indicator data and have further negative impact on malaria management. As it stands, the private health facilities are not fully integrated within the current health structure system neither is there any rigour on them to conform themselves to the public health sector reporting system.

Recommendation:

✓ **To NMCP**

- NMCP should issue clear guidelines to the private facilities and Quasi- government institutions regarding the format of the periodical (monthly or quarterly) summary report they are required to submit.
- Continuous technical assistance (TA) should be considered in the area of indicators reporting system and data management at the health facilities level to support the district and private partners to coordinate the development and implementation of the malaria indicators reporting system.
- A more in-depth study should be conducted by the NMCP to identify current mechanisms of coordination for malaria surveillance and reporting, and propose mechanisms for the improvement of collaboration and coordination between private and public sector.

✓ **To the Ayawaso Sub-Metro**

- The DHIMS database extension on health facilities level should be implemented to initially directly replace the existing spreadsheet functionality but should update the most recent data. Moreover, the health facilities level staff should have appropriate training on software and computer system handling to minimize data discrepancy. This extension should facilitate as well the interconnection between the District and the health facilities, eliminate the most frequent errors, and minimise the high workload and delays in reporting.

- The IT equipment which is power-saving and user friendly like notebooks and smart tablets should be introduced in order to minimize the risk of losing data due lack of electricity and internet connection which are very common current problems in the Ayawaso sub-metro.

✓ **Private health facilities**

- The private health facilities should ensure the traceability of malaria indicators records as well as other diseases and facilitate the public-private partnership initiative.

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APPENDICES

Appendix I: Interview guide for tracking indicators reporting system and data use on Malaria management in Ayawaso sub-metro.

Introduction: The MPH student at University of Ghana school of Public Health is conducting research on indicators reporting system and impact on Malaria management in Ayawaso sub-metro. The purpose of this paper is for academic interest for the award of MPH- HPPM degree. We are documenting system that is already in place. We are also interested in ideas about what should be recommended to be added in future.

With this in mind, we would like you to tell us about your experiences with and viewpoints on malaria indicators reporting system. We will not use your name, your personality or the content of any material you provide us in our background paper- your responses will be confidential.

1. In addition to any background or documents you have provided, what else can you tell us about the work you are doing, and how malaria indicators fit in?

2. What are the components of ideal indicators reporting system for malaria management? What information is essential?

3. What information contributes to a complete indicators reporting system? What is the leading reporting system to support malaria management? What do you think has taken this system successful? What are the key gaps?

4. Can you comment on the malaria indicators supervisory tool? What are its strengths and limitations?

5. What is the role of district health information systems for malaria management? What prevents effective district reporting system?

6. Are other diseases incorporated with Malaria indicators reporting system?

If so is there any conflicts or any inconvenience to have these diseases incorporated in Malaria indicators reporting system?

If not so should they be incorporated with malaria indicators reporting system? Which diseases? Why?

Is there any disease reporting systems that we should look into as models for malaria indicators reporting?

7. Thinking about malaria reporting system, what are the three biggest challenges to address the issue? Why?

8. We need particularly to know about new technology role in reporting system and malaria management, please could you help us understand what is key to the success of DHIMS, and what do you think still challenges need improvement in future?

9. In the terms of DHIMS, do you get any complaints from the reporting facilities about its use? Do you experience rate of facilities who submit their reports to the district for entry?

What do you think are challenges for this in terms of data quality?

What is a main reason for facilities to submit their report to the district for entry instead of enter them directly into DHIMS?

Are there any innovative approaches do you think would improve malaria data management and reporting system?

10. In terms of data quality and reporting system, do you have the way to measure the data from facilities reports?

When you suspect inaccuracy of data, delay reporting or incomplete data, is there any remarks or feedback you give to the facilities?

If you give a feedback is there any improvement for both next report and indicators improvement?

Do you have any challenge with your own reports to the regional or central level? Do you often receive their feedback about data quality or reports?

Appendix II: Ethics consent form for interview participants

Research project tittle: ***Tracking of malaria indicators reporting system and data-use on Malaria management in Ayawaso sub-metro.***

Project context: The MPH student at University of Ghana School of Public Health is conducting his research on indicators reporting system and impact on Malaria management in Ayawaso sub-metro. This study is for academic purpose to be awarded MPH degree with specialisation in health policy, planning and management. We are documenting practices that are already in place. Your cooperation is highly needed.

I agree to participate in this project, whose conditions are as follows:

- The study is aimed at tracking malaria indicators reporting system and data-use impact on Malaria management in Ayawaso sub-metro. For this purpose, in-depth interviews will be conducted with key staff: Health district Director of Ayawaso sub-metro; Deputy Director of Nursing Services; District disease control officer at Ayawaso Sub-metro; public health officer at Ayawaso Sub-metro; health information officer and Field technician.

- The participation for interview is compensated as it is determined by the study budget;

- The interview that I give and the information which it contains will be used solely for the purposes defined by the study.

- At any time, I can refuse to answer certain questions, discuss certain topics or even put an end to the interview without prejudice to myself.

- To facilitate the interviewer's job, he will be allowed to take notes of the interview. However, the notes will never mention neither my authority nor my name and will be destroyed as soon as it has been transcribed.

- All interview data will be handled so as to protect confidentiality. Therefore, no names will be mentioned and the information will be coded.

- All interview data collection tools will be destroyed at the end of study.

- For any information about the study, can contact **DR. REUBEN KWASI ESENA**, email: rkesena@hotmail.com , mobile phone: +233 (0)277220276; and **DR. YVES LUCIEN HAKORIMANA**, email: lucyveh@gmail.com, mobile +233 (0)556311413

Respondent's signature: ___________________________

Date: ____

Interviewer's signature: __________________________

Date: ____

Appendix III: Data extraction tool

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:--

Month	**2012**			**2013**			**2014**			**2015**			**2016**		
	A	**B**	**C**	**A**	**B**	C	**A**	**B**	**C**	**A**	**B**	C	**A**	**B**	**C**
January															
February															
March															
April															
May															
June															
July															
August															
September															
October															
November															
December															

Label **A:** Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Appendix IV: Raw data/ extracted data on indicators reports from January 2012 to May 2016

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:-Monthly morbidity

No.	Month	2012			2013			2014			2015			2016		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	January	3	0	4	3	3	4	3	3	4	3	3	3	4	4	4
2	February	3	0	4	3	2	4	3	3	4	3	3	3	3	2	4
3	March	3	0	4	3	3	4	3	3	4	3	3	3	3	2	4
4	April	3	0	4	3	3	4	3	3	4	3	3	3	3	3	4
5	May	3	0	4	3	3	4	3	3	4	3	3	3	3	2	4
6	June	3	0	4	3	3	4	3	3	4	3	3	3			
7	July	3	0	4	3	3	4	3	3	4	3	3	3			
8	August	3	0	4	3	3	4	3	3	4	3	3	3			
9	Septembe	3	0	4	3	3	4	3	3	4	3	3	3			
10	October	3	0	4	3	3	4	3	3	4	3	3	3			
11	Novembe	3	2	4	3	3	4	3	3	4	3	3	3			
12	December	3	3	4	3	3	4	3	3	4	3	3	3			
	Total	**36**	**5**	**48**	**36**	**35**	**48**	**36**	**36**	**48**	**36**	**36**	**36**	**16**	**13**	**20**

Labe A: Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:- statement of in-patient reports

No.	Month	2012			2013			2014			2015			2016		
		A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
1	January	1	0	2	1	0	2	1	1	2	1	1	2	2	2	2
2	February	1	0	2	1	0	2	1	1	2	1	1	2	2	2	2
3	March	1	0	2	1	0	2	1	1	2	1	1	2	2	2	2
4	April	1	0	2	1	1	2	1	1	2	1	1	2	2	2	2
5	May	1	0	2	1	0	2	1	1	2	1	1	2	2	2	2
6	June	1	0	2	1	1	2	1	1	2	1	1	2			
7	July	1	0	2	1	0	2	1	1	2	1	1	2			
8	August	1	0	2	1	1	2	1	1	2	1	0	2			
9	Septembe	1	0	2	1	1	2	1	1	2	1	1	2			
10	October	0	0	2	1	1	2	1	1	2	1	1	2			
11	Novembe	1	0	2	1	1	2	1	1	2	1	1	2			
12	Decembe	1	0	2	1	1	2	1	1	2	1	1	2			
	Total	**11**	**0**	**24**	**12**	**7**	**24**	**12**	**12**	**24**	**12**	**11**	**24**	**10**	**10**	**10**

Labe A: Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:- Monthly haematology reports

		2012			2013			2014			2015			2016		
No.	**Month**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
1	January	0	0	2	1	0	2	2	2	2	2	2	2	2	2	2
2	February	0	0	2	1	0	2	2	2	2	2	2	2	2	2	2
3	March	0	0	2	1	0	2	2	2	2	2	2	2	2	1	2
4	April	0	0	2	1	0	2	2	2	2	2	2	2	2	2	2
5	May	0	0	2	1	0	2	2	2	2	2	2	2	2	2	2
6	June	0	0	2	2	0	2	2	1	2	2	2	2			
7	July	0	0	2	1	0	2	2	2	2	2	2	2			
8	August	0	0	2	1	0	2	2	2	2	2	1	2			
9	Septembe	0	0	2	1	0	2	2	2	2	2	0	2			
10	October	0	0	2	2	0	2	2	2	2	2	2	2			
11	Novembe	0	0	2	2	0	2	2	0	2	2	2	2			
12	December	0	0	2	2	0	2	2	2	2	2	2	2			
	Total	**0**	**0**	**24**	**16**	**0**	**24**	**24**	**21**	**24**	**24**	**21**	**24**	**10**	**9**	**10**

Labe **A:** Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:- Monthly ANC/ Maternity Malaria reports

No.	Month	2012			2013			2014			2015			2016		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	January	2	0	3	3	2	3	3	1	3	3	3	3	3	3	3
2	February	3	0	3	3	0	3	3	3	3	3	3	3	2	1	3
3	March	2	0	3	3	0	3	3	3	3	3	3	3	2	0	3
4	April	1	0	3	3	0	3	3	3	3	3	3	3	2	2	3
5	May	3	0	3	3	0	3	3	2	3	3	3	3	2	2	3
6	June	3	0	3	3	2	3	3	3	3	3	3	3			
7	July	3	0	3	3	0	3	3	3	3	3	3	3			
8	August	3	0	3	3	1	3	3	2	3	3	1	3			
9	Septembe	3	0	3	3	3	3	3	3	3	2	2	3			
10	October	3	0	3	3	0	3	3	3	3	2	2	3			
11	Novembe	3	0	3	3	0	3	3	0	3	2	1	3			
12	December	3	1	3	3	2	3	3	3	3	3	3	3			
	Total	**32**	**1**	**36**	**36**	**10**	**36**	**36**	**29**	**36**	**33**	**30**	**36**	**11**	**8**	**15**

Labe A: Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:- Monthly Malaria returns reports

		2012			2013			2014			2015			2016		
No.	**Month**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
1	January	0	0	3	3	0	3	3	1	3	3	2	3	3	3	3
2	February	0	0	3	3	0	3	3	3	3	3	2	3	3	0	3
3	March	0	0	3	3	0	3	3	3	3	3	3	3	2	0	3
4	April	0	0	3	3	0	3	3	3	3	3	2	3	3	0	3
5	May	0	0	3	3	0	3	3	0	3	3	2	3	3	1	3
6	June	0	0	3	3	0	3	3	0	3	3	2	3			
7	July	0	0	3	3	0	3	3	3	3	3	3	3			
8	August	0	0	3	3	0	3	3	2	3	3	1	3			
9	Septembe	0	0	3	3	1	3	2	1	3	3	1	3			
10	October	0	0	3	3	0	3	2	1	3	2	0	3			
11	Novembe	0	0	3	3	0	3	2	0	3	3	1	3			
12	Decembe	0	0	3	3	0	3	2	1	3	3	3	3			
	Total	**0**	**0**	**36**	**36**	**1**	**36**	**32**	**18**	**36**	**35**	**22**	**36**	**14**	**4**	**15**

Labe A: Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Tracking of malaria indicators reporting system on Malaria management in Ayawaso District

Data extraction form

Report completeness and timeliness: Indicator report:- Monthly midwife returns reports

No.	Month	2012			2013			2014			2015			2016		
		A	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**	**A**	**B**	**C**
1	January	0	0	26	0	0	26	22	10	26	23	22	26	25	25	25
2	February	0	0	26	0	0	26	22	22	26	23	2	26	25	23	26
3	March	0	0	26	0	0	26	22	22	26	22	22	26	26	26	26
4	April	0	0	26	0	0	26	22	21	26	22	22	26	24	24	26
5	May	0	0	26	0	0	26	22	22	26	22	22	26	21	21	26
6	June	0	0	26	0	0	26	22	22	26	22	22	26			
7	July	0	0	26	0	0	26	22	22	26	22	22	26			
8	August	0	0	26	0	0	26	22	22	26	22	22	26			
9	Septembe	0	0	26	0	0	26	22	22	26	22	21	26			
10	October	0	0	26	0	0	26	22	22	26	22	21	26			
11	Novembe	0	0	26	0	0	26	23	18	26	22	22	26			
12	December	0	0	26	0	0	26	23	22	26	22	21	26			
	Total	**0**	**0**	**312**	**0**	**0**	**312**	**266**	**247**	**312**	**266**	**241**	**312**	**121**	**119**	**129**

Labe A: Completeness
B: Timeliness
C: Expected

Name of researcher: ____

Date: ________/_June_/_2016_

Appendix V: Malaria cases screen from health facilities in Ayawaso Sub-metro from January 2012 to May 2016

Year	Malaria Cases Seen		
	Negative	Positives	Total
2016	1639	2125	3764
2015	15072	4526	19598
2014	23284	6715	29999
2013	36272	1963	38235
2012	36219	535	36754