

Open Research Online

The Open University's repository of research publications and other research outputs

Producing Malaria Indicators Through District Health Information Software (DHIS2): Practices, Processes And Challenges In Kenya

Thesis

How to cite:

Okello, George Awuor (2017). Producing Malaria Indicators Through District Health Information Software (DHIS2): Practices, Processes And Challenges In Kenya. PhD thesis The Open University.

For guidance on citations see [FAQs](#).

© 2017 The Author

Version: Version of Record

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data [policy](#) on reuse of materials please consult the policies page.

oro.open.ac.uk

Producing malaria indicators through District Health Information Software (DHIS2): practices, processes and challenges in Kenya

George Awuor Okello

B.A (Social Studies), MSc (Public Health in Developing Countries)

Thesis submitted in fulfilment of the requirement for the degree of Doctor of Philosophy (PhD)

Open University, UK
Health and Social Care Discipline

June 2017

Abstract

Globally there is increasing interest in malaria indicators produced through routine information systems. Deficiencies in routine health information systems in many malaria endemic countries are well recognized and interventions such as the computerization of District Health Information Systems have been implemented to improve data quality, demand and use. However, little is known about the micro-practices and processes that shape routine malaria data generation at the frontline where these data are collected and reported.

Using an ethnographic approach, this thesis critically examined how data for constructing malaria indicators are collected and reported through the District Health Information Software (DHIS2) in Kenya. The study was conducted over 18-months in four frontline health facilities and two sub-county health records offices. Data collection involved observations, review of tools and data quality audits, interviews and document reviews. Data were analysed using a thematic analysis approach.

This study found that malaria indicator data generation at the health facility level was undermined by a range of factors including: understaffing; human resource management challenges; stock-out of essential commodities; poorly designed tools; and unclear/missing instructions for data collection and collation. In response to these challenges, health workers adopted various coping mechanisms such as informal task shifting and role sharing. They also used improvised tools which sustained the data collection process but had varied implications for the outcome of the process. Data quality problems were concealed in aggregated monthly reports. The DHIS2 autocorrected errors and masked data quality problems. Problems were compounded by inadequate data collection support systems such as supervision.

Many challenges for malaria data generation were not HMIS or disease specific but reflected wider health system weaknesses. Any interventions seeking to improve routine malaria data generation must therefore look beyond malaria or HMIS initiatives to also include those that address the broader contextual factors that shape malaria data generation.

Acknowledgement

This work would not have been possible without the support of many people. First, I would like to sincerely thank the Wellcome Trust for awarding me a Training Fellowship in Public Health and Tropical Medicine which funded this research and my entire PhD training. My appreciation also goes out to the KEMRI-Wellcome Trust Research Programme for providing me with all the resources that I required to undertake this research and my PhD training. I am very grateful to David Ngui for all the administrative support throughout this training fellowship.

My sincere gratitude goes to my supervisors, Dr. Caroline Jones, Dr. Sassy Molyneux and Dr. Rene Gerrets. Thank you very much for your invaluable advice, guidance and mentorship over the last four years. I could not have made it this far without your unwavering commitment and support! I also wish to thank my third party monitor, Dr. Dorcas Kamuya and mentor Prof. Kahindi for their advice and encouragement throughout my studies.

I also wish to extend my deepest gratitude to all research participants who welcomed me into their workplaces and freely shared with me their experiences in various forums. Your willingness to participate in this study made it a success. Thank you very much. I also wish to thank Scholastica Zakayo for all her help with data collection and other aspects of this research. There are many colleagues and friends who have supported me throughout this research project. Thank you all for standing by me and cheering me on.

Finally, I wish to sincerely thank my wife Mary, and daughters Angela and Amy for their patience, support and understanding. You have been my greatest inspiration.

Dedication

This thesis is dedicated to my wife Mary and daughters Amy and Angela who have endured my continued absence from home as I pursued this PhD. Angela, it will “not be another month again!”. I promise!

Table of contents

Abstract	ii
Acknowledgement.....	iv
Table of contents.....	vi
List of tables	x
Table of figures	xi
List of Acronyms.....	xii
1 INTRODUCTION AND OVERVIEW OF THE THESIS.....	1
1.1 The expansion of malaria indicators in low income countries	1
1.2 Malaria indicators in Kenya.....	4
1.3 Justification of the study.....	5
1.4 Research objectives	6
1.5 Thesis structure.....	8
2 SOURCES OF DATA FOR GENERATING MALARIA INDICATORS.....	10
2.1 Introduction	10
2.2 Malaria: burden.....	10
2.2.1 Malaria prevention, diagnosis and treatment interventions	11
2.2.2 Malaria monitoring and evaluation.....	14
2.3 Indicators	15
2.3.1 The rise of malaria indicators	17
2.3.2 Types of malaria indicators	20
2.4 Routine data collection systems.....	29
2.4.1 Sentinel surveillance systems	29
2.4.2 Health Management and Information Systems.....	30
2.5 Quality of data reported through HMIS.....	34
2.6 Summary.....	39
3 MALARIA DATA COLLECTION THROUGH THE DISTRICT HEALTH INFORMATION SOFTWARE (DHIS2) IN KENYA	40
3.1 Introduction	40
3.2 Kenyan context.....	41
3.2.1 An overview of Kenya’s health system	41
3.2.2 Malaria in Kenya	43
3.3 Malaria Monitoring & Evaluation framework in Kenya	44
3.3.1 The growth of malaria indicators in Kenya	44
3.3.2 The current framework for Malaria M&E	49
3.4 Kenya’s routine Health Information System	52
3.4.1 Data collection at front-line facilities	53
3.4.2 Data reporting at sub-county (district) level	55

3.5	Recording and reporting malaria data through the HIS: malaria indicator generation	58
3.5.1	Routine malaria data collected and reported at the health facility level	59
3.5.2	Malaria data reported through the Integrated Disease Surveillance and Response System (IDSR)	61
3.5.3	Malaria indicators reported in monthly reporting forms vs those listed in M&E Plan.....	62
3.5.4	Support systems for malaria M&E	64
3.5.5	Uses of routine malaria data	65
3.5.6	An overview of issues around malaria data reported through the DHIS2 ..	67
3.6	Summary.....	67
4	DESIGN AND METHODS.....	69
4.1	Introduction	69
4.2	Conceptual framework	69
4.3	Study design	71
4.3.1	Study setting	73
4.3.2	Sampling strategy	76
4.3.3	Data collection.....	78
4.4	Data management and analysis.....	91
4.4.1	Data management	91
4.4.2	Data analysis.....	91
4.5	Ethical considerations.....	95
4.6	Reflexivity	96
4.7	Chapter summary.....	100
5	RESULTS 1: THE STUDY SITES: THE CONTEXT FOR RECORDING AND REPORTING PRACTICES.....	101
5.1	Introduction	101
5.2	Description of study facilities.....	101
5.2.1	General characteristics.....	101
5.2.2	Workload	104
5.2.3	Sources of finances.....	105
5.2.4	Leadership	106
5.2.5	Staffing	106
5.2.6	Staff capacities.....	108
5.2.7	Roles of staff in service delivery	110
5.2.8	Roles of staff in data collection and reporting.....	111
5.3	Data collection and reporting tools in use	111
5.4	Organization of service delivery.....	113
5.4.1	General outpatient flow process	113
5.4.2	Laboratory test process.....	116

5.4.3	Antenatal care visit process	116
5.5	Sub-County Health Records and Information Office	117
5.5.1	Staffing at the sub-county health records office	118
5.5.2	Resources for data entry into the DHIS2	118
5.6	Summary.....	119
6	RESULTS 2: RECORDING AND REPORTING MALARIA DATA AT THE HEALTH FACILITY LEVEL: INTENTIONS VS REALITIES	121
6.1	Introduction	121
6.2	Daily recording practices for the two tracer indicators.....	122
6.2.1	Tracer indicator 1: Recording the number of suspected malaria cases tested using a parasitological based test.....	122
6.2.2	Tracer indicator 2: Recording the number of pregnant women who receive two doses of intermittent preventive treatment (IPTp2).....	134
6.3	Monthly Reporting of Data.....	140
6.3.1	Reporting the number of suspected malaria cases tested using a parasitological based test: data flow process from registers to reporting forms	143
6.3.2	Reporting IPTp2 data: data flow process from the ANC registers to reporting tools.....	151
6.4	Data submission and entry into the DHIS2	155
6.4.1	Data submission process.....	155
6.4.2	Data entry into the DHIS2	157
6.4.3	Support systems for data collection	158
6.5	Summary.....	158
7	RESULTS 3: DATA QUALITY ISSUES	160
7.1	Introduction	160
7.2	Data Quality Issues: Health facility level	160
7.2.1	Variations in daily aggregated malaria cases recorded in primary registers 160	
7.2.2	Reasons for these variations	166
7.2.3	Tracer 2: IPTp data quality issues	174
7.3	Data quality issues: DHIS2.....	177
7.4	Summary.....	184
8	FACTORS INFLUENCING ROUTINE MALARIA DATA COLLECTION AND REPORTING PROCESSES	185
8.1	Introduction	185
8.2	Human resource factors	185
8.2.1	Human resources shortages and informal task shifting	185
8.2.2	Human resource management challenges.....	190
8.3	Organization management issues	194
8.3.1	Production and distribution of tools.....	194
8.3.2	Stock-out of malaria commodities.....	198

8.3.3	Lack of support system for data collection.....	200
8.4	Influence of data collection tools.....	205
8.5	Data burdens.....	206
8.6	Summary.....	213
9	DISCUSSION AND RECOMMENDATIONS	215
9.1	Introduction	215
9.2	Summary of key findings	216
9.2.1	Revised conceptual framework.....	220
9.3	Key emerging themes	223
9.4	Towards a systems approach to understanding routine data quality	225
9.4.1	From global to national: the influences of global actors on national M&E choices	225
9.4.2	At the local: generating routine data in a health system with weak systems 'hardware'.....	231
9.5	Strengths and limitations of the study	245
9.6	Recommendations	247
9.6.1	Areas for further research	250
9.7	Conclusion.....	251
10	References	253
11	List of appendixes	275
11.1	Appendix 1: Data quality audit tool	275
11.2	Appendix 2: COREQ checklist.....	276
11.3	Appendix 3: Observation protocol	278
11.4	Appendix 4: Coding framework	280
11.5	Appendix 5: KEMRI Ethics Review Approval Letter.....	282
11.6	Appendix 6: Informed consent forms	285
11.7	Appendix 7: Data collection Registers & reporting tools.....	289

List of tables

Table 2.1 Malaria impact indicators	23
Table 2.2 Outcome indicators.....	25
Table 2.3 Malaria output data reported through routine information systems	32
Table 3.1 Malaria interventions by epidemiological zone.....	44
Table 3.2 Examples of indicators listed in Kenya’s funding proposal to the Global Fund	46
Table 3.3 Indicators from PMI Malaria M&E Framework included in Kenya’s M&E Plan	49
Table 3.4 Number of malaria indicators the revised M&E Plan for 2009-2018.....	51
Table 3.5 Data collection registers and reporting forms in Kenyan health facilities.....	54
Table 3.6 Routine malaria indicators listed in the Kenya M&E plan vs Global Fund indicators	59
Table 3.7 Malaria data recorded in standard registers	60
Table 3.8 Malaria data reported in monthly reporting forms	60
Table 3.9 Malaria indicators listed in Kenya’s M&E plan compared with data recorded in standard registers	63
Table 4.1 Profile of Siaya and Kilifi counties	76
Table 4.2 Registers and reporting forms reviewed.....	81
Table 4.3 Number of meetings attended over the study period	87
Table 4.4 Breakdown of interviews, interview topics and participants interviewed	88
Table 4.5 Breakdown of attendance to feedback meetings	90
Table 5.1 Facility workload on selected indicators	105
Table 5.2 Distribution of staff in four study facilities	107
Table 5.3 Programme specific registers and reporting tools	112
Table 6.1 Monthly reports compiled in the two sub-counties	142
Table 6.2 Malaria data collection registers and reporting forms	143
Table 6.3 Malaria diagnosis data reported using MOH 706 report	146
Table 6.4 Diagnosis data reported using malaria commodity form.....	147
Table 6.5 Malaria diagnosis data reported using MOH 643 reporting form	148
Table 6.6 Reporting practices for fever cases tested positive for malaria	150
Table 7.1 Confirmed malaria cases reported in monthly reports in January 2015	165
Table 7.2 Patients recorded as treated for malaria in outpatient and AL/RDT registers	172
Table 7.3 Paper vs electronic copies of monthly reports entered into the DHIS 2.....	178
Table 8.1 Types of feedback given to health facilities	202
Table 9.1 VeneKlesen & Miller’s Forms of power	225

Table of figures

Figure 2.1 Malaria M&E logic model	14
Figure 3.1 Organization of service delivery in Kenya.....	42
Figure 3.2 Malaria epidemiological zones in Kenya	43
Figure 3.3 Data sources for the M&E Plan	52
Figure 4.1 Conceptual framework	70
Figure 4.2 Map of Siaya County	74
Figure 4.3 Map of Kilifi county.....	75
Figure 5.1 Facility A.....	102
Figure 5.2 Facility B.....	103
Figure 5.3 Facility C.....	104
Figure 5.4 Facility D.....	104
Figure 5.5 Ideal patient/client flow process.....	114
Figure 5.6 Patients record books	115
Figure 5.7 Sub-county health records offices	118
Figure 6.1 Malaria outpatient flow process and data recording	123
Figure 6.2 Outpatient register: Under five & Over five	125
Figure 6.3 Outpatient Morbidity Tally Sheet: Over Five Year	129
Figure 6.4 Laboratory register data entry page for all routine tests.....	131
Figure 6.5 AL/RDT register	133
Figure 6.6 Data entry pages in the ANC register.....	136
Figure 6.7 Malaria diagnosis data flow process from registers into the DHIS2.....	143
Figure 6.8 Outpatient morbidity report: under five years.....	144
Figure 6.9 Over Five Years Daily Outpatient Morbidity Summary Sheet	145
Figure 6.10 Malaria commodities form.....	147
Figure 6.11 IPTp data flow process from registers to the DHIS2	152
Figure 6.12 MOH 711 reporting form.....	152
Figure 6.13 MOH 105 Service Delivery Report.....	153
Figure 6.14 AWP service delivery report.....	154
Figure 7.1 Facility D: malaria cases recorded in registers.....	162
Figure 7.2 Facility A: malaria cases recorded in registers.....	163
Figure 7.3 Facility B malaria cases recorded in registers.....	164
Figure 7.4 Facility C malaria cases recorded in registers.....	164
Figure 7.5 Patient management process and data recording in practice	171
Figure 9.1 Revised conceptual framework	222
Figure 9.2 Sheikh's framework for understanding the health system	224

List of Acronyms

ACT- Artemisinin-based Combination Therapy

ANC- Antenatal Care

AL- Artemether Lumefantrine

CDC- Centres for Disease Control and Prevention

CWC- Child Welfare Clinic

CHMTs- County Health Management Teams

DHIS2- District Health Information Software

DOT- directly observed treatment

DQA- Data Quality Audits

GAVI- Global Alliance for Vaccine Initiative

HIS- Health Information System

IPTp- Intermittent Preventive Treatment of malaria in pregnancy

IRS- In-door residual spraying

ITNs- Insecticide Treated Nets

KEMRI- Kenya Medical Research Institute

KEMSA- Kenya Medical Supplies Authority

KWTRP- KEMRI- Wellcome Trust Research Programme

KHSSP- Kenya Health Sector Strategic Investment Plan

KHDSS- Kilifi Health Demographic Surveillance System

KNBS- Kenya National Bureau of Statistics

MERG- Monitoring & Evaluation Reference Group

MCH- Maternal Child Health

M&E- Monitoring and Evaluation

NMS- National Malaria Strategy

NMCP- National Malaria Control Programme

NGOs- Non-Governmental Organizations

OBA- Output-Based Aid

PSC -Patient Support Centre

PMI- President's Malaria Initiative

PRISM- Performance of Routine Information System Management

RBM- Roll Back Malaria

RDTs- Malaria Rapid Diagnostic Tests

SCHMTs- Sub-County Health Management Teams

SHRIO- Sub-County Health Records and Information Officer

SSA- sub-Sahara Africa

SP- Sulphadoxine Pyrimethamine

UNICEF- United Nations Children Fund

USAID- United States Agency for International Development

1 INTRODUCTION AND OVERVIEW OF THE THESIS

1.1 The expansion of malaria indicators in low income countries

Malaria is a major public health problem in many low income countries where it disproportionately affects young children and pregnant women (World Health Organization 2015). Over the last 20 years international funding for malaria control has increased nearly thirty fold from under US\$100 million in 1998 to US\$ 2.9 billion in 2015 (Roll Back Malaria Partnership 2015). The bulk of these funds have come from major global health initiatives (e.g. the Global Fund & President's Malaria Initiative-PMI) that emerged at the beginning of the 21st century to address global inequalities in health and tackle specific disease problems in low income countries (Ollila 2005). Most of the increase in spending on malaria has been targeted at malaria endemic countries in sub-Saharan Africa (SSA) where the burden of the disease is heaviest (Pigott, Atun et al. 2012), and has resulted in the substantial scale up of malaria prevention, diagnosis and treatment interventions (World Health Organization 2015). Coinciding with malaria intervention scale-up in sub-Saharan Africa is the reported general decline in the burden of the disease (World Health Organization 2015), although it has been argued that the decline cannot be attributed to malaria intervention scale up alone (O'Meara 2010). Despite the decline, the disease still remains a major cause of morbidity and mortality in sub-Saharan Africa (World Health Organization 2016).

Alongside the enhanced funding for malaria control and intervention scale up, there has been an increased demand for monitoring and evaluation data produced in the form of indicators (Zhao 2011, MEASURE Evaluation, USAID-PMI et al. 2013, Herrera, Ivanovich et al. 2016). These indicators can be used to monitor disease trends, track the progress and impacts of malaria interventions, and facilitate evidence based decision making (Boerma and Stansfield 2007, Chan 2010, The Global Fund 2011). The increased demand for monitoring and evaluation has led to the expansion in the number and content

of malaria indicators and transformed their roles from tools for the diagnosis and management of the disease, to tools for the organisation of malaria interventions (Kerouedan 2010, Zhao 2011). The World Health Organisation (WHO) has produced globally agreed indicators recommended for use in malaria surveillance and monitoring and evaluation (M&E), which should be adapted to local disease contexts as required (World Health Organization 2007, Roll Back Malaria 2009, World Health Organization 2012). In addition, leading funders for malaria control (e.g. the Global Fund and PMI) have their own indicators (some adapted from internationally agreed indicators) that funding recipients are required to adapt and report on as part of results based financing arrangements (Presidential Malaria Initiative 2005, The Global Fund 2011). Efforts to standardize malaria monitoring and evaluation approaches globally are spearheaded by the Roll Back Malaria's Monitoring & Evaluation Reference Group (RBM-MERG) (Roll Back Malaria 2000, Roll Back Malaria Partnership 2013). Among other things, MERG is responsible for: harmonizing malaria M&E activities between international partners involved in malaria control; providing technical guidance on the selection and definition of indicators for national, inter-country and global reporting; and issuing guidelines on appropriate data collection methods and analytical strategies (Roll Back Malaria Partnership 2013).

The expansion in malaria indicators mirrors a trend in the health sector, and beyond, where the increased production and use of indicators is based on assumptions of their validity in promoting transparent and value free decision making processes (Merry 2011, Davis, Kingsbury et al. 2012). As such, indicators have become increasingly important in modern forms of governance; in shaping the way organizations operate and in influencing policies and resource allocation decisions both globally and locally (Rottenburg, Merry et al. 2015). In view of their ever increasing role in guiding such decisions, there is need for in-depth understanding of how data for constructing these indicators are generated at the local level,

and how these processes influence the kinds of knowledge produced (Merry 2011, Gerrets 2015).

In many malaria endemic countries, data for constructing malaria indicators are generated from population surveys (e.g. household surveys) as well as institutional based data collection systems (e.g. routine information systems) (Herrera, Ivanovich et al. 2016). Due to widely recognised weaknesses in routine health information systems in many malaria endemic countries, nationally representative household surveys are currently the preferred method for generating data for constructing malaria intervention coverage and service utilization indicators (Jima, Getachew et al. 2010, Eyobo, Awur et al. 2014). However, these household surveys are cross-sectional and, as such, do not provide longitudinal data for assessing seasonal and temporal trends of malaria prevalence, intervention coverage, and service utilization (de Savigny and Binka 2004, Cibulskis, Bell et al. 2007). Despite their recognised weaknesses, the renewed drive towards malaria elimination has reinvigorated the interest in malaria indicators constructed through routine health information systems due to their potential to provide near real time data, tracking actual case numbers reported rather than relying on mathematical modelled estimates of malaria burden (World Health Organization 2015). Such data are important for tracking the progress of malaria control, advocating for adequate investments, appropriate allocation and targeting of resources, assessing disease trends and responding to outbreaks (World Health Organization 2015). The importance of such data is emphasised in the recent Global Technical Strategy for Malaria 2016-2030, in which the transformation of surveillance into a core intervention forms the third pillar of the strategy (World Health Organization 2015). In high transmission settings reliable quality near real time data are equally important to help identify the most vulnerable populations and identify gaps in programme coverage (World Health Organization 2015).

Several attempts have been made over the years to strengthen the routine health information systems in countries in SSA, with recent efforts focussing on the computerization of district health information systems (Garrib, Stoops et al. 2008, Ayub Manyi 2012, Karuri, Waiganjo et al. 2014). For example, many countries in sub-Saharan Africa are currently using the District Health Information Software (DHIS2), a web-based health management and information system for the collation and reporting of routine health data (<https://www.dhis2.org/>). However, even if these interventions can help increase the quality of routine data, in many malaria endemic settings in sub-Saharan Africa the health system itself is fragile and concerns have been raised that increased requests for data associated with internal and external accountability demands can place a considerable burden on frontline staff and skew priorities in service provision, data reporting practices, and data quality (Boerma and Stansfield 2007, Aiga, Kuroiwa et al. 2008, Biesma, Brugha et al. 2009, Cavalli, Bamba et al. 2010, Trägård and Shrestha 2010). Underlying tensions may also exist in relation to who the data are for, how they will be used and the consequences of these measurements for donor support and priority setting at the local and national level (Low-Beer, Afkhami et al. 2007).

1.2 Malaria indicators in Kenya

Kenya has been a major beneficiary of external funding for malaria control over the past 15 years (Ministry of Health 2016). For example, while the government's total budget for malaria control in 2012-2013 was only US\$ 1.39 million, the Global Fund contributed \$16.7 million, USAID-PMI contributed 34.26 million, and DFID-WHO gave \$21.3 million (National Malaria Control Program 2013). These funds have been used to scale up malaria prevention, diagnosis, and treatment interventions (Ministry of Health 2014). Over this time there has been a general decline in the burden of the disease in the country (Githinji, Noor et al. 2016, National Malaria Control Program 2016), but this decline has not been uniform. Across the country's malaria endemic regions marked heterogeneity in malaria

transmission exists, and there is a recognized need for sub-national tailored approaches to malaria control (Bejon, Williams et al. 2010, Idris, Chan et al. 2016).

Mirroring the global interest in malaria surveillance and monitoring and evaluation, one of the objectives of the Kenya National Malaria Strategy 2009-2018 (revised in 2014 to align it to the global technical strategy for malaria) is to *“ensure that all malaria indicators are routinely monitored, reported and evaluated in all counties by 2018.”* (Ministry of Health 2014). Several data quality audits (DQAs) conducted in the country have documented numerous data quality issues with routine malaria data which have implications for the validity of malaria indicators constructed using these data (Division of Malaria Control 2012, Division of Malaria Control 2013, Ministry of Health 2014, National Malaria Control Program 2014, Githinji, Onyando et al. 2016). However, these DQAs have mainly focused on assessing the quantitative dimensions of data quality such as completeness, accuracy and timeliness (Chen, Hailey et al. 2014). There has been very limited focus on the data collection micro-processes which have a direct bearing on the overall data collection output and malaria indicators constructed using these data.

1.3 Justification of the study

Indicators have become important tools for malaria control, in influencing policies and resource allocation decisions at national and global levels. While the reliability and validity of health statistics produced through routine information systems is contested and interventions such as the computerisation of the district health information system have been implemented to improve the outcome of the data collection process, very little attention has been paid to front-line recording and reporting practices. These micro-level practices of data collection, collation and entry into the DHIS2 are central to the production of malaria indicators from routine data yet few studies have critically scrutinized how these data are created at the local level. Understanding how malaria data are generated and

collated at frontline health facility level, and appreciating the effect these activities have on service delivery practices is crucial for the on-going development of systems that are effective both in managing disease and in enhancing the management and accountability of interventions. Ensuring that indicators are relevant and produced from robust data is particularly important to support evidence based decision making in the context of the on-going malaria epidemiological transition and devolution of health care in Kenya. The information gathered in this study not only contributes to improved understanding of how these indicators produce malaria knowledge, but also form the basis of recommendations for improving malaria indicator data generation practices and reporting in Kenya.

1.4 Research objectives

Using a primarily ethnographic approach, this thesis examines the processes, practices, and challenges of producing malaria data through the routine District Health Information Software (DHIS2), in Kenya. Specifically, this thesis explores how routine malaria data are collected, collated, and reported at four frontline health facilities, and how these data are subsequently entered into the DHIS2 at two sub-county health records offices in Kenya. The influences of organizational, technical and behavioural factors on the output of the data collection processes are critically examined.

The overall aim of this research project is to critically examine how data for constructing malaria indicators from routine data are produced at the health facility and sub-county level in Kenya. Specifically, this research project aims to:

- a) Describe the processes of malaria indicator data generation (collection, management and reporting) at frontline health facilities, and at sub-county levels.
- b) Examine the outputs of data collection and reporting processes and describe the context, process and practices affecting malaria data quality.

- c) Critically assess the factors influencing the production of malaria indicators at the health facility and sub-county levels.
- d) Use the information gathered to make recommendations on how indicator production process using routine health systems can be improved.

This study builds on an interest I developed earlier on in my career while working on various malaria epidemiological studies. While working in Western Kenya, I often spent a lot of time with health workers at various service delivery areas in dispensaries and health centres. One of the things that struck me during this study was the number of registers and reporting forms that health workers were required to complete. I always asked myself what/who the data were for and what they were used for. Later on, I worked on another malaria study where I coordinated national malaria school surveys. Although I am a social scientist, I spent a lot of time in the laboratory where school children's blood samples were processed and transformed into simple numerical measures which I was tasked with the responsibility of keying into my laptop and forwarding to the national database on a daily basis. However, the process of getting these numbers was not that straight forward. We faced many challenges such as frequent power blackouts, driving for hours on dirt roads to collect samples, faulty microscopes, lost samples, and working past midnight in some cases to get the data to Nairobi. These challenges were lost in the numbers that I forwarded to the national database and were eventually used to produce very sophisticated malaria risk maps that are displayed in various policy documents.

While working as a research officer for yet another school based malaria intervention study, Caroline who was my supervisor introduced me to Rene. We had a meeting where they shared with me a concept note they had developed on the "*influence of global level indicators in shaping national and local level malaria control practices*". This work was building on Rene's earlier work in Tanzania. I got really interested in this project as it provided me with an excellent opportunity to investigate some of the issues that I had

encountered on numerous occasions while producing data and also observing health workers producing data. With the support of Caroline, Rene and Sassy, I developed a funding proposal which was successfully funded. And so begun this study.

1.5 Thesis structure

The thesis is divided into 9 chapters:

The current chapter provides an introduction to the study and sets out the aim and objectives of the PhD. Chapter 2 provides a review of the literature on current malaria interventions, malaria monitoring and evaluation, and major sources of data for constructing routine malaria indicators. Specific attention is given to malaria data generated through routine information system, the focus of this thesis. Chapter 3 describes Kenya's routine health information system, the evolution of malaria M&E in Kenya and the current malaria M&E framework. Malaria data collection and reporting processes through the DHIS2 are also described. Information presented in this chapter is primarily based on a review of policy documents, Ministry of Health reports and the grey literature. Chapter 4 provides a description of the study methodology and presents a conceptual framework that informed the choice of methods and data collection process. It also contains my reflections on my role in the data collection process. Chapters 5, 6, 7 and 8 contain the results of the empirical data collection. Chapter 5 provides a general description of the four study facilities and the two sub-county health records offices. Specifically, I describe data collection and reporting tools in use, staffing, and service delivery organization and processes in the four facilities. I also describe the two sub-county health records offices where data collation takes place (e.g. staffing, resources for data entry, data entry process, and support system for data collection). In chapter 6, I use the two tracer indicators identified in chapter 4 to describe how data for constructing these two malaria indicators are produced. Key issues with data collection tools (e.g. missing or unclear recording and reporting instructions) are highlighted. In chapter 7, I examine how some of the issues (e.g. unclear recording and reporting instructions, role sharing and patient management practices) identified in chapter

5 & 6 undermine the quality of malaria data that are collected routinely. I discuss how these data quality issues are concealed by data aggregation. In chapter 8, I examine the factors that influence malaria data generation at the health facility and sub-county level and compare my data with those from other studies. In chapter 9, I summarise the findings of this study, present my revised conceptual framework and discuss my results and emerging themes in relation to the literature and the health system context. I also provide recommendations for improving the process and discuss the strengths and limitations of the study.

2 SOURCES OF DATA FOR GENERATING MALARIA INDICATORS

2.1 Introduction

In this chapter, I provide an overview of the literature on malaria indicators and data sources. The chapter is divided into five sections. In section 2.2, I provide an overview of malaria, interventions for its control and the logic model for malaria monitoring and evaluation. In section 2.3, I introduce the concept of indicators, summarise their roles and describe the globally agreed impact and outcome indicators for malaria control and the methods used for their measurement. In section 2.4, I describe routine data collection systems, particularly the health management information systems used in the generation of the malaria output indicators, the focus of this thesis. In section 2.5, I present a summary of the literature on the challenges faced in producing reliable data through routine health information systems, particularly in sub-Saharan Africa. The chapter concludes with a brief summary in section 2.6.

2.2 Malaria: burden

Malaria is an acute febrile illness that is transmitted to human beings through the bites of infected female *Anopheles* mosquitoes. There are five parasite species that cause malaria in humans. The most prevalent parasite species in sub-Saharan Africa is *Plasmodium falciparum* which is responsible for the highest number of deaths globally. In its mild form, malaria signs and symptoms (e.g. fever, chills and profuse sweating) typically mimic those of common ailments which make it difficult to diagnose the disease clinically. If left untreated, the disease can progress to severe state and subsequently lead to death (World Health Organization 2017). Despite being preventable and curable, the disease continues to have devastating consequences on the health and livelihoods of the poor and on health systems, particularly in sub-Saharan Africa which accounts for 92% and 90% of global malaria cases and deaths respectively (World Health Organization 2016).

Increased investment in malaria control and substantial scale up of malaria prevention, diagnosis and treatment interventions since 2000 have contributed to a general decline in the burden of the disease globally (Bhatt, Weiss et al. 2015, Cibulskis, Alonso et al. 2016). It is estimated that the number of malaria cases fell from 262 million in 2002 to 212 million cases in 2015. Similarly, the number of malaria deaths also reduced from 839,000 to 438,000 within the same period (World Health Organization 2015). To sustain the gains made in malaria control over the past decade, the need for continued investment in malaria control and scale up of core malaria prevention, diagnosis and treatment interventions in the renewed drive towards malaria elimination has been reiterated (Roll Back Malaria Partnership 2015). However, estimating the malaria disease burden is notoriously difficult with wide variations in estimate depending on the model used (Cibulskis, Aregawi et al. 2011, Nkumama, O’Meara et al. 2017). This variation can cause confusion and concern among national governments and international donors with the potential for undermining support for malaria control efforts (Snow 2014). One of the aims of the current Global Technical Strategy for Malaria 2016-2030 is for countries to be able to transition from modelled estimates to actual numbers; an aim that to be fulfilled requires robust surveillance systems based on strong routine health information systems (World Health Organization 2015).

2.2.1 Malaria prevention, diagnosis and treatment interventions

The World Health Organization has recommended a package of interventions for controlling malaria in sub-Saharan Africa including: intermittent preventive treatment for malaria in pregnancy; effective case management; insecticide treated nets; and in-door residual spraying. These interventions are discussed in turn below.

a) Intermittent preventive treatment for malaria in pregnancy (IPTp)

Malaria infections during pregnancy can have serious consequences for the health of the mother, her foetus, and the new-born child (Guyatt and Snow 2004). IPTp, which involves administering therapeutic doses of Sulphadoxine Pyrimethamine (SP) to pregnant women during pregnancy, is one of the recommended interventions for the prevention of malaria in pregnant women living in areas of moderate to high transmission in sub-Saharan Africa. According to the 2014 WHO guidelines, pregnant women living in these areas should receive at least three doses of IPTp during pregnancy, starting from their second trimester. Ideally, IPTp should be provided as directly observed therapy (DOT) in antenatal care (ANC) clinics (World Health Organization 2014). Despite being formally adopted as a malaria prevention strategy over a decade ago, IPTp coverage has remained relatively low (Andrews, Lynch et al. 2015). Only 31% of eligible pregnant women in sub-Saharan Africa received the recommended three doses of IPTp in 2015 (World Health Organization 2016), and there is a widely recognized need to enhance uptake to maximize its public health impact (Chico, Dellicour et al. 2015).

b) Effective case management

Prompt diagnosis and effective treatment of suspected malaria cases is crucial in preventing the progression of the disease to a severe state which can be fatal. In addition, prompt and effective treatment is also promoted as a malaria control intervention since clearing all parasites from an infected person's blood, prevents them from remaining a reservoir of infection. For much of history malaria has been diagnosed and treated symptomatically. In 1993 the WHO malaria treatment guidelines recommended that any child visiting a health facility with a fever should be diagnosed and presumptively treated as a malaria case (World Health Organization 1993). This policy resulted in over-diagnosis and over-treatment of malaria cases (Amexo, Tolhurst et al. 2004, Reyburn, Mbatia et al. 2004). In 2010, WHO revised its guidelines and recommended that every suspected malaria case be tested for malaria by microscopy (the gold standard) or malaria rapid diagnostic tests (RDTs) before treatment with a recommended antimalarial (e.g. Artemisinin-based

combination therapies-ACTs for treatment of uncomplicated malaria caused by *plasmodium falciparum*) (World Health Organization 2011). Targeting malaria treatment to confirmed malaria cases can improve management of non-malaria related febrile illnesses, can prevent irrational use of drugs which increases the risk of drug resistance and resource wastages, and can also improve public trust in the efficacy of antimalarial medicines (World Health Organization 2011). It is estimated that the proportion of suspected malaria cases who received a parasitological test in the public sector in the WHO Africa region increased from 40% in 2010 to 76% in 2015, largely due to increased availability of inexpensive and easy to use malaria RDTs (World Health Organization 2016). However, some studies have shown that the treatment of patients with an antimalarial drug without a confirmed malaria diagnosis are not uncommon (Mubi, Kakoko et al. 2013, Keating, Finn et al. 2014). Qualitative studies have reported that such practices may be linked to health workers training backgrounds, pressure to conform to peer or patient's expectations, and perceptions of malaria diagnosis (Chandler, Jones et al. 2008, Ansah, Reynolds et al. 2013).

c) Insecticide Treated Nets (ITNs)

ITNs provide a protective barrier between mosquitoes and human beings at night when most infective bites occur. It is the most effective malaria control intervention in sub-Saharan Africa (Bhatt, Weiss et al. 2015). ITN ownership and use has increased substantially in sub-Saharan Africa over the past 15 years. For example, it is estimated that the proportion of the population at risk of malaria sleeping under ITNs in this region increased from 2% in 2000 to 55% in 2015 (World Health Organization 2015). However, ITN coverage remains well below the universal coverage rates (defined as one ITN for two people) recommended by the WHO (World Health Organization 2015). Recent reports about emerging resistance of mosquitoes to the insecticides used in ITNs has led to calls for countries to develop strategies for monitoring and managing insecticide treated nets (World Health Organization 2015).

d) *In-door residual spraying (IRS)*

IRS involves spraying approved insecticides on the resting places of malaria vectors (e.g. walls and roofs) to reduce human contact with mosquitoes. The WHO recommends targeted deployment of this intervention in high transmission settings. It is recommended that IRS is used alongside other malaria interventions (World Health Organization 2015).

2.2.2 *Malaria monitoring and evaluation*

Malaria monitoring and evaluation has been recognized as central to driving malaria control towards the target adopted by the World Health Assembly in May 2015, of reducing global malaria incidence and mortality rates by at least 90% by 2030 (World Health Organization 2015). In the context of malaria control, monitoring has been defined as the: *'routine tracking of the progress of implementation of a programme's activities and changes in programme performance over time'*. On the other hand, evaluation measures: *'how well the programme's activities have met their expected objectives, or whether the changes in the outcomes observed can be attributed to the programme'* (Herrera, Ivanovich et al. 2016). Generally, national malaria M&E frameworks follow the input-process-output-outcome-impact logic model (figure 2.1).

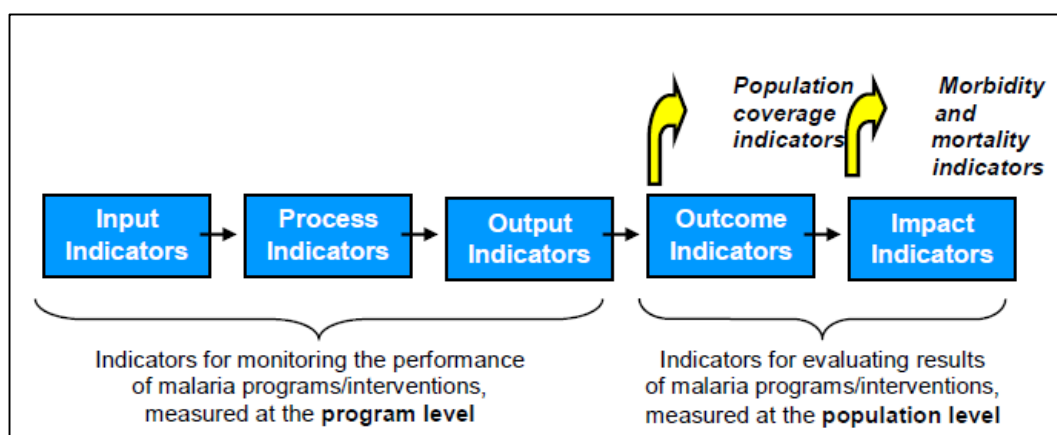


Figure 2.1 *Malaria M&E logic model*

Source: (Roll Back Malaria 2009): Guidelines for core population based indicators- pg. 11.

The M&E logic model assumes that there is a linear relationship between inputs, process, output, outcome and impact (Herrera, Ivanovich et al. 2016). For example, a logic model for monitoring and evaluating the performance of malaria control programme ITN strategies assumes that the inputs to malaria control (e.g. finances to purchase ITNs) can increase ownership (output) and utilization of ITNs (outcome) in targeted groups, and subsequently, reduce malaria morbidity and mortality (impacts). However, the causal link between the various components of the logic model can be difficult to establish, particularly the link between outputs and outcomes and outcomes and impact (Rowe, Steketee et al. 2007, Bhatt, Weiss et al. 2015). For example, while the causal link between the amount of funds available for malaria control (input indicator) and the number of ITNs (output indicator) available in sub-Saharan Africa is broadly accepted, the attribution of the reduction in malaria morbidity and mortality specifically to the number of ITNs is more widely contested (Rowe, Steketee et al. 2007, Rowe 2009, Snow 2014).

In any logic model, to gauge the development of a programme from inputs through process to outputs, outcomes and impact some marker of progress is required. In the logic model approach this generally involves the development of indicators.

2.3 Indicators

There is no universal definition of the term ‘indicator’ in the literature with available definitions mainly focusing on their roles and characteristics (Box 2.1).

Box 2.1. Definition of the term ‘indicator’

- “a variable that can be measured repeatedly (directly or indirectly) over time and provide measure of change in a system” (World Health Organization 2006)
- “a variable that evaluates status and permits measurement of changes over time” (Bodart and Shrestha 2000)
- “a summary statistic used to give an indication of a condition that cannot be measured directly.” (Bowen and Kreindler 2008)
- “statistical measures that are used to consolidate complex data into a simple number that is useful to policy makers and the public” (Merry 2011)
- “an indicator is a variable that measures one aspect of a project, program, or a health outcome. It serves to measure the value of change over time, in meaningful units, allowing for comparison between a baseline value and a future value” (Herrera, Ivanovich et al. 2016)

In general, indicators are numerical measures through which complex and contextually variable [social] phenomena are simplified to produce standardized knowledge about the constructs which they have been defined to measure (Merry 2011). Knowledge produced by indicators can be expressed in the form of numbers, proportions, rates or ratios (Herrera, Ivanovich et al. 2016). A good indicator should be: valid (accurate measure of the construct its designed to measure); reliable (consistently measured in a similar manner); measurable (easily quantifiable); timely; and programmatically important (Bodart and Shrestha 2000, Herrera, Ivanovich et al. 2016).

The rapid growth of indicators in recent times comes from a political culture that demands more transparency, accountability, efficiency, and the use of evidence to guide decision making (Chan 2010, Merry 2011, Gerrets 2015, Rottenburg, Merry et al. 2015). Indicators are designed to simplify a huge amount of information typically collected in varied contexts into simple numerical measures that are easily understandable to their consumers, and can be used to compare and evaluate performance of several reporting units and also drive evidence based decision making (Herrera, Ivanovich et al. 2016). However, some authors

have argued that that these simple numerical measures strips contextual information and the messiness of indicator production processes at the points of data collection (Merry 2011). Other authors have observed that indicators are also prone to measurement problems which are less obvious in aggregated statistics (Bowen and Kreindler 2008, Davis 2011, Gerrets 2015). As Bowen and Kreindler (2008) observe, indicators are only as good as the data that are used to construct them. They argue that the strong ‘faith in numbers’ may blind users from the methodological flaws in creating these indicators, or even data quality issues hence leading to the use of flawed indicators (Bowen and Kreindler 2008). In a rebuttal to Bowen and Kriendler’s precautionary view of indicators, Brown and Veillard (2008) observe that indicators have become important technologies for promoting accountability, transparency and fiscal responsibility between those who fund health care (e.g. donors) and those who organize or provide care (e.g. national governments). They argue that, indicators are at the core of performance management cycle and are useful in strategy development, goal articulation, priority setting, and performance measurement and as such, cannot be wished away (Brown and Veillard 2008). Furthermore, while indicators are only as good as the data used to create them, aggregate health indicators derived from large populations are designed to be reductive since their primary purpose is longitudinal monitoring of major health trends at the population level (Jima, Getachew et al. 2010, Eyobo, Awur et al. 2014).

2.3.1 The rise of malaria indicators

There has been a proliferation of indicators within the health sector at large since the turn of the 21st century (Murray 2007). Alongside the general proliferation of indicators to inform decision-making in the health sector, the emergence over the past two decades of international funders focussed on addressing the burden of malaria and other diseases in low-income countries, coupled with global health initiatives designed to address health inequities, has contributed to the development of increasing numbers of indicators designed for the monitoring and evaluation of malaria control efforts. These indicators have arisen

to meet two key demands: First, to address the needs associated with the rise of a results based approach to the funding of malaria control activities; and secondly the need to monitor progress towards international targets set by the United Nations, and the Abuja declaration among others.

i) Results based financing approaches

The first factor that has driven the growth of malaria indicators over the past 20 years is the rise of results based funding approaches that were adopted by the newly emerging major global funders for malaria control such as The Global Fund, Global Alliance for Vaccine Initiative (GAVI), and USAID-PMI (Low-Beer, Afkhami et al. 2007, Sridhar and Tamashiro 2009). Under performance based funding approaches, funding is pegged to reported performance on a set of predetermined targets that are tracked using specific indicators (Zhao 2011, Matsuoka, Obara et al. 2013). For instance, the Global Fund which is the leading funder for malaria control uses a performance based funding approach which is focused on linking resources to reported performance on a set of indicators as agreed in the performance framework signed between the Global Fund and the funding recipient (The Global Fund 2017). Funding recipients must provide data to demonstrate their performance as a condition for subsequent disbursements of funding, with sanctions such as suspension of funding attached to non-performance (Low-Beer, Afkhami et al. 2007). This approach is aimed at promoting accountability and transparency and providing incentives for recipient countries to use resources efficiently and effectively (Low-Beer, Afkhami et al. 2007, Chan 2010). Merry (2011) refers to this intended use of indicators as the ‘governance effect’ of indicators. She argues that indicators can promote ‘*governance by self-management*’ (i.e. the responsibility of adhering to the performance standards set by the indicator is placed on the funding recipient) or ‘*governance at a distance*’ (used by funders to check if funding recipients are complying with performance standards set in the indicator).

Proponents of performance funding approaches have argued that linking rewards/sanctions to the performance outcome can motivate organizations to align their goals to the standards set in the indicator (Jackson 2005, Meessen, Soucat et al. 2011). However, critics of performance based funding approaches have argued that they can lead to gaming (i.e. output distortions or manipulation of data to meet performance targets) or effort redirection where focus is placed on what is measured at the expense of other areas of service delivery (Gwyn and Christopher 2006, Eldridge and Palmer 2009). To provide a potential gaming example, in a study to estimate the validity of immunization coverage data reported by 45 countries, Murray and colleagues (2003) found that the officially reported immunization rates were higher than those reported from household surveys. High coverage was attributed to, among other things, non-monitory incentives which may have led to intentional inflation of figures to receive these incentives (Murray, Shengelia et al. 2003). Gaming responses have also been observed in UK hospitals where for example patients were made to wait in ambulances until they could be seen within the targeted period time in Accident & Emergencies departments (Wilson 2010). Other UK based studies have also highlighted that beyond deliberate gaming of the system, there can also be messiness and inconsistencies in everyday collection of data that contribute to performance management (Dixon-Woods 2012).

Several authors have argued that increased demands from these major global health initiatives has led not only to the proliferation of indicators but, in some cases it has also contributed to the fragmentation of health information systems in many low income countries (McKinsey & Company 2005, Oomman, Bernstein et al. 2008, Biesma, Brugha et al. 2009). For example, the demand for data to measure success and evaluate the impact of specific funding streams has led to the establishment of parallel information systems in some settings with direct consequences such as data burdens for country health information systems (Aiga, Kuroiwa et al. 2008, Oomman, Bernstein et al. 2008, Blumhagen 2010).

ii) Monitoring progress towards international targets and benchmarks

The growth of malaria indicators has also been driven by the need to monitor progress towards various international benchmarks and targets (Boerma and Stansfield 2007). For example, out of the 17 health related Millennium Development Goal indicators, two were malaria related (World Health Organization 2005). Countries were required by United Nation agencies such as WHO to report on their progress towards the 2015 MDG targets using these indicators (Boerma and Stansfield 2007). Similarly, the Abuja declaration on Roll Back Malaria signed by heads of African governments in 2000 identified specific targets that were to be realized in 2006 and 2010 (World Health Organization 2000). Countries were urged to select indicators for monitoring progress towards these targets from internationally agreed indicators (Roll Back Malaria 2000, Remme, Binka et al. 2001). Similarly, 15 indicators were developed by the World Health Organization to monitor progress towards the Global Malaria Action Plan (World Health Organization 2015). The Global Technical Strategy for Malaria 2016-2030 has identified 14 malaria indicators which are recommended for use in tracking malaria control progress towards the 2030 targets (World Health Organization 2015).

With the general increase in the number of indicators, there has also been an increase in the types of indicators that have been developed and an increase in their range of uses. The types of indicators and their uses in malaria M&E are discussed further in the following section.

2.3.2 *Types of malaria indicators*

Various input, process, output, outcome and impact indicators have been developed for use in malaria M&E. In summary, input indicators are designed to measure the resources available to support malaria control at the programme level; process indicators are used to verify if the interventions or programmes are being implemented as planned; output

indicators are designed to measure programme level performance (e.g. the number of suspected malaria cases who received parasitological diagnosis); outcome indicators have been developed to measure mid-term population level results (e.g. number of children under the age of five who slept under an ITN); and impact indicators are used to measure whether changes at population level can be attributed to the specific intervention that was implemented (Herrera, Ivanovich et al. 2016).

In malaria M&E, input, process and output indicators are used to monitor malaria programme performance at the programme level while outcome and impact indicators are used to evaluate the long term effects of malaria interventions at the population level (Herrera, Ivanovich et al. 2016). In principal, the development of malaria input, process, and output indicators is the remit of national governments, with technical support provide by international partners. Such indicators are primarily designed for the management and planning of malaria services at national level (Herrera, Ivanovich et al. 2016). Some are also used to fulfil global reporting requirements such as the WHO annual malaria reports which have been produced each year since 2005 (World Health Organization 2016). By contrast, malaria outcome and impact indicators are agreed at the global level and are designed to allow for cross country comparisons of progress towards global malaria control targets (Roll Back Malaria 2013). In addition, these indicators are also used by global funders for malaria control such as the Global Fund and PMI to evaluate the impacts of their funding on malaria control (Presidential Malaria Initiative 2015, The Global Fund 2016), to sustain global focus and financial commitment to malaria control (Boerma and Stansfield 2007), and to promote accountability and transparency in allocation and use of resources (Chan 2010).

Efforts to harmonise global malaria indicators are led by RBM Monitoring & Evaluation Reference Group (MERG). Established in 2003, MERG brings together a group of individuals from institutional partners who are experienced in malaria M&E. MERG is

responsible for providing technical guidance on the selection and definition of global malaria indicators; issuing guidelines on appropriate data collection methods, analytical strategies, and dissemination recommendations; and advocating for increased attention to and resources for malaria M&E at the global and national levels among other roles (Roll Back Malaria Partnership 2013). There are several impact and outcome developed by MERG for use in malaria M&E which should be adapted to local disease contexts as required (Remme, Binka et al. 2001, Roll Back Malaria 2009, Roll Back Malaria 2013). These indicators are described in detail in the following section.

a) Impact indicators

Impact indicators are used to measure the overall effect of malaria interventions on malaria morbidity and mortality. There are 12 internationally agreed impact indicators which are recommended for use in malaria impact evaluation (table 2.1) (MEASURE Evaluation, USAID-PMI et al. 2013). These indicators are constructed using data obtained from various sources such as household surveys, routine health information systems, verbal autopsy and demographic surveillance systems.

Table 2.1 Malaria impact indicators

Impact indicators	Recommended by	Data sources
1. Parasite Prevalence: proportion of children aged 6-59 months with malaria infection	RBM MERG	Household surveys
2. Anaemia Prevalence: proportion of children aged 6-59 months with a haemoglobin measurement of <8 g/dL	The Global Fund USAID-PMI	
3. All-cause under five mortality rate	UNICEF	
4. Inpatient malaria cases per 10000 persons/ year	RBM MERG	Routine health information systems
5. Inpatient malaria deaths per 1000 persons/year	The Global Fund	
6. Confirmed malaria cases/1000 persons per year	USAID-PMI UNICEF	
7. Malaria test positivity rate	Global Fund	Routine health information systems
8. Malaria specific deaths/1000 persons	Global Fund	Routine health information systems
9. Number of malaria deaths per 100,000 persons/year	WHO	Not stated
10. Proportion of the population with evidence of infection with malaria parasites	WHO	No stated
11. Proportion of deaths attributed to malaria in children <5 in demographic surveillance sites	PMI	DSS
12. Proportion of deaths attributed to malaria in children <5 nationally	PMI	Verbal autopsy
Sources: (Presidents Malaria Initiative 2009, The Global Fund 2011, MEASURE Evaluation, USAID-PMI et al. 2013, World Health Organization 2015)		

These indicators are not without their problems, particularly problems in their measurements. The household surveys, used to gather data for the first three indicators in the table, are conducted only once every three years and are subject to several constraints (discussed in further detail later in this chapter). The first indicator in table 2.1, *malaria parasite prevalence*, is subject to seasonal variations in malaria transmission. As such, single point measures collected during household surveys cannot be a reliable estimate for measuring the short term impact of malaria interventions on malaria morbidity (de Savigny and Binka 2004, Cibulskis, Bell et al. 2007). There are also well known challenges in measuring the impact of malaria interventions on malaria morbidity and mortality (Rowe, Steketee et al. 2007, Snow 2014). For example, without the presence of external controls (comparison areas where intervention activities are not implemented) it is not possible to

ascribe changes in mortality and morbidity to the malaria interventions (Habicht, Victora et al. 1999). That is, this measurement is prone to many confounders such as rainfall patterns, HIV/AIDS prevalence, and coverage of other non-malaria specific interventions (Rowe, Steketee et al. 2007); an issue that is equally true for the prevalence of anaemia.

The indicators described in table 2.1 constructed using routine data are also frequently difficult to measure due to the weaknesses of vital registration systems in many of the low income settings where malaria is endemic. Vital registration systems (also known as civil registration systems) refers to the on-going and compulsory recording of live births, deaths, and causes of deaths in a particular population (Boerma and Stansfield 2007). Where these systems are functional, they can be a reliable source of data for constructing malaria impact indicators (e.g. *Malaria specific deaths/1000 persons*). However, in many malaria endemic countries, vital registration systems are dysfunctional and as such, do not collect reliable or comprehensive data (World Health Organization 2011). In addition, counting malaria deaths in many low income countries is a major challenge (Iley 2006). For example, a substantial number of malaria deaths may occur outside the formal health care system, and as such, may go unreported. In addition, malaria signs and symptoms are non-specific and without proper diagnosis, it may be difficult to establish malaria related deaths (Rowe 2005, Rowe, Steketee et al. 2007, Fottrell 2009, Snow 2014).

Due to these inadequacies, malaria mortality is often estimated through verbal autopsy (as part of health demographic surveillance or household surveys), or through complex statistical models (Rowe, Steketee et al. 2007). Baiden (2007) defines verbal autopsy as ‘*a method of ascertaining probable causes of a death based on an interview with a caregiver about the signs, symptoms and circumstances preceding death*’ (Baiden, Bawah et al. 2007). Although verbal autopsy is widely used as a method for ascertaining cause of death in many low income countries, it is also fraught with many challenges such as: lack of standardized death classification which can lead to misclassification of deaths; interviewer

and respondent bias; lack of standardization of verbal autopsy instruments and administration methods; and challenges in identifying gold standard methods for validation studies (Rowe 2005, Soleman, Chandramohan et al. 2006, Thatte, Kalter et al. 2009). Due to non-specificity of malaria symptoms, there is the potential for verbal autopsy to miss true malaria deaths and misclassify non malaria deaths as malaria (Rowe 2005).

b) Outcome indicators

Outcome indicators are used to measure population level coverage of core malaria interventions. There are 13 internationally agreed outcome indicators which are recommended for use in malaria M&E (MEASURE Evaluation, USAID-PMI et al. 2013).

See table 2.2.

Table 2.2 Outcome indicators

Vector control
1. Proportion of households with at least one ITN
2. Proportion of households with at least one ITN for every two people
3. Proportion of population with access to an ITN within their household
4. Proportion of population that slept under an ITN the previous night
5. Proportion of children under five years old who slept under an ITN the previous night
6. Proportion of pregnant women who slept under an ITN the previous night
7. Proportion of existing ITNs used the previous night
8. Households covered by vector control: Proportion of households with at least one ITN and/or sprayed by IRS in the last 12 months
9. Universal coverage of vector control: Proportion of households with at least one ITN for every two people and/or sprayed by IRS within the last 12 months
IPTp
10. Proportion of women who received three or more doses of IPTp for malaria during ANC visits during their last pregnancy
Case management
11. Proportion of children under five years old with fever in the last two weeks who had a finger or heel stick
12. Proportion of children under five years old with fever in the last two weeks for whom advice or treatment was sought
13. Proportion receiving an Artemisinin-based Combination Therapy (ACT) (or other appropriate treatment), among children under five years old with fever in the last two weeks who received any antimalarial drugs
Sources: MEASURE/RBM 2013; USAID PMI 2009 M&E plan; Global Fund 2011 M&E

All malaria outcome indicators listed in table 2.2 are constructed using data collected from three nationally representative household surveys which are implemented by various government institutions in collaboration with international partners. These are:

- a) *Demographic and Health Surveys (DHS)*: DHS are funded by USAID. These surveys are designed to collect data for constructing key demographic and health indicators that relate to men, women and children. DHS also contains a module that collects data on coverage and utilization of malaria interventions such as ITNs and IPTp on women of reproductive health and children under five (Kenya National Bureau of Statistics 2014).

- b) *Multiple cluster indicator surveys (MICS)*: MICS are funded by United Nations Children Fund (UNICEF). MICS are designed to specifically collect data on the child development, child protection, access to water and sanitation, HIV/AIDS and sexual behaviour, and reproductive health. MICS also contains a malaria module which collects data on coverage and utilization of malaria interventions (ITNs and IPTp) in children under the age of five and women of reproductive age (Kenya National Bureau of Statistics 2011).

- c) *Malaria Indicator Survey (MIS)*: MIS are mainly funded by USAID and other global actors involved in malaria control. As opposed to the other two surveys that collect data on a wide range of health and demographic health topics, MIS are specifically designed to collect data on the coverage of malaria interventions (ITNs, LLINs, case management) as well as the prevalence of parasitemia and anaemia in high risk groups. These surveys are only implemented in malaria endemic countries (Jima, Getachew et al. 2010, Eyobo, Awur et al. 2014).

Generally, household surveys are highly standardized and are considered by many researchers and international donors to be the ‘gold standard’ method for generating data for constructing outcome and impact indicators (Roll Back Malaria 2009). Because of standardization of survey procedures, outcome indicators generated using these surveys (e.g. ITN ownership) can be used to compare performance between countries as well as temporal changes in intervention utilization (Noor, Mutheu et al. 2009).

Despite their potential advantages in producing standardised data, these surveys are resource intensive, requiring significant inputs from international donor organizations, collaborating with local institutions (Bryce, Arnold et al. 2013, MEASURE Evaluation, USAID-PMI et al. 2013). Furthermore, although considered to be the most reliable estimates of malaria intervention coverage and service utilization, there are potential concerns about the validity of malaria indicators that are produced from these surveys. For example, one of the indicators produced using these surveys is the “*proportion of children under 5 with fever in the previous 2 weeks who had a finger or heel stick*” (table 2.2). Due to recall bias, caregivers might not accurately recall fever episodes in the past two weeks or even whether a blood sample was taken from the child or not. In addition, finger prick blood samples are used to conduct other tests and as such, could lead to the over-estimation of this intervention (Eisele, Rhoda et al. 2013, Eisele, Silumbe et al. 2013). Recall bias is also noted as a challenge in the measurement of other outcome indicators (e.g. *proportion receiving ACTs among children under five years old with fever in the last two weeks*). To address these measurement challenges, the use of visual aids to help participant recall previous events, and use of medical records to validate verbal responses from participants is encouraged (Bryce, Arnold et al. 2013).

There are also challenges in measuring the “*proportion of women who received three or more doses of IPTp for malaria during ANC visits during their last pregnancy*” indicator. Cultural sensitivities associated with pregnancies may prevent pregnant women from

discussing detail of their pregnancy, undermining data generation for this indicator (World Health Organization 2007). There are also challenges around data collection for ITNs related outcome indicators. For example, not all nets found within the household may be fit for use (MEASURE Evaluation, USAID-PMI et al. 2013). These challenges are compounded by the process of data collection itself. Ethnographic evidence has shown that despite standardization of survey procedures, field data collection is a complex process that is shaped by daily negotiations and social relations between data collectors and survey respondents (Biruk 2012, Kingori and Gerrets 2016). Negotiations can pose a potential threat to standardization and the validity of the indicators produced from the data.

While the data from such surveys is an important source of information for mid-term population level results and progress towards targets, they are conducted infrequently (once every 3-5 years) which makes them less sensitive to rapid changes in malaria intervention coverage and impact (de Savigny and Binka 2004). Due to their cross-sectional survey design, they also only provide single point and retrospective measures which are subject to seasonal variations (MEASURE Evaluation, USAID-PMI et al. 2013). For example, MIS are usually conducted during the dry season for operation reasons. Since malaria prevalence and intervention utilization may differ between seasons, these surveys can underestimate malaria prevalence or intervention coverage (de Savigny and Binka 2004). In addition, these surveys are mainly designed to collect national level data and as such, the data generated cannot be disaggregated to the local level; constraining their utility for sub-national decision making, particularly where there are significant intra-country variations in malaria transmission intensity (Cibulskis, Bell et al. 2007).

In light of these limitations and in the context of rapid changes in malaria epidemiology and the renewed focus on malaria elimination, global attention has recently turned to the potential of using output indicators produced through routine health information systems to provide real time data for malaria surveillance, performance monitoring and evaluation,

and health system management (Agarwal, Alonso et al. 2015, World Health Organization 2015). For example, the latest ‘Global Call to Action’ on IPTp recommends that countries should use routine health information systems to monitor IPTp implementation and identify barriers to successful implementation (Agarwal, Alonso et al. 2015). The Global Technical Strategy for malaria 2016-2030 has also reiterated the need for countries to strengthen routine information systems so as to generate information that can aid malaria programme planning, implementation and evaluation (World Health Organization 2015).

Such data have the potential to produce both timely and programmatically relevant indicators. In the next section of this chapter I describe the types of routine data collection systems which are used to generate the malaria output indicators that are the focus of this thesis.

2.4 Routine data collection systems

Routine malaria data can be generated from two sources: i) sentinel surveillance systems; and ii) health management and information systems.

2.4.1 *Sentinel surveillance systems*

Sentinel surveillance for malaria refers to the ‘*on-going systematic collection, analysis and interpretation of data carried out in a small number of health facilities*’ (Herrera, Ivanovich et al. 2016), usually located in a malaria endemic zone (Presidential Malaria Initiative 2005). Due to concerns about the weaknesses in routine health information systems in many malaria endemic settings, it has been suggested that sentinel surveillance systems can be set up to collect high quality data on: malaria morbidity and mortality; epidemic outbreaks and response; intervention coverage; and service utilization (Sserwanga, Harris et al. 2011, Yukich, Butts et al. 2014). According to PMI which has listed several indicators constructed using data generated through sentinel surveillance systems (Presidents Malaria

Initiative 2009), a sentinel surveillance site should have an outpatient department that sees at least 50 patients in a day, a laboratory capable of malaria microscopy, written guidelines for malaria diagnosis, availability of ACTs, and designated personnel responsible for data collection and reporting (Presidential Malaria Initiative 2005). Surveillance can either be passive (dependent on patients seeking malaria related services from health facilities) or active (involving actively seeking out symptomatic cases from the community) (Stresman, Kamanga et al. 2010, World Health Organization 2012). Due to intense monitoring, training and supervision, sentinel surveillance systems can be expensive to operate. Detailed data requirements can also introduce significant data burdens on health workers (Yukich, Butts et al. 2014). In addition, due to scale up of malaria interventions in these settings, they usually become atypical of normal health facilities over time and data generated through these surveillance systems are not generalizable beyond these sentinel surveillance sites (Herrera, Ivanovich et al. 2016).

2.4.2 Health Management and Information Systems

According to the WHO, a Health Management and Information System (HMIS) is as an *‘information system that is specifically designed to assist in the management and planning of health programs as opposed to delivery of care’* (World Health Organization 2004). In many low income countries, the HMIS is the most comprehensive source of routine health statistics (Wagenaar, Sherr et al. 2016). Typically, the HMIS collects data on the health of patients/clients seeking various curative, promotive, and preventive services at health facilities; the services provided to these patients/clients; and the resources used in the provision of these services (Bodart and Shrestha 2000).

There are specific guidelines that have been provided by WHO regarding malaria data collection and reporting through the HMIS (World Health Organization 2007, World Health Organization 2011, World Health Organization 2012). For instance, WHO

recommends that outpatient and inpatient registers should capture data on each patient's demographic details (e.g. name, residence, age, and sex); particulars of the visit (i.e. whether new or repeat visit); diagnosis information (initial diagnosis, type of malaria test conducted, test result, and final diagnosis); treatment provided; and outcome at discharge (for the case of inpatient registers). There are also specific guidelines regarding the recording and reporting of laboratory data, such as the requirement to record types of malaria parasite species (World Health Organization 2012). It is also recommended that antenatal care (ANC) registers should have separate columns for recording the exact dose of IPTp provided to pregnant women (e.g. IPTp1, 2, or 3) (World Health Organization 2007).

The WHO guidelines recommend that, at the end of each month, these data are collated and forwarded to higher reporting levels (e.g. districts) usually in paper form. Ideally, malaria data reported from health facilities should distinguish between 'suspected', 'tested', 'confirmed', and treated malaria cases and should be stratified by age group (under 5, over 5 and adults), and type of test conducted (whether RDTs or microscopy) (World Health Organization 2011). At the district, these data should be further collated and forwarded to the next level either manually or by entry into a computerized database such as the DHIS2 (Garrib, Stoops et al. 2008, Karuri, Waiganjo et al. 2014). The malaria data that are collected and reported routinely through the HMIS from health facilities and the indicators produced using these data are shown in table 2.3. These indicators are contained in the Global Fund's malaria M&E tool kit, WHO's Universal Access to Malaria Diagnosis Operational Manual, Disease Surveillance for Malaria Control, and Guidelines for measuring key malaria in pregnancy indicators (World Health Organization 2007, The Global Fund 2011, World Health Organization 2011, World Health Organization 2012).

Table 2.3 Malaria output data reported through routine information systems

Data reported from health facility	Malaria indicators produced
1. No of suspected malaria cases ¹	1. Percentage of suspected malaria cases tested by RDTs ¹
2. No of patients tested by RDTs ¹	2. Percentage of suspected malaria cases tested by microscopy ¹
3. No of patients tested positive by RDTs ¹	3. Percentage of suspected malaria cases tested ¹
4. No of malaria cases tested by microscopy ¹	4. Percentage of health facilities reporting no stock-out of RDTs per month ^{1,4}
5. No of patients tested positive by microscopy ¹	5. Percentage of health facilities reporting no stock-out of key consumables ^{1,4}
6. No of patients tested for malaria ¹	6. Percentage of health facilities reporting no stock-out of ACTs ^{1,4}
7. No of confirmed malaria cases ¹	7. Percentage of confirmed malaria cases that received first line treatment for malaria according to national policy ^{2,4}
8. Suspected malaria cases ²	8. No. of confirmed malaria cases per 1000 population per month ^{2,4}
9. Cases in which patient is tested by microscopy ²	9. No. of inpatient malaria cases per 10,000 population/ month or year ^{2,4}
10. Cases in which patient is tested by RDT ²	10. Malaria test positivity rate (RDT and/or slide positivity rate) ²
11. Cases confirmed by microscopy (< 5 and ≥ 5 years of age) ²	11. Percentage of inpatients with a discharge diagnosis of malaria ²
12. Cases confirmed by RDT (< 5 and ≥ 5 years of age) ²	12. Percentage of inpatient deaths due to malaria ²
13. Confirmed cases treated with antimalarial medicine ²	13. Annual blood examination rate ^{1,2,4}
14. Presumed malaria cases (not tested) treated with antimalarial medicine ²	14. Percentage of suspected malaria cases receiving a diagnostic test ²
15. Inpatient cases of malaria among patients 5 and ≥ 5 years of age ²	15. Completeness of reporting ^{2,4}
16. Deaths from malaria among patients 5 and ≥ 5 years of age ²	16. Percentage of pregnant women who received IPTp1, 2, & 3 as DOT ³ .
17. No patients receiving first line antimalarial treatment ⁴	
18. No. of pregnant women who receive IPTp1, 2, & 3 as DOT ³	
<p>Note: Indicators listed in the following WHO documents: ¹Universal Access to Malaria Diagnosis Operational Manual; ²Disease Surveillance for Malaria Control; ³Guidelines for measuring key malaria in pregnancy indicators; ⁴Global Fund Malaria M&E Toolkit.</p>	

Uses of routine malaria data reported through HMIS

There are several potential uses for routine malaria data. At the health facility level, these data can be used to improve patient management (e.g. in making sure that only patients with confirmed malaria cases are treated with recommended antimalarial); and managing

essential supplies. Where facility registers collect enough details about patients (e.g. residential addresses), such data can be used in local disease surveillance and control by identifying the origin of malaria cases and targeting malaria interventions to such places (Larsen, Chisha et al. 2015, Ohrt, Roberts et al. 2015). At higher reporting levels (e.g. districts), these data can be used for health system management (planning for malaria resources), monitoring disease outbreaks, and in advocating for additional resources for malaria control (Ohiri, Ukoha et al. 2016). In addition, the National Malaria Control Programme require these data in order to fulfill various global reporting requirements. For example, the WHO relies on routine data as well as other data from other sources to compile annual malaria reports which are used to track progress towards global targets for malaria control (World Health Organization 2016).

Routine data can also be used for evaluative purposes. For instance, some studies have used routine data to evaluate the impacts of malaria intervention scale up on malaria morbidity and mortality (Otten, Aregawi et al. 2009, Chanda, Hemingway et al. 2011). However, critics of this approach argue that when routine malaria data are used to evaluate the impacts of malaria interventions, the limitations of such studies need to be actively acknowledged (Rowe 2009). Limitations that include recognition of the fact that the HMIS captures data on patients accessing health services through the formal health care system (mainly public health facilities) and, as such, are non-representative of the general population (de Savigny and Binka 2004, Erhart, Thang et al. 2007, Rowe 2009, Karema, Aregawi et al. 2012). In addition, the effects of potential confounders such as variations in annual rainfall patterns, seasonality of malaria transmission, facility utilization rates, and the quality of malaria diagnostics need to be taken into account when using routine data to evaluate the impacts of malaria interventions (Rowe 2009, Karema, Aregawi et al. 2012).

2.5 Quality of data reported through HMIS

The potential utility of malaria data available from an HMIS to provide data for patient management, health system management, disease surveillance, and operations research are clear. However, many studies assessing the quality of health statistics produced through routine information systems such as HMIS in low income settings have shown that these data are often of poor quality and as such, cannot generate reliable health indicators (Chilundo, Sundby et al. 2004, Ronveaux 2005, Murray 2007, Makombe 2008, Mate, Bennett et al. 2009, Gimbel, Micek et al. 2011, Chiba, Oguttu et al. 2012, Hahn, Wanjala et al. 2012, Yukich, Butts et al. 2014).

In this section, I briefly review some of the specific issues that can influence malaria data collection and reporting through the routine health information system. Borrowing from Aqil and colleagues (2009) framework for evaluating the performance of routine health information systems, I categorize these factors into three broad categories: technical; social and behavioral; and organizational factors (Aqil, Lippeveld et al. 2009).

a) Technical factors

Technical issues include factors that are related to the tools used for data collection, the instructions provided and the use of information, communication and technology (ICT) interventions (Aqil, Lippeveld et al. 2009). The design of data collection registers and reporting forms has been cited as an important factor in routine data generation (Lippeveld T 2000, Shaw 2005, Ledikwe, Grignon et al. 2014, Herrera, Ivanovich et al. 2016). In Tanzania, Mubyazi et al. (2014) found that a lack of designated spaces in antenatal care (ANC) registers for recording IPTp data led to variations in IPTp data recording practices. They also noted that ANC registers did not allow for the recording of the gestational age when pregnant women were issued with IPTp hence making it difficult to assess whether health workers were adhering to IPTp implementation policy (Mubyazi, Byskov et al.

2014). In Kenya, Barbara (2014) found that a lack of separate columns for recording data on IPTp 3 to 7 led health workers to record these data in the IPTp2 column hence inflating IPTp2 figures (Rawlins, Ngindu et al. 2014). A similar evaluation conducted by Msukwa et al. (2014) in Malawi also found that there were no specific columns for recording ‘malaria in pregnancy cases’. As a result, these cases were all simply recorded as ‘malaria’ (Msukwa, Rawlins et al. 2014). Some non-malaria studies have also reported that unclear instructions in data collection registers and reporting tools can cause confusion and lead to standardization challenges (Garrib, Stoops et al. 2008, Chiba, Oguttu et al. 2012, Hahn, Wanjala et al. 2012). For example, in South Africa, Garrib et al. (2008) found that data collection tools supplied to frontline health facilities were poorly designed hence making them difficult to use. This same study found that while an indicator manual existed at the health facility level, it did not contain instructions on indicators that were supposed to be analyzed at the health facility level, or even how these were supposed to be interpreted (Garrib, Stoops et al. 2008).

Other technical issues that have been highlighted in the literature include unclear case definition. For example, the lack of a clear definition of the category ‘malaria’ (which may include both clinical and confirmed malaria cases) has been identified as one of the factors that leads to misclassification and over-reporting of malaria cases reported through the HMIS (Chilundo, Sundby et al. 2004, Kunimitsu 2009, Willey, Schellenberg et al. 2011, Karema, Aregawi et al. 2012, Yukich, Butts et al. 2014, Gerrets 2015, Mpimbaza, Miles et al. 2015, Many and Nielsen 2016). There are also questions about the correct denominator for constructing the IPTp indicators reported through the HMIS (Mubyazi, Byskov et al. 2014). WHO recommends that the ‘*number of first antenatal care visits*’ be used as the denominator for calculating the ‘*proportion of pregnant women who received IPTp 1 as DOT*’ although this may underestimate IPTp1 coverage if a significant proportion of ‘*first ANC visits*’ women are ineligible for IPTp (i.e. in their first trimester of pregnancy when IPTp is not recommended) (World Health Organization 2007). In Kenya, a recent study

found that ‘new ANC visit’ was used as the denominator for calculating ‘*the proportion of pregnant women receiving IPTp*’. This practice may bias estimates since pregnant women may seek ANC services from several facilities during their pregnancy where ANC registers capture them as ‘new ANC visit’ (Rawlins, Ngindu et al. 2014).

Recent studies have shown that in several low income settings the use of SMS technology to report routine data from the health facilities to the next level can improve reporting rates, timeliness and decision making (Kamanga, Moono et al. 2010, Githinji, Kigen et al. 2014, Yukich, Butts et al. 2014, Toda, Njeru et al. 2016). However, the use of SMS technology to send data does not overcome the data quality problems that occur at the health facility level during data collection and collation (Mate 2009, Manya and Nielsen 2016). Some authors have argued that the use of ICT can improve data quality and timeliness, and also promote a culture of data analysis and use for decision making (Garrib, Stoops et al. 2008, Lungo and Igira 2008, Manya, Nielsen et al. 2016). However, effective functioning of a computerised HMIS is dependent on the availability of resources such as computers, reliable electricity supply, good internet connectivity and technical skills which may be a challenge in many low income settings. For example, Ledwike and colleagues (2014) found that data losses in Botswana’s computerized information system were blamed on computer crashes, viruses, and misfiled electronic data (Ledikwe, Grignon et al. 2014). Similar challenges have been reported in Malawi where it was noted that despite health workers submitting their paper reports to the district level on time, these data were not entered into the computer database due to system challenges (Bausell and Katherine 2014).

b) Social and behavioral factors

Various studies have documented several social and behavioral factors that have an influence on routine health data collection and reporting. For example, health workers’ perceptions of the rationale and motivations for data collection has been found to have a

direct bearing on data recording and reporting practices (Mavimbe, Braa et al. 2005, Otwombe, Wanyungu et al. 2007, Garrib, Stoops et al. 2008, Mate, Bennett et al. 2009, Hahn, Wanjala et al. 2012, Mbachu, Uzochukwu et al. 2013, Ledikwe, Grignon et al. 2014). In Botswana, Ledikwe et al (2014) found that health workers did not view recording of health data as one of their responsibilities. As a consequence, they did not record patients records in registers at the time of service delivery, an issue that may contribute to data quality problems (Ledikwe, Grignon et al. 2014). Chaulagai et al. (2005) also reported that despite efforts that were aimed at strengthening Malawi's routine health information system, some health workers still perceived that the submission of monthly reports was the ultimate aim of data collection, an issue that possibly prevented them from utilizing routine data at the local level (Chaulagai, Moyo et al. 2005). In Nigeria, Mbachu and colleagues (2013) found a high knowledge and positive perceptions of malaria monitoring and evaluation requirements among front-line health facility staff. However, they also noted huge disparities between reported and actual malaria M&E practices suggesting that recording practices are not entirely dependent on health workers' knowledge (Mbachu, Uzochukwu et al. 2013).

There are also issues around health worker documentation of all stages in the malaria diagnosis and treatment process which can influence the quality of routine health data. A study in Ethiopia, found inconsistencies in the number of malaria cases that were recorded in facility registers and the number of malaria cases that were reported (Yukich, Butts et al 2014). The authors speculated that this discrepancy may have been caused by patients who were tested for malaria without their details being recorded in outpatient registers, incomplete registration of patients in outpatient clinics, and patients being referred to the laboratory from other service delivery areas not just the outpatient clinics (Yukich, Butts et al. 2014). Similar observations were made in Malawi where it was noted that the test results of pregnant women referred to the laboratory register were not always captured in the antenatal care register (Msukwa, Rawlins et al. 2014). In Tanzania, missing IPTp data

were attributed to health worker recording practices (e.g. use of personal notes and pencils to record data) and poor record keeping practices (Mubyazi, Byskov et al. 2014). Similar documentation challenges have been reported in other studies (Chiba, Oguttu et al. 2012, Hahn, Wanjala et al. 2012).

c) Organization factors

Various assessments of malaria data collection through the routine health information system have shown that health system constraints such as staff shortages have a bearing on recording practices at frontline health facilities (Chilundo, Sundby et al. 2004, Kunimitsu 2009, Mubyazi, Byskov et al. 2014, Gerrets 2015). For example, the failure of health workers in Ethiopia to complete outpatient registers was linked to their workload (Yukich, Butts et al. 2014). In the Solomon Islands, Kunimitsu (2009) found a direct relationship between nursing workload and data discrepancies that were noted in facility reports (Kunimitsu 2009). In Zambia, Topp et al (2015) reported that, due to shortages of staff, nurses often delegated data collection responsibilities to untrained and underpaid casual workers (Topp, Chipukuma et al. 2015). The involvement of untrained staff in data collection and reporting has also been reported in other studies conducted in sub-Saharan Africa (Ledikwe, Grignon et al. 2014).

Shortage of data collection tools and the use of improvised registers has also been found to have an influence on the outcome of the data collection process (Chilundo, Sundby et al. 2004, Chiba, Oguttu et al. 2012, Hahn, Wanjala et al. 2012, Mubyazi, Byskov et al. 2014). In addition, inconsistent policy guidelines (e.g. on IPTp implementation) can influence IPTp administration practices and subsequently, recording practices (Gomez, Gutman et al. 2014, Mubyazi, Byskov et al. 2014).

Several authors have argued that support systems for data collection such as the provision of feedback to managers, regular data quality audits, and building capacity could, if implemented effectively, improve the outcome of the data collection process (Chaulagai, Moyo et al. 2005, Otwombe, Wanyungu et al. 2007, Maokola, Willey et al. 2011, Braa, Heywood et al. 2012, Mutale, Chintu et al. 2013, Ledikwe, Grignon et al. 2014). However, due to health system weaknesses in many low income countries, these support systems for data collection are rarely implemented (World Health Organization 2011).

2.6 Summary

In this chapter, I have provided an overview of the broader literature around malaria data generation. The nature and role of indicators in the health sector and malaria control has been discussed and I have described the major sources of data for constructing malaria indicators. Specifically, I have highlighted some of the key issues around malaria data generation using the routine health information system. In the next chapter, I describe how routine malaria data are generated through the routine health information system in Kenya.

3 MALARIA DATA COLLECTION THROUGH THE DISTRICT HEALTH INFORMATION SOFTWARE (DHIS2) IN KENYA

3.1 Introduction

In chapter 2, I provided a summary of the literature on malaria monitoring and evaluation, described the variety and role of malaria indicators in malaria M&E at global and national levels and outlined the sources of data for malaria indicators production. I subsequently reviewed the literature on the benefits and challenges associated with the use of routine health system data for the construction of malaria indicators. In this chapter, I focus on the country in which this study was conducted, Kenya. I use information gathered from a review of various policy documents, ministry of health reports, grey literature and published articles to describe how malaria data are generated and reported routinely through the DHIS2 in Kenya. The chapter has four main sections:

- Section 3.2 provides an overview of Kenya's health system and current malaria situation in Kenya broad malaria and health system context in Kenya.
- Section 3.3 describes Kenya's Malaria M&E framework. This section opens with a brief account of how malaria indicators have expanded in Kenya since 2000 and provides an overview of the current malaria M&E framework.
- Section 3.4 provides an overview of Kenya's Health Information System including a summary of the data collection and reporting tools and processes.
- Section 3.5 describes the types of malaria data that are collected through the routine HIS and the indicators generated from these data. It also contains information on the support systems in place to facilitate the collection of quality data, the uses of the data produced and the challenges in data production.

3.2 Kenyan context

3.2.1 An overview of Kenya's health system

Kenya's new constitution passed in August 2010 introduced a devolved system of government that, in 2013, transferred health service management functions from the central government to 47 semi-autonomous government units known as counties. Presently, the national government is responsible for setting health care standards, the provision of technical support to county governments, and the management of national referral hospitals (Ministry of Health 2014). On the other hand, county governments are responsible for service delivery; human resource management; and procurement of medicines and other essential supplies for county health facilities among other functions. Health service delivery and management functions at the county level are overseen by the County Departments of Health. Within the County Departments of Health, County Health Management Teams (CHMTs, made up of senior managers drawn from various departments such as laboratory, pharmacy, health records, nursing, public health etc.) provide technical oversight for health service delivery functions. Each county is further sub-divided into smaller administrative units known as sub-counties (equivalent to a district). Sub-county Health Management Teams (SCHMTs) whose compositions mimic CHMTs, are responsible for the supervision and management of frontline health facilities (both public and private) within their jurisdiction (Nyikuri M, Tsofa B et al. 2017).

Service delivery within the public sector is organized into five tiers (figure 3.1):

- *Community services (level 1)*: This includes all health promotive and preventive services which are offered at the community level as part of the community strategy.
- *Primary health care services (level 2)*: These includes dispensaries and health centres. They are the first level of contact with the formal public healthcare system.

Dispensaries provide the lowest level of facility based outpatient care. In addition to outpatient care, health centres provide the lowest level of inpatient care and other services such as oral examination (Ministry of Health 2012). The ministry of health recommends staffing levels of between 2-5 nurses per dispensary although less than half of dispensaries in the country met this criterion in 2012 (Ministry of Health 2012). Health centres are typically staffed by clinical officers, nurses, and other cadres of staff such as laboratory technologists, and public health technicians among others.

- *Primary referral services (level 3)*: These includes sub-county hospitals that serve as referral centres for primary health care facilities.
- *County referral hospitals (level 4)*: These provide access to specialized services and inpatient care. They also act as training centres for medical staff and serve a population of close to a million.
- *Tertiary hospitals (level 5)*: includes national referral hospitals that offer highly specialized services

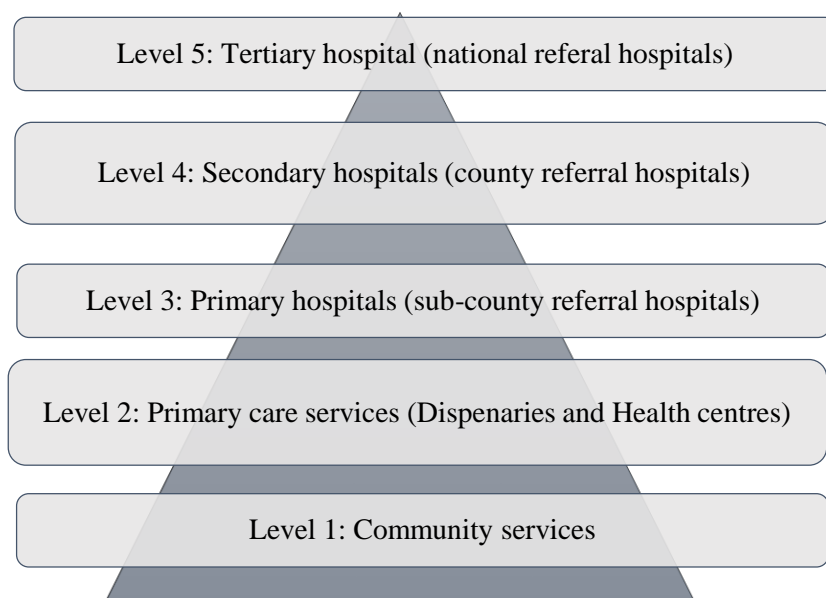


Figure 3.1 Organization of service delivery in Kenya

3.2.2 Malaria in Kenya

There are four malaria epidemiological zones in Kenya (figure 3.2), with diversity in risk determined mainly by altitude, rainfall pattern, temperature and malaria prevalence (Ministry of Health 2014).

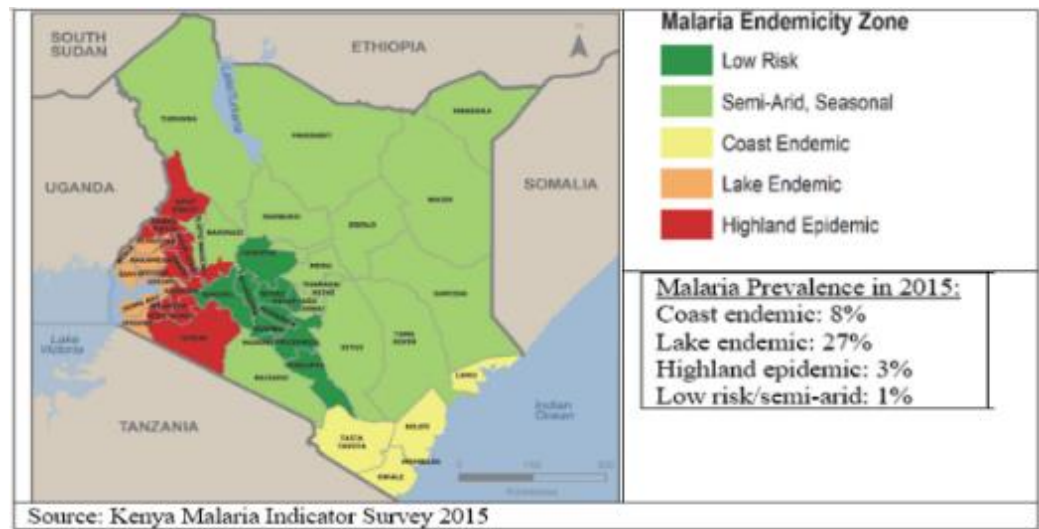


Figure 3.2 Malaria epidemiological zones in Kenya

According to the 2015 malaria indicator survey report, malaria prevalence in children aged 6 months to 14 years declined nationally from 11% in 2010 to 8% in 2015, although this varies across the country's four epidemiological zones (National Malaria Control Program 2016). The prevalence is highest in the lake endemic region (27%) where transmission is intense throughout the year, and lowest in the low risk zones in the central highlands (less than 1%) where low temperatures do not favour transmission (National Malaria Control Program 2016). Malaria transmission is intense throughout the year in the coast and lake endemic regions, but peaks during the short and long rainy seasons between April and July and October and December respectively.

Specific malaria interventions are recommended for use in each of the four epidemiological zones as shown in table 3.1.

Table 3.1 Malaria interventions by epidemiological zone

Epidemiological zone	Vector control: LLINs	IPTp	Case management	Surveillance	Epidemic preparedness and response	BCC
Highland epidemic	✓		✓	✓	✓	✓
Endemic	✓	✓	✓	✓		✓
Seasonal zones			✓	✓	✓	✓
Lower risk			✓	✓		✓
BCC: behaviour change communication;						

3.3 Malaria Monitoring & Evaluation framework in Kenya

3.3.1 *The growth of malaria indicators in Kenya*

There has been a rapid increase in the number of malaria indicators for use in programme management, monitoring and evaluation in Kenya since the launch of the first 10-year National Malaria Strategy in 2001 (Ministry of Health 2014). The National Malaria Strategy 2001-2010 identified four strategic approaches (vector control, prevention of malaria in pregnancy, clinical management, and epidemic preparedness and response) for driving malaria control towards the RBM goal of halving the burden of malaria by 2010 (Remme, Binka et al. 2001). In line with the Abuja Declaration on rolling back malaria in Africa (World Health Organization 2000), this national malaria strategy set medium term goals that were to be realized by 2006 (Ministry of Health 2001). Although the national strategy did not specify indicators for monitoring progress towards these medium term goals, it stated that process and outcome indicators were to be adapted from standardized RBM core indicators (Roll Back Malaria 2000, Remme, Binka et al. 2001). A Malaria Monitoring & Evaluation Methodology Working Group was set up to “agree on tools and mechanisms for monitoring and evaluating progress against strategic objectives”. The NMS 2001-2010 identified 7 impact indicators (adapted from RBM indicators) for

evaluating the overall impact of the national strategy on malaria control (Ministry of Health 2001).

The entry of major international funders for malaria control such as the Global Fund and PMI to Kenya's malaria funding landscape in the early 2000's fuelled demand for data for performance measurement and contributed to the rapid increase in malaria indicators designed to meet these performance measurement demands. For instance, Kenya's first grant application to the Global Fund made in 2002 identified 8 impact, 12 output and 15 outcome indicators (examples in table 3.2) that were designed to measure progress towards the 2007 targets set in the proposal (<http://globalfundkcm.or.ke/proposal/>). Additional input and process indicators were also listed in the proposal, consistent with the Global Fund's requirement for data to show coverage of activities aimed at scaling up malaria interventions (e.g. training). These indicators were primarily adapted from the Global Fund M&E tool kit (The Global Fund 2004).

Table 3.2 Examples of indicators listed in Kenya’s funding proposal to the Global Fund

	Kenya’s Global Fund round 2 proposals	Global Fund Malaria M&E indicators
ITNs	<ul style="list-style-type: none"> • % of children <5 sleeping under a mosquito net • % of children <5 sleeping under ITN • % of pregnant women sleeping under mosquito net • % of pregnant women sleeping under ITN • % of HH owning at least one ITN 	<ul style="list-style-type: none"> • Households owning ITNs • Children <5 sleeping under ITN • Pregnant women using ITNs
IPTp	<ul style="list-style-type: none"> • % of pregnant women who have accessed IPTp from ANC services during pregnancy 	<ul style="list-style-type: none"> • Number of pregnant women receiving correct IPTp
Prompt effective antimalarial treatment	<ul style="list-style-type: none"> • Proportion of <5 with fever receiving anti-malarial treatment within 24 hours of onset • % of health facilities reporting no stock-outs 	<ul style="list-style-type: none"> • Children < 5 years of age with access to prompt effective treatment • Health facilities with no reported stock-out of antimalarial drugs
Sources: Kenya National Proposal to the Global Fund Round 2 proposal; Global Fund Malaria M&E Toolkit 2004		

Funding for malaria control in Kenya was further boosted in 2007 with financing, particularly for malaria control commodities, from the President’s Malaria Initiative (PMI). As funders, PMI listed several input, process, output, outcome and impact indicators in their M&E framework which funding recipients were required to respond to. Although PMI emphasised the importance of standardization of malaria M&E among donors and across countries, the organisation still required recipients of their funding to generate indicators specific to their funding stream that focused on details of how their funds were being spent (Box 3.1) (Presidents Malaria Initiative 2009).

Box 3.1. PMI specific indicators

- Number of ITNs purchased with US government (USG) funds
- Number of people who have been trained with USG funds to deliver IRS
- Number of SP tablets purchased using USG funds
- Number of ACTs purchased using USG funds
- Number of treatments of severe malaria purchased using USG funds

By 2008, millions of dollars had been spent on malaria control activities in Kenya and a review of Kenya's malaria programme performance showed that the country had made remarkable progress in scaling up malaria interventions due to this increased investment in malaria control (Ministry of Public Health and Sanitation 2009). However, the review also identified a number of challenges to malaria control, among them the lack of a comprehensive malaria M&E strategy that was undermining a coordinated approach to malaria M&E in the country. For example, there was no routine reporting of malaria service delivery data from the district to national level, delaying the preparation of quarterly reports (including the Global Fund programme performance reports). The laboratory reporting system did not feed data into the national HMIS creating challenges for acquiring data on confirmed malaria cases. Likewise, data on ACTs were not entered into the HMIS. The need for the development of a comprehensive malaria M&E strategy was therefore recognized (Ministry of Public Health and Sanitation 2009).

In 2009, Kenya developed its second 10 year National Malaria Strategy (NMS) for 2009-2017 (Ministry of Health 2009). In addition to scaling up existing malaria control interventions, this NMS identified the need for a change in policy from clinical to treatment based on confirmed malaria diagnosis (Ministry of Health 2009). The NMS 2009-2017 included as its fourth objective, the need to "*strengthen surveillance, M&E systems so that key malaria indicators are routinely monitored and evaluated in all malarious districts by 2011*", reflecting the growing prominence of malaria M&E (Ministry of Health 2009). Alongside the NMS 2009-2017, the first comprehensive malaria M&E Plan (for 2009-

2017) was developed (Ministry of Public Health and Sanitation 2009). The development of this M&E Plan was a pre-requisite for Kenya's second application to the Global Fund for malaria funding (Ministry of Public Health and Sanitation 2009). All indicators listed in Global Fund's first grant application were included in this first M&E Plan. This M&E plan was based on the M&E logic model that is centred on identifying appropriate indicators and using them in the measurement of inputs, process, output, outcome and impacts of malaria control (figure 2.1 chapter 2) (Roll Back Malaria 2009). The plan provided a comprehensive list of indicators and their data sources that were to be used to monitor each of the six objectives of the NMS 2009-2017 (Ministry of Health 2009). This first M&E Plan contained over 300 indicators: 70 input; 81 process; 95 output; and 76 outcome indicators. Impact indicators also increased to 10 from the 7 listed in the NMS 2001-2010. A number of these indicators were adapted from global malaria indicators and the malaria M&E frameworks of international funders (The Global Fund 2006, World Health Organization 2007, Presidents Malaria Initiative 2009, Roll Back Malaria 2009). Table 3.3 provides an example of LLINs and case management indicators listed in the PMI M&E framework (Presidents Malaria Initiative 2009) which were adapted and included in Kenya's M&E Plan (Ministry of Public Health and Sanitation 2009).

Table 3.3 Indicators from PMI Malaria M&E Framework included in Kenya's M&E Plan

	<i>PMI M&E Plan</i>	<i>Kenya Malaria M&E Plan</i>
LLINs		
Input	Procurement of nets	Number of LLINs/ITNs purchased
Process	Training for distribution teams	Number of people trained in distribution/retreatment
Output	Number of nets distributed	Number of nets distributed through mass campaigns/health facilities
Outcome	Household net ownership	Proportion of households with at least one/two ITNs
Case management		
Input	Procurement of RDTs, ACTs & microscopy supplies	Number of RDTs, ACTs and malaria microscopy supplies procured
Process	Training of providers, lab techs	Number of health workers trained (clinical and lab)
Output	Number of RDTs slides examined	-
Outcome	% of <5s with fever tested/treated for malaria with an ACT	Proportion of patients with fever tested for malaria & test positive prescribed ACT [<5 years and >5 years of age]

In 2010, the WHO changed their guidance on the diagnosis and treatment of malaria, shifting from treating all fevers as malaria to treatment based on parasitological confirmed diagnosis (World Health Organization 2011). Kenya changed their diagnosis and treatment policy in line with this guidance in the same year. Following this shift in policy, the National Malaria Control Programme recommended that a specific tool be developed for monitoring RDT consumption data which at the time, were not reported through the routine Health Management Information System (HMIS). ACT consumption data were reported through a parallel system known as the Logistics Management and Information System (LMIS).

3.3.2 The current framework for Malaria M&E

Between 2013 and 2014, Kenya conducted a midterm review of the national malaria strategy 2009-2017 (Ministry of Health 2014). The revision of the national malaria strategy was informed by the need align malaria control goals to:

- a) The Kenya Health Sector Strategic Investment Plan (KHSSP) 2014-2018 which identified malaria as one of the conditions targeted for elimination in the country (Ministry of Health 2014) as envisioned in the Global Technical Strategy for Malaria Elimination 2016-2030 (World Health Organization 2015).
- b) Decentralization of health service delivery functions to county governments as per the 2010 constitution.
- c) The changing malaria epidemiology in the country (Division of Malaria Control 2010, National Malaria Control Program 2016)

As recommended in the Global Technical Malaria Strategy 2016-2030 (World Health Organization 2015), the revised Kenyan NMS 2009-2018 reiterated the need for universal access to malaria prevention, diagnosis, and treatment interventions. It also recommended that IPTp implementation be restricted to the 14 malaria endemic counties in the country (Ministry of Health 2014). The M&E plan 2009-2017 was revised alongside the national malaria strategy to reflect these changes in objectives and targets. As a result, the number of indicators increased from 322 to 387 (Ministry of Health 2014). Table 3.4 shows the objectives of the current NMS and the number of input, process, output, and outcome indicators used to monitor each objective area.

Table 3.4 Number of malaria indicators the revised M&E Plan for 2009-2018

KNMS 2009-2018 Objective	Indicator			
	Input	Process	Output	Outcome
a) To have at least 80% of people living in malaria risk areas using appropriate malaria interventions by 2018	10	19	17	16
b) To have 100% of suspected fever cases presenting to a health facility managed according to national malaria treatment guidelines by 2018	15	29	15	14
c) To ensure that 100% of epidemic prone and seasonal malaria transmission sub-counties have the capacity to detect, prepare and prepare for and timely respond to epidemics	10	15	15	8
d) To ensure that all malaria indicators are routinely monitored, reported and evaluated in all counties by 2018	17	27	22	17
e) To increase utilization of malaria control interventions in Kenya to at least 80% by 2018	10	24	19	6
f) To improve capacity in malaria coordination, leadership, governance, and resource mobilization at all levels towards achievement of the malaria programme objectives by 2018	17	25	18	2
Total	79	139	106	63

There are 8 major data sources of data for constructing these indicators (figure 3.3). Some of these sources (household surveys, health facility surveys, and sentinel surveillance) have been described in the previous chapter.

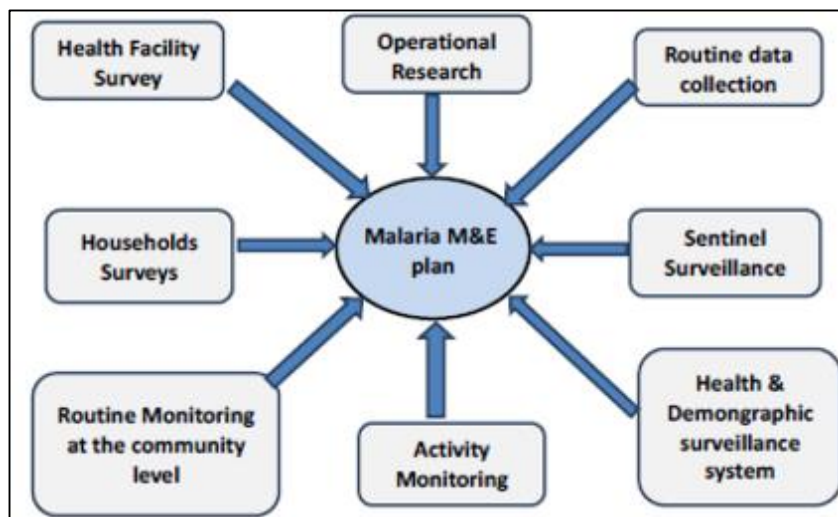


Figure 3.3 Data sources for the M&E Plan

(Ministry of Health 2014): Malaria M&E Plan (pg. 44)

In this thesis, my focus is on malaria data collected through the routine health information system (routine data collection in figure 3.3). In the following section I describe the routine health information system in Kenya and subsequently summarise malaria indicators generated through this system.

3.4 Kenya's routine Health Information System

Kenya's health information system (HIS) has continued to evolve in response to local and international demands since its establishment in 1972 (Odhiambo-Otieno 2005, Karuri, Waiganjo et al. 2014). The second Kenya Health Sector Strategic Plan II (KHSSP) 2005-2010 adopted a performance-based monitoring approach recognizing the need to strengthen the country's health information system (Ministry of Health 2005). This health sector strategic plan recommended a number of interventions among them:

- i) the need to develop a national monitoring and evaluation policy and a list of priority indicators for overall health sector monitoring;
- ii) development of integrated data collection and reporting tools; and

- iii) computerisation of District Health Information Systems to enable rapid transfer of data from the district to the national level (Ministry of Health 2005).

In 2008, the MOH developed a comprehensive document known as the Indicator Manual which contained a list of over 70 priority indicators for health sector monitoring; integrated data collection and reporting tools (12 registers and 15 reporting tools); and standard operating procedures for streamlining health data collection and reporting in the country (Ministry of Health 2008). To ensure standardization of health data collection and reporting in the country, the Ministry of Health through the Health Information Systems (HIS) unit is responsible for designing the integrated registers and reporting forms (also referred to as standard tools in this thesis) which are recommended for use in all public and private health facilities in the country (Ministry of Health 2012)

3.4.1 Data collection at front-line facilities

The integrated registers and reporting forms are present in all public health care facilities and collect a range of health and service delivery data for various diseases, conditions or programmes. These tools are developed through a consultative and collaborative process that brings together various programmes under the ministry of health (MoH) (Ministry of Health 2012). This process is coordinated by the Health Information Systems department. The current Indicator Manual, contains 14 registers and 16 monthly reporting forms, outlines standard operating procedures for health data collection in the country and also contains a list of indicators for overall health sector monitoring. Each register and reporting tool has been assigned a unique code (e.g. MOH 204A for outpatient register for over 5 years) to distinguish it from the rest (see table 3.5). The actual number of registers and reporting forms used at any particular facility depends on types of services provided. For instance, Radiology and Laboratory registers are only used in facilities providing these services. Ideally, information should be entered into each of these registers by the attending health worker at the time of service delivery.

Table 3.5 Data collection registers and reporting forms in Kenyan health facilities

Register	Reporting forms
1. MOH 204A Outpatient Register (under five years)	1. MOH 105 Service delivery
2. MOH 204B Outpatient Register (over 5 years)	2. MOH 701 A <5 Daily outpatient morbidity tally sheet
3. MOH 511 Child Welfare Clinic (CWC) Register	3. MOH 701 >5 outpatient morbidity summary
4. MOH 510 Immunisation Register	4. MOH 705A <5 outpatient morbidity summary
5. MOH 333 Maternity (Delivery) Register	5. MOH 705B >5 outpatient morbidity summary
6. MOH 406 Postnatal Register	6. MOH 702 Immunisation Tally sheet
7. MOH 512 Daily Activity (Family Planning) Register	7. MOH 710 Immunisation summary sheet
8. MOH 301 In-Patient Register	8. MOH 704 Child Health and Nutrition Information System tally sheet
9. MOH 209 Radiology Register	9. MOH 711 Integrated tool for RH, HIV/AIDS, Malaria, TB, and Child nutrition summary
10. MOH 240 Laboratory Register	10. MOH 717 Monthly Workload report
11. MOH 268 Diagnostic Index Card	11. MOH 268 Diagnostic Disease Index
12. MOH 405 Antenatal Clinic (ANC) Register	12. MOH 718 In-patient morbidity and mortality summary sheet
13. MOH 513 Community Health Workers Log Book	13. MOH 708 Environmental Health services
14. MOH 514 House Hold Register	14. MOH 715 Health Facility services inventory form
	15. MOH 514 Community Health Extension Worker (CHEW) Summary
	16. MOH 515 Community Chalk/white Board

Source: 2nd Health Sector Indicator Manual: Last revised in 2012

At the end of the month, data recorded in standard registers are collated and entered into monthly reporting forms which are completed in duplicate; one to be submitted to the sub-county and the second retained at the health facility level for record purposes. Facility managers are charged with the responsibility of ensuring that all monthly reports are completed, and that these are submitted to the respective sub-county health records offices by the 5th of every month (Ministry of Health 2012). The Indicator Manual does not state who is responsible for collecting or reporting various types of health data at the health facility level. However, in primary health care facilities (health centres and dispensaries), most data recording functions are undertaken by nurses and clinical officers (Ministry of

Health 2012) due to shortage of health records and information officers (Ministry of Health 2014).

3.4.2 Data reporting at sub-county (district) level

In 2008 in Kenya, an electronic File Transfer Protocol (FTP) system was introduced to district level health information offices to enable electronic transfer of data from the district to the national level (Luoma 2010, Karuri, Waiganjo et al. 2014). Under the FTP system, health facilities submitted their aggregated monthly paper reports to the district level where the data were entered into Excel spreadsheets by district health records officers. Aggregated monthly reports were forwarded to the national level through the electronic FTP, or as an email attachment, from where the data were analysed and used to produce various reports (Karuri, Waiganjo et al. 2014). Although the FTP simplified the data transfer process from the district to the national level, it faced a number of challenges outlined in box 3.2, which undermined its effectiveness (Luoma 2010, Karuri, Waiganjo et al. 2014, Manya, Nielsen et al. 2016). These challenges led to concerns, among programmes within the MoH and donors, about the quality of data in these reports; subsequently leading to the creation of many parallel information systems to respond to donor and programme specific requirements for data (Luoma 2010).

Box 3.2 Challenges associated with the FTP system:

- Data entry errors due to unintended changes in Excel cell functions
- Major time lag between when data was reported and when it was received at the national level
- The system lacked internal error validation rules
- Poor internet connectivity slowed down data submission to the national level
- Files were infected with viruses hence rejected at the national level leading to incomplete data

Source: (Karuri, Waiganjo et al. 2014)

In response to these challenges, a five-year (2009-2014) strategic plan for Health Information System and the HIS policy were developed to provide a strategic framework and policy direction for the country's health information system (Government of Kenya 2009, Ministries of Health 2009). These two documents outlined a number of interventions for strengthening the country's health information system, among them the *use and application of information technology in data management* (Government of Kenya 2009, Ministries of Health 2009). In line with this recommendation, Kenya adopted the web-based District Health Information Software 2 (DHIS2) to replace the FTP system in 2011 (Ayub Many 2012, Karuri, Waiganjo et al. 2014).

DHIS2 is a free and open source “*database tool for collection, management, validation, analysis and presentation of aggregate statistical data, tailored to integrated health information management activities*” (Ayub Many 2012). The system was first tried in South Africa in 1998 then subsequently rolled out to other low income countries (Braa, Heywood et al. 2012). The DHIS2 is currently the main HMIS platform for 47 low income countries, the majority of them in sub-Saharan Africa (<https://www.dhis2.org/>). In Kenya, national roll-out of the DHIS2 was preceded by training of district managers and health records and information officers on use of the system (Ayub Many 2012). Funding support for the DHIS2 is provided by United States Agency for International Development (USAID) which also facilitates technical support for the same (Many, Nielsen et al. 2016).

It is estimated that close to 10,000 health facilities are now submitting their data through the system on a monthly basis, over half of them being government owned health facilities (Githinji, Onyando et al. 2016). In line with the HIS policy recommendation for standardization and harmonization of information systems in the country (Government of Kenya 2009), there are on-going plans to integrate other information systems that still operate in parallel into the DHIS2 (Manya, Nielsen et al. 2016).

Sub-county (previously district) managers are responsible for ensuring that submitted facility reports are entered into the DHIS2 by the 15th of every month. The Health Information Systems policy recommends the enforcement of a mandatory reporting requirement for all health facilities regardless of their ownership status (i.e. whether public, or private) to the sub-county health offices on a monthly basis (Ministry of Health 2010). The Kenya Health Bill 2016, which provides the guiding legal framework for implementation of health related activities in the country, does not contain any clause for enforcing a mandatory reporting requirement in the country hence making it difficult to enforce this policy recommendation (Government of Kenya 2016). The Indicator Manual instructs sub-county level managers to *“enforce response by prosecuting those not reporting and provide regular feedback on those not reporting with a list of shame”* (Ministry of Health 2012). Ideally, staff receiving monthly reports at the sub-county health records office should use a checklist to document the process (i.e. to keep a record of reporting facilities and number of reports submitted) (Ministry of Health 2012).

Data entry forms in the DHIS2 have been customized to replicate the paper copies of each monthly report (Ayub Manya 2012, Karuri, Waiganjo et al. 2014). That is, all data fields in the paper copies of each report are included in the electronic form in the DHIS2. Data entry can be done by each monthly reporting form (i.e. all MOH 705A reporting forms for all health facilities entered) or by facility (all reports from facility A, then B, then C...). The system has inbuilt validation rules for picking up errors during data entry (Ayub Manya

2012). Once data is entered into the system, it is automatically aggregated to form sub-county, county and national level reports from where it becomes accessible to all users with access to the DHIS2. Data entered into the system can be viewed by reporting unit (e.g. facility A), reporting form (e.g. MOH 705A reports), or selected indicators (no. of women who received IPTp2). Ideally, all health workers and district level managers should have access to the DHIS2 and are expected to make use of analytical tools available in the DHIS2 to analyse their data for decentralized decision making (Ayub Many 2012, Karuri, Waiganjo et al. 2014).

To help ensure that information does not flow unidirectionally, the Health Information Systems policy recommends the development of clear administrative guidelines on provision of feedback at all data collection and aggregation levels (Ministry of Health 2010). For example, health facilities are required to provide regular feedback to community members through community forums such as community health days. Similarly, sub-county managers are required to share their performance indicators with health facilities and other sub-county stakeholders during regular facility managers' meetings and other sub-county level meetings. Counties should also share their performance data in county level stakeholder forums (Ministry of Health 2012). Ideally, these data should also be used to improve patient management at the health facility level, and for health system management at all levels.

3.5 Recording and reporting malaria data through the HIS: malaria indicator generation

There are twelve indicators listed in the Kenyan Malaria M&E Plan which are constructed using routine malaria data (table 3.6). These indicators have been adapted from the Global Fund M&E tool kit and are consistent with the WHO disease surveillance indicators discussed in chapter 2 (The Global Fund 2011, World Health Organization 2012).

Table 3.6 Routine malaria indicators listed in the Kenya M&E plan vs Global Fund indicators

Global Fund Indicator	Indicator: Kenya M&E Plan
Inpatient malaria cases per 10000 persons/ year (<i>disaggregated by age and sex</i>)	Total inpatient malaria cases/1000 persons per year
	Inpatient malaria cases among children <5yrs/per 1000 persons per year
Inpatient malaria deaths per 1000 persons/year (<i>disaggregated by age and sex</i>)	Total inpatient malaria deaths/1000 persons per year
	Inpatient malaria deaths among children <5 years/1000 persons per year
Confirmed malaria cases/1000 persons per year (disaggregated by type of test: RDT or microscopy) (<i>disaggregated by age, sex & parasite species</i>)	Total confirmed outpatient malaria cases at health facility level/1000 persons per year
	Confirmed malaria cases among children <5/1000 persons per year
Number of suspected malaria cases tested	Percentage of suspected malaria cases tested using a parasitological based test
Malaria test positivity rate (RDT and/or slide positivity rate)	Slide/RDT test positivity rate at health facility level
Percentage of pregnant women attending ANC who received at least 2 doses of IPTp	Number of pregnant women who received IPTp1 in targeted counties
	Number of pregnant women who received IPTp2 in targeted counties
-None	Total clinical outpatient malaria cases at health facility level/1000 persons per year
Number of ITNs distributed	Number of LLINs distributed through health facilities

3.5.1 Routine malaria data collected and reported at the health facility level

There are six standard registers at frontline health facilities designed to capture various types of malaria data (table 3.7). These registers are located in four service delivery areas: Outpatient departments; inpatient clinics; antenatal care clinic and the laboratory. In addition to the two outpatient morbidity registers, there are corresponding tally sheets that should be completed alongside the registers to aid in the transfer of data from these registers into monthly reporting forms.

Table 3.7 Malaria data recorded in standard registers

Register	Service delivery area	Malaria data collected
Antenatal Care Register (MOH 405)	ANC	-LLINs distributed to pregnant women -IPTp 1 & 2 -Malaria in pregnancy
Child Welfare Clinic Register (MOH 511)	CWC	-LLINs distributed to children <1
Inpatient Register (MOH 501)	Inpatient clinics	-Inpatient malaria cases -Inpatient malaria deaths
Laboratory Register (MOH 240)	Laboratory	-Tested for malaria -Confirmed malaria
Outpatient (Under 5) Register (MOH 204A)	Outpatient	-Confirmed malaria -Clinical malaria
Outpatient (Over 5) Register (MOH 204B)	Outpatient	-Confirmed malaria -Clinical malaria

At the end of the month, malaria data recorded in these registers are manually counted and entered into five monthly reporting forms which are also used to report other types of data (Table 3.8). As shown in table 3.8, laboratory registers collect data on total number tested for malaria while laboratory reporting form requires age and test disaggregated data.

Table 3.8 Malaria data reported in monthly reporting forms

Reporting form	Data sources	Malaria data reported
MOH 705A <5 Outpatient Morbidity	MOH 204A	Clinical & Confirmed malaria
MOH 705B >5 Outpatient morbidity	MOH 204B	Clinical & Confirmed malaria Malaria in pregnancy
MOH 105 Service Delivery Report	MOH 204A & B Outpatient MOH 301 Inpatient Register	<5 & 5yrs treated for malaria Inpatient malaria cases LLINs to children <1 & women Inpatient malaria deaths IPTp2 No of HH sprayed with IRS
MOH 706 Lab Summary report	MOH 240 Lab Register	Total tested & confirmed malaria (<5 & >5) by microscopy Total tested & confirmed malaria (by RDTs)
MOH 711 Integrated report	MOH 405 register	LLIN given to pregnant women IPTp 1 & IPTp2

3.5.2 *Malaria data reported through the Integrated Disease Surveillance and Response System (IDSR)*

The IDSR systems collect weekly surveillance data on diseases, events and conditions of public health importance (Ministry of Public Health and Sanitation 2012). There are 8 malaria indicators which are reported through the IDSR reporting system (box 3.3).

Box 3.3 Malaria data reported through the IDSR system

1. Number of malaria cases <5
2. Number of malaria cases >5
3. Number tested <5
4. Number tested >5
5. Number positive <5
6. Number positive >5
7. Number of malaria deaths <5
8. Number of malaria deaths >5

These data are obtained from standard MoH registers (e.g. Laboratory, Inpatient and Outpatient registers) and are reported using the *IDSR Weekly Epidemic Monitoring Form (MOH 505)*. Facility managers are required to submit this form to the sub-county disease surveillance coordinator on a weekly basis. The sub-county disease surveillance coordinator is responsible for aggregating and entering data reported through the MOH 505 reporting form into the web-based IDSR system (referred to as e-IDSR). Once entered into the system, these data become available to county and national level managers with access to the system. The National Malaria Control Programme malaria data reported through the e-IDSR system to generate a number of malaria surveillance indicators (e.g. *outpatient test positivity rate*) which are contained in quarterly surveillance bulletins (National Malaria Control Program 2016). A recent assessment of routine malaria data reported through the e-IDSR found that there has been a substantial increase in the number of sub-counties that are reporting their data through the e-IDSR system between 2012-2015. This assessment also found that timeliness of reporting has also increased from 13.2% in 2012 to 65.8% in 2015 (Githinji, Onyando et al. 2016). There are on-going efforts to integrate the weekly e-IDSR weekly reporting into the DHIS2.

3.5.3 Malaria indicators reported in monthly reporting forms vs those listed in M&E

Plan

As shown in table 3.9, most of the malaria indicators listed in Kenya's M&E plan have data sources at the health facility level. However, there are indicators listed in the facility monthly reporting forms for which there are no clear data sources at the health facility and which are not required to be generated at facility level in the M&E plan. One such indicator is the number of *number of houses sprayed with IRS-indoor residual spraying*. According to the M&E plan, IRS is a community level intervention and as such, data required by this indicator cannot be reliably collected at the health facility level. According to malaria M&E Plan, this indicator is supposed to be collected through activity reports.

Table 3.9 Malaria indicators listed in Kenya's M&E plan compared with data recorded in standard registers

Indicator: Kenya M&E Plan	Data collected at health facility	Sources
Total inpatient malaria cases/1000 persons per year	<ul style="list-style-type: none"> inpatient malaria cases 	-Inpatient register
Inpatient malaria cases among children <5yrs/per 1000 persons per year		
Total inpatient malaria deaths/1000 persons per year	<ul style="list-style-type: none"> number of inpatient malaria deaths 	-Inpatient register
Inpatient malaria deaths among children <5 years/1000 persons per year		
Total confirmed outpatient malaria cases at health facility level/1000 persons per year	<ul style="list-style-type: none"> confirmed malaria <5 & >5 malaria Bs <5 & >5 (number positive) malaria RDTs <5 & >5 (number positive) 	-Laboratory register -Outpatient register <5 & >5
Confirmed malaria cases among children <5/1000 persons per year		
Total clinical outpatient malaria cases at health facility level/1000 persons per year	<ul style="list-style-type: none"> clinical malaria <5 & >5 	-Outpatient register <5 & >5
Percentage of suspected malaria cases tested using a parasitological based test	<ul style="list-style-type: none"> total tested for malaria (by RDTs and microscopy) malaria Bs <5 & >5 (total exam) malaria RDTs <5 & >5 (total exam) 	-Laboratory register
Slide/RDT test positivity rate at health facility level		
Number of pregnant women who received IPTp1 in targeted counties	<ul style="list-style-type: none"> number of pregnant women receiving IPTp1 	-ANC register
Number of pregnant women who received IPTp2 in targeted counties	<ul style="list-style-type: none"> number of pregnant women receiving IPTp2 	
Number of LLINs distributed through health facilities	<ul style="list-style-type: none"> number of LLIN distributed to pregnant women number of LLIN distributed to children under five years 	-ANC register -Child Welfare Clinic register

3.5.4 Support systems for malaria M&E

In line with the devolved structure of governance, county governments are responsible for monitoring and evaluation of all health services in their counties. For example, they are responsible for conducting Data Quality Audits (DQA) with technical support from the national government. Technical support and oversight for malaria surveillance and M&E is provided by the Malaria M&E Technical Working Group based at the National Malaria Control Programme (NMCP) and involves inputs from various stakeholders with an interest in malaria M&E in the country (Ministry of Health 2014).

To improve the outcome of the collection, collation and reporting of routine health data, sub-county health managers are required to conduct regular support supervision visits to frontline health facilities. There is a standard support supervision checklist developed by the National Malaria Control Programme that is recommended for use during these supervision visits (Ministry of Health 2014). Ideally, managers conducting these support supervision visits should review: human resource capacity and training at health facilities; the delivery of malaria services and health workers' conformity to best practices; the availability of malaria commodities; and the availability of relevant malaria documents. In addition, they should review data management and reporting practices at health facilities (i.e. whether recommended registers and reporting forms are available and if these are correctly filled and up to date); verify facility data for the previous month (i.e. compare reported data with data in the source documents); and review the timeliness of submitting monthly reports (i.e. whether malaria reports are submitted to the sub-county by the 5th of every month). Feedback on these supervision visits should be communicated to health workers at the end of the exercise (Ministry of Health 2014).

In addition to these support supervision visits, the National Malaria Strategy 2009-2018 has recommended that the county government should routinely conduct malaria data

quality audits at health facility and sub-county levels (Ministry of Health 2014). Specifically, these DQAs should: verify the ability of data management system to collect, manage and report quality malaria data; assess the quality of key malaria indicators at selected service delivery sites; and identify corrective measures and plans for strengthening the data management and reporting system (National Malaria Control Program 2014). To this effect, the National Malaria Control Programme has developed standard data quality audit tools adapted from the global DQA tool (Global Fund, PEPFAR et al. 2008) that county governments are required to use when conducting these audits (appendix 1). Previous DQAs conducted by the National Malaria Control Programme were mainly funded by the Global Fund (Division of Malaria Control 2012, Division of Malaria Control 2013, National Malaria Control Program 2014). Since devolution, it has been unclear if these activities will still be funded from the national level or whether responsibility will shift to county governments. In addition, the Health Information Systems department also conducts national DQAs on routine health data. The DQA audit tool used has also been adapted from the global DQA tool. The last national DQA was conducted in 2014 with financial support from USAID (Ministry of Health 2014).

3.5.5 Uses of routine malaria data

The malaria M&E Plan 2009 – 2017 states that the “*National Malaria Control Programme (NMCP) will endeavour to provide leadership in data demand and use which will ultimately improve malaria interventions*” (Ministry of Health 2014). The data available through the DHIS2 are used by the NMCP in disease surveillance as well as health system management. The NMCP uses routine malaria data from the DHIS2 and e-IDSR to produce quarterly surveillance bulletins which are shared with various stakeholders involved in malaria control in the country (National Malaria Control Program 2016). Indicators listed in these surveillance bulletins are consistent with the global disease surveillance indicators discussed in chapter 2. Production of these

quarterly surveillance bulletins is supported by the President's Malaria Initiative (PMI). These data are also used to fulfil various global reporting requirements (e.g. in compiling the Global Fund's grant performance reports). At the health facility level, routine malaria data can be used to quantify malaria commodity needs or for local disease surveillance. Box 3.4 provides a summary of some of the uses of routine malaria data as listed in the M&E plan (Ministry of Health 2014).

Global funders such as PMI and the Global Fund have invested in building local capacity in malaria surveillance and M&E in the country. For example, PMI has sponsored national and county managers to attend both local and international trainings workshops on malaria surveillance, and M&E (Garley, Eckert et al. 2016). It has also supported the NMCP in integrating malaria information systems that previously operated in parallel (e.g. the Logistics Management and Information System-LMIS) into the DHIS2. Similarly, PMI has sponsored various trainings at the national and county levels on DHIS2 use (USAID-PMI 2017).

Box 3.4 Uses of malaria data

- Quantifying malaria commodities and monitoring stock levels so as to avoid stock-outs
- Monitoring appropriate case management practices and organize trainings
- Monitoring disease trends over time, population, and place
- Mapping sub-national malaria risk
- Measuring testing rate of confirmed malaria
- Measuring infection transmission intensity
- Detecting malaria outbreaks and conducting investigations
- Identifying malaria hot spots
- Developing national strategic plans
- Assessing impact of interventions
- Advocating for malaria control resources

Source: (Ministry of Health 2014)

3.5.6 An overview of issues around malaria data reported through the DHIS2

Despite attempts to improve the quality of routine malaria data, several data quality audits and other studies conducted in Kenya over the past five years have identified persistent data quality issues with malaria data reported through the DHIS2. For example, a DQA conducted by the NMCP in western parts of the country noted that confirmed malaria cases were rarely recorded in outpatient registers as required. In addition, it reported that AL doses dispensed were also over-reported. Due to shortage of health records and information officers, most of the data entry roles at the health facility level were mainly undertaken by casual staff hence contributing to some of the observed data quality issues (Division of Malaria Control 2013). Similar findings have also been noted in other DQAs and assessments of routine malaria data that have been conducted in the country (Division of Malaria Control 2012, National Malaria Control Program 2014, Githinji, Onyando et al. 2016). For instance, one such DQA noted that most facilities did not distinguish between clinical and confirmed malaria cases, leading to underreporting or over-reporting of these cases. To address the problem, this DQA recommended that *“there is need to train more clinicians on malaria case management to be able to distinguish clinical from confirmed malaria”* (Division of Malaria Control 2012). National DQAs have also highlighted various organizational (e.g. stock-out of tools and human resources shortages), social and behavioural (e.g. data recording practices) and technical factors (tools and indicators) that undermine health data collection in the country (Ministry of Health 2014). However, such DQAs are primarily cross sectional and focused on the data produced, revealing little about the underlying practices that contribute to data quality issues.

3.6 Summary

In this chapter, I have described how Kenya’s routine health information system has undergone various changes since its inception which eventually led to the adoption of the DHIS2 in 2011. In attempts to standardize data collection in the country, the ministry

of health has developed standard registers and reporting tools which all health facilities are required to use for routine data collection and reporting. This chapter has also described the massive expansion over the past 15 years in the number of malaria indicators that are supposed to be generated through the routine health information system. The growth of these indicators has mainly been driven by external demands for data for performance measurement and accountability. This demand is reflected in the ever increasing number of indicators that have been included in the country's M&E plan. Support systems have been designed to help improve the outcome of the data collection process but several recent data quality audits conducted across Kenya show that there are considerable concerns about data quality, with implications for the validity of malaria indicators constructed using such data. The focus of this thesis is on exploring the practices that contribute to these recorded outcomes and in the next chapter I describe the methodology I adopted for this study.

4 DESIGN AND METHODS

4.1 Introduction

In the previous two chapters I have described the increased global demand for the production and use of malaria indicators and summarised the policies and processes in place in Kenya for the collection of routine malaria data and its entry into the DHIS2 software. In this chapter I explain the conceptual framework and approach I developed to guide my research. I then provide a detailed description of the study design, data management processes, and analytical strategies. Key ethical considerations made in this study are also discussed. The chapter concludes with a reflection on my positionality in the research process.

4.2 Conceptual framework

The overall aim of this study is to critically examine how data for constructing global malaria indicators from routine data are produced at the health facility and sub-county level in Kenya. Drawing on the literature presented in chapter 2 and 3 and the PRISM framework for designing, strengthening and evaluating routine health information systems (Aqil, Lippeveld et al. 2009), I have developed a conceptual framework to help guide the design of the study (figure 4.1).

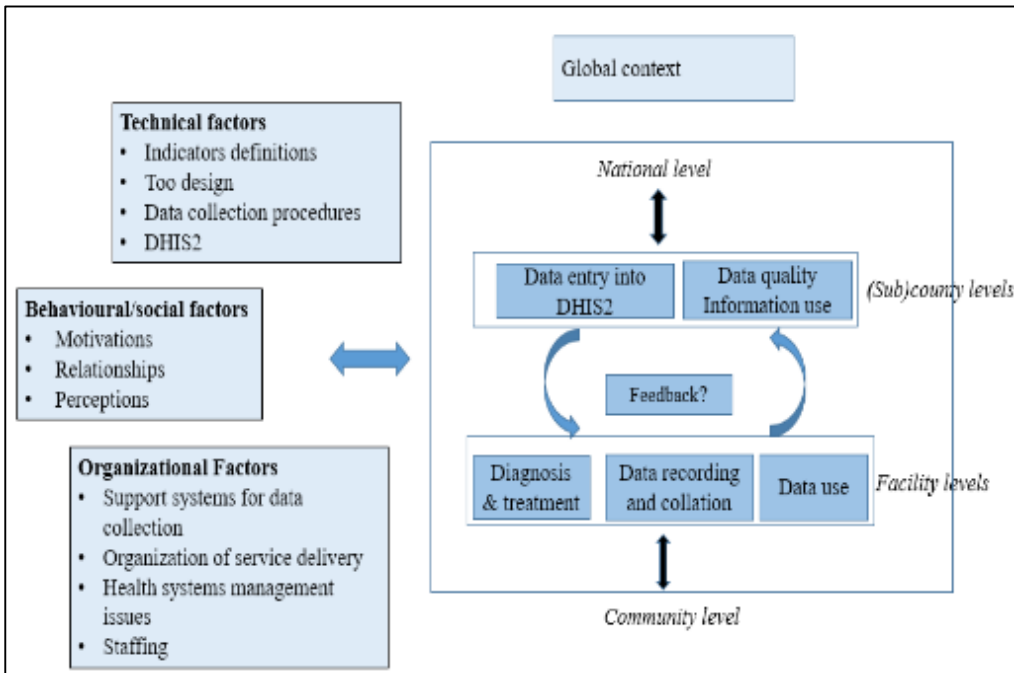


Figure 4.1 Conceptual framework

The inner box in the figure illustrates the process of routine data collection, collation and entry into the DHIS2 in Kenya. As shown in the framework, the key locations for data collection and indicator production are the health facilities and the sub-county health management offices; and these two locations are the focus of my empirical data collection activities. I have included the national level inside the inner box because, while facilities and sub-counties are the primary focus for my data collection, national level processes influence the nature and content of the data recording and reporting tools found at facility and sub-county levels (refer to chapter 3). As such, I also aim to develop an overview of the national level context. I did not collect primary empirical data at the global level as the focus of my study is on how the routine malaria indicators suggested by global level actors are produced through the routine health information systems in Kenya.

The boxes on the left of the framework are the factors that I identified in literature review as being potential influencers on the outcome of malaria indicator production process through the DHIS2. These factors can be divided into three broad categories as

suggested by Aqil et al. 2009 (2009) (Aqil, Lippeveld et al. 2009). The first category contains technical factors such as: the design of data collection tools; definition of indicators; instructions for data collection and reporting; and DHIS2 systems design and supporting infrastructure. The second key category relates to behavioural/social factors which includes: motivations for data collectors; social relationships between those involved in the process; perceptions of those involved in the process; and data collection and reporting practices. The final category contains issues relating to management and organization (organization factors) including: support systems for data collection, resources available to support data collection, organization of service delivery, staffing, and health system management issues (e.g. supply chain management).

An outline of how this study methodology aligns with the requirements of the consolidated criteria for reporting qualitative studies (COREQ) (Tong, Sainsbury et al. 2007) is provided in the table attached in appendix 2. In summary, Domain 1 of COREQ involves consideration of the role of the research team and reflexivity; Domain 2 covers study design; and Domain 3 covers analysis and findings. Domains 1 and 2 are covered in this chapter while Domain 3 is covered in this chapter and in the subsequent results and discussion chapters.

4.3 Study design

The approach to this study was underpinned by a pragmatic interpretive framework, not committed to any particular system of philosophical thought but focussed more on the idea that ‘reality’ is what is useful, or what ‘works’ (Creswell 2012). This approach allows for the ontological assumption that there are multiple realities and the epistemological supposition that there are multiple ways of knowing ‘reality’, but is primarily concerned with identifying how reality works in the study context (Creswell 2012). That is, having a focus on understanding the problem and coming up with recommendations to improve the process. The methodology is both inductive (ideas

emerging from the participants and their ‘emic’ perspectives) and deductive (recognising that there are certain factors likely to influence the data collection and reporting process that should be considered from the outset). Based on this interpretive framework and with the objective of critically examining how data for constructing routine malaria indicators are generated at the health facility and sub-county level in Kenya, I adopted a primarily qualitative, descriptive frame of inquiry (Sandelowski 2000, Sandelowski 2010).

Qualitative inquiry can involve many different data collection methods with a focus on understanding the why and how of decision making; it can be valuable when seeking to develop an understanding of underlying motivations and reveal opinions and rationales for action. The specific objectives of my study are to understand: how malaria data are collected and reported; who is involved and how they influence the process; and how these data are transformed from service delivery areas into the DHIS2. They are also aimed at identifying factors that influence practices and processes. In view of these objectives, I employed an ethnographic approach to data collection involving longitudinal observations (participant and non-participant) in health facilities and sub-county health management offices, document reviews, and interviews (formal and informal) (Savage 2000). The ethnographic approach allows for the development of an in-depth understanding of complex realities in their natural setting, and provides answers to the ‘*why, who, how, what, where*’ of events (Sandelowski 2000, Neergaard, Olesen et al. 2009). It facilitates the generation of a ‘thick description’ of indicator production; developing an in-depth and firsthand account of the processes, artefacts, perspectives, practices, and interactions that shape routine malaria data generation at health facilities and sub-counties (Silverman 2015).

My data collection, therefore, primarily involved spending a considerable amount of time in the ‘field’, interacting with research participants in their ‘natural settings’ and taking part in their day to day activities to gain an insider perspective of their views and

experiences. Throughout this process I borrowed heavily from the constant comparative method; collecting new data, comparing it with existing data and between cases, and collecting additional data to elucidate emerging themes (Creswell 2012). In addition, both while in the field and since, I have reflected on my positionality in the research process (Milne and Oberle 2005), issues which I address further in section 4.6.

4.3.1 Study setting

The study was conducted in two sub-counties located in Siaya and Kilifi counties. These two counties are among the 14 malaria endemic counties where core malaria prevention, diagnosis and treatment interventions have been scaled up over past decade (Ministry of Health 2014). In the following section, I provide a profile of the two counties.

i) Siaya county

Siaya county is located along the shores of Lake Victoria in western Kenya (figure 4.2). It covers an area of 2,530km² and is divided into six sub-counties. According to the Kenya National Bureau of Statistics (KNBS) projections, the county would have an estimated population size of 963,007 in 2015 (Kenya National Bureau of Statistics 2012). The road network is fairly good with all the roads connecting major towns in the county constructed of tarmac. There are 123 public health facilities in the county: 1 county referral hospital; 6 sub-county hospitals and 116 health centers and dispensaries (Health Policy Project 2017). Malaria is the leading cause of morbidity in this county, accounting for over half of all outpatient morbidity cases in 2013 (County of Siaya 2013). Although the county has a generally high coverage of core malaria interventions, malaria prevalence remains high (table 4.1). It is estimated that malaria prevalence declined from 38% in 2010 to 27% in 2015 in the lake region where this county is located (National Malaria Control Program 2016). The county has the second highest HIV/AIDS prevalence rate in the country (23.7% compared to the national average of

6%) (Open Data Kenya 2017). In 2013, there were about 20 non-governmental organizations (NGOs) that were operating within the county, the majority of them focusing on HIV/AIDS prevention and reproductive health (County of Siaya 2013). The county is home to a Health Demographic Surveillance System (HDSS) operated by the KEMRI/Centers for Disease Control (KEMRI-CDC) research collaboration. The HDSS covers 3 out of the 6 sub-counties and provides a platform for several epidemiological studies (Odhiambo, Laserson et al. 2012).

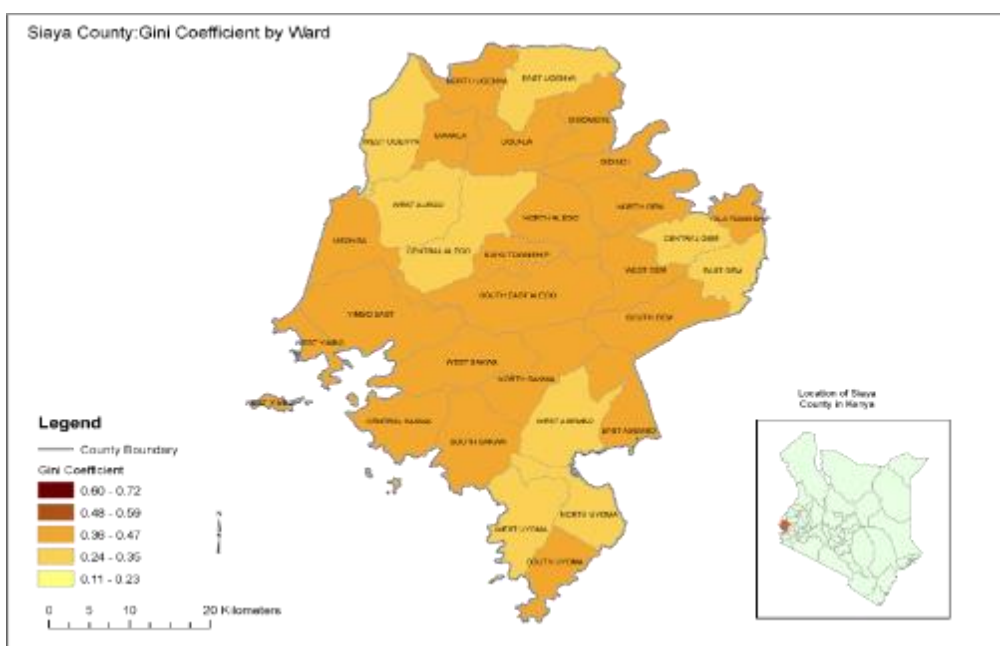


Figure 4.2 Map of Siaya County

Courtesy: Google maps

ii) *Kilifi county*

Kilifi county is located in the eastern part of Kenya, bordering the Indian ocean (figure 4.3). It is five times larger than Siaya county, covering an estimated area of 12, 317km² and is divided into seven sub-counties. According to KNBS projections, the county would have an estimated population size of 1.35 million in 2015 (Kenya National Bureau of Statistics 2012). The road network is poor which makes access to certain parts

of the county difficult especially during the rainy seasons. Malaria, lower respiratory infections, stomach ache and diarrhea were the leading causes of morbidity in the county in 2013 (County of Kilifi 2013). It is estimated that malaria prevalence in the coast region doubled from 4% in 2010 to 8% in 2015 (National Malaria Control Program 2016). There are 127 public health facilities in the county: 2 county referral hospitals, 7 sub-county hospitals; 20 health centers and 98 dispensaries (County of Kilifi 2013, Health Policy Project 2017). HIV/AIDS prevalence in the county is 4.4% (Open Data Kenya 2017). The main health related NGO that was operating in the county in 2013 was supporting HIV/AIDS care and treatment services in county health facilities (County of Kilifi 2013). This county also has an HDSS that is run by KEMRI Wellcome Trust Research Programme (KWTRP). This HDSS provides a platform for various epidemiological studies (Scott, Bauni et al. 2012).

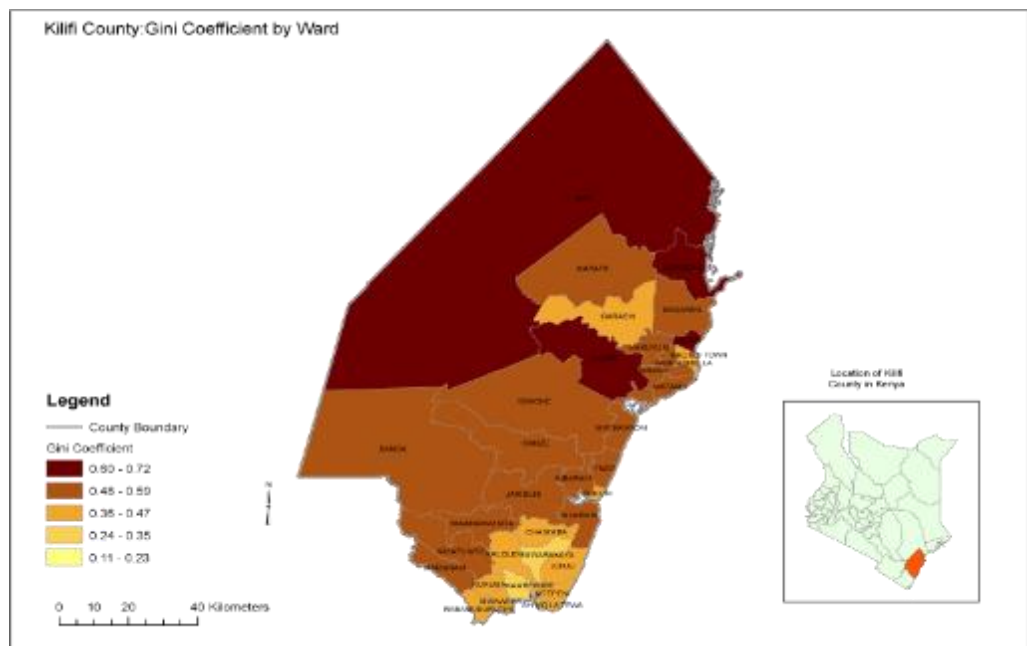


Figure 4.3 Map of Kilifi county

Source: Google maps

These two counties have similar levels of malaria intervention coverage but very different current levels of malaria prevalence (table 4.1). They provided an interesting

opportunity for investigating malaria data generation practices in different epidemiological contexts.

Table 4.1 Profile of Siaya and Kilifi counties

	Siaya county	Kilifi county
General		
Number of sub-counties ⁴	6	7
Number of public health facilities ¹	123	107
HIV/AIDS prevalence (%) ³	23.7	4.4
Malaria indicators		
Malaria prevalence ⁵	27%	8
Malaria cases per 100,000 ¹	69,761	10,861
LLIN ownership (at least one LLIN) ² (%)	86.8	73.3
Proportion of children reported with a fever tested for malaria	59%	43.9%
IPTp coverage (IPTp2) ² (%)	54.7	58.1
¹ Health Policy Project: https://www.healthpolicyproject.com/index.cfm?id=kenyaCHFS ² Malaria indicator survey 2015 ³ Open Data Kenya: http://blog.opendata.go.ke/hiv-situation-in-kenya/ ⁴ HIS Kenya: https://hiskenya.org/dhis-web-commons/security/login.action ⁵ Malaria indicator survey 2015		

4.3.2 Sampling strategy

I used a purposive sampling strategy that incorporated a combination of *maximum variation sampling* and convenience sampling to select study sites and interview respondents (Creswell 2012). This sampling strategy allowed me to explore differences between participants' perspectives and study sites (Creswell 2012). This approach is described below.

a) Selection of sub-counties

In each county the study was conducted in one sub-county. For selection of the study sub-counties, maximum variation was based on similarity in malaria intervention coverage but maximum variation in current levels of malaria prevalence (table 4.1).

It was also informed by other considerations such as existing relationships, familiarity and distance from the county offices (convenience). In Kilifi county, the selected sub-county was part of an on-going research project known as ‘the learning site study’ which is being implemented by researchers from the KWTRP, my home institution. A ‘learning site’ is a collaborative research process implemented within a specific geographic location where researchers and health managers decide together on key health system research questions and interventions (Nyikuri, Tsofa et al. 2015). In Siaya county, the study sub-county was selected on the basis of familiarity due to my previous work experience in the same area.

b) Selection of health facilities

From each of the two sub-counties, I selected two frontline health facilities (a health centre and a dispensary) where I conducted the facility level study. Dispensaries and health centres have varying levels of staffing and workload. For instance, while health centres serve an average population of 30,000 people, dispensaries serve an average population of 10,000 people (Ministry of Health 2012). Sampling of health facilities within the sub-counties therefore aimed to capture variation based on facility size and workload (maximum variation) but was also informed by their accessibility (convenience). In Kilifi, I selected two health facilities that were already part of the learning site project that met my inclusion criteria. However, following the reorganization of district boundaries post devolution, one of the selected health facilities was moved to another sub-county during the preliminary stages of this study. Subsequently, a new health facility was selected in consultation with sub-county health managers. In Siaya, the two health facilities that met my inclusion criteria were selected with the help of sub-county health managers.

c) Selection of study participants

This study sought to investigate how routine malaria indicators are produced through the routine health information system. The selection of study participants was therefore purposive. That is, all health workers and sub-county managers in the selected sub-counties and health facilities who were involved in routine health data generation were included in various study procedures as described in the next section.

d) Selection of tracer indicators

In chapter 3, I identified 12 malaria indicators that are constructed using routine malaria data (table 3.6). In this study, I specifically focused on investigating practices and processes around two of these indicators:

- i. Percentage of suspected malaria cases tested using a parasitological based test*
- ii. The number of pregnant women who received IPTp2 in targeted counties*

These indicators were selected because they represent two key malaria intervention areas (diagnosis and prevention) that have been recommended for scale up to universal coverage in the national malaria strategy in Kenya (Ministry of Health 2014). Thus, they allowed me to explore if there are any differences in practices and processes that shape data generation for diagnosis and treatment indicators. In addition, SP for IPTp is provided by the county government while the malaria RDTs that are widely used in malaria testing in most frontline health facilities, are procured and supplied by the national government using external funds from PMI and the Global Fund. These organisational and supply differences provide an opportunity to explore differences in practices that may be associated with different accountability demands.

4.3.3 Data collection

4.3.3.1 Preliminary field work

I conducted preliminary exploratory field visits in the two sub-counties and the four selected health facilities during July and August 2014. The aim of these preliminary visits were twofold: first, they were aimed at familiarizing myself with staff working in these four facilities and the two sub-counties; secondly, they were also aimed at collecting background information about the facilities and sub-counties. Over the two-month period, I spent at least a week in each of the four health facilities, visited the sub-county health records offices and also took part in any relevant sub-county wide activities (e.g. monthly facility in charges meeting in the coast region sub-county) that took place while I was around. I conducted informal observations of daily routines at these health facilities and sub-county health records offices, reviewed registers and reporting forms to identify types of malaria data that were collected and reported, and also held informal conversations with health workers and sub-county managers. These preliminary field visits enabled me to refine my research questions and data collection tools.

4.3.3.2 Recruitment of a research assistant

Since this study involved data collection at two sites at two extreme parts of the country, it was necessary that I recruit a research assistant (SZ) to help me with data collection. SZ who is an anthropologist by training had extensive experience in qualitative research having worked in another qualitative, ethnographic study at the KWTRP and having been trained in qualitative research methodology and research ethics. I personally conducted all the fieldwork in the lake region sub-county. In the coast region, I conducted the first month of fieldwork (May 2015) in collaboration with my research assistant (SZ) who then completed the remainder of the five months of the main ethnographic fieldwork in the coast sub-county on her own.

4.3.3.3 Data collection procedures

Data collection for this study took place over 18 months between January 2015 and August 2016. The main fieldwork in the lake region sub-county was conducted in two three month blocks, first between January and March 2015, and later between June and August 2015. The major fieldwork in the coast region sub-county was conducted in one five-month block between May and September 2015. Follow up visits to the facilities and sub-counties were made on varied dates between December 2015 and August 2016 to follow up on specific issues that were emerging from preliminary data analysis.

Data for this study were obtained from multiple sources, including reviews of tools and data quality audits, observations, interviews, review of meeting minutes, and feedback meetings. Each of these data collection methods is discussed in detail in the following section.

a) Review of tools, and data quality audits

Review of registers and reporting tools

At the start of fieldwork in each site, I identified various registers and reporting tools that were used to collect and report data for the two tracer indicators (table 4.2). In each of the four facilities, I reviewed data collection and reporting records for the past three months from the time I began fieldwork to document data collection and reporting practices. This review was informed by the understanding that these recording practices were actual representation of the daily realities involved in malaria data collection in these four facilities. The retrospective review of registers provided insight into the recording and reporting practices in all four facilities, prior to the start of this study. I

noted any variations in recording practices and whenever possible, I sought clarification from health workers who were responsible for recording data in these registers. I also noted cases where symbols used to record data in these registers were inconsistent with instructions provided in the register. Similarly, I also took note of instances when health workers made additional notes in the registers other than what they had been instructed to do. I sought their views about the rationale for making these additional notes. With the permission of facility managers, I took photos of these observations and also recorded them in my diary. Observations made during this review formed part of my field notes.

Table 4.2 Registers and reporting forms reviewed

Registers	Reporting tools
<i>Tracer 1: Percentage of suspected malaria cases tested using a parasitological based test</i>	
<ul style="list-style-type: none"> • Outpatient register for < 5 • Outpatient register >5 • AL/RDT register • Laboratory register 	<ul style="list-style-type: none"> • Outpatient morbidity report for under five • Outpatient morbidity report for over five • Annual Work Plan • Laboratory reporting form • Malaria commodities reports
<i>Tracer 2: Number of pregnant women who received IPTp2 in targeted counties</i>	
<ul style="list-style-type: none"> • Antenatal Care register 	<ul style="list-style-type: none"> • Annual Work Plan • Integrated tool for RH, HIV/AIDS, Malaria, TB, and child health • Service delivery report

Data quality audits

To understand how malaria data travelled from service delivery areas into monthly reports and eventually into the DHIS2, I extracted and compared confirmed malaria cases recorded in the various registers and reporting forms over a period of three months for the first tracer indicator (*percentage of suspected malaria cases tested using a parasitological test*). Ideally, every patient visiting the four facilities who is diagnosed with a confirmed case of malaria should have their details captured in three registers: *outpatient registers for over five (or under five); laboratory register; and AL/RDT registers*. I used patient visit number to extract confirmed malaria cases recorded in

these registers on a daily basis. I compared daily aggregated confirmed malaria cases that were recorded in these three registers and recorded them in a notebook (box 4.1). I did not conduct a similar analysis for the second tracer indicator at the health facility level. Programme managers at the National Malaria Control Programme had indicated to me during the formative stages of this study that there were fewer problems with IPTp data. As a result, they had removed it from their priority list of malaria indicators that were routinely audited (see *appendix 1 for indicators edited*).

Box 4.1 Confirmed malaria cases extracted from outpatient register

Date	247	250	251	252	253	254	255
22/11	258	261	262	264	266	267	269
22/11	271	272	273	274	275	277	278
26/11	280	281	282	283	284	286	287
	288	289	290	291	293	294	295
	296						

To compare the data in the paper reports at health facility level with the information recorded in the DHIS2 I also extracted data that were reported in various monthly reporting tools for the two tracer indicators (table 4.2) and compared these data with data in the online copies of the same forms in the DHIS2. Where reporting forms could not be traced at the health facility level, the same were sought from the sub-county health records offices. The aim of this exercise was not to conduct a data quality audit as per the usual audits conducted in the counties in which the quality of data is assessed quantitatively (i.e. determine the accuracy of data in reporting forms or DHIS2 against source documents) (National Malaria Control Program 2014); rather, I used the process to document issues around the data transfer process. Inconsistencies noted during these analyses were noted and discussed during the interviews and preliminary feedback meetings described later in this chapter.

b) Observations

Extended observations of malaria data generation practices and process in the four study facilities and two sub-counties were undertaken by me with the assistance of my research assistant, SZ. The daily observations that provide the main source of data for this thesis were conducted between January and September 2015 with a break during March to April 2015 to reflect on data that had been collected and refine my research questions. This extended period of field observations enabled participants to be comfortable with my, or SZ's presence, helping to diminish 'observer effects' (Bernard 1995). During our time spent in the health facilities and sub-county health management offices, our roles constantly shifted between 'non-participant observer' and 'observer as participant' (where we actively took part in activities) depending on time and context (Creswell 2012). Van der Geest & Finkler (2004) argue that '*participant observation*' in the true sense of that word is hardly ever possible within a clinical set up due to ethical challenges. These authors identify three possibilities that researchers conducting ethnographic field work in clinical settings can choose from: i) joining the staff; ii) joining the patients; or iii) joining the visitors (Van der Geest and Finkler 2004). The staff in all facilities and both sub-counties were aware of our research activities but often asked for assistance in completing non-clinical tasks such as recording data. Where possible we fulfilled these requests. Consequently, in this study, both SZ and I frequently informally '*joined the staff*' (see section 4.6 & chapters 5 & 6).

Typically, the observations involved rotational visits between frontline health facilities and sub-counties (e.g. spent the first three weeks in facility A, then one week at the sub-county, then three weeks in facility B, then another three weeks in A, then one week at the sub-county etc.). However, there was significant flexibility with this schedule. For example, if there was a facility in charge meeting at the sub-county or other related activities, we suspended fieldwork at the health facility level and attended such events.

Observations at the health facility level

Observations at the health facility level focused on the following service delivery areas: the laboratory; outpatient clinics; pharmacies; and antenatal care clinics. In our initial roles as *non-participant observer*, at each facility we spent time around these service delivery areas documenting staff involved in recording data in the register, types of registers used to record data, and recording practices including frequency of recording. We also observed patient management practices, noting the locations where malaria tests were conducted or ANC services were provided and who provided which service in which particular location. These observations were guided by an observation protocol that I developed to help manage the process (appendix 3).

As *participant observers*, we were asked to record data in outpatient registers (in three facilities). In two of these facilities, this involved selling patients their record books. I was asked to record data in laboratory registers in the two facilities located in the lake region, and my research assistant was asked to record data in the AL/RDT register in one facility in the coast region. I also weighed patients and took height and weight measurements (two facilities), and helped in compiling monthly reports (one facility). My research assistant was asked to help in dispensing medicines in one facility. Before involving me or SZ in data recording, staff usually took us through an induction process where they explained to us what we were supposed to record, how we were supposed to record it, and what we were not supposed to record. Whenever certain issues were unclear to us, we sought clarifications from them. These experiences of participating in the processes of data collection and recording helped to enrich our understanding of why health workers did or did not do certain things in a particular manner (at a particular time) and their rationale for acting in a certain way (Savage 2000). Throughout these observations, both SZ and I constantly engaged in informal and natural conversations with participants on various topical issues. Whenever practical and appropriate, we made field notes of these informal conversations. At the end of each day of fieldwork, I wrote both descriptive and reflective notes about my field experiences and I had daily

debriefing phone conversations with SZ. She also sent her daily field notes which I reviewed. Emerging issues that required additional data collection were followed up in subsequent fieldwork.

Observations at the sub-county level

At the sub-county level, the observations were mainly concentrated at the sub-county health records offices. Typically, our visits to the sub-county health records office coincided with the monthly reporting period although we also made random visits to these offices throughout the month. For instance, we would pass-by the offices in the morning on our way to the field, or conclude our day by spending some time in these offices to write our field notes and have informal conversations with staff. The main reason for visiting these offices during the reporting period was to observe the data submission and collation process.

In the lake region sub-county office, I was mainly a *non-participant observer* although there were a few instances when I was left alone in the sub-county health records office and asked, by the volunteer staff working in the office to deal with any issues that arose during their absence. During such instances, I handled most of the queries from visitors who sought help from this office (through phone call consultations with the responsible staff). By contrast, SZ became an active *participant observer* in the coast region sub-county office. Because of her information technology skills and a lack of such skills in this sub-county health records office, she was often asked to troubleshoot various computing problems. She was given full access to the DHIS2 and actively took part in data entry. The access granted enabled her to manipulate sub-county's data in the DHIS2 e.g., change figures on data that had been keyed in. Such access rights are normally restricted to sub-county managers who are directly responsible for data entry into the DHIS2. This first hand access to the DHIS2 enabled her to gain useful insights on technical issues around data entry into the DHIS2 which helped me in interpreting the results of this study.

Observations of sub-county and national meetings

In addition to spending time in health facilities and at the sub-county offices, in both sub-counties we also took part in sub-county wide activities such as facility in charges meetings. Although these meetings are referred to by facility and sub-county staff as ‘facility in charges’ meetings, any health worker sent by the facility manager (including auxiliary staff) can attend these meetings.

In the lake region, I was also invited by the sub-county managers to other meetings at the sub-county level where malaria related issues were discussed. At these meetings I always introduced myself and the purpose of my research to participants. During the meetings I took field notes and, where possible, after the meetings I held informal conversations with meeting participants on various topical issues that were of interest to my research study. A manager at the National Malaria Control Programme who was aware of my research also invited me to take part in two separate training workshops that were conducted in the lake and coast regions. The first workshop was aimed at training county managers from malaria endemic counties on malaria surveillance; while the second workshop provided training to county managers from the lake region on how to conduct malaria data quality audits in their counties. Details of the sub-county wide activities that I took part in, in the two counties, are shown in in table 4.3.

Table 4.3 Number of meetings attended over the study period

Lake region sub-county
<ul style="list-style-type: none"> • Malaria stakeholder forum: NGO sponsored: Oct 2014 • Health worker training on use of modified OPD/ANC registers: NGO sponsored- Nov 2014 • Sub-county malaria supervision feedback meeting: sub-county sponsored- Nov 2014 • County Annual Work Plan report: NGO sponsored: Jan 2015 • Sub-county malaria stakeholder forum: NGO sponsored July 2015
Coast region sub-county
<ul style="list-style-type: none"> • Monthly review meeting: sub-county sponsored: August 2014 • Facility in charges meeting: June 2015
National level meetings
<ul style="list-style-type: none"> • National Malaria forum: NMCP: Oct 2014 • Data quality audit trainings for malaria endemic counties: April 2016 • Malaria surveillance trainings: NMCP: Feb 2016 • National dissemination meeting on quality of routine malaria data: August 2016

c) Interviews

Following the completion of the observations and to add depth to the data that I had collected from these observations and document reviews, I conducted formal interviews with frontline staff, sub-county managers, and national managers. Since I had gathered a considerable amount of information from observations, document reviews, and repeated informal interviews, I specifically sought to interview participants who I perceived had rich information about the major themes that had emerged during this study (Palinkas, Horwitz et al. 2015). In addition to the general issues that I was interested in (table 4.4), I used the audit data and/or observation notes to guide discussions on context specific issues that I had observed in these four facilities and sub-counties. The groups of people and the topics for each set of interviews are summarised in table 4.4.

Table 4.4 Breakdown of interviews, interview topics and participants interviewed

Level	Interview topics	Total	Participants
Health facility level	<ul style="list-style-type: none"> • tools and indicators • service delivery practices • recording practices • reporting practices • coping strategies • support systems for data collection • challenges to data collection • data quality issues • resources 	10	<ul style="list-style-type: none"> • Facility managers • Nurses • Laboratory technologists
Sub-county managers	<ul style="list-style-type: none"> • tools and indicators • resources available to support data collection • support systems for data collection • stock-out of tools and commodities • data uses • data quality issues • DHIS2 issues 	9	<ul style="list-style-type: none"> • Malaria coordinators • Health records and information officers • Disease surveillance coordinator • Laboratory coordinator • Pharmacy coordinator
National	<ul style="list-style-type: none"> • tools and indicators • policy context for health data collection • devolution influences on the process • stock-out of tools and commodities • DHIS2 technical issues 	5	<ul style="list-style-type: none"> • National Malaria Control Program • Health information systems • Disease surveillance
<p>Note: Apart from these formal interviews, I had several informal interviews with sub-county and health facility participants listed in this table.</p>			

At the health facility level these interviews took place inside quiet rooms, usually in the evening or over lunch time. Interviews were predominately conducted in English although occasionally we switched to Kiswahili. Interviews lasted for less than an hour. At sub country level, the majority of managers were interviewed in their offices, although three were interviewed in social places. These interviews were conducted in English and lasted for less than an hour. At national level the interviews were conducted in participants' offices. These interviews were conducted in English and also lasted less than an hour. Where consent was provided, I recorded these interviews on a digital recorder. All national managers (except one) preferred to be interviewed off the record.

Likewise, two sub-county managers also declined to be audio-recorded. I took field notes during such interviews.

d) Review of M&E TWG meeting minutes

In addition to conducting interviews, at the national level I also reviewed minutes of meetings held by the monitoring and evaluation (M&E) technical working group (TWG) which provides technical guidance on malaria surveillance, monitoring and evaluation (M&E) in the country. Membership of the working group consists of senior managers from the National Malaria Control Programme, malaria researchers, M&E experts, and representatives from various institutions involved in malaria control in Kenya. These meetings are held after every three months to discuss emerging issues around malaria surveillance, and M&E both locally and globally. They are also forums for disseminating results of various M&E activities conducted by the NMCP and its partners. I reviewed the minutes of meetings held between 1st December 2014 and 7th September 2016 (7 in total) that corresponded to this study's fieldwork period. Through these minutes, I was able to identify on-going debates and policy discussions around malaria surveillance and M&E in general in the country. Information obtained from these minutes helped me put into context, the meaning of practices and processes observed this study.

e) Preliminary feedback meetings

Following the initial analysis of the data collected through the observations and interviews at sub-county and facility levels, I held preliminary feedback meetings with health workers and sub-county managers in both sub-counties. Feedback meetings were held in the lake region sub-county on 11th and 13th May 2016, and in the coast region sub-county, on 15th and 17th August 2016 (table 4.5). The main aim of these feedback meetings was to share preliminary findings from this study, and through discussion of

findings to elicit further data and understanding. In the lake region sub-county, health workers and their managers attended the same meeting. In the coast region sub-county, separate meetings were held for health workers and their managers. Sub-county managers were charged with the responsibility of organizing these feedback meetings. Their decision on who they invited to these meetings were informed by staffing levels in each facility and on-going sub-county wide activities which also required health workers' time.

During these meetings I made a power point presentation of the key findings from the study. This was followed by a plenary discussion where health workers and their managers deliberated on these results. They sought explanations from me on specific issues which were not clear and also clarified a number of issues which I had not accurately captured in my presentation. I also asked specific questions. Apart from validating my study results, these meetings also enabled me to collect additional data which I factored into my analysis (Mays and Pope 2000).

Table 4.5 Breakdown of attendance to feedback meetings

Meeting no	Date	Location	Participants
Feedback 1	11 th May 2016	-Lake region	-9 health workers -9 managers
Feedback 2	13 th May 2016	-Lake region	-11 health workers -8 managers
Feedback 3	15 th August 2016	-Coast region	-11 sub-county managers
Feedback 4	17 th august 2016	-Coast region	-12 (clinical officers & nurses):
Note: Each health facility was represented by one health worker (a nurse or clinical officer). In the lake region sub-county, some of the managers who attended the first feedback meeting also attended the second meeting. I also held feedback meetings with health workers in all four facilities where I conducted this study.			

4.4 Data management and analysis

4.4.1 Data management

The data collected in this study include: pictures; textual information from interview transcripts, field notes and documents reviews; audio-files from interviews; and quantitative data from records review and audit. To manage these data, I saved them in specific folders (by data type and source) in my documents. For instance, pictures, field notes, and audit data from the lake region were saved in separate folders and then stored under a folder containing all material from the lake region sub-county. Quantitative data extracted from registers were entered into excel spreadsheets for analysis. All interviews were transcribed verbatim. Interview transcripts, diarised field notes, and personal reflections were all imported into Nvivo® 10 (QSR international) for data management and analysis.

4.4.2 Data analysis

Data analysis was undertaken concurrently with data collection. For example, the findings from the quantitative data analysis described below were used to elicit health workers' responses about data quality issues and recording practices during informal and formal interviews.

a) Analysing qualitative data

A large volume of qualitative data were collected during the course of this study. This included: interview transcripts, field notes, reflective notes, and fieldwork reports. I used a thematic analysis approach to analyse these data (Vaismoradi, Turunen et al. 2013). At the end of each round of field work, I wrote a detailed analytical field report which contained my description of people, artefacts, events, practices, processes, and interactions (Creswell 2012) as well as my thoughts and initial reactions/interpretations of what I had observed and heard (see box 4.2 for examples). My research assistant, SZ,

also submitted a similar report which we subsequently discussed. These detailed analytical reports were the first step in the analysis process. Apart from just summarizing key issues from the field, they enabled me to move a step further in the data analysis process; this step involved asking myself questions about the meanings of these events, actions, and artefacts in relation to the phenomena under study. Key emerging issues from each round of fieldwork were also discussed with my supervisors during routine supervisory meetings.

Box 4.2. Example of reflective notes from a round of field work

Artefacts

This book therefore plays a central role in the data transfer process. However, from experience, extracting data particularly diagnosis and treatment information from the record book is not always a straightforward process. It is at this stage where data quality can be compromised especially if the health worker's handwriting cannot be read and interpreted by those transferring the data into the OPD register...

People

Although he tells me how much he hates filling the registers and reporting forms, I still see him recording test results in patients' record books and the laboratory register (*the CO once wrote to him on a patient's record book that he should write test results legibly!*). He is quite technical in the way he records data in the laboratory register. For instance, instead of simply recording malaria test results as 'BS POSITIVE', he records this as '*TROPHOZITES OF PF SEEN 35/200 WBC*'. He does the same for other diseases. He performs both malaria RDTs and microscopy and jokes that the decision on whether to use RDT or microscopy depends on his 'mood'. My observation is that he tends to use RDTs when the workload is high...

Practices

In this facility, all first visit ANC mothers are tested for malaria as part of the ANC profile tests. Malaria tests conducted as part of the ANC profile tests are added to the total number of malaria tests done at the end of each month and reported as the '*total number of malaria tests done*'. This increases the denominator when calculating the *percentage of diagnosed malaria cases that received a parasitological test*. It is not clear to me whether the requirement that all mothers coming for the first ANC visits should be tested for malaria is national or county policy requirement, or a unique practice to this facility...

Throughout the fieldwork period, I carefully read through my field notes, analytic reports and interviews transcripts to familiarize myself with the dataset. I made notes about the pertinent themes that were central to this study that were emerging from field notes and interview transcripts. I also began to develop an initial coding framework which contained a list of key themes that were emerging from the data. Each code in the framework was assigned a label based on my understanding and interpretation of the text. I constantly reviewed this coding framework. As new data were collected and new themes emerged, I added them to the coding framework, renamed existing ones, and deleted or merged others. This was an iterative process that happened throughout the fieldwork. The final coding framework was developed at the end of the field data collection process (appendix 4). I used the final coding framework to code the entire dataset. The coding process involved reading through the transcripts, field notes and analytic reports, assigning specific codes to corresponding sections of the text, and aggregating these texts into specific themes. Sections of text that did not fit within the coding framework were coded as ‘free nodes’ (i.e. assigned other labels) in Nvivo 10. Recurrent nodes classified as ‘free nodes’ were eventually included in the main coding framework. Sections of texts that were not relevant to the study objectives were not coded. The final step in the data analysis process involved looking for patterns and relationships between themes and sub-themes and relating these to my conceptual framework and with the wider literature that formed the background of this study (Pope, Ziebland et al. 2000).

b) Analysing quantitative data

Quantitative data obtained from records review were entered into Excel spreadsheets. No statistical tests were employed in analysing these data. Analysis was undertaken in a series of steps. First, I used patients OPD numbers to compare the daily records in the outpatient and AL/RDT registers to find out if all confirmed malaria cases recorded in

outpatient registers were also captured in AL/RDT registers in the pharmacy. It was not possible to check if outpatient confirmed malaria cases captured in outpatient registers were tested and recorded as such in the laboratory register because in all four facilities, the patient numbering system used in the laboratory register was different from the numbering system used in AL/RDT and outpatient registers. The second step in analysing these data involved aggregating confirmed malaria cases recorded in each of these three registers on a daily basis and comparing the totals to assess if these data were consistent among the three service delivery areas. For the purposes of this thesis, I restricted this analysis to the month of January 2015 when I began fieldwork. January falls outside the peak transmission season that occurs during the short rainfall season (between October and December). As noted previously, my aim was not to quantify errors but to identify and explore their causes and reflect on their implications for the generation of routine malaria indicators. As such, one month's equivalent of data was considered to be an adequate representation of the key issues around routine malaria data generation in these four facilities.

I also reviewed and compared the data for the two tracer indicators captured in the monthly paper report forms at the health facility with the equivalent data fields in the DHIS2. This was achieved by entering the data into an excel spread sheet in two columns and comparing the columns. In the first column, I entered the data from the paper report (obtained from the health facility or the sub-county health records office) and in the second, I entered data for the same months that I had downloaded from the DHIS2. I made notes on cases where data were available in the DHIS2, but was unavailable in the paper reports and vice versa. I also noted cases where values entered in the DHIS2 were inconsistent with data recorded in paper reports.

4.5 Ethical considerations

The protocol for this study was reviewed and approved by the KEMRI Scientific Steering Committee and the KEMRI Ethics Review board before the study commenced (appendix 5). Before I started data collection I held meetings with key stakeholders at various levels to brief them about the study and seek their permission to conduct the study at the selected sites. At the national level, I held meetings with senior managers in the National Malaria Control Programme and in the Health Information Systems (HIS) Department of the Ministry of Health. During these meetings with senior national managers, it became apparent that all health data collection functions (including malaria monitoring and evaluation) had been devolved to county governments. These national managers therefore advised me to engage directly with county departments of health. At the county level, I held meetings with county health management teams. I briefed them about the study and sought their permission to conduct the study in their counties. Once permission to conduct the study was granted, I held briefing meetings with the sub-county management teams to also explain to them the purpose of my study. In the coast region sub-county, a colleague working in the learning site project introduced me to the sub-county health management teams. In the lake region, the responsible county manager introduced me to the sub-county health management team. I also sought sub-county and county managers' permission to visit the four selected health facilities. In the coast region, a colleague working with the learning site project accompanied me to these introductory meetings. In the lake region, the sub-county assigned me a staff member who was working at the sub-county health records office to take me to the two health facilities for introductions.

In all four facilities, I introduced myself, briefed health workers about the study, and took them through study procedures. I also gave them copies of study information sheets (appendix 6). Verbal consent to conduct observations at the sub-county health records office and at various service delivery areas in the health facilities was individually

sought from all participants working in these areas. All participants were informed that their participation in the study was entirely voluntary and that they were free to decline to be observed or interviewed without any consequences. In addition, I obtained verbal consent from managers at the health facility and sub-county level to review various documents. Individual written consent was sought from all participants who were interviewed. None of the staff working in any of the four facilities and the two sub-county health records offices declined to take part in the study. Interviews were only audio recorded if participants provided written consent through signing the informed consent form. I took notes where participants were unwilling to be audio recorded or to sign informed consent forms. To ensure anonymity, the names of the two sub-counties and the four health facilities that were included in this study have not been reported in this thesis. The four facilities are simply referred to as facility A, B, C, and D. The two sub-counties are referred to by their location (i.e. lake region sub-county and coast region sub-county). Quotes used in the results sections have also been anonymized.

To ensure safety of documents and other materials used in this study, all original documents used in this study are stored in a secure locker at the KWTRP and are only accessible to concerned researchers. In addition, audio files, transcripts, and field notes have been stored in password protected computers.

4.6 Reflexivity

I designed this study, collected the data with the help of SZ, analysed the data, and interpreted its findings. In an ethnographic approach, the researcher plays a central role in the data generation process, bringing their own experiences to bear on the questions asked, the practices observed and the data reviewed. As such, it is imperative that I reflect on how my personal biases and experiences may have shaped the overall research process (Milne and Oberle 2005, Creswell 2012). Furthermore, my own presence in ‘the

field' and that of SZ creates its own influences on participant perceptions and practices. Being aware of these biases and effects and actively reflecting on their influences is a process that has been termed *reflexivity* - an activity that is an integral part of any qualitative research (Mays and Pope 2000, Milne and Oberle 2005).

Throughout the fieldwork period, I wrote my own reflections of my experiences, personal feelings about various events that I observed, and the ethical dilemmas that I faced. My research assistant also provided me with regular updates about her field experiences. My status as a KEMRI employee, a well-known government parastatal that was conducting several studies in the two sub-counties generally facilitated my access to the study sites but also caused some confusion. In the lake region county for instance, it took health workers and their managers a while to understand that I was not affiliated to the local research centre (KEMRI-CDC). There were a few instances when people asked me to help them secure job opportunities at KEMRI (in reference to the local research institute). My research assistant was also asked by some of the volunteers working at the sub-county health records offices to help them secure employment at the KWTRP. Because of my research interest in malaria, health workers and their managers at times asked me to clarify certain policy positions. For instance, one sub-county manager asked me to explain to him how he was supposed to calculate *malaria test positivity rate*. He was unsure whether to use malaria microscopy or RDT test results. While I could not give a straight answer to such questions, the discussions we had were always illuminating and shaped my views. My research assistant was also asked to fix various computing issues, including in other sub-county offices, or was asked by other sub-county managers to help in preparing reports.

I am a social scientist by training. However, because of my association with KEMRI, a medical research institute, health workers in all four facilities perceived that I had some clinical training. In all four facilities, I was fondly referred to as '*daktari*' (Kiswahili

word for doctor). I was asked to attend to outpatients or conduct malaria RDT tests when laboratory technologists were away or if workload was heavy. I politely declined and explained to these health workers that I was not a clinician, although some of them misinterpreted this to mean that I was unwilling to help. My research assistant was also asked to help in conducting HIV tests in antenatal care clinics. She politely declined and explained to the nurse in this facility that she was not a trained VCT counsellor. It was always unsettling to see patients wait for over four hours in some cases to be attended when only one nurse was left on duty yet I could do little to help. There were a few instances when some patients asked me why I was 'just sitting there' yet they were waiting to be served. Such uncomfortable experiences may have influenced my interpretation of certain themes that emerged during this study.

In one facility, a health worker used my presence in the facility to try to change the behaviour of a staff member who had a drinking problem and often came to work late. They told him that I had specifically been sent to monitor him so he needed to be on his best behaviour. It worked for them briefly but as I interacted more with the laboratory technologist and my research activities became clearer to him, he went back to his old ways. The facility manager asked me to speak to him as a friend. I did not.

We began fieldwork by auditing records in each of the four facilities. This involved asking health workers to clarify their recording or service delivery practices. Initially, this was misinterpreted to mean that we were auditing facility records to assess if they were conforming to recommended practices and government policies. As a result, health workers may not have given us entirely accurate responses to our questions which they perceived we would reveal to their managers. Our close working relationship and association with the sub-county managers reinforced such fears. For example, it was not unusual for facility managers or other health workers from the four health facilities to find us at the sub-county health records office while submitting their monthly reports.

However, we constantly reminded them that our main aim of auditing their records and asking questions was purely driven by the need to answer our research questions, and that information they provided would not be shared with their managers. These concerns diminished over time as health workers became used to our presence in their facilities and trusting relationships developed. They involved us in their social activities both within and outside the health facility. In the lake region, health workers openly expressed their discontent about their managers and other activities, in a few instances asking me to 'go tell them [their managers] about this and that...' I became deeply embedded in the daily lives of health workers in these four facilities.

My gender also had an influence on my interactions with staff working in these four facilities. While I interacted with everyone in these four facilities, I spent more time with the male staff who were working in these four facilities both within and outside the health facilities. As such, their perspectives may have dominated my understanding and interpretation of events. Similarly, my research assistant spent more time with the female nurses. As a female, staff did not mind her presence inside the ANC clinic when they were performing various pregnancy related procedures, an issue that I struggled with myself. This may have given her more insight on IPTp data recording practices inside ANC clinics.

I also encountered various ethical dilemmas. For instance, when a pregnant woman passed on in one of the four facilities due to what was widely acknowledged as negligence by the health worker who handled the case, health workers in this facility had to find a common ground of absolving their colleague from blame by developing a common narrative (which was false) and manipulating their records to support their narrative. I was aware of all these events. This case attracted a lot of attention from the community and the sub-county health management team. I was not sure whether to side with health workers in their false narrative (who considered me as one of them) or with the

community (who wanted to know the truth about what had happened) or sub-county managers (who also viewed me as their ‘eye’ in the field). My research assistant also witnessed cases where a casual staff working in one of the facilities sold medicines to patients although this was against government policy. She was unsure whether to report this to the facility in charge. In one instance, while manning outpatient registration desks, two school-going children came for outpatient consultation but did not have the US\$0.2 registration fee. I consulted the facility manager who asked me to ask them to go back home and bring the registration fee. They went back home and left their record books at the registration desk. They never returned. Their patient records books constantly reminded me of this event. I asked myself what happened to them. Did they ever get help? Should I have paid for them? There were also a few instances in the outpatient registration desk when records were unclearly written in patient record books, or were missing altogether. When I consulted support staff who were responsible for recording data in these registers, they asked me to ‘*come up with something*’ to write or ‘*came up with that something themselves*’ and asked me to record it.

4.7 Chapter summary

I began this chapter by describing the broader malaria context and Kenya’s health system and subsequently, described the two malaria endemic counties where the four health facilities and two sub-county health records offices where I conducted this study were located. I then described my conceptual framework which was adapted from the works of others and was informed by my literature review. In this study I adopted a qualitative descriptive approach, using an ethnographic approach to data collection which included participants and non-participant observations, document reviews, and interviews. I used a thematic approach to analyse these data and a pragmatic interpretative framework to interpret the findings of this study. I have concluded this chapter by reflecting on my positionality in the original research process. In the next chapters, I present the findings of this study.

5 RESULTS 1: THE STUDY SITES: THE CONTEXT FOR RECORDING AND REPORTING PRACTICES

5.1 Introduction

In chapter 3, I provided an overview of the data collection registers, reporting forms, and support systems designed for data collection and data entry into the DHIS2; the source of routine health information in Kenya. This chapter provides a brief description of the background in which the process is realised; a description of the context of health data collection and reporting in the four study facilities and two sub-county health records offices where this study took place. The chapter is divided into five sections:

- Section 5.2 provides an overview of facility characteristics (infrastructure, staffing, roles of staff, staff capacities and workload, and sources of finances).
- In section 5.3 I report on the data collection and reporting tools which are in use in study facilities.
- Section 5.4 focuses on a description of how service delivery is organized in the four study facilities with a specific focus on the outpatient, ANC and laboratory visit processes.
- Section 5.5 provides a description of the sub-county health records office with a focus on staffing, resources available to support data entry, data entry process into the DHIS2, and support systems for data collection.
- Section 5.6. provides a summary of the chapter.

5.2 Description of study facilities

5.2.1 *General characteristics*

For the purposes of this thesis, the four facilities are referred to as facility A, B, C and D (figures 5.1 -5.4). Facility A and D are located in the coast region sub-county, and B and C in the lake region sub-county. Facilities B, C and D are situated in rural areas, less than 25 kilometres from the main referral hospitals where the sub-county health

offices are located. Due to unreliable public transport networks, health workers in these three facilities rely mainly on motorcycle taxis to access the sub-county offices. By contrast, facility A is located in a busy urban centre, about 2 kilometres from the main sub-county referral hospital. A general description of the four facilities are provided in figures 5.1-5.4 below.



Figure 5.1 Facility A

This is the largest health facility. Its classified as a health centre. It has two large buildings. Outpatient consultation rooms, registration desk, laboratory, pharmacy, HIV/AIDS and child welfare clinics are all located in the first building shown in the picture. ANC clinic and maternity ward are located in the second building that was recently renovated by an international NGO. The facility has running tap water. It provides inpatient maternity care on a 24-hour basis.



Figure 5.2 Facility B

The building shown in the picture is the HIV/AIDS clinic (patient support centre) constructed by an NGO. Due to shortage of rooms in this facility, outpatient consultation services are provided from this clinic. The pharmacy is located in the same building. The laboratory, and MCH clinics are all located in the second building. This facility relies mainly on rain water or water vendors. It provides inpatient maternity care on a 24-hour basis.



Figure 5.3 Facility C

This facility has five separate blocks. The first one is the HIV/AIDS clinic. Outpatient consultation clinics, laboratory, and pharmacy are located in the second building. Outpatient registers are located inside the main consultation clinic. ANC services are provided from a separate building. The laboratory is quite small and disorganized. It is also under resourced and lacks the most basic equipment such as a laboratory stool. It relies on a borehole for its water supply. Although classified as a dispensary, it provides 24-hour inpatient maternity care and emergency outpatient care.



Figure 5.4 Facility D

There are two main buildings in the facility. The outpatient consultation clinic, pharmacy, and MCH clinic are located in the first building. Due to shortage of rooms, ANC services are provided from the outpatient consultation room or child welfare clinic. The laboratory is located in a second building which was in a derelict state at the start of field work (leaking taps, no electricity). It does not provide emergency outpatient or maternity care.

5.2.2 Workload

Table 5.1 shows each facility's monthly workload data on selected service delivery indicators in 2015. Generally, facility A is the busiest. It has the highest number of

outpatient and ANC attendances in a month. It also conducts the highest number of routine laboratory tests. There are more outpatient confirmed malaria cases in facility B & C which are located in the lake region sub-county. This is consistent with results of a recently concluded malaria indicator survey which shows that malaria parasite prevalence is highest in the lake region (National Malaria Control Program 2016). Facility D administered the least number of IPTp doses in a month in 2015. This was attributed to a severe stock out of SP at this facility that lasted for close to 8 months. The remaining three facilities also experienced partial stock-outs of SP which was a nation-wide problem at the time of this study (National Malaria Control Program 2016).

Table 5.1 Facility workload on selected indicators

Average monthly workload 2015	A	B	C	D
Outpatient attendance per month	1,953	882	1,169	571
Outpatient confirmed malaria cases	39	314	475	18
Total ANC attendance per month	328	67	91	70
Clients given IPT2 dose	94	13	16	2
Laboratory tests per month	1333	674	669	-
<i>Facility D laboratory data for 2015 was not available in the DHIS2</i>				
Source: DHIS2. https://hiskenya.org/dhis-web-commons/security/login.action				

5.2.3 Sources of finances

All four facilities depend mainly on government funding to finance their operations. Despite the abolition of user fees in 2013 (Nyikuri, Tsofa et al. 2015), all four facilities still collect user fees on various services. For example, in facility D, all outpatients are required to pay about US \$0.2 for each outpatient visit. Laboratory tests are also offered at a fee in all four facilities. HIV, TB and malaria tests are offered free of charge (although in facility A & B, patients pay US \$0.3 for malaria tests which is waived for those who cannot afford). All the four facilities also sell patients record books at a cost of \$0.1 (in facility B, C & D); and at US \$0.5 (in facility A). Facility A & D receive a substantial amount of funding from a subsidized voucher programme (known as Output-Based Aid - OBA) that is implemented by the national government in collaboration with

a development partner. Under this scheme, facilities are reimbursed US \$7 for each first antenatal care visit, US \$1 for every follow up ANC visit, US \$15 per delivery and US \$20 for family planning services. There is significant paper work involved in filing these claims. Nonetheless, OBA funds provide a critical source of revenue for these two facilities as facility A manger told me:

“If that [OBA voucher] programme dies, we also die. It is what we use to pay water, electricity, pay casuals, we buy furniture, we buy medical equipment...”

Facility manager, FA

5.2.4 Leadership

Managers of frontline health facilities (dispensaries and health centres) are commonly referred to as ‘*facility-in-charges*’. In this thesis, I refer to them as ‘*facility managers*’. Facility managers are typically the most senior member of the clinical staff in a given facility. Apart from performing administrative duties (e.g. planning and budgeting, hiring casual staff, organizing workflows and duty rosters, and fulfilling various administrative accountability requirements), they are also involved in normal clinical duties (Nyikuri, Tsofa et al. 2015). According to government guidelines, health centres are supposed to be headed by clinical officers or a medical officer, and dispensaries by nursing officers (Government of Kenya 2016). However, facility B which is classified as a health centre is managed by a nursing officer. There is no government employed clinical officer in this facility. Facility A (a health centre) is managed by a clinical officer. Facilities C and D are managed by nursing officers.

5.2.5 Staffing

Nursing officers are the main cadre of staff found in all four facilities (table 5.2). All nurses working in these four facilities are employed by the county government and have worked in these facilities for a minimum of two years. Government employed clinical

officers are only present in facility A. The two clinical officers in facilities B & C are employed by HAWI NGO which also employs other cadres of staff (health records and information officers, peer educators and VCT counsellors). Although these staff are formally employed by the NGO, they are required to operate under existing county government structures and participate in routine service delivery. Only one laboratory technologist in facility A is formally employed by the county government. The rest are employed by health facility management committees as casuals. Health facility management committees are responsible for overall management of health facilities. This committee comprises of selected representatives from the surrounding community. They are responsible for preparing facility's annual operations and quarterly implementation plans (Waweru, Goodman et al. 2015). Another category of staff found in all four facilities are support staff who also work as casuals. They comprise: nurse aids (only in facility A); data clerks; and dispensers. Their roles include: registering patients, taking height and weight measurements, recording data in outpatient registers, and dispensing medicines. The majority of these staff have worked in these facilities for over five years.

Table 5.2 Distribution of staff in four study facilities

Cadre of staff	Facility A	Facility B	Facility C	Facility D
Clinical Officer	2	1*	1*	0
Nursing Officer	4	3	4	2
Laboratory Technologist	3	1	1	1
Community Health Extension Worker	1	1	1	1
VCT Counsellor	2*	1*	1*	1*
Support staff	7	2	3	3
Health Records Officers	0	1*	1*	0
Peer Educators	0	2*	2*	0
* NGO employed staff. The table doesn't include other casual staff such as cleaners, groundsmen and watchmen.				

5.2.6 Staff capacities

Apart from casuals, all the remaining cadres of staff are, in general, professional staff with formal health training. However, two of the laboratory technologists (in facilities A & D) were reportedly unqualified although they conducted routine tests, which informed clinical decisions, on a daily basis.

“Mathayo [not real name] hasn’t studied laboratory [science]. He learnt it on the job. And he conducts even sputum test. How he does it I don’t know.”

Facility manager, FA

When I asked the facility manager if he had doubts about the tests results of one these laboratory technologists, he retorted:

“How do I countercheck and I am not a lab tech. That is not my work. I found them here. So the day the county people [managers] will feel that they need to do proper work, they will come and do it themselves. I am not a QA [quality assurance] person” Facility manager, FA

Concerns about lack of formal training or qualifications were not the only issue that caused clinical staff to be concerned about the reliability of the laboratory tests (box 5.1). As described in box 5.1, in one facility, the conduct of the laboratory technician was also a cause for mistrust of results.

Box 5.1 Facility C Laboratory technologist

Yuanita, the laboratory technologist in one of the four facilities had a drinking problem which everyone in this facility recognized. Health workers had doubts about the quality of tests he conducted. He used a candle to dry malaria blood slides so as to hasten the process. From my observations, it took him less than 10 minutes to conduct malaria microscopy in some cases. Staff alleged that there were instances when he sent patients back to the OPD consultation rooms without indicating test results in these patients' record books. When asked about these, he would write diagnosis information without referring to the laboratory register. Despite their concerns about his capacity, they still relied on the results of tests he conducted to inform their clinical decisions. Yuanita unceremoniously resigned after a laboratory supervision visit that was sponsored by one of the NGOs operating in this area revealed non-compliance to laboratory standard operating procedures. One of the supervisors explained to me that the Field Stain he used to prepare blood slides was 'stale' and as such, could not give accurate results. Staff attributed his abrupt resignation to this supervision visit although he had previously mentioned to me that he was planning to quit to go back to school. The sub-county laboratory manager later explained to me that Yuanita was not a certified laboratory technologist.

None of the support staff working in these four facilities had any formal health training, a fact that they also acknowledged (box 5.2). Although their roles are mainly auxiliary, there were instances when I observed these staff taking on more clinical duties such as giving injections to patients without supervision.

Box 5.2 Support staff in facility B

Norah, the dispenser in facility C had worked in this facility for over 5 years. Her initial roles were to sell patient record books but was later expanded to include recording data in outpatient registers to reduce workload for the nurse who was alone in this facility. She told me that she had never attended any training on health data collection or dispensing. She had learned her skills on the job. Mark, the data clerk in the same facility used to audit facility accounts. He was brought on board to help Norah who was dispensing medicines and at the same time recording data in outpatient registers. Norah mainly worked in the pharmacy from where she dispensed medicines, issued record books to patients, and also collected laboratory fees. If Mark was away, Norah assumed his roles and vice versa. He had mastered both roles over the three years that he had worked in this facility.

5.2.7 Roles of staff in service delivery

Typically, clinical services in all four facilities are primarily provided by clinical officers, nurses and laboratory technologists. Throughout the study period, I observed a lot of role sharing and cooperation between various cadres of staff working in all four facilities (see box 5.3). For instance, the HAWI employed clinical officers in facility B & C regularly assist government employed nurses by conducting outpatient consultations. In facility B, these consultations are carried out in the HIV/AIDS consultation clinic while in facility C, the clinical officer normally undertakes consultations in the outpatient consultation room. VCT counsellors in facilities B, C & D also conduct malaria tests in the absence of laboratory technologists.

Box 5.3 Role sharing in facility D

Facility D had only two government employed nurses. On a number of occasions, only one nurse was on duty. The second nurse was constantly away from the facility on both personal and official engagements. Once left alone, the nurse on duty provided outpatient consultations, immunizations, and family planning services among other services. She also performed other administrative duties. To manage the workload, the VCT counsellor occasionally stepped in and provided outpatient consultations while the nurse was engaged in other service delivery areas (he was not qualified to provide these services). While he did this, a volunteer conducted HIV tests in the VCT clinic. The data clerk, with the support of the OBA data clerk assisted the nurse in provision of immunizations services. The dispenser assumed the roles of the data clerk in such instances. If there were no patients in the laboratory, the laboratory technologist dispensed drugs in the pharmacy. There was a lot of teamwork in this facility.

5.2.8 Roles of staff in data collection and reporting

Virtually all staff in all four facilities are involved in one way or the other in health data collection and reporting. For example, data clerks are responsible for recording data in outpatient registers in facilities A, B & D. Dispensers (also casual staff) are responsible for data collection in pharmacies. Laboratory technologists, nurses, and clinical officers are responsible for recording data in various registers located across various service delivery areas whenever they provide a particular service. Likewise, reporting responsibilities are also shared between various cadres of staff working in all four facilities.

5.3 Data collection and reporting tools in use

a) Programme specific tools

Standard ministry of health registers and reporting tools were described in chapter 3. In all four facilities, in addition to the 14 standard registers, and 16 reporting tools, there are additional registers which are used to record data for specific disease programmes (mainly vertically funded disease programmes such as HIV/AIDS, malaria and TB).

Examples of programme specific registers and reporting tools found all four facilities are shown in table 5.3.

Table 5.3 Programme specific registers and reporting tools

Programme specific registers	Programme specific reporting tools
<u>Malaria</u> <ul style="list-style-type: none"> • AL/RDT register • Net Pack register <u>HIV/AIDS</u> <ul style="list-style-type: none"> • HIV Testing & Counselling register • ART register • Pre- ART register • Nutrition & HIV/AIDS register • Defaulter Tracing register • HIV Care & Treatment register • Daily Activity Register for CCC • HIV Exposed Infants (HEI) register <u>TB programme</u> <ul style="list-style-type: none"> • TB register 	<u>Malaria</u> <ul style="list-style-type: none"> • Malaria Commodities Form • Net pack reporting form <u>HIV/AIDS</u> <ul style="list-style-type: none"> • HEI Cohort Summary Report • Facility Consumption Data Request (FCDR) for Lab Commodities • Nutrition Services • FCDR: Nutrition <u>TB</u> <ul style="list-style-type: none"> • TB Case findings • TB FCDR
Note: This list is not exhaustive. Depending on services provided at a particular facility, there may be additional registers that are also completed at the health facility	

b) Improvised tools

During this study, there was a severe shortage of the standard registers and reporting tools in all four facilities. A review of facility records showed that some of the tools had been out of stock for over a year.

“Leave alone the lab register [also out of stock]. The ANC register is getting filled up. I had gone there [sub-county office] and they told me they don’t have. We don’t know how we are going to get registers.” Facility manager, FC

In the absence of standard registers, health workers use various improvised registers to record service delivery data. For example, inpatient registers were used in place of the standard laboratory register in facility B and as the outpatient register in facility C. In facility A, the facility manager used funds received from the OBA voucher programme to print modified versions of the laboratory and pharmacy registers.

None of the four facilities has a specific room for storing completed registers. This makes it difficult to locate completed registers as these are usually strewn across the various service delivery areas. Although all facilities file completed copies of their monthly reporting tools, as is the case with registers, these are not stored in one place which also makes data retrieval difficult. During the data review for each facility, I was unable to locate some of these documents.

5.4 Organization of service delivery

5.4.1 General outpatient flow process

Outpatient consultation services are mainly provided during official working hours (weekdays, 8am to 5pm) in each of the four facilities. However, in facility B, outpatient consultations are also provided for half a day on Saturdays, and on an emergency basis. In each facility, there are four main service delivery areas where patients seeking outpatient consultation services can report to: outpatient clinics; HIV/AIDS clinic; MCH clinic; or maternity/delivery rooms. If patients visiting HIV/AIDS and MCH clinics present with other conditions, they are referred to the laboratory for tests. These patients can also be treated clinically. If prescribed medicines are available in the facility, they are referred to the pharmacy (or advised to purchase these treatments elsewhere). Those not presenting with any other condition are seen in respective clinics after which they exit the facility. The typical outpatient flow process in the four facilities is shown in figure 5.5.

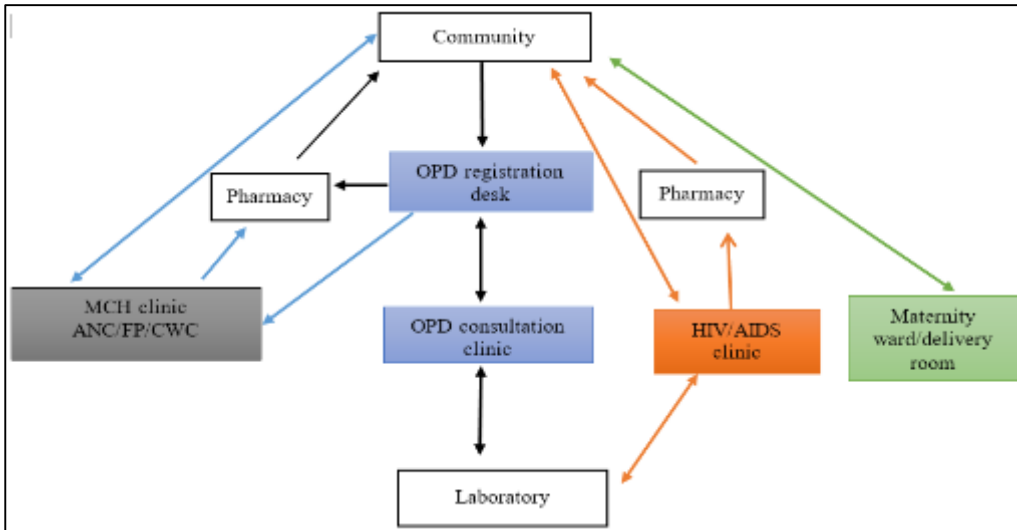


Figure 5.5 Ideal patient/client flow process

All patients visiting the outpatient department in the four facilities must have patient record books (also referred to as passbooks - box 5.4). If visiting the facility for the first time, the patient is required to purchase facility branded record books from the facility. Patients coming for repeat visits should bring along patient record books issued during the previous visits. Because of its central role in capturing diagnosis and treatment information and data transfer between service delivery areas (outpatient, laboratory, and pharmacy), no patient can be attended to in any of these four facilities without these patient record books.

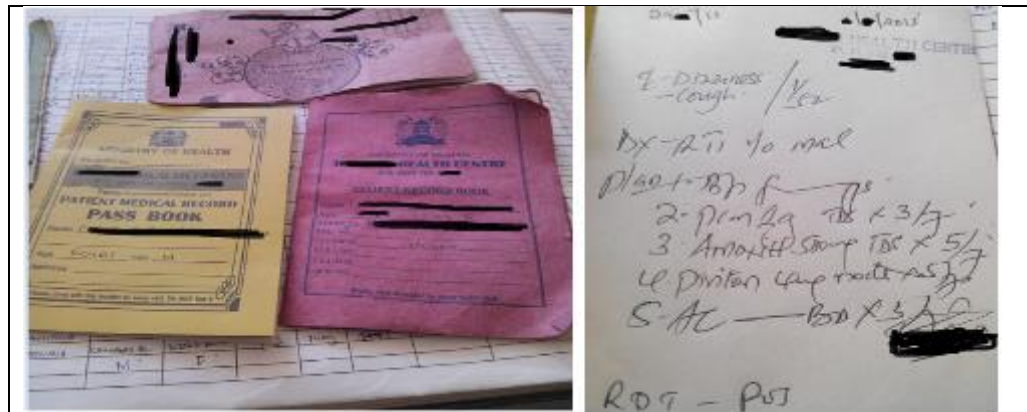


Figure 5.6 Patients record books

Patient record books are used to record patients' outpatient visit number (OPD number), address, age, gender, provisional and final diagnosis and treatment information provided during the visit. This book is the main channel of communication for health workers in different service delivery areas (OPD, laboratory, and pharmacy).

In facility D, patients cannot be issued with drugs in the pharmacy if OPD visit numbers are not indicated in their patient record books. This is used as a local data quality control strategy (Box 5.5).

Box 5.5 Outpatient data recording in facility D

On my first day at the outpatient registration desk, Agatha, the data clerk showed me how to record data in the outpatient (OPD) registers. However, she did not mention to me that I was supposed to write patients' OPD numbers on their record books before referring them to the pharmacy. As a result, I only transferred patients details from their record books into the OPD registers then sent them to the pharmacy to pick their medicines. Leonida, the dispenser declined to issue drugs to these patients because their record books lacked OPD visit numbers which served as proof that their details had been entered into the Outpatient register. She sent all of them back to the registration desk with instructions that I indicate their visit numbers in their record books. Leonida later on explained to me that in this facility, patients are only issued with drugs if their OPD visit numbers are recorded in the record books. She explained that this practice minimised cases where patients left the facility without their details being recorded in the OPD registers.

5.4.2 *Laboratory test process*

The laboratory process is quite similar in all four facilities. See Box 5.6 for the summary of the process.

Box 5.6 The laboratory process

1. Patients are referred to the laboratory from outpatient clinics (or other clinics) by the nurse or clinical officer.
2. They are required to pay the required laboratory fees to the casual staff at the outpatient registration desk (in facilities B, C & D) & at the cash office (in facility A)
3. Once in the laboratory, they hand over their record books to the lab tech who instructs them to wait outside the laboratory.
4. The lab tech reviews patients' record books to determine the type of test requested by the nurse/clinical officer.
5. Patients are then called inside one by one.
6. If malaria test is requested, the lab tech takes a finger prick blood sample which is used to prepare a blood smear for microscopy. Testing can also be done using RDTs.
7. The lab tech labels each slide/RDT with the patient's identifier (e.g. lab visit number or name).
8. The lab tech examines the blood slide/ reads the results of the RDT
9. The lab tech records test results in the laboratory register as well as patient's record books then hand over their record books to them
10. Patients are then referred back to outpatient consultation clinics or other clinics for prescription which is issued by the data clerk.

5.4.3 *Antenatal care visit process*

ANC services are provided mainly by nurses or clinical officers on a daily basis in facilities A, B and C and once a week in facility D due to shortage of staff. In facilities B & C, first visit ANC women are required to pay about US \$1 for ANC profile tests. The costs of ANC profile tests in facilities A & D are covered by the OBA voucher programme. All pregnant women visiting these facilities for the first ANC visit are issued with Mother Child Health (MCH) booklets free of charge where their antenatal profile and details of each services provided throughout the pregnancy period are recorded. If the standard MCH booklet is out of stock, the women are instructed to purchase exercise books which are adapted and used for the same purpose. The ANC visit process is similar in all four facilities (box 5.7).

Box 5.7. The ANC visit process for new ANC visits

1. In facilities A, B, & C, pregnant women coming for ANC services are required to proceed to the ANC clinic registration desk where they are registered by casual staff. In facility D, they report to OPD registration desk.
2. First ANC visit women are issued with MCH booklets by casual staff
3. They are assigned new *ANC visit numbers* which are recorded in their MCH booklets by the casual staff alongside other demographic details
4. The casual staff takes the woman's height and weight measurements then refers them to the ANC consultation clinic (facilities A, B, C) or consultation clinic (facility D)
5. Inside the ANC clinic, the woman is attended to by the nurse who refers them to the laboratory for ANC profile tests
6. In facilities B & D, they are expected to pay required laboratory fees described above
7. Once in the laboratory, they are taken through the process described in box 5.6
8. Back in the ANC room, they are taken through routine pregnancy procedures by the nurse. Each procedure is documented in the antenatal care register (and MCH booklet where required) by the nurse as it is given

In the next section, I briefly describe the two sub-county health records offices where aggregated monthly reports from the four health facilities are submitted.

5.5 Sub-County Health Records and Information Office

As outlined in chapter 3, completed monthly reports should be forwarded to the sub-county health records offices where these data are collated and entered into the DHIS2. In both of counties in which this study took place, the sub-county health records and information offices are located within (sub)-county referral hospital grounds. In the coast region sub-county, this office is located in a tiny room which also serves as a store for completed monthly reports, new registers and reporting forms. The health records and information office in the lake region sub-county is much more spacious. It has a reception area, a store, data entry room, and an office for the sub-county health records officer who is the only government employed officer in this office. Figure 5.6 shows the two sub-county health records offices.



Figure 5.7 Sub-county health records offices

Left: coast region sub-county records office; right: lake region sub-county office

5.5.1 Staffing at the sub-county health records office

There are two health records and information officers in the coast region sub-county: the sub-county health records and information officer (SHRIO) and an assistant. In the lake region, there is only one health records and information officer; the SHRIO. In both sub-counties, there are volunteers (mainly young college graduates) who do most of the data entry into the DHIS2. Their roles are more evident in the lake region sub-county where they run the health records and information office, with one of them (a health records and information officer) assuming the unofficial position of the 'sub-county health records and information officer' due to persistent absence of the SHRIO from the office. She coordinates all data entry roles in the records office, and represents the SHRIO in meetings (occasionally in senior management meetings). Although they are not formally employed by the county government, they are paid allowances whenever they take part in sub-county wide activities such as support supervision visits and public health campaigns (in both sub-counties).

5.5.2 Resources for data entry into the DHIS2

There are two functional desktop computers in the coast region sub-county health records office. In the lake region sub-county, there are three computers donated by

HAWI (the NGO providing HIV/AIDS care and treatment) but none were functional at the time of this study, leaving the records office with no computer at all.

“There are no computers. They [volunteers entering data] go to the PSC [patient support centre]. Even the laptop that I use is a personal one. Even the one that one of the records officers has is a personal one.” Sub-county Manager, SCA

Access to the internet in the two offices is mainly through modems. In the lake region sub-county, HAWI provides the SHRIO with mobile airtime which is meant at supporting data entry. However, this rarely gets to the volunteers who do most of the data entry into the DHIS2. This is also the case in the coast region sub-county where the SHRIO is allocated some minimal amounts of money for purchasing airtime which occasionally, runs out before data entry is completed. On some occasions, staff entering data have to use their own resources to purchase mobile broadband. In both sub-counties, data entry staff regularly borrowed our modems when they ran out of airtime. In the coast region sub-county, another HIV/AIDS NGO helps with photocopying of HIV/AIDS related forms (when these are out of stock). Both HAWI and the coast HIV NGO rely heavily on the DHIS2 for data to support their M&E needs hence their interest in the process.

5.6 Summary

In this chapter, I have provided a description of the four study facilities and the two sub-county health records offices involved in the study. Human resource shortages are a problem both at the sub-county and health facility level, necessitating informal task shifting and role sharing in data collection and service delivery in general as a coping strategy. There are concerns from health workers about the capacity of some of the staff working in these four facilities. Nonetheless, these staff continue to take part in routine service delivery and data collection in all four facilities. In addition to the standard

registers and reporting tools listed in chapter 3, there are additional registers and reporting tools used to collect programme specific data present in all four facilities. At the sub-county health records offices there are inadequate resources for supporting data entry into the DHIS2.

Having provided a general overview of the context in which the health data collection and collation process occurs, I will now use the two tracer indicators defined in chapter 4 to describe in detail how data for constructing routine malaria indicators are generated and reported through the DHIS2 in these two sub-counties.

6 RESULTS 2: RECORDING AND REPORTING MALARIA DATA AT THE HEALTH FACILITY LEVEL: INTENTIONS VS REALITIES

6.1 Introduction

Chapter 5 set the context within which routine health data are collected and collated in the study sites; four health facilities and two sub-counties in Kenya. In this chapter I will describe the actual practices of data recording, reporting and entry into the DHIS2 for the two tracer indicators (described in 4.5.1) at these sites. For each of the data collection (register) and collation (reporting form) tools, employed for recording the information required for producing the tracer indicators I describe the ‘intentions’ (intended process) and realities (how it happens in practice). Innovations employed by health workers in response to some of the challenges observed are highlighted. The chapter is divided into three main sections:

- The first section, section 6.2, describes the daily recording practices for the two tracer indicators: 1. *Percentage of suspected malaria cases tested using a parasitological based test*; and 2. *The number of pregnant women who received IPTp2 in targeted counties*
- Section 6.3 contains a description of the monthly reporting practices at the four health facilities with a focus on the details of the reporting practices for the two tracer indicators
- Section 6.4 – provides a description of how monthly reports are submitted to the sub-county health records offices and eventually entered into the DHIS2 in both sub-counties.

6.2 Daily recording practices for the two tracer indicators

6.2.1 Tracer indicator 1: Recording the number of suspected malaria cases tested using a parasitological based test

According to national guidelines on malaria diagnosis and treatment, all suspected malaria cases presenting to a health facility should be tested for malaria and only those testing positive should be treated with recommended antimalarial (currently, Artemether Lumefantrine-AL for uncomplicated malaria) (Ministry of Health 2014). Malaria diagnosis can be undertaken using microscopy (where microscopy services are available), or RDTs (in facilities without laboratories). There are standard operating procedures for blood sample collection, sample processing, examination and reporting which laboratory technologists and other health workers conducting malaria tests are required to adhere to (Ministry of Health 2013, Ministry of Health 2014). The suspected malaria outpatient visit process follows the general outpatient visit process described in chapter 5 (5.4.1). The standard process is summarized in figure 6.1.

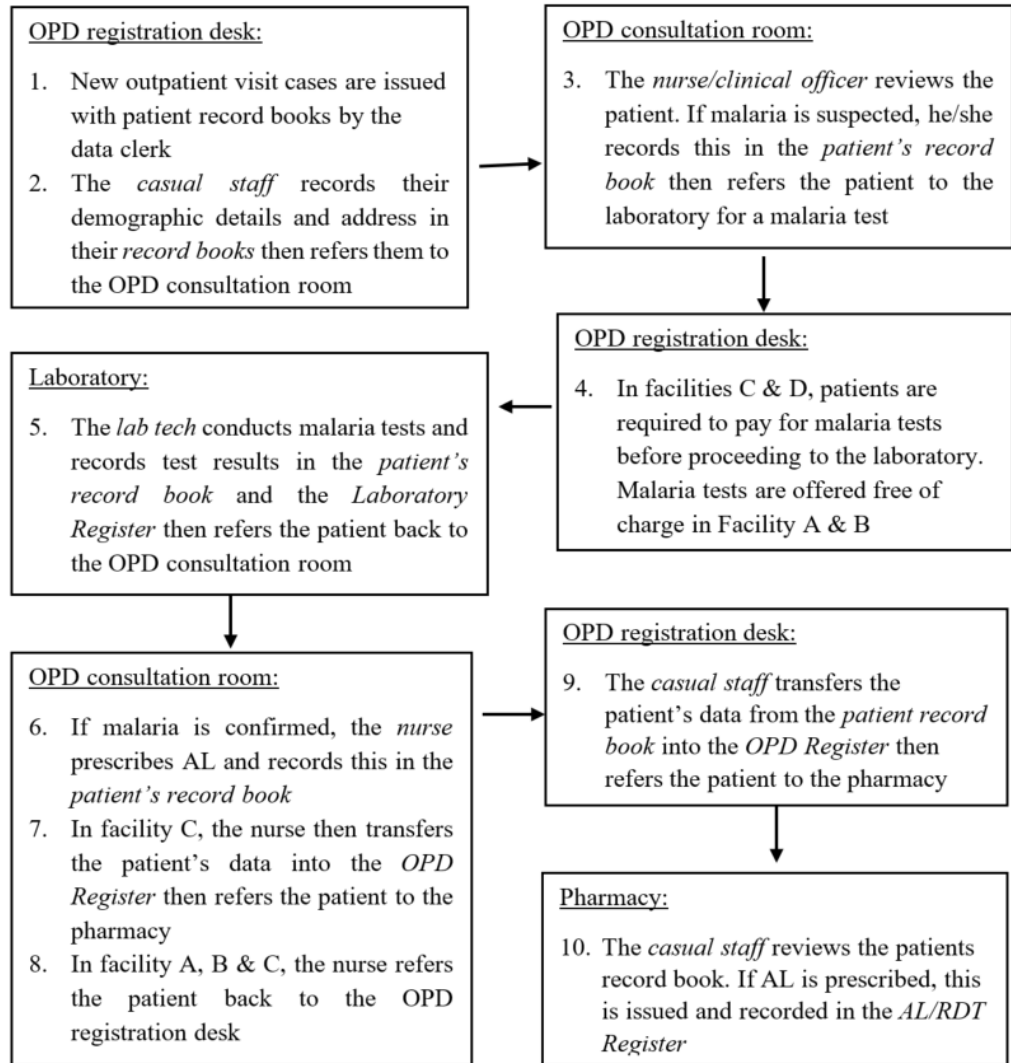


Figure 6.1 Malaria outpatient flow process and data recording

As the diagram illustrates, malaria tests should be undertaken in the laboratory. However, in practice, malaria RDT tests are often also conducted in other service delivery areas such as the VCT rooms (facility B & C), the HIV/AIDS consultation clinic (facility C & D) as well as in outpatient consultation room (facility B).

Producing this indicator requires that health workers keep accurate records of ‘*the number of all suspected malaria cases*’ and the ‘*number of all suspected malaria cases that receive a parasitological test*’; the denominator and numerators for calculating this indicator respectively (The Global Fund 2011). As shown in bold in figure 6.1, there are three registers that capture malaria diagnosis data at frontline health facilities. These

are: a) Outpatient registers (two versions: Under five and Over five); b) the Laboratory register; and c) the AL/RDT register. The processes of recording data in these registers are described below.

a) Outpatient Registers

In each health facility there should be two outpatient registers: i) Outpatient register for under five (204A) (figure 6.2-A); and ii) Outpatient register for over five (MOH 204B) (figure 6.2-B).

The structures of these outpatient registers are consistent with the WHO disease surveillance guidelines discussed in chapter 2 (2.4.2) (World Health Organization 2012). For instance, there are separate columns for recording ‘new visits’ (recorded under OPD no.) and ‘revisits’. Similarly, the two registers have separate columns for recording diagnosis and treatment information. As described in chapter 5, diagnosis information recorded in outpatient registers is usually obtained from patient record books (Box 5.4), after the results of the parasitological test (figure 6.1).

A: Outpatient Register Under Five																			
Date	OPD No.	CWC Number	Revisit	Full Names	Age	Sex	Village / Estate / Landmark	Telephone Number	Weight	Height	Temp	Danger signs	Duration of Illness	Diagnosis/ classification	Given: 1=ORS 2=Zinc 3=Vit A	HIV: 1=Counselled 2=Tested	HIV Status: 1=Known positive 2=Positive this visit 3=Negative 4=Unknown	Nutrition Status: 1=Nutrition education 2=Nutrition supplements	Treatment / Prescription Number
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T

B: Outpatient Register Over Five																	
Date	OPD No.	Re-visit	Full Names	Age in Years	Sex	Village / Estate / Landmark	Telephone Number	Weight	Height	Visual Acuity " RE(Right Eye) 'LE (Left Eye)	HIV: 1=Counselled 2=Tested	HIV Status: 1=Known positive 2=Positive this visit 3=Negative 4=Unknown	Nutrition Status: 1=Nutrition education 2=Nutrition supplements	Diagnoses	Treatment / Prescription Number		
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P		

Figure 6.2 Outpatient register: Under five & Over five

In the OPD, the malaria diagnosis data are copied from the patient record book into the 'diagnosis' column of the two registers where all diagnoses information are recorded. Instructions available in the two registers for recording data in this column state that: *'the provisional or final diagnosis from the clinician must be recorded in this column'*. That is, both clinical and parasitologically confirmed cases are recorded in the same diagnosis column. There are no instructions regarding how *clinical* and *confirmed* malaria cases are supposed to be distinguished in this column. In addition, these registers are not designed to record data on all *suspected malaria cases who are tested for malaria*. As such, it does not provide comprehensive data of all *suspected malaria cases* seen in outpatient clinics (i.e. total tested for malaria), an issue that health workers identified as a limitation of this register.

"There is no column in the outpatient register for recording suspected [clinical] malaria. You only have confirmed malaria although we have suspected malaria in the reporting tool". Health worker, feedback meeting, SCA

Similarly, the diagnosis column in the register is narrow which makes it difficult for health workers to include all information when a patient is diagnosed with multiple conditions (e.g. where malaria is diagnosed alongside respiratory tract infection). In response to these problems, health workers in all four facilities adopted local recording strategies which enabled them to navigate through these limitations.

In all four facilities, if malaria was diagnosed alongside other conditions (e.g. respiratory tract infections-RTI), health workers used their own abbreviations such as 'MAL/RTI'. In some cases, they squeezed in these information in the diagnosis column, or used more than one column to record data, an issue that presented challenges when compiling monthly reports. These practices varied within and between the four

facilities. In facility C, health workers used the comments section of the outpatient register to record ‘no test’ (if malaria was treated clinically); ‘RDT pos/Bs++’ (for confirmed malaria cases) or ‘RDT neg’ (for negative malaria cases). This elaborate recording strategy allowed them to capture data on ‘all suspected malaria cases’ seen in the facility. The facility manager explained that they adopted this recording strategy to enable them distinguish the two categories of malaria after a malaria supervision visit where managers put them on the spot to state whether malaria recorded in the register was clinical or confirmed. In facility B, a retrospective review of outpatient registers showed that health workers recorded clinical malaria cases as ‘cl. Malaria’ in the diagnosis column. No clinical malaria was recorded in the outpatient registers during fieldwork. In facility D, all malaria cases were simply recorded in the diagnosis column as ‘malaria’. The facility manager explained that in this facility, they rarely treated malaria clinically. In facility A, the data clerk used a red pen to record confirmed malaria cases in outpatient registers.

“It is meant to make it easier to count the data so that even if we left you with the book, we can explain to you that the red ones are the positive [confirmed malaria cases]” Health worker, FA- LT

Box 6.1 provides an illustration of recording practices in outpatient registers in the four facilities.

Box 6.1. OPD recording practices

Facility A

2	3	GE	Amoxicillin	N	N
2	3	Septicem	Amoxicillin	2	2
2	3	MALARIA	Amoxicillin	2	2
2	2	Gastritis	Amoxicillin	2	2

Confirmed malaria cases recorded using red pen in facility A

Facility B

ND	ND	cl mal.	Amoxicillin	NM	-
ND	ND	cl mal.	Amoxicillin	NM	-
ND	ND	RTI	Amoxicillin	NM	-
ND	ND	Ceftriaxone	Amoxicillin	NM	-

Clinical malaria cases recorded as 'cl malaria' in the diagnoses column of the OPD register.

Facility C

M	N	D = Dead	Referral	Remarks
-	-	-	-	mal
-	-	-	-	mal
-	-	-	-	mal
-	-	-	-	mal
-	-	-	-	Anaemia

Health workers use the 'remarks' column to indicate whether malaria cases treated were tested.

Facility D

		Malaria	Amoxicillin		

Malaria is simply recorded as 'malaria' in the diagnosis column

b) Outpatient tally sheets

Malaria diagnosis information is also supposed to be captured in outpatient morbidity tally sheets. Tally sheets should be used alongside outpatient morbidity registers. There are two outpatient morbidity tally sheets:

- i. Outpatient Morbidity Tally Sheets: (MOH 701A under five)
- ii. Outpatient Morbidity Tally Sheets (MOH 701B Over Five) (figure 6.3).

Ideally all of the diagnosis information recorded in outpatient registers should also be recorded in the tally sheets at the time of consultation. In contrast to outpatient registers, tally sheets allow health workers to separately record *clinical malaria and confirmed malaria* (in MOH 701A under five) and also *malaria in pregnancy* cases managed (in MOH 701B over five). To ensure accuracy in the compilation of outpatient morbidity reports, data recorded in these tally sheets should be transferred into outpatient morbidity reports (discussed below) on a daily basis, preferably at the end or beginning of each business day (Ministry of Health 2008).

DISEASES (New Cases Only)		DATE:			
1	Diarrhoea	00000	00000	00000	00000
2	Tuberculosis	00000	00000	00000	00000
3	Dysentery	00000	00000	00000	00000
4	Cholera	00000	00000	00000	00000
5	Meningococcal Meningitis	00000	00000	00000	00000
6	Tetanus	00000	00000	00000	00000
7	Poliomyelitis (AFP)	00000	00000	00000	00000
8	Chicken Pox	00000	00000	00000	00000
9	Measles	00000	00000	00000	00000
10	Infectious Hepatitis	00000	00000	00000	00000
11	Clinical Malaria	00000	00000	00000	00000
12	Confirmed Malaria	00000	00000	00000	00000
13	Malaria in pregnancy	00000	00000	00000	00000
14	Typhoid fever	00000	00000	00000	00000

Figure 6.3 Outpatient Morbidity Tally Sheet: Over Five Year

In practice, these tally sheets were only used in facility A. Health workers in the other three facilities perceived that these tally sheets: increased their workload; were difficult to implement due to the multiplicity of individuals involved in provision of outpatient consultation services; and their use contributed to confusion and data quality problems.

“We stopped using tally sheets because it [data recorded] was never the same with the [outpatient] register. When someone is in the mood, he will tally. When

he is not in the mood, he doesn't tally. So by the end of the day, that data will not tally. So we opted to use the register. So from that register is where we tally [extract data]". Health worker, FB-RO

c) Laboratory Register (MOH 240)

The laboratory register (MOH 240) is meant for recording data on all routine laboratory tests conducted at a particular health facility. The standard laboratory register in use at the time of this study had 26 columns where a range of information relating to each patients' demographics details, specimen, type of tests requested, and test outcome among other things were recorded (figure 6.4). The register also has separate columns for recording *outpatient/inpatient* visit number and laboratory *visit number*. According to standard guidelines, if malaria parasites are detected in a patient's blood by way of microscopy, laboratory technologists are required to report the parasite density and type of malaria parasites seen (reported as xxx number of parasites per 200 white blood cells-WBC) (Ministry of Health 2014). During malaria support supervision visits, managers are expected to assess whether health workers are adhering to this requirement (Ministry of Health 2013). However, there are no instructions for recording malaria parasite density in the register as recommended in standard guidelines, nor is there a separate column in the register for recording malaria parasite density information. If RDTs are used, test results should be recorded as RTD 'positive', 'negative' or 'invalid' (if test results are indeterminate) (Ministry of Health 2014). Malaria test results (confirmed and negative malaria cases) are recorded in the 'results' column where results of all other routine laboratory examinations are also recorded.

Date	OPD / IP / Ref. No.	Lab. No.	Re-visit No.	Full Names	Age in Years	Sex	Village / Estate / Landmark	Telephone Number	Clinical Diagnosis	Prior Treatment	Type of Specimen	Condition of the specimen
A	B	C	D	E	F	G	H	I	J	K	L	M

Investigation required	Date Sample collected	Date Sample received	Clinician Name	Date Sample Analysed	Results	Date Results dispatched	Amount Charged	Receipt Number	Other HF 2= To Other HF 3= To reference units	Comments	Name of analysing Officer	Signature
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Note: All columns in the standard register are in a single page. They have been split specifically for the purpose of this presentation.

Figure 6.4 Laboratory register data entry page for all routine tests

In practice, only laboratory technologists in facility A & B adhered to this recording strategy (i.e. recording parasite density count). They used the results column to record these data. They had some concerns about its value in improving malaria management.

“...as much as this system of reporting gives you the parasite load per millilitre (ml) of blood, there is no specific guideline saying that this number of parasites in a ml of blood we can now term this as severe malaria” Health worker, FB-LT

In facility C & D, malaria test results were simply recorded as ‘RDT pos or neg’, ‘Bs pos/neg’ or ‘Bs ++’. Recording practices in laboratory registers in all four facilities are shown in Box 6.2.

Box 6.2. Laboratory registers and recording practices

Facility A

Date	Type of Specimen	Investigation required	Results
	H	I	
01	Blood	B/S	0 mps / 200 w b c's
01	Blood	B/S	15 mps / 200 w b c's
01	Blood	B/S	0 mps / 200 w b c's
01	Blood	B/S	0 mps / 200 w b c's

Malaria microscopy tests results are recorded by parasite density count as shown in the photo. Notice the use of red pen to record confirmed malaria cases. The register in use is improvised.

Facility B

B/S	No mps	
B/S	Trophozoite of P f a	9/20
H. pylori		
Pw 9	NEG	pH - 6.0

As is the case in facility A, malaria microscopy test results are also recorded by parasite density. The registers shown in the photo has been improvised.

Facility C

0	M	B/S	RDT	POS
0	F	B/S	RDT	POS
0	12	B/S	RDT	POS

Malaria microscopy and RDT test results are simply recorded as 'Bs no mps' or 'Bs mps seen'. This also the case with malaria RDT test results which are recorded as 'positive' or 'negative'. The register in use is improvised.

Facility D

Clinical Diagnosis	Prior Treatment	Type of Specimen	Condition of the specimen	Investigation required	Date Sample collected	Date Sample received	Clinician Name	Date Sample Analyzed	Results	Results dispatched
Cinical		B	S	RDT	4/1/16			4/1/16	Negative	50
Cinical		B	S	RDT	11		11	11	Negative	50

Malaria RDT test results are recorded as 'negative' or 'positive'. Malaria microscopy was not done in this facility at the time of field work due to lack of reagents.

d) Malaria Commodities Daily Activity Register (AL/RDT register)

The Malaria Commodities Daily Activity Register (AL/RDT register) was specifically designed to capture data on the consumption of malaria RDTs and AL which are funded by PMI and the Global Fund. This register is supplied by the National Malaria Control

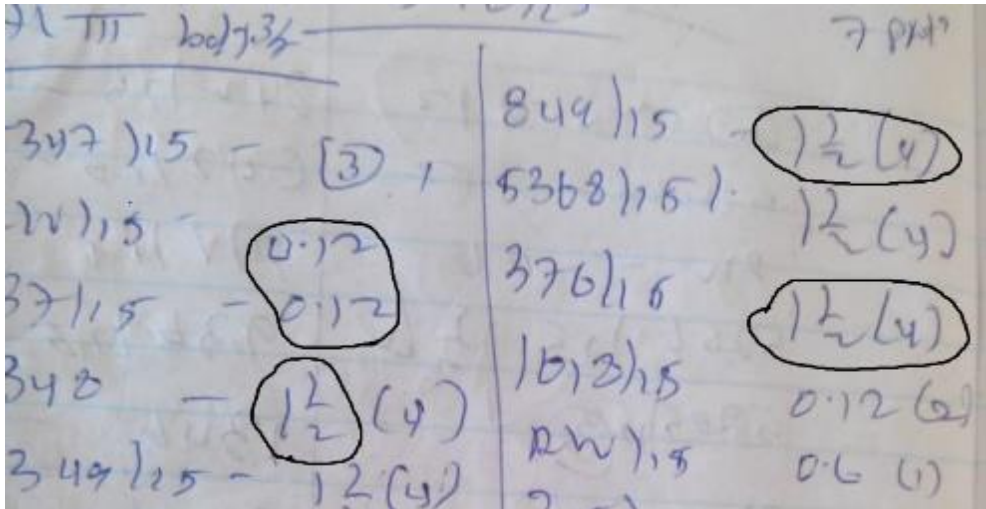
Programme through the Kenya Medical Supplies Authority during the routine distribution of malaria commodities. The register has 17 columns where data including the patients' *weight category*; *tests not done (clinical malaria)*; and *test results (by microscopy and RDTs)* are recorded (figure 6.5).

Republic of Kenya – Ministry of Health										RDT Tests				Artemether-Lumefantrine				Doses		
The total quantities of drugs dispensed are counted										Tests	AL 6's	AL 12's	AL 18's	AL 24's						
Balance previous page										42	27	28	1	19						
Receipt Date		6/9/16																		
Reference Number		05FD15007																		
Total Stock of AL Available										42	27	28	1	19						
Date	IP / OP	Malaria Test type (Tick)					Weight Category (Tick)				Quantities Dispensed									
		Microscopy		RDTs			No test done	5-14	15-24	25-34							35+			
		POS	NEG	POS	NEG	INA														
6/9/16																				
6/9/16																				
6/9/16																				
6/9/16																				
6/9/16																				

Figure 6.5 AL/RDT register

In larger facilities with laboratories, it is recommended that two copies of this register should be used: one at the dispensing point (pharmacy-for recording AL) and the other one at the testing point (laboratory- for recording RDT). Malaria diagnosis data recorded in this register should be obtained from the patient's record book (where testing and AL dispensing points are separate). As shown in figure 6.5, AL treatments should be administered according to a patient's weight category. That is, patients weighing 5-14kgs should be issued with 6 tablets that are taken for 3 days; those weighing 15-24kgs, 12 tablets; those weighing 25-34kgs, 18 tablets; and those weighing over 35kgs, 24 tablets. During partial stock-outs e.g. when AL for 5-14kgs are unavailable, health workers split adult doses (AL 24s) into four which are administered to children. When such coping strategies are employed, balancing the quantity of AL doses dispensed vs the number of confirmed malaria cases treated becomes a challenge, hence forcing health workers to innovate their recording practices as shown in box 6.3.

Box 6.3 Recording practices in AL/RDT register



This photo shows an improvised AL/RDT register in use in facility C. Notice the use of 0.12 and 1.5 to indicate cases where AL blister packs were split and issued to patients.

In practice, only a single copy of the AL/RDT register was available in all four facilities (located mainly in the pharmacy). In three of the four facilities (A, B & C) the dispensers in the pharmacy only recorded confirmed malaria cases in the AL/RDT register. In facility D where the AL/RDT register was kept in the laboratory not the pharmacy, the laboratory technologist used the laboratory register to complete the AL/RDT register, usually several days after the test had been done. The AL/RD register was inconsistently used in facility A, a practice that had a direct influence on data quality as I will illustrate in the next chapter.

6.2.2 Tracer indicator 2: Recording the number of pregnant women who receive two doses of intermittent preventive treatment (IPTp2)

Current national guidelines recommend that pregnant women living in the 14 malaria endemic regions of Kenya are given at least three doses of IPTp (IPTp3) as directly observed treatment (DOT) during their pregnancy (Ministry of Health 2014). However, at the time of this study, monthly reporting forms had not been revised to capture data

on the number of pregnant women who receive more than three doses of IPTp although this information is collected in the ANC register. There are three main instances when IPTp is not supposed to be administered: i) if the woman is in the first trimester of pregnancy; ii) if the woman is on cotrimoxazole (CTX) prophylaxis for the prevention of opportunistic infections in HIV/AIDS infected patients, making them ineligible for SP; and iii) if the woman had been given a high dose of folic acid (Ministry of Health 2014).

The ANC visit process was discussed in chapter 5 (refer to box 5.7). To produce the IPTp2 indicator, health workers are required to record data on *the number of pregnant women who received IPTp2* (the numerator) and the *number of first antenatal clinic visits*. The limitation of using ‘*no of first ANC visit*’ as the denominator for calculating IPTp was highlighted in chapter 2 (section 2.5). The main source of data for IPTp administration is the ANC register. This register captures a range of information relating to a woman’s pregnancy in 43 different columns spread over two pages. The ANC register has a single column in which health workers are expected to record the dose of IPTp given (1 to 7), as it is given. According to these instructions, health workers should record either a number (1, 2 or 3) or ‘NO’ or ‘NA’ in the IPTp column of the ANC register. There are boxes at the bottom of each page of the register which are used to prepare a summary of various ANC indicators. Summary indicators for IPTp are: *No. given IPTp1* and *No. given IPTp2+*. These summaries boxes are supposed to be filled as each page is completed. An example of pages in the ANC register in use in study facilities at the time of this study is shown in figure 6.6.

Page 1

Date	New ANC No.	Re-Att (ANC No.)	No. of visits (1st, 2nd, TT plus boosters)	Full Names	Age	Phone Number	Marital Status: 1-Married 2-Widowed 3-Divorced 4-Single 5-Separated	Village / Estate / Landmark	Parity	Gravidae	LMP	EDD	Gestation age (weeks)	weight (kg)	Height (Centime tree)	BiP	Breast examination (Y/N)	Hb	RPR/VDRL Pos/Neg (ONLY those tested during this visit)	HIV- Status: 1-Known positive 2-Positive this visit 3-Negative 4-Unknown
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U

Page 2

Received HIV results? (Y/N or NA=Not applicable)	screened for TB? (Y/N)	Other Medical Conditions (use codes from cover page)	Cotrimoxazole given? (Y/N)	Dose of TT Given (e.g. TT1, TT3, Plus)	Given Iron supplementation? (Y/N)	Given Folic (Y/N)	Given IPT (Dose 1, 2, etc.)	ART Eligibility assessed through:		Started on ART in ANC	Received ARV prophylaxis Mother? (Y/N)	Received ARV prophylaxis Baby? (Y/N)	Received LLITN? (indicate the visit No.)	Counselled on? use key provided at the bottom of the page	Additional Treatment given for? Use key provided	Partners: 1=C, 2=T, 3=R	Partners status: 1=P, 2=N	HIV+ Partners Referred for follow-up? (Y/N)	ANC Exercise given (Y/N)	Referrals: 1=FROM other HF 2=TO other HF 3= FROM CU 4=TO CU	Remarks
								WHO Stage (1,2,3,4.)	CD4 Counts												
V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AR

Page summary

No. given IPT 1: _____ No. assessed for ART eligibility - WHO: _____ No. of clients issued with preventive ARVs: _____
 No. given IPT 2: _____ No. assessed for ART eligibility - CD4: _____ No. of infant nevirapine issued: _____
 No. of clients received ITN: _____ No. started on ART: _____ No. of Partners Counseled for HIV: _____
 No. Counseled for HIV: _____ *Do not count those staged through WHO if they have a CD4 value to avoid double counting* No. of Partners Tested for HIV: _____
 No. Tested for HIV: _____ No. of partners HIV +ve: _____
 No. found HIV +ve: _____

Key on Counselling
 1= Birth Plan, 2= Danger signs, 3 = FP, 4 = HIV, 5= Supplemental feeding
 6=Breast Care, 7=Infant feeding 8= ITN Use and 9=STIs/RTIs
Key on Treatment
 1 = Hypertension, 2=Diabetes, 3=Epilepsy, 4=Malaria in Pregnancy (MIP)

Referrals	
From other Health Facility	
To other Health Facility	
From community Unit	
To Community Unit	

Figure 6.6 Data entry pages in the ANC register

Instructions provided in the register for recording IPTp data state that: *‘Intermittent presumptive treatment first, second, or third dose. Write the dose which has been given or NO if not given. If the woman is not eligible record ‘NA’ for not applicable’*. However, there are no clarifications regarding when health workers are supposed to use ‘NO’ or ‘N/A’. In addition to the three instances identified above, IPTp is not also administered to pregnant women who are allergic to SP or if the drug is out stock. Instructions in the register are unclear regarding how each of these events is supposed to be recorded, which creates confusions leading to variability in recording practices as discussed during one of the feedback meetings with health facility staff (see box 6.4).

Moderator: So when do you write ‘not applicable’?

Participant 5: In fact, I don’t write ‘not applicable’. It’s either a NO or 1st, 2nd, 3rd. NO means not given. So the reasons could be HIV, it (SP) is out of stock. She is allergic...

Participant 3: I write NO... NO...

Moderator: For everything?

Participant 3: Yes

Participant 4: No includes everything

Participant 1: That is where the problem is. Because everyone understands things differently. When someone writes a NO, the NO can mean other things” Health workers, feedback meeting, SCB

Not being able to distinguish in the daily ANC register the reason why a dose of SP had not been given to a pregnant woman was clearly an issue for the health workers across all four facilities as they had developed a series of their own annotations (often unique to each facility) to provide more specific information on why IPTp had not been issued.

For instance, in facility C, to indicate that a woman was on Cotrimoxazole (CTX) prophylaxis for HIV which disqualified her from getting IPTp, they recorded 'CTX' in the IPTp column even though this information was also collected in a separate column in the register. Staff explained that this made it easier for them to identify women on 'CTX' prophylaxis in the future, a practice also reported by one of the health workers during the feedback meeting.

"If the mother is HIV positive, I normally just write 'CTX' so that somebody can know that this mother is on CTX Septrin so cannot use Fansidar." Health worker, feedback meeting, SCB

The use of 'CTX' to record women who were on CTX prophylaxis was not observed in the remaining three facilities. Generally, when facilities ran out of SP, health workers gave pregnant women a prescription, and asked them to purchase the drug at a local pharmacy. These events were variably labelled in the ANC register and women's MCH booklets. For example, in facility C, health workers recorded '*to buy*' in the ANC register. In Facility D, the nurse prescribed the drug and urged women to purchase it in local pharmacies. This was recorded as 'N' (not issued) in the register. In facilities A & B, SP stock-out information was marked as 'O/S' in the IPTp column in the register. Recording SP stock-out information, particularly where health workers used local resources to purchase SP (as was the case in facility A) which was administered to pregnant women free of charge, also posed a challenge to health workers.

"What about a case where we used other funds to purchase the drug? We cannot say 'OS' [out of stock] when we have the drug. That is why it is very difficult to capture that data." Health worker

Box 6.4 IPTp recording practices

Facility A

Pregnancy STIs/RTI Others (Specify)	Devormin	IPT 1-3	TT Dose	Given supplements	Received LLTM	Additional Treatment 1=Hypertension 2=Diabetes 3=Epilepsy 4=Malaria in Pregnancy 5=STIs/RTI 6=Others (Specify)
	(Y/N) AI	(1,2,3,NA) AJ	(1 to 5) AK	1,2,3,4 AL	(Y/N) AM	
AH	2	5	N	7	2	N
4-1	7	0/S	N	7	2	N
2	7	0/S	5	7	7	N

IPTp column marked as ‘O/S’ to show that the drug was out of stock and as such, was not issued to the woman.

Facility B

Pregnancy STIs/RTI Others (Specify)	Devormin	IPT 1-3	TT Dose	Iron	Folic Acid	Received ITN	Additional Treatment 1=Hypertension 2=Diabetes 3=Epilepsy 4=Malaria in Pregnancy 5=STIs/RTI 6=Others (Specify)
	(Y/N) (af)	(1,2,3,NA) (ag)	(1 to 5) (ah)	(Y/N) (ai)	(Y/N) (aj)	(Y/N) (ak)	
no) ANCH	N	4 th	N	7	7	10	
Mod AN	N	2 nd	N	7	7	10	
MVU	N	3 rd	2 nd	7	7	10	
M I	N	NA	3 rd	7	7	10	

The dose of IPTp is recorded in the IPTp column as ‘4th, 2nd, 3rd’. ‘N/A’ is also used although it is unclear what this means.

Facility C

Pregnancy STIs/RTI Others (Specify)	Devormin	IPT 1-3	TT Dose	Iron	Folic Acid	Received ITN	Additional Treatment 1=Hypertension 2=Diabetes 3=Epilepsy 4=Malaria in Pre 5=STIs/RTI 6=Others Sp
	(Y/N) (af)	(1,2,3,NA) (ag)	(1 to 5) (ah)	(Y/N) (ai)	(Y/N) (aj)	(Y/N) (ak)	
E	7	2	N	7	N	N	
HE	7	on CTX	7	7	7	7	N/O
HE	7	1st	5 th	7	7	7	7
HE	7	NA	7	7	7	7	7

‘On CTX’ has been recorded in the IPTp column to show women who are on cotrimoxazole prophylaxis who do not qualify for IPTp.

Facility D

Pregnancy STIs/RTI Others (Specify)	Devormin	IPT 1-3	TT Dose	Given supplements	Received I	Additional Treatment 1=Hypertension 2=Diabetes 3=Epilepsy 4=Malaria in Pregnancy 5=STIs/RTI 6=Others (Specify)
	(Y/N) AI	(1,2,3,NA) AJ	(1 to 5) AK	1,2,3,4 AL	(Y/N) AM	
AH	7	N	7	7	7	
4-1	7	N	7	7	7	
2	7	7	7	7	N	

IPTp column marked as ‘N’ although it is unclear what ‘N’ means.

In this section I have described the process and challenges associated with the daily recording of data on outpatient malaria cases and the delivery of IPTp to pregnant women at front line health facilities. In the next section, I describe the process and issues around monthly data collation and reporting each of the two indicators.

6.3 Monthly Reporting of Data

Facility managers are charged with the responsibility of ensuring that all required monthly reports are completed at the end of the month. In all four facilities, reporting responsibilities were shared between health workers. For example, staff working in the OPD at the end of the month compiled outpatient morbidity reports while those working in the ANC clinic compiled ANC related reports. All laboratory related reports were compiled by the laboratory technologists. Likewise, ANC related reports were mainly compiled by the nurse working in this service delivery area during the reporting period. In facility B & C, HAWI employed staff assisted government employed nurses in compiling their monthly reports. For example, the health records officer in facility B verified all facility reports before these were forwarded to the sub-county health records office (although in practice, he mainly concentrated on HIV/AIDS related reports).

Typically, compilation of monthly reports begun at the end of the month and were usually completed on or the 5th of every month when these reports were supposed to be handed in at the sub-county health management offices. Reports were compiled in between service delivery, in the evening, or from home. The process was entirely manual. That is, health workers manually counted and aggregated data from the standard registers then transferred these in respective monthly reporting forms. None of the standard monthly reporting form in any of the four facilities had instructions for data collation. Similarly, there were no written guidelines in any of the four facilities that

stated the number of standard monthly reporting tools that health workers were supposed to compile at the end of the month.

At the time of this study, standard monthly reporting tools designed with carbon copies to enable automatic completion of each report in duplicate (e.g. MOH 705 A & B; and MOH 105) were out of stock in these four facilities. In the absence of these tools, health workers used photocopied report forms which they manually completed in duplicate.

“Data collection tools are always photocopied. You photocopy them and no one wants to know where you get the money for photocopying”, Health worker, Feedback meeting, SCA

Some of these report forms contained over 200 data fields that required different types of data obtained from multiple registers. Manual duplication as a routine practice significantly increased the workload of health workers.

Table 6.1. provides a list of monthly reporting forms that frontline health facilities were required to complete and submit to various sub-county health management offices in both sub-counties.

Table 6.1 Monthly reports compiled in the two sub-counties

Lake region sub-county	Coast region sub-county
1. OPD summary <5 years: MOH 705A	1. OPD summary <5 years: MOH 705A
2. OPD summary >5 years: MOH 705B	2. OPD summary >5 years: MOH 705B
3. Immunization Services: MOH 710	3. Immunization Services: MOH 710
4. Integrated RH, CH: MOH 711	4. Integrated RH, CH: MOH 711
5. Workload: MOH 717	5. Workload: MOH 717
6. Service Delivery- MOH 105	6. Service Delivery- MOH 105
7. Annual Work-plan (AWP)	7. Annual Work-plan (AWP)
8. HIV/AIDS: MOH 731	8. HIV/AIDS: MOH 731
9. Lab Summary: MOH 706	9. Lab Summary: MOH 706
10. CHEW Summary: MOH 515	10. CHEW Summary: MOH 515
11. MOH Net Pack	11. MOH Net Pack
12. Nutrition: MOH 713	12. Nutrition: MOH 713
<u>Others</u>	<u>Others</u>
13. Lab HIV consumption	13. Malaria data report
14. Cold chain	14. Incentives Report
15. FP commodity consumption	
16. HEI Cohort summary	

As shown in table 6.1, there were 12 standard monthly reporting forms that were completed in all four facilities. There were other monthly reporting forms that were only completed in either of the two sub-counties. For example, the HIV Exposed Infants (HEI) cohort summary report was only completed in the lake region sub-county. Likewise, the Malaria data report form was only completed in the coast region sub-county. This form was used by the sub-county malaria coordinator to extract data on priority indicators for her management needs instead of waiting for these to be uploaded in the DHIS2.

“I think that form is for her [malaria coordinator] own management. it is not for everyone [standard]” Health worker, feedback meeting, SCB

Having provided a general overview of the reporting process, in the next section, I describe how the two tracer indicators were reported in each of the four facilities.

6.3.1 Reporting the number of suspected malaria cases tested using a parasitological based test: data flow process from registers to reporting forms

As I described in chapter 3, health workers are required to aggregate malaria diagnosis data recorded in the four registers and feed these into the following six monthly reporting forms. See table 6.2.

Table 6.2 Malaria data collection registers and reporting forms

Register	Monthly reporting form
Outpatient register < 5 (MOH 204A)	OPD summary <5 years: MOH 705A
Outpatient register >5 (MOH 204B)	OPD summary >5 years: MOH 705B
Laboratory register (MOH 240)	Lab summary: MOH 706
AL/RDT register	Malaria Commodities reporting form
Lab register & AL/RDT register	Facility Consumption Data Request form (MOH 643)
Lab register; MOH 204A; & MOH 204B	Annual Work Plan (AWP) Service delivery report

These reports were forwarded to three sub-county health management offices: Sub-county Laboratory; Sub-county Pharmacy; and Sub-county Health Records and Information offices. Figure 6.7 shows how malaria diagnosis data flows from registers into monthly reporting forms and eventually, into the DHIS2.

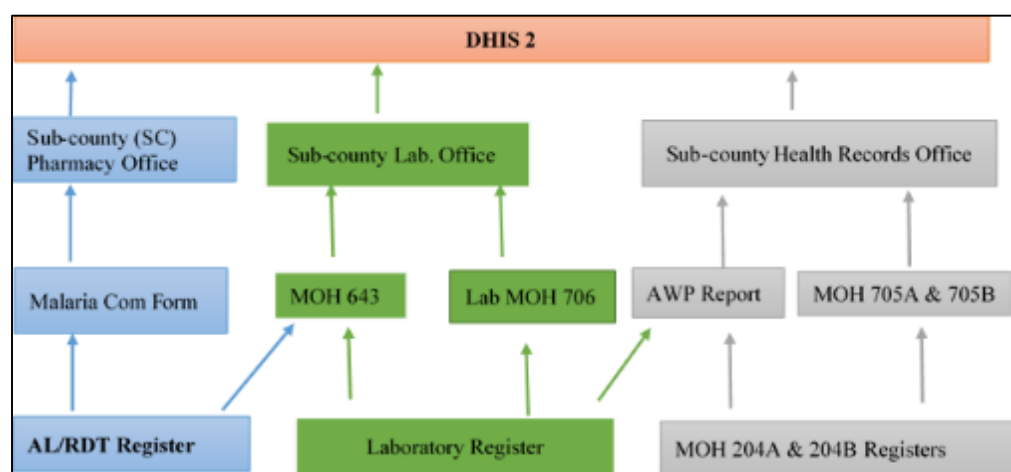


Figure 6.7 Malaria diagnosis data flow process from registers into the DHIS2

a) *Outpatient Summary Sheet Under Five Years (MOH 705A)*

The Outpatient Summary Sheet Under Five Years (MOH 705A) form is used to report outpatient morbidity data in children under five years of age (figure 6.8). MOH 705A reporting form in use at the time of this study captured data on 40 diseases/conditions. These data were obtained from the Outpatient register for under five years (MOH 204A) and the Outpatient morbidity tally sheets for under five years (MOH 701A). Ideally, outpatient morbidity data should be transferred to the outpatient morbidity summary form on a daily basis.

Malaria diagnosis data reported using this form are: *clinical* (suspected cases treated without a parasitological test) and *confirmed malaria* (suspected cases tested positive). However, as noted above, these two categories of malaria are not distinguished in outpatient register (MOH 204A). They are distinguished only on the outpatient morbidity tally sheet (MOH 701A), a recording form that was not used in three of the four facilities.

DISEASES (New Cases Only)		1	2	3	4	5	6	7
1	Diarrhoea							
2	Tuberculosis							
3	Dysentery (<i>Bloody diarrhoea</i>)							
4	Cholera							
5	Meningococcal Meningitis							
6	Other Meningitis							
7	Neonatal Tetanus							
8	Poliomyelitis (AFP)							
9	Chicken Pox							
10	Measles							
11	Hepatitis							
12	Mumps							
13	Suspected Malaria							
14	Confirmed Malaria (<i>only Positive cases</i>)							
15	Urinary Tract Infection							
16	Typhoid fever							

Figure 6.8 Outpatient morbidity report: under five years

b) *Outpatient Summary Sheet Over Five Years (MOH 705B)*

The Outpatient Summary Sheet Over Five Years (MOH 705B) is designed for reporting outpatient morbidity data in patients aged five years and above. At the time of the study, there were 43 diseases/conditions that were captured in this form. The data for completing this report form should be obtained from the Outpatient register for over five years (MOH 204B) and Outpatient morbidity tally sheet for over five years (MOH 701B). Malaria diagnosis data reported using this form are: *clinical malaria; confirmed malaria; and malaria in pregnancy cases* (figure 6.9). Outpatient registers are also not designed to capture ‘*malaria in pregnancy cases.*’ However, these data could be obtained from the outpatient morbidity tally sheets if they were completed. Malaria in pregnancy cases may also be obtained from Antenatal Care registers.

DISEASES (New Cases Only)		1	2	3	4	5	6
1	Diarrhoea						
2	Tuberculosis						
3	Dysentery (Bloody diarrhoea)						
4	Cholera						
5	Meningococcal Meningitis						
6	Other Meningitis						
7	Tetanus						
8	Poliomyelitis (AFP)						
9	Chicken Pox						
10	Measles						
11	Hepatitis						
12	Mumps						
13	Suspected Malaria						
14	Confirmed Malaria (only Positive cases)						
15	Malaria in pregnancy						
16	Typhoid fever						
17	Sexually Transmitted Infections						
18	Urinary Tract Infection						

Figure 6.9 Over Five Years Daily Outpatient Morbidity Summary Sheet

In facilities A and D, the outpatient summary sheets (morbidity reports MOH 705A & 705B) were frequently completed by casual staff. In facility B & C, these reports were compiled by any of the nurses on duty at the end of the month (typically the health worker sitting at the outpatient registration desk). In facility A, outpatient morbidity data were transferred into these two reporting forms at the end of the day or in the

morning by the data clerk (casual staff). At the end of the month, daily outpatient morbidity data recorded in the two forms were aggregated to form the facility's monthly report. In facility B, C, D, where tally sheets were not used, staff compiling these data had to manually count the number of cases seen within the month for each of the conditions. Due to some of the challenges with data recording that were highlighted in the previous section, compiling data for these two reports usually took a significant amount of time.

c) Laboratory Workload Summary Report (MOH 706)

At the time of this study, the MOH 706 report form for monthly reporting of the laboratory workload had over 250 data fields although the actual number of data fields completed by laboratory technologists at any given health facility depended on types of laboratory tests offered. Malaria diagnosis data reported in this form are obtained from the laboratory register (MOH 240). See table 6.3.

Table 6.3 Malaria diagnosis data reported using MOH 706 report

<i>Malaria test</i>	<i>Total Exam</i>	<i>Number positive</i>
Malaria Bs under five years		
Malaria Bs over five years		
Malaria RDTs		

The laboratory register was not structured to collect age and test disaggregated data that was required in this reporting form. To compile data for this monthly report, laboratory technologists manually counted and classified these data from the laboratory register. Like outpatient morbidity reporting forms, the laboratory reporting form also lacked instructions for data collation.

d) Monthly Summary Report for Malaria Medicines (Malaria Commodities Form)

The Monthly Summary Report for Malaria Medicines form is specifically used to report consumption data of various malaria commodities such as AL, RDTs and SP (figure 6.10).

Drug name	Basic Unit	Beginning Balance	Quantity Received this period	Total Quantity Observed	Losses (Excluding Expired)	Positive Adjustments	Negative Adjustments	Physical Count	Expired Drugs	Months in Supply	End of Stock	Comments
		A	B	C	D	E	F	G	H	I	J	K
Malaria commodities												
Artemether-Lumefantrine 25/125	Tablets	11	0	0	0	0	0	11	0	11	0	
Artemether-Lumefantrine 20/75	Tablets	14	0	0	0	0	0	14	0	14	0	
Artemether-Lumefantrine 20/120	Tablets	0	0	0	0	0	0	0	0	0	20	
Artemether-Lumefantrine 20/125	Tablets	12	0	2	0	0	0	12	0	12	0	
Quinine Table (200mg)	Tablets	0	0	0	0	0	0	0	0	0	0	
Quinine Table (300mg)	Tablets	0	0	0	0	0	0	0	0	0	0	
Quinine 600mg/20ml	Syringe	30	0	0	0	0	0	30	0	30	0	
Sulfadoxine Pyrimethamine	Tablets	3000	0	271	0	0	0	3000	0	271	0	
Sulfadoxine Pyrimethamine 250mg	Tablets	0	0	0	0	0	0	0	0	0	0	
Sulfadoxine Pyrimethamine 250mg/125mg	Tablets	0	0	0	0	0	0	0	0	0	0	
Sulfadoxine Pyrimethamine 250mg/125mg	Tablets	0	0	0	0	0	0	0	0	0	0	
Alaridine 50mg Injection	Vials	721	0	191	0	0	0	530	0	0	0	
RDTs	Tests											

Patients on AL by Weight Band Summary Report

5-14 kgs 15-24 kgs 25-34 kgs 35+ kgs

Number of days facility did NOT have ANY of the AL Packs:

Number of Pregnant women receiving IPTp:

Comments (including explanations of losses and adjustments):

Results	Microscopy	RDT	Totals
Positive	0	3	3
Negative	0	133	133
Invalid	0	0	0
Total Tested	0	136	136
Not tested	0	0	0

Figure 6.10 Malaria commodities form

This form was developed by the National Malaria Control Programme with support from the Global Fund and President’s Malaria Initiative. There are stringent guidelines regarding accountability for malaria commodities as evidenced in the instructions for completing this form which state that: ‘any missing or lost drug unaccounted for should be documented in the report and suspected theft investigated according to the government’s policy’. Malaria diagnosis data reported using this form are shown in table 6.4.

Table 6.4 Diagnosis data reported using malaria commodity form

Results	Microscopy	RDT	Totals
Positive			
Negative			
Invalid	N/A		
Not tested	N/A	N/A	

Instructions in the register state that “*record the number of patients that were tested using microscopy or RDTs*”. However, it is unclear whether these data should be obtained from the AL/RDT register or from the laboratory register (or both). In facility B & C, the form was completed by the facility manager or any nurse on duty at the time of compiling monthly reports. In facility D, it was mainly completed by the laboratory technologist and in facility A, by the dispenser (a casual staff). In all four facilities, staff used malaria diagnosis information recorded in the laboratory register to complete the diagnosis section of this form.

e) Facility consumption data request form (MOH 643)

The Facility Consumption Data Request form (MOH 643) is used to report data on the consumption of various laboratory commodities such as HIV and malaria RDTs. It has fields for collecting malaria diagnosis data disaggregated by age and type of test (RDTs or microscopy) as shown in table 6.5.

Table 6.5 Malaria diagnosis data reported using MOH 643 reporting form

<i>Test</i>	<i>Category</i>	<i>No of tests performed</i>	<i>No positive</i>
RDT	<ul style="list-style-type: none"> • Patients under 5 years • Patients 5-14 years • Patients aged over 14 		
Microscopy	<ul style="list-style-type: none"> • Patients under 5 years • Patients 5-14 years • Patients aged over 14 		

The source of malaria diagnosis data reported in this form is undefined. There was no register at the health facility level that collected age disaggregated diagnosis data as was required in the form, an issue cited as a challenge with this reporting form.

“You go to the FCDDR [MOH 643] and you are told to segregate the data in terms of ages- <5, 5-14, 14 and above. But you go to the primary tool and you

only have <5 & >5 register and that is all. So it means that at the end of the month, you have to go the nitty gritty of counting how many of the 5-14 years old did you test for malaria” Health worker, Feedback meeting, SCA

This form was completed by laboratory technologists in facility B, C & D. This form was not completed in facility A. The laboratory technologist reported that they were unaware of the existence or even the requirement to complete the MOH 643 reporting form.

f) Annual Work Plan service delivery form (AWP)

The Annual Work Plan Service Delivery form contains 71 indicators which are used to monitor health sector strategic objectives (Ministry of Health 2014). It is not listed in the official documents as one of the standard reporting forms for use at health facility level. The form collects data on the ‘*number of fevers tested positive for malaria (confirmed malaria)*’. At the time of this study, the data source for this indicator was unclear since no register in use collected data on ‘*fever cases*’. Health workers in all four facilities were unsure whether they were supposed to use confirmed malaria cases recorded in outpatient or laboratory registers to compile data for this indicator.

“You see that’s where you now start reasoning. And when you reason, you give them that wrong data. Because now, which fevers are these? Should it be fever that you had in under five over five [outpatient registers]? Or should it be what the lab guy tested? So which fever do you give?” Facility Manager, FA-N1

Sub-county managers were also aware of the vagueness of this indicator.

“So it is assumed that clinical malaria presents with fever because they are not confirmed. So I think all clinical malaria is referred to as though I think the tool

should be developed to cover fever. But you know again fever is not a diagnosis.

It is just a state. It's a condition” Sub-county Manager, SCA-MC

The vagueness of this indicator and uncertainty of its correct source led to variations in reporting practices between the four facilities (see table 6.6.)

Table 6.6 Reporting practices for fever cases tested positive for malaria

		Jan 2015		Feb 2015	
Facility A					
<i>Report</i>	<i>Indicator</i>	<i>Paper report</i>	<i>DHIS2</i>	<i>Paper report</i>	<i>DHIS2</i>
MOH 705A	Confirmed malaria <5	51	51	6	6
MOH 705B	Confirmed malaria >5	162	162	19	19
	Malaria in pregnancy	1	1	2	2
MOH 705A+B	Outpatient confirmed malaria	214	214	27	27
AWP form	Fever cases tested positive	213	213	20	25
MOH 706	Lab confirmed cases	205	-	11	-
Facility B					
MOH 705A	Confirmed malaria <5	138	212	84	84
MOH 705B	Confirmed malaria >5	157	157	170	170
	Malaria in pregnancy	0	0	4	4
MOH 705A+B	Outpatient confirmed malaria	295	369	258	258
AWP form	Fever cases tested positive	295	369	254	254
MOH 706	Lab confirmed cases	285	-	267	267
Facility C					
MOH 705A	Confirmed malaria <5	264	-	213	213
MOH 705B	Confirmed malaria >5	403	-	408	408
	Malaria in pregnancy	8	-	9	9
MOH 705A+B	Outpatient confirmed malaria	675	-	630	630
AWP form	Fever cases tested positive	660	-	620	621
MOH 706	Lab confirmed cases	660	-	626	626

In facility A, the total number of *outpatient confirmed malaria cases* (n=214) in paper reports in January was inconsistent with the *total number of fever cases tested positive* (n=213) and *laboratory confirmed malaria cases* (n=205). It is unclear where facility A obtained their data in February as the total number of *fever cases tested positive* reported

(n=20) did not correspond to either the total number of *outpatient confirmed malaria cases* (n=27) or *laboratory confirmed cases* (n=11) reported in paper reports. In facility B, the total number of *fever cases tested positive* (n=295) was consistent with the total number of *outpatient confirmed malaria cases* (n=295) in January but different from the *total number of laboratory confirmed malaria cases* (n=285). This was also the case in February where the total number of *outpatient confirmed malaria cases* (n=258) was inconsistent with the total *number of fever cases tested positive* (n=254) and *laboratory confirmed malaria cases* (n=267). In facility C, the total number of *fever cases tested positive* (n=660) was the same as the total number of *laboratory confirmed malaria cases* (n=660). However, the data source for this indicator in February was unclear since the figure reported (n=621) was inconsistent with *outpatient confirmed malaria cases* (n=630) and *laboratory confirmed malaria cases* (n=626).

The AWP reporting forms for facility D for the two months were not available at the health facility and sub-county level. In all three facilities, the DHIS2 automatically excluded *malaria in pregnancy* cases from the tally of *fever cases tested positive* (a practice which was also consistent with the figure reported for this indicator in facility A in January).

6.3.2 Reporting IPTp2 data: data flow process from the ANC registers to reporting tools

At the time of this study, there were four monthly reporting forms present in the health facilities which were used to report IPTp2 data to the sub-county for entry into the DHIS2 (figure 6.11). These were: a) the National Integrated Summary report form (MOH711); b) the MOH 105 Service delivery report form, and two of the forms also used for reporting malaria diagnosis data; c) Then Annual Work Plan; and d) the Malaria Commodity form. IPTp data flow process from registers into the three monthly reporting forms is shown in figure 6.11.

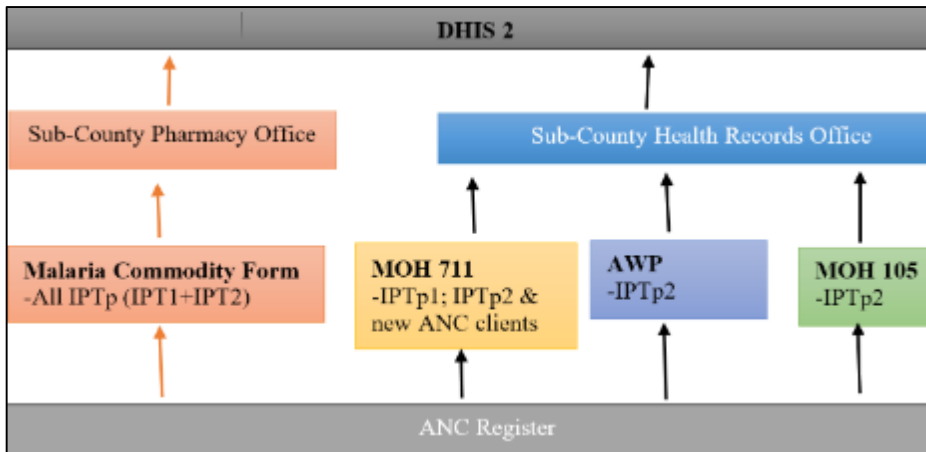


Figure 6.11 IPTp data flow process from registers to the DHIS2

a) National Integrated Summary Report (MOH 711)

The National Integrated Summary Report (MOH 711) form compiles data on reproductive health, HIV/AIDS, malaria, TB and child nutrition indicators (figure 6.12). This form has over 380 data elements requiring different types of data. Data entered into this form are obtained from several different registers (e.g. ANC registers, PMTCT registers, & ART registers).

B: MCH - ANC / PMCT		New	Re-visit	TOTAL
1.	No. of ANC Clients	88	198	276
2.	No. of Clients with Hb < 7 g/dl			0
3.	No. of Clients given IPT (1 st dose)			86
4.	No. of Clients given IPT (2 nd dose)			109
5.	No. of Clients completed 4th Antenatal Visit			28
6.	No. of ITNs distributed to ANC clients			88
7.	No. of ANC clients	Counselled		88
		Tested for HIV		88
		HIV+	4	7
8.	No. of clients			88
9.	No. of clients			0

C: MATERNITY- PMCT	
1.	No of Women counsellor
2.	Women tested for HIV
3.	Women found HIV+
4.	No. of Women issued w preventive ARVs
5.	No. of Infant Preventive ARVs administered
6.	Total Deliveries from HIV
7.	No initiated cotrimoxazole

Figure 6.12 MOH 711 reporting form

For IPTp2 reporting the page summary in the ANC register requires health workers to summarise “no. given IPT2+” (i.e. number of women who received more than 2 doses of IPTp), this information does not directly correspond to the data fields in the MOH

711 form which requires health workers to report: *no. of clients given IPT (2nd dose)*; and *no. of clients given IPT (1st dose)*. In all four facilities, page summary data were inconsistently completed. Instead, health workers manually counted IPTp1 and IPTp2 doses administered within the month and transferred these into the MOH 711 reporting form. In facility B & C, MOH 711 reporting forms were completed by nurses and the HAWI employed records officers (for HIV/AIDS sections of the form). In facility A, MOH 711 was completed by the nurse present in the ANC clinic at the end of the month. In facility D, this form was either completed by the VCT counsellor or by the nurse.

b) MOH 105 Service Delivery Report

The Service Delivery Report MOH 105 form collates data on the ‘*number of pregnant women receiving IPT2*’. (figure 6.13). The source of IPTp data reported in this form is unclear. The information in this form appears to overlap with the indicator reported in the AWP service delivery report. This is true for several of the indicators in MOH 105 and AWP forms. In all four facilities, IPTp2 data reported using this form was obtained from the ANC register. Specific issues around this reporting form are discussed in the next section.

#	NATIONAL INDICATOR	Eligib
A	Pregnancy, Delivery and the Newborn (upto 2 weeks)	
1	Number of WRA receiving FP commodities	
2	Number of women attending at least 4 ANC visits	
3	Number of deliveries conducted by skilled health attendants in Health facilities	
3b	Number of live births	
4	Number of new bornes with low birth weight (LBW)	
5	Number of HIV positive pregnant women receiving preventive ARVs treatment (PMTCT)	
6	Number of LLITN distributed to pregnant women	
7	Number of pregnant women receiving IPT 2	
8	Number of HFs providing Basic Obstetric Emergency Care (BOEC)	
9	Number of HFs providing Comprehensive Obstetric Emergency Care (COEC)	

Figure 6.13 MOH 105 Service Delivery Report

c) *Annual Work Plan (AWP) Service Delivery Report*

IPTp2 data collated in the Annual Work Plan is in the form of the: ‘*number of pregnant women receiving IPT2 in endemic and epidemic districts*’ (figure 6.14). The source of IPTp data reported in this form is undefined. This form was completed by any of the nurses who was on duty at the end of the month. Although this report form was present and filled in all of the participating health facilities the framing of the indicator (...*endemic and epidemic districts*) appeared to suggest that this indicator should have been aggregated at higher reporting levels as will be discussed further in chapter 8.

A	Eliminate Communicable Conditions	Num
1	HIV+ pregnant mothers receiving preventive ARV's to reduce risk of mother to child transmission (PMTCT)	
2	Number of Pregnant Women receiving TT2 Plus immunization	
3	Number of pregnant women receiving IPT2 in endemic and epidemic districts	
4	Children under 1 year of age fully immunized	
5	Children under 1 distributed with Long Lasting Insecticide Treated Nets (LLITNs) in endemic and epidemic districts	2
6	Number of pregnant women distributed with Long Lasting Insecticide Treated Nets in endemic and epidemic districts	
7	Number of people receiving MDA for schistosomiasis in endemic districts	0

Figure 6.14 AWP service delivery report

d) *Monthly Summary for Malaria Commodities*

Data on ‘*the number of pregnant women receiving IPTp*’ are collated in the Monthly Summary for Malaria Commodities report form (refer to figure 6.10). According to instructions available in the monthly summary for malaria commodities register, health workers are required to tally the number of women receiving IPT (IPTp1 and IPTp2) in the ANC register and report this as ‘*the number of pregnant women receiving IPTp*’. Data fields in the online copy of this form and the paper copy are inconsistent. While the paper copy requires health workers to report the total number of women receiving IPTp (i.e. IPTp1+IPTp2), online copies of the same form in the DHIS2 has IPTp1 and

IPTp2 data fields. This suggests that these data are autocompleted using IPTp1 and IPTp2 data derived from MOH 711 reporting form.

6.4 Data submission and entry into the DHIS2

6.4.1 Data submission process

As explained in chapter 3 (refer to 3.4.1), all completed monthly reports should be submitted to the sub-county health management offices by the 5th of every month. In the coast region sub-county, only 8 reporting forms were submitted to the sub-county health records office. Other monthly reports were submitted to respective sub-county management offices from where they were entered into the DHIS2 (i.e. laboratory reporting forms submitted to the sub-county health records office).

In both sub-counties, staff receiving data used manual checklists to document the process. In the lake region sub-county, health facilities were scored on completeness and timelines when they submitted their reports to the sub-county records office. Completeness was calculated based on whether health facilities submit all the expected reports (i.e. 100% if all the 16 expected reports are submitted) as opposed to completeness of data fields in the reports, generally accepted as a better method of assessing data quality (Global Fund, PEPFAR et al. 2008). If a facility submitted all the required reports by the 5th of the month they scored 100% on both timeliness and completeness of reports. Written feedback indicating each facility's score on these dimensions was provided to the health worker submitting these reports. Those who consistently scored 100% on both timeliness and completeness (e.g. facility C manager) were rewarded by sub-county managers. For example, they were invited to take part in sub-county wide activities such as supervision and public health campaigns where they received some allowances. In the coast region, the sub-county staff documented the

process using the checklist but health facility managers were not scored on completeness and timeliness and no written feedback was provided.

In both sub-counties, staff receiving the monthly reports from health facilities conducted occasional cross-checks on the reports submitted. From observations, HIV/AIDS related forms (MOH 711 & MOH 731) appeared to receive the most scrutiny. Since a number of indicators were duplicated between the two forms, staff often checked to see if the values between the two forms were consistent. There was more scrutiny of these forms by sub-county managers and HIV/AIDS related NGOs operating in both sub-counties. For example, HAWI collected all copies of MOH 711 & MOH 731 forms from the records office at the end of the month. An M&E officer with the NGO explained to me that they used these paper reports to validate data entered into online copies of the same forms in the DHIS2.

Throughout the fieldwork period, failing to report on time was a common occurrence in both sub-counties. Whenever timely submission appeared unlikely, facility managers called the sub-county office and negotiated for more time to submit their reports. In some instances, they submitted partial reports to beat the deadline, with a promise to submit the remainder at a later date. Similarly, whenever health workers did not submit their monthly reports on time, sub-county managers and volunteers phoned them to ask why they had not submitted them. We never observed any facility manager who was sanctioned for submitting reports late in either of the two sub-counties, as one of the sub-county managers explained.

“In our case, they are very cooperative. There is no time we have issued warning letters. We have never even discussed that issue in the meetings.” Sub-county Manager, HRO, SCB

6.4.2 Data entry into the DHIS2

Once monthly reports were received at the sub-county health offices, they are supposed to be entered into the DHIS2 by the 15th of every month. In the coast region sub-county data entry was mainly carried out by the assistant HRIO with the help of volunteers and students on attachment. In both sub-counties, the data entry process involved the entry for data from each reporting form into the DHIS2. Due to lack of computers in the lake region sub-county, volunteers relied on their personal laptops or entered these reports from the computer available in the HAWI operated pharmacy (PSC) which was located within the hospital grounds. Staff entering these data occasionally had to balance their time between taking part in sub-county wide activities where they received allowances and entering these data. For example, I observed an instance in the lake region sub-county where a volunteer entered these reports in between a workshop where she was also the rapporteur. These volunteers also entered these data from home or came to work over the weekend to beat reporting deadlines. Due to fluctuations in mobile network connections, internet connectivity was slow or non-existent at times, which slowed down the data entry process. During the data entry process, staff usually made a note of any errors in the paper copies of monthly reports that they have received. Whenever this was the case, they used their mobile phones to call facilities to inform them about these errors and also sought clarifications. Common errors seen during data entry are summarized in Box 6.5. Once the reports have been entered into the DHIS2, the original paper copies are stored in box files which are kept in open shelves.

Box 6.5 Common errors noted in reporting forms during data entry

- Missing data in paper reports
- Wrong entries- e.g. values erroneously reported for highly infectious diseases such as measles, polio, and hepatitis
- Missing identifier information in paper reports (e.g. name of health facility & staff completing the form)
- Inconsistent data values for similar indicators between different reporting forms
- Illegible records (some entries cancelled)
- Missing reports (i.e. some monthly reporting forms missing)

6.4.3 Support systems for data collection

Support supervision visits, and regular feedback meetings are encouraged by the ministry of health to improve the data collection process. In the coast region sub-county, there are monthly facility managers' meetings. These meetings are usually timed to coincide with the 5th of the month when monthly reports are due. Sub-county managers use these forums to provide policy updates, and to provide feedback on routine activities conducted in the county (include support supervision visits) to the health facility managers. Health workers are also given an opportunity to seek clarifications on policy directives or other emerging issues of concerns from their health facilities. In the lake region sub-county, these meetings although previously present, have become quite irregular post-decentralization (blamed on lack of funds). Due to financial constraints, support supervision visits have also become rare in both sub-counties. I revisit this issue in chapter 8.

6.5 Summary

In this chapter, I have described how data for the two tracer indicators are collected and reported at the health facility level. While instructions exist in all malaria data collection registers, some of these are unclear which results to variability in data recording practices. While some of the instructions for data recording may be unclear, there is even more confusion over the processes of data collation and reporting with few guidelines and a general lack of clarity on the appropriate data sources for some of the indicators listed in the monthly reporting forms.

Malaria diagnosis data come mainly from the laboratory and AL/RDT registers. These data are transported into either of the two outpatient registers and AL/RDT register through patient record books. Ideally, each confirmed malaria case visiting these four facilities should be captured in these three registers if the standard process is followed. These data are then fed into 6 report forms which are sent each month to three sub-

county offices for data entry into the DHIS2. Although disaggregated differently, confirmed malaria cases reported in these reporting forms should ideally be the same. This is not always the case. The multiplicity of forms used to report malaria data also shows hidden duplications that exist in these forms. This is also the case with IPTp2 indicator which comes from the same source but is reported in four different forms which all end up in the DHIS.

In the next chapter, I use data obtained from a review of facility records to illustrate how some of the issues described in this and the previous chapter impacts on quality of malaria data that is collected and reported at the health facility level.

7 RESULTS 3: DATA QUALITY ISSUES

7.1 Introduction

In chapters 5 and 6, I highlighted some of the contextual factors that influence data collection and reporting practices in the study sites and have the potential to undermine data quality. These include: unclear recording and reporting instructions; human resource constraints; use of inappropriate tools; and lack of adequate resources to support data entry at the sub-county offices. In this chapter, using data obtained from a review of records at the four facilities and the DHIS2 data available on the Kenya's DHIS2 website for these facilities, I investigate in more detail the quality of malaria data recorded and reported at health facility and sub-country levels. The chapter is divided into two sections:

- The first section focuses on data quality issues at the health facility level.
- The second section compares facility data with DHIS2 data

In both sections, observed as well as reported practices that possibly contributed to poor data quality are explored.

7.2 Data Quality Issues: Health facility level

7.2.1 *Variations in daily aggregated malaria cases recorded in primary registers*

In chapter 6, I identified the four recommended registers and outpatient morbidity tally sheets for collecting malaria diagnosis data. In facilities with laboratories, each outpatient confirmed malaria case should be recorded in one of the two Outpatient registers (depending on the age of the patient); the Laboratory register, and the AL/RDT register (if AL is issued). In each facility, to investigate if there were variations in daily data recording practices across the three service delivery areas (outpatient clinic, laboratory and pharmacy), I looked at the registers for January 2015 and aggregated the total number of malaria cases recorded in the Laboratory & Outpatient registers on a

daily basis and compared these with aggregated malaria cases recorded as having been issued with AL in the AL/RDT register (refer to chapter four- 4.6.1). There were no reported stock-outs of AL in any of the four facilities during the month of January 2015 and as such, all malaria cases treated should have ideally been issued with AL (or other antimalarial in case of severe malaria) in the facility pharmacies. Likewise, all four facilities had malaria RDTs in stock during this month. However, throughout the study period, these facilities also experienced periodic stock-out of malaria RDTs. To mitigate against stock-outs, they borrowed malaria RDTs from neighbouring facilities (if these were available in stock) or resorted to malaria microscopy (if reagents were available).

Of all four facilities, only Facility D had relatively consistent data across the three registers (figure 7.1). As discussed in chapter 5 (table 5.1), this facility had the least number of outpatient confirmed malaria cases which made it easier for health workers to document them. In addition, some of the practices described in chapter 5 and 6 (e.g. laboratory technologist updating AL/RDT register using the Laboratory register and recording strategy described in Chapter 5- Box 5.5) may have contributed to the observed consistencies. Nonetheless, there were still a few instances where malaria cases recorded in the three registers were inconsistent.

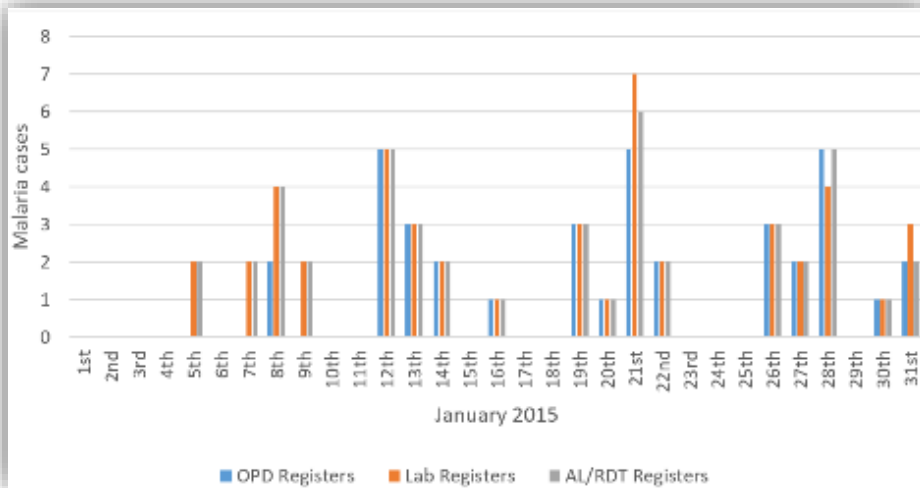


Figure 7.1 Facility D: malaria cases recorded in registers

- No cases recorded in the outpatient registers on the 5th, 7th, and 9th
- Cases recorded in outpatient and AL/RDT registers higher than outpatient cases on 8th & 21st
- Cases recorded in outpatient and AL/RDT registers higher than those recorded in lab register on 28th

There were discrepancies in malaria cases recorded in registers in the other three facilities as shown in figure 7.2-7.4.

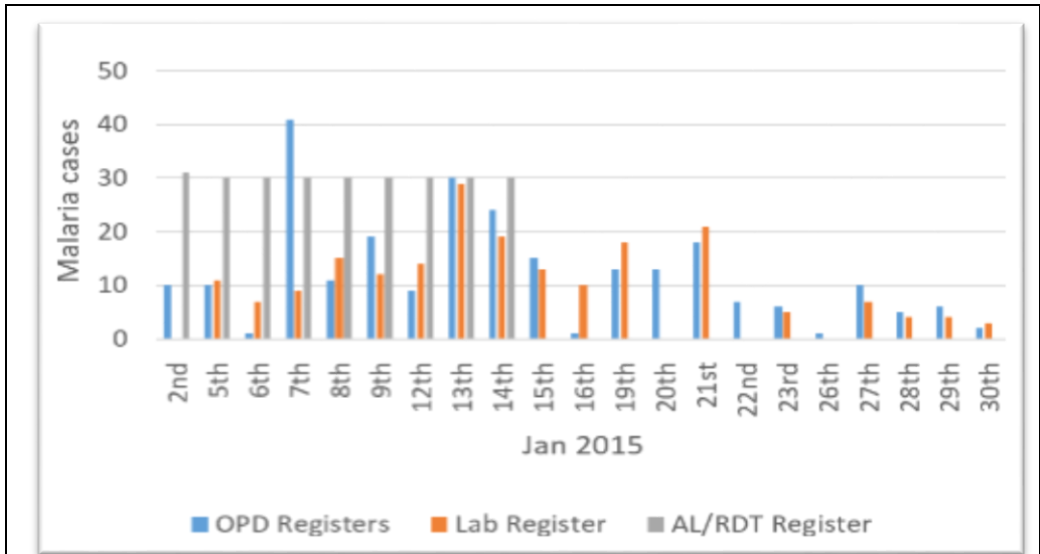


Figure 7.2 Facility A: malaria cases recorded in registers

- Cases treated for malaria consistently higher than outpatient and lab confirmed cases between 2nd and 14th
- No cases recorded as treated in AL/RDT register between 15th and 30th despite lab and OPD recording cases
- Outpatient confirmed cases higher than AL/RDT & Lab cases on 7th. Lab cases also fewer than AL/RDT cases
- Missing data: e.g. lab data on the 2nd and 20th
- Lab confirmed malaria cases higher than outpatient confirmed cases on 16th

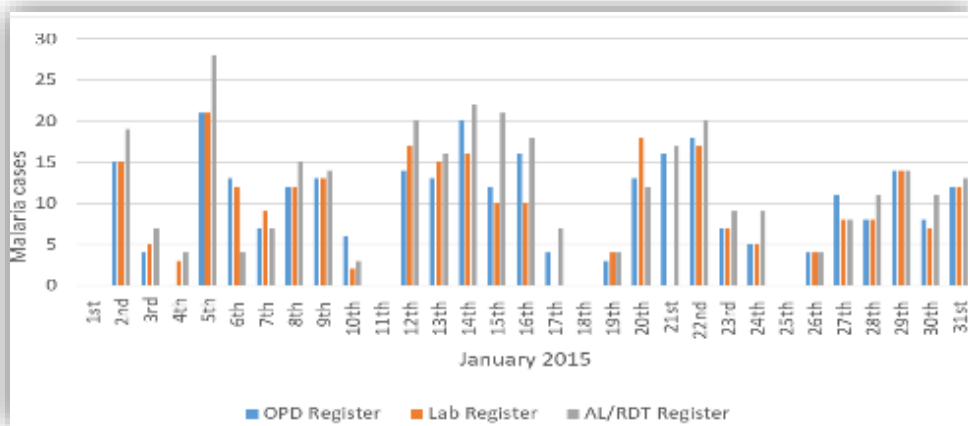


Figure 7.3 Facility B malaria cases recorded in registers

- Cases treated higher than outpatient and laboratory confirmed cases on 2nd, 5th, 15th, and 24th.
- Lab data missing on 17th & 21st
- Outpatient data missing on 4th
- Outpatient and laboratory confirmed cases higher than AL/RDT cases treated on 6th
- OPD cases higher than cases recorded in the lab and AL/RDT register on the 27th

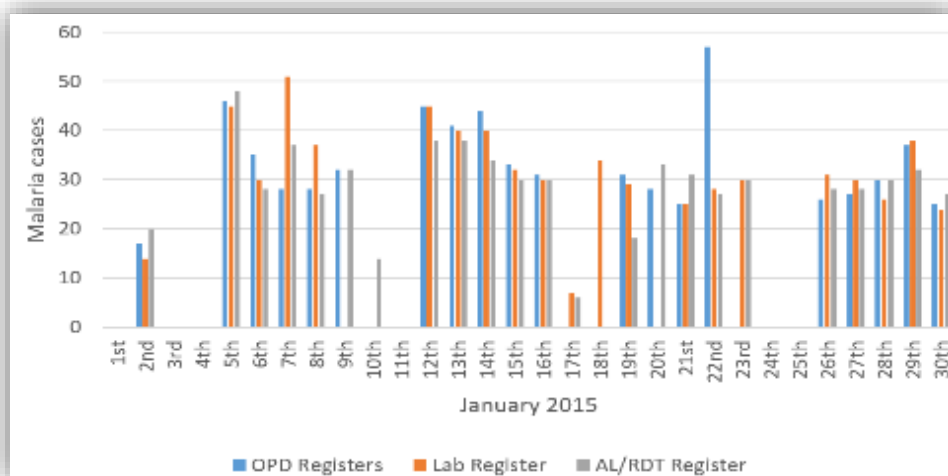


Figure 7.4 Facility C malaria cases recorded in registers

- Lab data missing on the 9th & 20th
- Outpatient confirmed cases double number of lab and AL/RDT treated cases treated on the 22nd
- Outpatient confirmed cases and AL/RDT cases treated missing on the 18th
- Outpatient cases missing on the 17th & 23rd
- Lab and outpatient confirmed cases missing on the 10th

These daily variations and inconsistencies in reporting within and among the registers in each facility were concealed in the monthly reports. In one of the facilities, facility B despite these variations (including missing laboratory data on 17th and 21st), their monthly reports (MOH 705A+B and MOH 706) indicated that the total number of malaria cases seen in the outpatient clinic were equivalent to confirmed cases in the laboratory (see table 7.1). This may be misinterpreted to mean that each confirmed malaria case recorded in the laboratory register was also recorded in the outpatient register which was not the case. In the other three facilities some of the inconsistencies between the registers were visible with different totals of confirmed malaria cases being reported in forms MOH 705 (A&B) and form MOH 706 (table 7.1). In facility C I was told by the health facility manager that to try and ensure consistency in data recorded between the two registers, they used laboratory confirmed malaria cases (which was perceived to be the most accurate) to compile outpatient morbidity reports. Nonetheless, despite these attempts to ensure consistency, data in outpatient morbidity and laboratory reports for this facility were still inconsistent as shown table 7.1.

Table 7.1 Confirmed malaria cases reported in monthly reports in January 2015

Reporting form: Jan 2015	Facility A	Facility B	Facility C	Facility D
Outpatient morbidity (705A+B)	214	295	675	45
MOH 706 Laboratory	205	295	660	Missing

Health workers in all four facilities acknowledged that these discrepancies indeed existed.

“I have also been querying that [inconsistencies] a lot but I have not found an answer. This is what made me to realize [MOH 505 Surveillance report]. I am the one who used to compile this report. When I was compiling this, I would realize that the report that was coming from the lab was different from the report that was coming from the OPD and also different from the pharmacy where the drugs were being dispensed”. Health worker, FB-RO

Sub-county managers attending feedback meetings on preliminary findings from this study also agreed with this finding.

“These variations are there. You are just right. We have even tried to compare MOH 705A plus MOH 705B and MOH 706 or maybe those who don’t have labs, [MOH] 643. We found out that the data was not the same in most facilities. We have tried to analyse the data here and in most cases, the data is not the same... So we are wondering where they get the data from. This data is supposed to come from the same source, but they are different.” Sub-county manager, SCA-LT

7.2.2 Reasons for these variations

These variations can be linked to some of the practices described in chapters 5 and 6.

a) Patient management practices

i) Malaria tests conducted outside the laboratory

As described in chapter 6, in addition to the laboratory, malaria tests (RDTs) in facility B & C were sometimes conducted at other service delivery areas (VCT rooms, HIV/AIDS consultation clinic or outpatient consultation rooms) to manage workload and also adhere to case management guidelines. In facility C, when the VCT counsellor conducted these tests, he retrieved the laboratory register from the laboratory and used it to record tests results. However, in facility B there were several improvised registers introduced by the laboratory technologist that were used to record results of tests conducted outside the laboratory.

“I am the one who brought those [improvised] registers to help me with those people. So that let them not complain maybe that a client comes at night when the lab is locked and somebody uses RDT and has nowhere to record” Health worker, FA-LT

The facility B manager explained that these improvised registers were inconsistently used, a practice that might explain why data appeared to be missing from the laboratory register on some occasions in facility B (figure 7.3).

“Yes we have put a book there though some people will assume it’s not there and just do the tests only. It mostly happens to clients being seen at night, where somebody uses RDT and once he has given the drugs that’s all” Facility manager, FB-N1

While extracting data from facility B’s laboratory register, I came across loose sheets of paper with malaria test results. There were also blank pages in the register. The laboratory technologist explained that these loose sheets were the results of tests conducted in other service delivery areas while he was away. He was meant to transfer these data into the blank pages in the laboratory register but had been unable to do so due to his busy schedule. This facility’s laboratory served as a reference laboratory for nearby facilities and as such, had a relatively higher workload. See box 7.1.

Box 7.1 Facility B: Laboratory workload

Every Tuesday and Thursday, Mathayo, the laboratory technologist arrived in the facility at 6am to collect and process blood samples from HIV/AIDS patients for viral load tests. Previously, this work was done by a HAWI employed laboratory technologist whose contract ended. At around 9am, he went back home to have his breakfast. Normally, by the time he arrived back in the facility, there would be a long queue of patients waiting to be attended to. There were mothers waiting for ANC profile tests (each requiring at least four different tests); and outpatients- the majority of them suspected malaria cases. This laboratory also served as a reference laboratory for surrounding health facilities. He also had private patients who were referred for special tests (which he did using his own reagents at a fee to supplement his 'meagre salary' as he referred to it). Mathayo had a strong preference for malaria microscopy and only conducted RDTs when overwhelmed. It took him about 30 minutes to collect, process and examine each slide. He always ensured that he conducted at least 15 malaria microscopy tests per day for 'quality control' although in some cases he conducted up to 30 malaria microscopy tests in a day. Normally, he recorded test results on a piece of paper, transferred this into patients' record books and later on, into the laboratory register (sometimes after the patient had left). Mathayo complained about the increased workload occasioned by the departure of the HAWI laboratory technologist, and the fact that he was now answerable to HAWI officials, who he said, were not his employers. HAWI did not pay him for this additional workload although he hoped that he would receive a salary top up from them (which never happened) or get employed (which eventually happened).

ii) *Malaria cases treated outside outpatient consultation rooms*

In chapter 5, I noted that role sharing was practiced in all four facilities as a strategy for managing workloads. In addition to outpatient consultation clinics, malaria outpatient consultations were also provided at other service delivery areas such as HIV/AIDS consultation clinics (facility B & C), the OPD waiting bay (facility C) and ANC clinics (facility A, B & C). If the patients provided with outpatient consultation services in the HIV/AIDS consultation room, ANC clinics, and OPD waiting bay were subsequently tested for malaria in the laboratory then the records of these patients were always captured in the laboratory and AL/RDT registers. In facility C, details of patients seen from the waiting bay were not recorded in the outpatient registers (which were located

inside outpatient consultation clinics). This may explain why outpatient registers recorded fewer cases than laboratory and AL/RDT registers in some cases (figure 7.4).

“Then the other challenge that we also have if you have been keen, in the late afternoon, you will see people being sent to the lab for tests from the waiting bay. The patient will go to the laboratory and will be prescribed a treatment. The patient will go straight to the pharmacy without his details being recorded in the register. So automatically the pharmacy person will record that in his register.” Facility manager, FC-N1

iii) Referrals

Health workers in facility B explained that there were cases when patients were referred to the laboratory from private pharmacies for malaria tests. Data from these patients were captured in the laboratory registers but not outpatient and AL/RDT registers since such patients exited the facility without going through the pharmacy or outpatient clinics. This practice may explain instances where malaria cases recorded in the laboratory register were higher than those recorded in outpatient and AL/RDT registers. It was not possible to verify this claim since the laboratory register did not indicate such referral cases. However, as noted in box 7.1 above, I observed a number of cases where patients were referred to this facility’s laboratory for specific tests which the laboratory technologist conducted at a fee. Results of these tests were always recorded in the laboratory register.

In facility D, health workers explained that there were rare occasions when patients with confirmed malaria were referred to the facility’s pharmacy from other facilities to be issued with AL (when AL was out of stock in these facilities). Since these patients had already been tested for malaria, they didn’t pass through the laboratory. As such, their

data were not captured in the laboratory register but were recorded in outpatient registers (they were required to report to outpatient departments for registration).

“There are cases where you find that patients are referred from other facilities to come pick AL from this facility. So the patient’s details will be recorded there [outpatient] register but not in the lab register.” Health worker, FD-N2

However, I never observed this in practice, and so cannot verify how often this happened, if at all.

In facility C, health workers explained that there were a few instances when community health workers (CHWs) conducted malaria tests at the community level as part of the community case management strategy. If CHWs did not have AL, they referred confirmed malaria cases to the health facility to be issued with AL. Since these patients had been tested for malaria in the community, they were issued with AL without having to go through the laboratory. These patients’ records were captured in outpatient registers which could explain instances when malaria cases recorded in outpatient and AL/RDT registers were higher than cases recorded in laboratory registers.

Other explanations provided by health workers for these inconsistencies included instances when patients with confirmed malaria cases reportedly left the facility without their details being entered in the outpatient or AL/RDT registers, a practice I also observed while recording data in outpatient registers in facility B & D.

“This is what I have been asking myself for the past three days now. At the end of a working day, you will find that there are close to 20 people who were prescribed antimalarial but they don’t come for them. So it gets to evening when am closing down the pharmacy and you don’t see them. So you wonder where they have gone to.” Health worker, FA-DS

Figure 7.5 summarizes the observed as well as reported practices in all four facilities that had an influence on data recording.

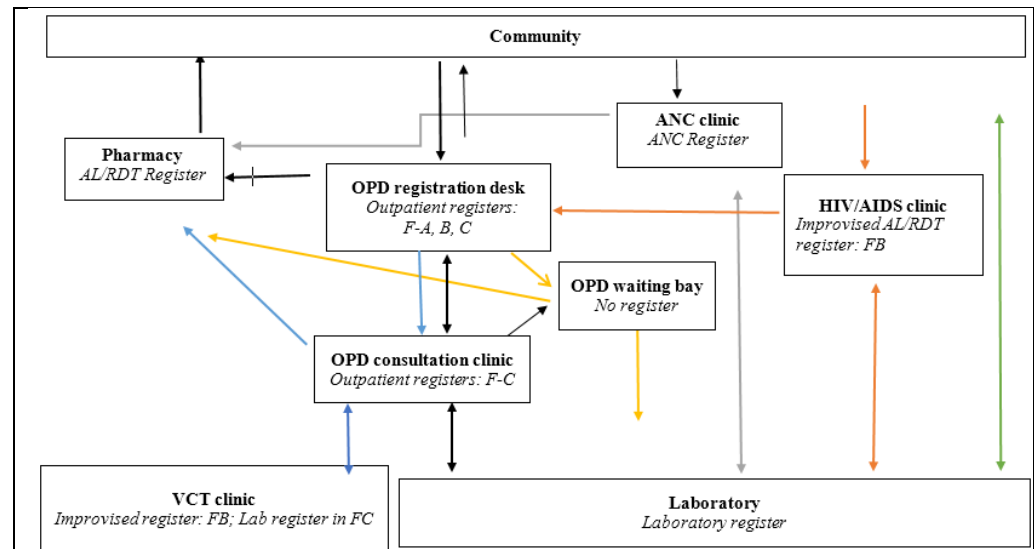


Figure 7.5 Patient management process and data recording in practice

Note: The standard patient flow process described in chapter 6 (figure 6.1) is shown by black arrows. Green: patients who are referred from private facilities to facility B's (F-B) lab for tests. They do not go through OPDs/pharmacy; Orange: patients tested for malaria in HIV/AIDS clinic in F-B. They do not go through OPD/laboratory. Grey: ANC women tested and treated for malaria without going through OPD. Yellow: patients seen from the OPD waiting bay in F-C. They do not go inside OPD consultation room. Blue: patients tested by CHWs who are referred to the facility to pick AL in F-C. They do not go to the lab. There are also patients who follow the standard process but exit the facility before they are issued with AL.

b) Influence of clinical malaria

Despite some of the variations pointing to the possibility of malaria being treated on clinical suspicion, without a diagnostic test (i.e. cases where the number of patients recorded as having been issued with AL was higher than outpatient or laboratory confirmed malaria cases; e.g. in facility C, figure 7.4), none of the four facilities reported any clinical malaria case in their outpatient morbidity summary reports. I was unable to verify if all malaria cases recorded in outpatient registers were clinical or confirmed cases. Nonetheless, a review of patient records in the outpatient registers in facilities C

& B (with the highest number of cases) revealed that not every confirmed malaria case recorded in the outpatient registers was issued with AL in the pharmacy. Similarly, not every patient recorded in AL/RDT register as having been issued with AL was recorded in outpatient registers as having been treated for malaria (which points to clinical malaria treatment). See table 7.2 for facility B & C data.

It was not possible to compare these data with confirmed cases recorded in laboratory registers. The improvised registers in use in facilities A, B & C did not capture patients' OPD visit numbers as recommended. In addition, in all four facilities, patients visited the laboratory before being assigned OPD visit numbers. In facility A, the AL/RDT register did not indicate outpatient visit numbers which made it practically impossible to compare these data. Facility D data were largely consistent across the registers for some of the reasons described above.

Table 7.2 Patients recorded as treated for malaria in outpatient and AL/RDT registers

Facility C			
Jan	Matching records: AL/RDT and Outpatient registers	Records present only in AL/RDT register	Record present only in Outpatient registers
1st	15	5	2
4th	29	19	17
5th	17	11	18
6th	21	16	8
7th	16	13	12
8th	20	18	12
9th	0	14	0
Facility B			
2nd	14	1	5
3rd	1	3	6
4th	0	0	4
5th	18	3	10
6th	6	7	0
7th	6	1	1
8th	11	1	4
9th	13	0	1
Note: Matching record refers to a case where a patient's OPD number is appearing in the two registers.			

Sub-county managers from the lake region sub-county reported that they had witnessed a number of cases where health workers had treated malaria clinically but failed to report the same, a practice that may have also contributed to some of these inconsistencies.

“The reason why they don’t match we are suspecting is that the clinicians treat clinical malaria cases but they report them as positive cases. They report them as positive in the 705, but you know positive malaria cases are only confirmed in the laboratory.” Sub-county manager, feedback meeting, SCA

They explained that their emphasis on treatment of confirmed malaria cases had made some health workers to fear reporting clinical malaria.

“The only reason why they do that now [treat malaria clinically but fail to report] is because it’s the government policy now. And we are also hard on them. We are hard on them. AL is supposed to be given to positive cases. So they would like to write that this person was a confirmed case of malaria and the person may not have even gone to the lab.” Sub-county manager, feedback meeting, SCA

Health workers were aware of this requirement and made every effort to ensure that in all cases, only confirmed malaria cases were treated and reported. As one of them remarked during informal chat, *“if you treat a malaria case clinically, the sub-county officers will scream at you like you have killed somebody!”*. However, while every effort was made to follow this directive there were instances when parasitologically confirmation was not immediately possible (see box 7.2). When this occurred treatment was prescribed but these practices were not reported. Such practices may contribute to over-reporting of confirmed malaria cases as previous data quality audits have reported (Division of Malaria Control 2013, Githinji, Onyando et al. 2016).

Box 7.2. Clinical malaria treatment in facility C

During one of the observation days, the laboratory technologist failed to show up. There were no RDTs in stock so nurses on duty treated malaria clinically (but with a lot of apprehension). The laboratory technologist later showed up at midday looking intoxicated. He proceeded to conduct routine tests. By the time he arrived, 16 cases have been treated clinically and were clearly marked as such (clinical malaria) in outpatient registers. At the end of the month, all these 16 malaria cases were misreported as confirmed malaria. When I pointed out this error to the nurse who was compiling this monthly report, she insisted that all malaria cases managed in the facility were confirmed cases (she was not on duty on the day during which 16 cases were treated clinically). We counterchecked the register where she noted that indeed, these cases had been marked as '*clinical malaria*' cases. However, she did not correct the reporting error, though this was after she established from me that my data was purely for research purposes and that I would not share it with the sub-county managers. This facility's monthly reports reported no clinical malaria while this was not the case.

7.2.3 Tracer 2: IPTp data quality issues

A review of ANC registers showed that recording practices whenever IPTp was issued were consistent in all four facilities and there were fewer data quality issues. However, in facility A, it was noted that between January and March 2015, IPTp doses administered were simply marked as 'Y' or '1' in the ANC register. This made it difficult to identify the dose of IPTp given to a woman. In February 2015 for example, all doses of IPT issued were marked as '1', implying that all women received only IPT1 during this month. Nonetheless, the facility still produced reports on IPTp1 and IPTp2. None of the nurses working in the ANC clinic was able to explain where they obtained IPTp2 data that was entered into the reporting form. Informal interviews with nurses working in the ANC clinic suggested that around this period, the register had been filled by an untrained member of support staff whose practices had contributed to the observed errors. One of the nurses explained that to address the problem, they had transferred this member of support staff to other service delivery areas and conducted on the job training for the remaining members of staff to improve their skills in data recording.

According national guidelines, IPTp should only be recorded as administered if its provided as directly observed therapy (DOT). This was largely the case in facilities A, B & C whenever SP and clean drinking water was available. In facility D, the nurse prescribed SP in the ANC room but delegated IPTp administration to a support staff member in the pharmacy. One of the nurses explained that their decision to shift SP administration to the pharmacy was to reduce the workload and that it made sense to do this because other drugs requiring directly observed therapy (DOT) were prescribed and dispensed in this way.

I: So why was it [SP] prescribed this side [ANC clinic] but administered in the other room [pharmacy]?

R: To reduce the workload...

I: Is it not supposed to be administered as DOT?

R: Yes. We assumed that if AL is administered as DOT in the pharmacy, then even SP can be administered as DOT in the pharmacy. Health worker, FD-N3

In facility D the nurse marked IPTp as issued in the woman's MCH booklet and instructed the mother to collect the drug from the pharmacy. He also marked IPTp as issued in the MOH 405 register although he had no way of ascertaining whether these mothers received SP or not. In the pharmacy, women were given IPTp either as DOT or were issued with SP tablets and instructed to take them at home. At the end of the month, all IPTp doses recorded in the ANC register were counted and reported as IPTp although it is probable that these data comprised of two categories: i) women who were prescribed IPTp in the ANC room by the nurse and received the drug in the pharmacy as DOT; and ii) mothers who were prescribed SP in the ANC rooms but there was no proof that they picked up the drugs from the pharmacy or even ingested them (which may lead to over reporting of IPTp doses administered). However, because of a lack of

documentation of SP doses issued in the pharmacy, it was not possible for me to verify whether or not IPTp was being over reported.

Across all four facilities there was confusion regarding the reporting of IPTp2, particularly at the initial stages of this study. This confusion emanated from inconsistencies between the summary indicator listed at the bottom of each page of the ANC register (No. given IPT2+) and the indicator reported in MOH 711, AWP, and MOH 105 reports which all required data on *number of pregnant women receiving IPTp2* (but labelled differently across the three forms). This inconsistency between page summary data and monthly reporting requirement coupled with unclear guidelines on IPTp implementation following the change in IPTp policy created confusions which led health workers to report IPTp2+ in place of IPTp2. That is, all women receiving two to seven doses of IPTp were counted and reported as IPTp2. This over-reporting of the IPTp2 indicator was a well-recognized problem in Kenya (surveillance bulletins issue 8) (National Malaria Control Program 2016) and resulted in corrective actions being taken from the national and county levels such as refresher training for health workers, and demands for health workers to recount and resubmit IPTp 1 & 2 data for the three preceding years in one of the two sub-counties for correction in the DHIS2 (Rawlins, Ngindu et al. 2014).

Having described data quality issues with the two tracer indicators in reports at the health facility level, next I describe some of the observed data quality issues with the two tracer indicators at the sub-county level where aggregated facility reports are entered into the DHIS2.

7.3 Data quality issues: DHIS2

In chapter 6, I described some of the challenges encountered during the process of entering data from the paper monthly report forms into the DHIS2. Completed copies of the paper monthly reports from each facility were manually entered into online copies of the same forms in the DHIS2; by the SHRIO (and volunteers) in the coast region sub-county and volunteers entirely in the lake sub-region. If this transfer is done accurately, then the data in the paper reports should match the data in the online copies of the same forms in the DHIS2. To explore the consistency between the data in the paper forms and the same forms in the DHIS2 I compared facility data reported in paper copies of monthly reports (outpatient morbidity reports, AWP service delivery reports, laboratory reports, MOH 711 report, MOH 706 report, and MOH 643) and data entered in the DHIS2 over a three-month period for all four facilities. The results of this comparison suggests that, while perhaps not so frequent, there is also the potential for considerable discrepancies at this step in the indicator production process as discussed below.

a) Discrepancies between paper and online DHIS2 reports

Confirmed malaria cases reported in the paper copy of outpatient morbidity summary forms (705A and 705B) in facility A & D located in the coast region were all identical to those reported in the DHIS2 over the three-month period reviewed (table 7.3). This was also the case with facility B's MOH 705B report. However, as can be seen from table 7.3 there were several discrepancies between the paper forms and the data in the electronic forms in the DHIS2. These discrepancies are discussed in the following sections.

Table 7.3 Paper vs electronic copies of monthly reports entered into the DHIS 2

2015		Jan		Feb		Mar	
Facility A							
Reporting form	Indicator	Paper	DHIS2	Paper	DHIS2	Paper	DHIS2
MOH 705 A	Confirmed	51	51	6	6	3	3
MOH 705 B	Confirmed	162	162	19	19	6	6
AWP	Confirmed	missing	213	20	25	10	9
MOH 706	Positive	205	missing	11	missing	9	missing
MOH 643	Positive	Not used					
Facility B							
MOH 705 A	Confirmed	138	212	84	84	104	104
MOH 705 B	Confirmed	157	157	170	170	180	180
AWP	Confirmed	295	369	254	254	284	284
MOH 706	Positive	285	missing	267	267	290	290
MOH 643	Positive	285	missing	267	missing	290	missing
Facility C							
MOH 705 A	Confirmed	264	no data	213	213	151	151
MOH 705 B	Confirmed	403	no data	408	408	216	216
AWP	Confirmed	660	blank	620	621	0	367
MOH 706	Positive	missing					
MOH 643	Positive	660	Missing	626	Missing	367	Missing
Facility D							
MOH 705 A	Confirmed	8	8	2	2	1	1
MOH 705 B	Confirmed	37	37	12	12	8	1
AWP	Confirmed	missing	46	missing	15	missing	9
MOH 706	Positive	missing					
MOH 643	Positive	missing					

b) Missing data in the DHIS2

In several instances data were missing from one or other or both forms. It is understandable that if data is missing from the paper form then no data should be entered into the electronic form, as is the case for MOH 643 in facility A & D; and MOH 706 in facility C & D for all three months. However, where data are present in the paper form they should also appear in the DHIS2. This was not the case for the MOH 706 laboratory data from facility A where there were data available on the MOH 706 paper report forms at the health facility between January and March but these data were missing in the DHIS2. Facility B's MOH 706 data for January were also missing in the DHIS2 even though they were available in the paper report. One of the sub-county

managers explained that data fields in the MOH 706 reporting form in use during this period were incompatible with data fields in the electronic copy in the DHIS2 which made it impossible to key in these data.

“The DHIS2 was not compatible with the MOH 706 (Lab report). So most of the places in the country were not even able to upload the data. If they uploaded the data, they used to cook the data. The DHIS talks about different things and the MOH 706 hard copy also talks about different things. It is only this month that they reviewed the tools in the DHIS so that it can be compatible with the tool on the ground. Now we are seeing that it is a bit compatible. So we have started to upload data.” Sub-county Manager, feedback meeting, SCB-LT

A review of data fields in the paper and online copy of MOH 706 laboratory report confirmed the above observation. This was also the case with the MOH 643 reporting form (box 7.3). While the paper copy of this form completed at the health facility level collected malaria diagnosis data, the online copy of this form did not contain data fields for capturing this information. Instead, it only contained data fields for recording consumption data of malaria RDTs. This may explain why facility B & C’s data were available at the health facility level, but was missing in the DHIS2. As stated in chapter six, MOH 643 reporting form was not completed in facility A.

Box 7.3: Data fields in paper vs online copies of MOH 706 and MOH 643 reporting forms	
Data fields in the paper copy of MOH 706	Data fields of MOH 706 in the DHIS2
<ol style="list-style-type: none"> 1. Malaria BS (< 5 years) total exam 2. Malaria BS (>5 years) total exam 3. Malaria RDTs total exam 4. Malaria BS (<5 years) no positive 5. Malaria BS (>5 years) no positive 6. Malaria RDTs no positive 	<ol style="list-style-type: none"> 1. Malaria (total exam) 2. Malaria (positive)
MOH 643 reporting form	
<p><i>No of tests performed (by RDTs)</i></p> <ul style="list-style-type: none"> • Patients under 5 years • Patients 5-14 years • Patients aged over 14 <p><i>No of tests performed (by microscopy)</i></p> <ul style="list-style-type: none"> • Patients under 5 years • Patients 5-14 years • Patients aged over 14 <p><i>No positive (by RDTs)</i></p> <ul style="list-style-type: none"> • Patients under 5 years • Patients 5-14 years • Patients aged over 14 <p><i>No positive (by microscopy)</i></p> <ul style="list-style-type: none"> • Patients under 5 years • Patients 5-14 years • Patients aged over 14 	<p><i>Malaria testing commodities (malaria RDTs)</i></p> <ol style="list-style-type: none"> 1. Quantity received from central warehouse 2. Quantity received from other sources 3. Quantity used 4. Number of tests done 5. Losses and wastage 6. Positive adjustments 7. Negative adjustments 8. End of month physical count 9. Quantity expiring in less than 6 months 10. Days out of stock this month 11. Quantity requested for re-supply 12. Quantity requested for re-supply (auto-calculated)

c) *Data entry errors*

It is also clear from the data in table 7.2 that there were cases where data reported in the paper copy of monthly reporting forms were different from the data entered in the electronic reporting form in the DHIS2. This was the case with facility A AWP form for February and March; Facility B's MOH 705A and AWP forms for January. One of the sub-county health records acknowledged these discrepancies when I showed him the data during an interview.

“This should be [a data] entry problem. I think this is a good feedback. This one I can correct. This one I can correct...This one is too big!” Sub-county manager, SCA-RO

Some health workers also blamed data entry errors on the sub-county health records office:

“I think they also have to look at themselves. Do they put what we have given them? What we have is not what they have. And you see what we have here is a photocopy of what we leave with them” Facility manager, FC-N1

d) Discrepancies due to system challenges

Some of these discrepancies between paper and DHIS2 reports were attributed to software system challenges. For example, a senior manager reported that problems had occurred with the DHIS2 in January 2015. Consequently, some of the data entered into the system were not uploaded, leading to missing data.

“For January, I think the issue was that the DHIS2 was not updating. So many indicators were being fed even twice or thrice but they were not being updated. So to date, we are having problems with the data. So it was not a data entry problem but a system issue” Sub-county manager, SCA-PA

Facility manager supported this view:

“I think in January; it was a challenge for those people there. There is a training-a meeting for malaria that we attended. Nearly everybody didn't have that data. So it is like whoever was keying in data did not” Facility manager, FC-N1

e) Discrepancies due to auto-completion

Observations of the data entry process into the DHIS2 revealed that most data elements in the AWP reporting form were auto-completed based on entries made on other reports in the DHIS2 hence rendering manual copies of this form redundant. For example, the

‘confirmed malaria’ field in the AWP form in the DHIS2 is automatically populated by summing the data from MOH 705A and MOH 705B (confirmed malaria in under-fives and over fives respectively). This may explain why the electronic copy of this form in the DHIS2 for facility D had data for the three months (table 7.2) even though paper copies of this form were unavailable in both the facility and at the sub-county health records office. This was also the case with the AWP form for facility C in January. There were also discrepancies between this facility’s paper report of AWP data for the month of February and March and the data in electronic form in the DHIS2 suggesting that the DHIS2 data had come from a different source (table 7.2).

In general health workers were unaware of the data entry omissions and errors at the sub-county level or of the data redundancy and recording issues in the DHIS2. Across all of the four facilities only one health worker, a health records officer employed by the HAWI NGO, had access to the DHIS2. Once the health facility managers had submitted their monthly reports, they did not make any follow up on the outcomes. The facility managers and other health staff only became aware of the discrepancies between their reporting data and the data in the DHIS2 when sub-county managers, or other stakeholders, extracted the data from the DHIS2 and showed it to them during support supervision visits, or during sub-county level meetings. See box 7.4

Box 7.4 Malaria support supervision in facility B

Two sub-county managers have visited the facility today. No one in the facility seems to have been aware of their visit. They invite health workers to a quick meeting. It is a very informal meeting. They explain that they have come for malaria support supervision. One of them proceeds to show health workers confirmed malaria cases vis a vis AL doses dispensed which he says, they have retrieved from facility reports in the DHIS2. These data shows that the facility is over-consuming AL. Health workers disagree. They say that these are not their data. To prove their point, one of them retrieves copies of submitted facility reports and shows the sub-county managers their 'true data.' The health worker argues that the data they complete at the health facility level are of 'good quality' and ask the sub-managers if the data they submitted and was subsequently entered into the DHIS2 '*has been eaten by a viral infection*' to make it different from what they have in the paper report. Other health workers support him. These two managers promise to look into the matter. They leave the facility shortly after about half an hour without visiting any service delivery areas or even reviewing facility registers. They are proceeding to the next facility.

One of the two managers explained during the feedback meeting I organized that they had encountered a number of cases where data they extracted from the DHIS2 were different from data in the paper copies of the monthly reports:

“That one [data entry errors] we noted. In fact, last week we were doing some CMEs [continuous medical education], and the in-charges were saying that was not their data. So we asked them to bring their photocopied reports. So when we checked it was actually different from what was in the DHIS” Sub-county Manager, feedback meeting, SCA-VC

7.4 Summary

Discrepancies exist in the malaria diagnosis and treatment data that are recorded in the various registers found in the front-line health facilities. These variations are concealed in aggregated monthly reports submitted to the sub-counties and mask underlying service delivery practices which do not conform to recommended best practices. Although the DHIS2 corrects some of these issues through auto-correction and auto-completion, the underlying problems around unclear definition of indicators are obscured and the auto-completion potentially compounds both reporting and data entry errors. Rather than containing standardised objective measure of malaria my data suggest that the DHIS2 contains multiple interpretations of the ‘malaria reality’ that current data quality audit tools, with their focus on aggregated monthly reports, may not reveal. In my experience, these data quality issues are rarely caused by health workers deliberately manipulating their data, but rather are the result of various organizational, technical and behavioural factors. I will explore these underlying factors in detail in the next chapter.

8 FACTORS INFLUENCING ROUTINE MALARIA DATA COLLECTION AND REPORTING PROCESSES

8.1 Introduction

In the previous two chapters I have outlined the context within which routine malaria data collection and reporting takes place in Kenya, described daily data collection and monthly data reporting practices and explored the quality of the data produced. In this chapter, I describe how some of the broader contextual factors (specifically, human resources, health system organisation and management and technical issues) influence the malaria data collection and reporting practices in the four facilities and sub-county health records offices involved in this study and compare my findings with those from other studies in sub-Saharan Africa. The chapter is divided into six sections.

I start the chapter with a discussion of some of the human resource factors that influenced routine malaria data generation. Specifically, I explore how informal task shifting was being used as a strategy for coping with human resource shortages. Human resource management challenges are also discussed. In section 8.3, I then describe the broader health system and organization management challenges and discuss the influence that these challenges were having on data collection. The third section, section 8.4, addresses how the design of data collection tools also shaped the malaria indicator data generation process in these facilities, and in section 8.5 I describe how uncoordinated demands for data from the national level perpetuates data burdens at the frontline health facility level. A summary of the chapter is provided in section 8.6

8.2 Human resource factors

8.2.1 Human resources shortages and informal task shifting

In chapter 5, I described how human resource shortages were a challenge in all four facilities as well as at the two sub-county health records offices. Shortages of adequately

trained health professionals and technical support staff is a well-recognized problem in Kenya (Blumhangen 2010, Luoma 2010, Ministry of Health 2014, Wakaba, Mbindyo et al. 2014) and other countries in sub-Saharan Africa (Kinfu, Dal Poz et al. 2009, Willcox, Peersman et al. 2015). To cope with these shortages of government employed professional staff, all four facilities employed casual staff to perform various auxiliary duties; a practice that is also commonly found in many other settings (Ferrinho, Sidat et al. 2012, Mpofu, Semo et al. 2014, Topp, Chipukuma et al. 2015). These casual staff do not have a clear job description and perform multiple roles, including clinical duties, which are beyond their scope (chapter 5). A recently published systematic review of task shifting in sub-Saharan Africa suggests that this form of task shifting is a frequently used strategy for coping with shortages in professional staff (Mijovic, McKnight et al. 2016). In all four facilities, data collection responsibilities in outpatient and pharmacy departments were mainly handled by these casual staff who acknowledged their lack of formal training in data collection:

“We don’t have a registry clerk and I am only doing to help. It is not my profession. If someone came and asked me questions [about data], I wouldn’t be in a position to respond to him... I have never studied anything to do with data or registry. I am just here to assist.” Casual staff, FA-DC

Due to the lack of formal training, these support staff relied mainly on their experience acquired over time to fulfil their data collection roles. Some of their practices strengthened the data collection process (for example support staff in facility D declining to issue medicines to patients without outpatient visit numbers- refer to box 5.5). However, some had the potential to undermine the recommended data collection processes. For example, in facilities B & D, whenever diagnosis or treatment information in patients’ record books was illegible, rather than seek clarifications from the prescribing health worker, the support staff used their ‘experience’ to determine the ‘correct’ diagnosis or treatment and recorded this interpretation in the outpatient register. Their lack of clinical training made these interpretations open to question and

a lack of training in accurate data recording practices contributed to them being unaware that best practice would be to seek clarification before recording potentially inaccurate information. It is unclear the extent to which their interpretations were correct, but the data recorded in the outpatient registers and subsequently reported at the end of the month hid these interpretations and any differences with nurses/clinical officer records. Some health workers and sub-county managers acknowledged that the involvement of support staff in the data collection process possibly undermined data quality, an issue that has also been documented in data quality audit reports in Kenya (Division of Malaria Control 2013, Ministry of Health 2014).

“We have been using support staff to fill these reports. At the end of the day, whatever these support staff will fill is what you will get. So garbage in garbage out. At the end of the day, we will complain that our data is not of good quality”

Health worker, feedback meeting, SCB,

Other studies conducted elsewhere in SSA have also documented mixed outcomes from delegating certain tasks to untrained staff (Ferrinho, Sidat et al. 2012, Mpofu, Semo et al. 2014, Topp, Chipukuma et al. 2015, Mijovic, McKnight et al. 2016). For instance, Mpofu et al. (2014) found that shifting monitoring and evaluation duties from nurses to other professionals improved data quality, management and reporting, and also freed up time for nurses to concentrate on other duties in Botswana (Mpofu, Semo et al. 2014). In Malawi, managers raised concerns that lay health workers were posing as doctors and providing services that were beyond their scope (Callaghan-Koru, Hyder et al. 2012).

Despite the critical role they played in the data collection process, and recognition of their limited capacities in data recording, these support staff rarely got an opportunity to attend sub-county level training. Such training was popular in both sub-counties due to extra allowances earned. For instance, the clinical officer from facility B attended the

training organized by an NGO to sensitize health workers on the use of the modified registers described below (8.3.1), despite the fact that he hardly ever recorded data in either of the two outpatient registers. When these registers were rolled out in this facility, the data clerk and the pharmacy assistant (both casual staff) were left to figure out by themselves how to complete them. In trying to complete this new process they made several mistakes which undermined data quality. This was an issue of concern for the support staff:

“In reality, it is the support staff who do everything. Those who are formally employed don’t do the reports. It’s up to us support staff to do the reports. Yet we don’t go to any training. You need to have a job group [be in government payroll] to be invited to these trainings. We don’t have job groups so what will we say we are? So if we are not seen to be important, then those who are eligible who go for those trainings should do them so that the reports are correct”

Casual staff, FD-LT

Several studies from across sub-Saharan Africa have found that these training workshops are popular among health workers, who are often poorly paid, because the allowances received supplement their income (Coulibaly, Cavalli et al. 2008, Hanefeld and Musheke 2009, Sullivan 2011). However, studies have also shown that such training workshops are a major cause of frequent health worker absenteeism, an issue that disrupts service delivery (Coulibaly, Cavalli et al. 2008). During the period of my fieldwork, in both sub-counties facility managers spent a considerable amount of time away from their health facilities attending training workshops and meetings. I observed a number of instances in facility B, C, & D when only a single nurse was available in the facility. The lack of professional staff subsequently led to delegation of certain tasks such as immunizations to casual staff. In addition, these training workshops can fuel tensions and conflict between health workers if they perceive that they have been denied an equal chance to access benefits associated with attendance (Sullivan 2011). For

example, I observed a case where one of the casual staff (a laboratory technologist) declined to conduct HIV tests because he had not been invited to a training session where health workers were taken through a new testing procedure. Although he said he knew how to do the test, he insisted that the nurse who attended the training be the one to conduct these tests. This affected the provision of certain services such as IPTp which in this facility, was only administered to women with a known HIV status.

Although task shifting has been promoted as a possible strategy for addressing staffing challenges in the region, and improving service delivery (World Health Organization 2008), these experiences suggest that such strategies would require the provision of training opportunities, good working environment, adequate support supervision and effective regulatory frameworks, to ensure both effective service delivery and adequate data recording and reporting practices (Lehmann, Van Damme et al. 2009).

As noted in chapter 5, alongside casual staff, volunteers played a major role in the data generation process in both sub-counties. This was especially the case in the lake region sub-county where their roles were prominent. Volunteerism within the health sector, in particular, is not a new phenomenon (Laleman, Kegels et al. 2007, Wilby, Kitutu et al. 2012). For example, community health volunteers have been used widely in sub-Saharan Africa to deliver various health interventions at the community level (World Health Organization 2016). However, in the context of high youth unemployment rates in many low income countries such as Kenya (The World Bank 2016), Brown and Green (2015) note that volunteering is increasingly becoming professionalized (Brown and Green 2015). Most of the volunteers working at the two sub-county health records offices were fresh college graduates. Informal conversations with them revealed that their main motivation for volunteering was to acquire relevant work experience which increased their chances of securing job opportunities in the future (either within or without the offices where they volunteered). This suggests that volunteerism was not entirely

altruistic (Brown and Green 2015). These ‘volunteer positions’ also accorded these category of staff an opportunity to earn certain allowances payable to formally employed government staff whenever they took part in sub-county wide activities (e.g. mass bed-net distribution campaigns). When their intrinsic motivations were unmet (e.g. when excluded from sub-county activities where they could receive allowances), they got demoralized and indirectly subverted the process (e.g. by withdrawing their services). For example, when one of the volunteers in the lake region sub-county failed to secure employment with the county government after a recruitment process, she went on a ‘go slow’ for a few days which affected data entry in the sub-county. She eventually secured employment with the HAWI NGO (referred to in chapter 5) with the help of senior managers.

The intrinsic motivation for providing assistance with little pay or security was also evident among many of the casual staff. Across all four facilities the casual staff worked with the expectation that they would be employed in government or NGO roles in the future. In facility A, the laboratory technologist took over the HAWI laboratory duties with the hope of securing employment with the same organization and he was eventually employed by them (chapter 7- box 7.1). Similarly, the laboratory technologist in facility D who was paid by the facility management committee explained to me on several occasions about her struggles working in this facility due to the poor salary which was also often delayed. However, she considered it a ‘service to the community’ and also hoped to be absorbed by the county government. Although she was eventually employed by the county government, she was still categorised as a casual and was paid the same amount of money as other subordinate staff with no formal health training.

8.2.2 *Human resource management challenges*

During the period of my study it became clear that at both sub-county and health facility level, the frequent delays in the payment of staff salaries were creating a challenge for

staff management in terms of retention and motivation. Such payment delays are a well-recognized constraint in many public health systems in sub-Saharan Africa (Witter, Kusi et al. 2007, McCoy, Bennett et al. 2008), including Kenya (Barker, Mulaki et al. 2014, Towett and Kaseje 2016). However, the situation in Kenya has been exacerbated by the accelerated decentralization process that took place from 2013 (Ministry of Health 2015, Tsofa, Goodman et al. 2017). Devolution resulted in the transfer of human resource management functions from the national government to county governments (Ministry of Health 2015). This process was implemented far more rapidly than initially intended, bringing significant confusion and anxiety regarding roles and responsibilities of county level health managers, the mechanisms and timing of pay for health workers, and whether or not transfers to health workers' counties of origin were going to be preferred/required (Tsofa, Molyneux et al. 2017). There were significant delays in salary payments and movement of staff as a result, which had a direct influence on staff morale in both sub-counties, particularly in the earlier stages of field work.

Throughout the study period, there was a wave of health worker strikes across the country to protest against delayed salaries. There were also concerns about poor working environments linked to funding and drug supply delays. In the lake region sub-county for example, health workers went on strike twice during the study. In both counties, there were also resignations and movements of health staff that may or may not have been related to devolution. Over the one-year field work period for example, two sub-county managers and at least two government employed nurses resigned from their positions in my locations of study, and another nurse retired from the government sector. Importantly, none of these staff had been replaced by the time I completed field work for this study.

At facility level, challenges were felt as a result of the lack of clarity about how the health sector services fund (HSSF) would be administered under devolution, as well as

the sudden announcement, by the new president immediately after the election in 2013, that user fees would be removed (Nykuri, Tsofa et al. 2015). User fees and HSSF funds were critical to the financial management of facilities prior to devolution, and in particular were key to facilities being able to pay for casual staff. Over the time of my fieldwork, health facilities were experiencing significant financial constraints due to delays in getting HSSF style funds from counties or national level; and they were concerned about going against government pronouncements to the public that facility services should be free. When I began field work, casual staff working facilities B & D had not received their salaries for over 3 months. They attributed this delay to the sudden removal of user fees.

“We used to charge for tests. Lab collections is what was used to pay us. Then we were told that we shouldn’t charge. That it is free. So when we started offering services for free, casual staff couldn’t be paid...” Casual staff, FD-LT

In response, they adopted certain coping mechanisms such as stocking and selling certain drugs to patients at a fee (facility D), procuring their own reagents and conducting tests at a fee (facility B & D), and charging patients for certain services which was contrary to government policy (e.g. family planning and wound dressing). Other members of the casual staff sought additional employment to cope with delays in their regular employment payments. To compensate for loss of pay in the main facility in which he was employed (facility B), one of the laboratory technologists worked on locum in a neighbouring health facility over the weekend, even though facility B was also open over the weekend. Since the laboratory technologist was not in post in facility B the laboratory was closed and the health workers on duty conducted the malaria RDTs. When this happened test results were recorded in improvised tools because the lab register was kept locked in the laboratory (7.2.2-a). This use of improvised tools contributed to some of the data quality issues highlighted in the previous chapter. Similarly, a data clerk from facility D worked on ‘locum’ in a nearby health facility

without the approval of the facility manager. As stated in chapter 6 (6.3.1), this particular casual staff member was responsible for compiling outpatient morbidity reports (and other non-malaria related reports). This practice therefore led to the late compilation of monthly reports which he was responsible for.

When health workers in the lake region sub-county went on strike to protest against delayed salaries, the dispenser (casual staff) who was assisting the HAWI clinical officer to provide services in the absence of government nurses, joined the strike. He explained that he had not been paid for 6 months as well. He closed the pharmacy and left the facility, forcing the HAWI clinical officer to terminate service delivery altogether.

An additional consequence of delays in salaries and low pay that affected the operation of the health facilities, influencing their ability to produce consistent quality data, was the rapid turnover in casual staff. Compared to the government employees, these staff have much less job security but also much greater autonomy in terms of their ability to move and choose where they work. Over the one-year that I was working in the field, facility C employed five different laboratory technologists. Because of poor pay, these laboratory technologists only worked in this facility for a short time and left as soon as they secured better jobs elsewhere. Although the facility manager blamed one of the sub-county managers for 'poaching' these laboratory technologists, none of them had secured employment with the county government. For example, when one of these laboratory technologists left, he informed the facility manager that he had been invited to a training workshop by the sub-county manager which was not true. He had confided me the previous day that he had secured a job with an NGO. He argued that if he told the facility manager the truth, he would not be paid his salary for that month. He brought in another laboratory technologist to stand in for him without discussing this with the facility manager. No one in the facility knew the qualifications of this new laboratory

technologist including the outgoing laboratory technologist who had brought him on board.

“I am going to tell the lab coordinator that even if I find a quack, he will work in that laboratory because they are making my work difficult. You come and do your supervision and then realize that I have a quality [good] person and then you pick them. And when I request you to employ these guys you don’t want to employ them. When they come for interviews where you can pick and retain them, you don’t want. Instead, you get them better jobs. So this time round, I am not looking for another one. I am not looking for another one. You see like this guy [New laboratory technologist]; I don’t know his qualifications. I don’t know anything about him. He came to hold brief for him when he went for some activity.” Facility manager, FC-N1

A key issue raised by these practices is the nature of the role of the casual staff within the health facility structure. Although the community health strategy has laid out the terms of engagement for community health volunteers (Ministry of Health 2014), to the best of my knowledge, no such regulatory framework exists for casual staff working within the formal health care system. Despite the fact that they work within the formal health care system, they are not answerable to sub-county managers which may explain why they have more freedom to engage in additional activities as explained above. In addition, they are not formally bound by long term contracts, and as such, have much greater autonomy in terms of their ability to move and choose where they work.

8.3 Organization management issues

8.3.1 Production and distribution of tools

As noted in chapter 5, there was a severe stock-out of standard MoH registers in all four facilities at the time of this study. Stock-out of registers and reporting tools is a

recurrent problem in Kenya (Blumhangen 2010, Chiba, Oguttu et al. 2012, Division of Malaria Control 2013) and other settings across sub-Saharan Africa (Chilundo, Sundby et al. 2004, Mubyazi, Byskov et al. 2014). The use of improvised tools allowed health workers to continue fulfilling various accountability requirements but undermined standardization of data collection and reporting. When no standard registers were available and the health workers develop their own improvised registers, these registers only included the data columns that were perceived to be useful for the compilation of the monthly reports. As Anne [not real name] explained to me when I asked her how they were planning to improvise the ANC register which had close to 40 columns:

“We will only include what we need [for reporting]. There is no reason why you have something that you will not use”. Nurse, FC-N1

For example, the improvised AL/RDT register in use in facility C only captured data on the number of AL doses dispensed, the only information required for reporting at the end of the month. Other data categories such as patient’s weight, which were important in determining the correct dose of AL but were not transferred to any of the reports at the end of the month, were not included in the improvised register. This suggests that improvisations are mainly motivated by the need to fulfil reporting obligations. Irrespective of whether the standard tools are available or not, submission of monthly reports is compulsory (chapter 3). Health workers are aware of this requirement hence the common practice of developing and using improvised tools when standard registers are unavailable.

“When it comes to end month you are expected to submit a report. You know reports can only be generated from these documented data. So when somebody comes and asks did you submit your report? Then you say yes. Where is the source of the report? Then you give this one” Health worker, FB-LT

A message posted in the DHIS2 messaging system in early 2014 attributed the stock-out of standard MoH tools to logistical challenges and on-going revision of these tools to align them with the revised health sector strategic plans. According to this message, it was envisaged that the revised tools would be made available to county governments for printing by July 2014. In the interim, county governments were instructed to photocopy existing MoH tools and distribute these to their facilities. However, throughout this study, the stock-out of tools persisted. Compounding this problem at the time of the study was a lack of clarity on the roles of county and national government in tool development and printing post-devolution.

“The national is supposed to supply the counties with the tools but now because of devolution you know there is that push and pull. The national now say that it’s counties mandate to provide the tools. The county also says that the national have not provided us with funds to bring these tools.” Sub-county Manager, SCA-HO

“Then with devolution, we [MoH] really did not think it was our function. We developed the templates and for those who had partners, we gave them the template to print for themselves.” National Manager, HO

In the lake sub-county, a local NGO working in collaboration with the county government modified outpatient and ANC registers. These revised registers were rolled out to all public health facilities in the county (facility B & C included) as a replacement for the standard MoH registers in March 2015. The revised registers introduced new data categories for the collection of additional malaria indicators. However, these data could not be reported using existing standard reporting forms. A manager at the national level informed me during an interview that county governments were not allowed to modify standard tools. He explained that the decision by this county to modify these tools, may have been driven by this NGO’s own interests.

“They are not allowed to develop their own registers. What I think is that the partner may have a special interest on the indicators that are there. Maybe the programme the partner was supporting...” National manager, HO

In facility B & C where they were deployed, health workers silently refused (Kamuya, Theobald et al. 2013) to follow instructions for recording data in these modified registers. They used blue instead of black pens to mark the register, ticked data fields instead of shading as required, and failed to write their initials when they made mistakes as per protocol. These registers were withdrawn from wide-scale use after a month following widespread protests from health workers about the stringent rules for completing them, and their bias towards data collection for malaria indicators which undermined the generation of other non-malaria indicators required in standard national reports.

I: Why did they [county health managers] stop [the use of these registers]?

R: People complained. It was impossible. Then it had some data that at the end of the month, we needed to report but you can't get.

I: I have seen in the OPD they are taking BMI [body mass index]

R: There are some indicators that when it gets to month end, you look for it but you can't just get it. So it forces you to add a column for your easy reporting”

Facility manager, FC-N1

A review of records in facility C showed that they had stopped using these registers a week before they were officially withdrawn. A nurse in this facility explained to me that this happened after the facility manager who was on duty alone on one particular day found that the registers were taking too much time to fill. She resorted to the use of the old tools and everyone in the facility followed suit. The sub-county health records

officer explained to me that the decision to withdraw these tools was also informed by the realization that development of standard registers is a function of the national government.

“Our [County] Director said that designing the registers is a national function. Those ones were designed by [HERA NGO] and it looks like they are not standard to the national. So he was saying that we stop using them because the function of designing a register is not under the county [government].” Sub-county Manager

Despite their withdrawal from wide-scale use, the registers continued to be piloted in selected facilities (facility B included) where they were used interchangeably with the standard ministry of health registers hence complicating data collation at the end of the month. Concerns about the revision of national tools by county governments and potential challenges for standardization of health data collection in the country were discussed in one of the national dissemination meetings I attended (chapter 4- table 4.4). These concerns were also captured in the minutes of malaria monitoring and evaluation Technical Working Group meeting held on the 31st March 2015. At this meeting it was agreed that the issue be brought up for discussion with the Health Information Systems Department. It was also to be tabled at the intergovernmental forum where disputes between national and county governments are discussed and resolved (Malaria M&E TWG minutes).

8.3.2 Stock-out of malaria commodities

As described in chapter 3, one of the purposes of collecting routine data on malaria diagnosis and treatment is to help quantify the use of malaria commodities for supply management (Box 3.4). However, during the course of this study, all four facilities experienced stock-outs of various malaria commodities (RDTs, AL and SP); a common

occurrence in Kenya (Kangwana, Njogu et al. 2009, Sudoi, Githinji et al. 2012) and in other malaria endemic counties in sub-Saharan Africa (PLoS Medicine Editors 2009, Mikkelsen-Lopez, Shango et al. 2014). Across all four facilities the stock-outs of externally funded malaria commodities (AL & RDTs) procured by the national government, were not as severe as the stock-outs of SP for IPTp. For example, SP was completely out of stock in facility D for 8 consecutive months. Stock-outs of SP, which several studies have identified as one of the major barriers for IPTp scale up (Hill, Hoyt et al. 2013, Thiam, Kimotho et al. 2013, Rassi, Graham et al. 2016) was a nationwide problem at the time of this study (National Malaria Control Program 2016). A senior manager at the NMCP explained that the supply of SP in Kenya had dwindled since it was withdrawn as a first line treatment for malaria in 2004 as most local suppliers stopped stocking SP because it became unprofitable to sell. For similar reasons, KEMSA had removed SP from its stock list, forcing county governments to source for it from elsewhere. As one sub-county pharmacist explained:

“KEMSA doesn’t even have SP. It is not even in their ordering tool. So what has been done is that we are going to the external supplier. But the quantity we get is less.” Sub-county Manager, SCA-PC

As a consequence, county governments faced difficulties procuring SP, resulting in the widespread shortages and stock-outs across the country that led to the decline in IPTp coverage indicators described in the study by (Githinji, Onyando et al. 2016). This illustrates the potential challenges of scaling up malaria interventions where the tools are specific to the intervention (not widely available) and where such tools are not externally funded and/or their supply not centrally financed or co-ordinated. When they became aware of the issue and to address the shortage, PMI provided funds which the national government used to procure two years supply of SP and distributed supplies to targeted county governments (National Malaria Control Program 2016). There were

also stock-outs of other non-malaria commodities which health workers perceived, had been exacerbated by political decentralization.

“KEMSA were not paid in time so it doesn’t deliver because we are meeting people from other counties and they are receiving their drugs in time. So it is us who are having problems. Just before devolution, KEMSA used to supply us with enough drugs. If you see what we are supplied with now, you will be shocked. Almost a quarter of what we order” Facility manager, FA-C1

However, stock-out of medicines was a well-known problem even before devolution (Government of Kenya 2009) and there were challenges in the procurement of essential medicines at the earlier stages of decentralization which may have worsened the problem (Tsofa, Goodman et al. 2017).

8.3.3 Lack of support system for data collection

a) Support supervision

Support supervision visits, described in chapter 3, if implemented as recommended can provide managers with an opportunity to assess adherence to service delivery practices, provide mentorship to health workers and give feedback. However, due to lack of funds attributed to the withdrawal of user fees following the presidential directive and a delay in disbursement of government funding (Nyikuri M, Tsofa B et al. 2017), the frequency of these support supervision visits has reportedly declined over recent years. Sub-county managers explained that as a result, they had to rely on partners to support these activities.

“Mostly what we do now is supervision but it is not frequent. It is supposed to be done quarterly. The [county] government is supposed to provide for that but

you know that we don't have funding for that. So currently we are doing it with the support of APHIA Plus [NGO]" Sub-county Manager, SCB-HO

However, this led to a lack of integration in conducting supervision visits as each partner tended to support the supervision activities that targeted the disease programmes that they were interested in and funded.

"because of these county government issues they don't support us and that is a fact. So a partner will come, for example XX NGO says that we are only supporting malaria [coordinator] to go for supervision. So malaria person will go then come back. Then WHO will say they are supporting the disease surveillance [coordinator] to go out. Hardly will you find someone coming in to support the Health Records Office" Sub-county Manager, SCA-HO

During the study I was able to accompany a team of sub-county managers including the malaria co-ordinator, disease surveillance coordinator, laboratory coordinator, and vector born disease coordinator, on a day of support supervision visits to health facilities in the lake region sub-county. The sub-county health records officer was not part of the team. When we arrived at a facility, we introduced ourselves and asked the facility manager to provide us with the malaria data collection tools; the registers and reporting forms for the previous month (July 2015). My observations of the process indicated that it was more of a 'tick-box' activity that rarely served its intended purpose of identifying problems and providing mentorship (World Health Organization 2008). Our focus was mainly on verifying the accuracy of aggregated numbers entered in reporting forms against source documents as other studies have also reported (Mavimbe, Braa et al. 2005, George 2009). Because of the number of facilities that we had to visit on that particular day (six in total), we did not have time to conduct observations at any service delivery area, or even to listen to health workers' problems and clarify issues which are an essential component on an effective support supervision visit (World Health Organization 2008). We only provided feedback to the facility manager in the form of

a written feedback form which identified their weaknesses and action points for improving performance (see table 8.1).

Table 8.1 Types of feedback given to health facilities

Problem	Action needed	Person to take action	By when
<i>Facility 1</i>			
Lab RDT and OPD RTDs disparity	Clean all data to correspond	In charge	12 th August 2015
Register is not clear	Improve on recording in OPD register	In charge	12 th August 2015
Lack of IDSR register tool	Photocopy IDSR form	In charge	12 th August 2015
<i>Facility 2</i>			
OPD register has less patients	Capture and register all patients	In charge	Immediate
Underreporting of IDSR monthly data	Report all cases to tally with 705A&B & 643	In charge	By September
Lab data is missing in some days	Capture and record all lab data in the lab register	In charge and lab	Immediately
<i>Facility 3</i>			
IDSR form lack total tested patients	The form should include tested	In charge	20 th August
705 A & B are not tallying with the OPD register	Create a column in OPD for pos/neg.	In charge	12 th August
Treatment of clinical malaria but not being recorded	Test all suspected cases and record (3Ts)	In charge	Immediately

Four months after the exercise, I asked the sub-county malaria coordinator who was in charge of the support supervision visits if he had made any follow up with any of these six facilities to establish if health workers had implemented the suggested action points. This manager explained to me that he had not made any follow up and was yet to compile a report of the exercise due to his busy schedule. Although I did not observe any instance where managers reprimanded health workers during this support supervision visit, some of the health workers attending a feedback meeting I organized

reported that some managers were more interested in ‘fault finding’ as opposed to ‘support supervision’.

“They should handle me with respect. When they come to my facility, I may not score 100% during support supervision. But at least someone should tell you in a polite way. It has to be positive. We sit together. They ask me where the challenge is, what I have done to address the challenge and also suggestions on what I can do to address the challenge. This should be done in a friendly manner.” Health worker, feedback meeting, SCB

In facility D, I observed a case where the sub-county manager in charge of one of the disease programmes reprimanded a member of support staff for completing the data incorrectly. In his defence, the member of staff explained that ‘*that is how he thought it should be done*’. This manager asked the staff member to re-do this report and ensure that this report was submitted to him within a week.

b) Feedback mechanisms

Interviews with health workers in the four facilities and those attending feedback meetings on the preliminary findings of this study revealed that, despite their innovations and efforts to collect and report the routine health data, health workers rarely received any positive feedback from their managers; instead, feedback was only received when their reports had errors, or are incomplete.

“Who gives you feedback? They only call you to complain about the data you submit” Health worker, FB-LT

However, one health worker said that they appreciated receiving these calls before the data were entered since it meant that someone was looking at the data and concerned about the data quality:

“I always expect a phone call from the records office after submitting my data. That is something that I also appreciate when it arises because it means they are looking at the reports before they are entered.” Health worker, feedback meeting, SCB

As noted in chapter 5, the sub-county monthly review meetings provided facility managers with an opportunity to receive feedback as well as updates on various activities from the sub-county health managers. A manager in one of the two sub-counties agreed that although they provided feedback to health workers during these monthly review meetings, the feedback was often not balanced as it tended to focus more on areas of weaknesses as opposed to their strengths.

“The issue of feedback is one of the things that we have been having problems with. Okay we have been giving feedback through review meetings. I don’t know if it is proper feedback. We give them feedback on the areas where they have made mistakes. You know that is not a good feedback because we need to give them their strengths and weaknesses...” Sub-county Manager, SCB-HO

The sub-county managers also used these forums to provide clarification to facility managers about issues that were unclear (e.g. data sources of various indicators as was observed during one of the meetings). In the coast region-sub-county, facility managers were required to make presentations on their facility’s performance on selected indicators. Sub-county managers and other facility managers provided critical feedback on these presentations and this process provided them with a sense of belonging. However, due to funding constraints, the frequency of these meetings had reportedly declined, an issue that health managers and health workers across the two sub-counties were concerned about.

“Then previously, we would come together in a meeting and feel that you are part of the sub-county community. But that’s not the case these days because of lack of funds. Nowadays you submit your report at the end of the month then stay for a whole month without anyone visiting you” Health worker, feedback meeting, SCB

Sub-county managers explained that they were forced to seek support from other partners to fund these activities and this was influencing their nature and content. I attended several of these meetings in both study sites where the agenda of the sponsoring partner normally took precedence.

8.4 Influence of data collection tools

In chapter 6, I explored in detail key issues with the current official health data collection and reporting tools that are affecting what data are recorded, potentially weakening the utility of the data collected. In chapter 7, I showed how unclear instructions for data collection add to the confusion leading to variations in recording and reporting practices which undermines standardization. These registers are designed at the national level (chapter 3) by managers who, according to many of the health workers and managers involved in this study, are oblivious to service delivery or data collection realities.

“I think the people who prepare these registers are not experienced in terms of sitting in a clinical area and seeing what is needed and what is not needed. This is someone who is very learned. They are put in a hotel and then they do these things. I wish they could get our views. Maybe as a district these are the rural facilities and these are the number of clients who we see. We make some recommendations and then it goes up like that. So they know that this can be done and this cannot be done.” Health worker, FA-C1

For instance, while the AL/RDT register was designed to be completed in the pharmacy and laboratory/outpatient clinics, the multiplicity of individuals involved in conducting malaria tests spread across various service delivery areas, impeded its effective use. The AL/RDT register required health workers to record the total number of malaria tests conducted (negative and confirmed cases). However, this was not always possible since some patients without a confirmed malaria diagnosis exited the facility without going through the pharmacy where this register was located (refer to figure 7.5). Since laboratory technologists recorded details of RDT tests conducted in the laboratory, recording the same information in this register contributed to duplication of effort. This was also the case with outpatient morbidity tally sheets which health workers found impractical to use.

Several authors have argued that the design of data collection tools have a direct influence on recording and reporting practices, and data quality (Lippeveld T 2000, Shaw 2005, Chiba, Oguttu et al. 2012, Mubyazi, Byskov et al. 2014). For instance, Mubyazi et al. (2014) found that the poor design of ANC registers coupled with unclear recording instructions led to variations in IPTp data recording practices in Tanzania (Mubyazi, Byskov et al. 2014). In Kenya, Rawlins and colleagues (2014) found that lack of separate columns for recording the data on IPTp 3 to 7 led health workers to record these data in the IPTp2 column hence inflating IPTp2 figures (Rawlins, Ngindu et al. 2014). A similar evaluation conducted by Msukwa (2014) in Malawi also found that there were no specific columns for recording 'malaria in pregnancy cases'. As a result, these cases were all simply recorded as 'malaria' (Msukwa, Rawlins et al. 2014).

8.5 Data burdens

There were constant complaints from health workers and their managers who observed that most of the data collected and reported routinely were duplicated across various report forms. They were concerned that much of this repetition was unnecessary and was increasing their workload and undermining their capacity to delivery services.

Throughout the study, health workers and their managers acknowledged that there was need to remove unnecessary duplications in these tools.

“My concern is the issue of duplication of data. I don’t know but I think at the national level, they need to integrate some of these tools. It’s an issue because the health workers are being overwhelmed by the many tools...?” Sub-county Manager, SCB-FP

Many of the duplications and data burdens were blamed on demands for data from disease specific programmes at the national level. While the health information systems department was charged with the responsibility of coordinating the development of integrated tools, certain programmes circumvented the process and introduced their own tools.

“As I told you, some of them [programmes] have more influence than us. They will go round and we have no alternative. We shall see forms coming from the facilities. When you ask, well you are told ‘that those were the orders given from up’” Manager, National-HO

This statement was supported by the numerous programme specific data collection registers and reporting forms which I saw in use at the health facility level (chapter 5).

“You see the programme people confuse us down here. The program people who make their data tools up there and liaise with the HMIS. Then they just drop the tools down here. It is important that they align their data.” Sub-county Manager, SCB-LT

Despite the continued proliferation of tools, health workers reported that they were rarely trained on the use of new tools. This, coupled with the absence of instructions as for data reporting in almost all of the standard MoH reporting forms, a fact that has been

reported by several others (Chiba, Oguttu et al. 2012, Ministry of Health 2014, Manya and Nielsen 2016) may have contributed to some of the confusions and variability in reporting practices that were described in chapter 6.

“The other problem comes in when we have new data collection tools. The registers keep on changing and then they are brought to our facilities where we are told to use them. Then we just read the instructions but my understanding may not be the same as hers. We are not invited to a training and told how we are going to fill the registers. So that is a problem. The new tools come but we are not shown how to fill them” Health worker, feedback meeting, SCB

The AWP, MOH 105 and MOH 711 reporting forms were said by the health workers to contain the most number of duplicated indicators. Observations of the reporting tools suggested that there were a number of indicators that were duplicated in these forms (including non-malaria indicators). I observed that the AWP and MOH 105 service delivery reporting forms were manually completed on a monthly basis at the health facility level but were not entered into the DHIS2 in the sub-county offices. Instead, data fields in these two forms were auto-completed by the DHIS2 software using data recorded in other monthly reporting forms (chapter 7- table 7.3). Document reviews and interviews with managers at the national and sub-county level revealed that the MOH 105 reporting form was introduced to monitor the objectives of the National Health Sector Strategic Plan (NHSSP) 2005-2010 (chapter 3.). However, this had been replaced with the Kenya Health Sector and Strategic Investment Plan (KHSSIP) 2014-2018. The AWP form was introduced as a replacement of MOH 105 and the MOH 105 form should have been withdrawn from use. Sub-county managers were aware of this but they explained that since they had not received official communication from the national government, they could not withdraw the MOH 105 from use in their facilities.

“Service delivery is actually supposed to cease. We are supposed to stop it, but you know we have not gotten clear communication from national. So at my level I can’t communicate” Sub-county Manager, SCA-HO

The AWP form was a tool that was a particular focus of discussion both at facility and sub-county levels. There were divergent views among the health facility managers and health workers regarding whether this form should actually be completed at the health facility level at all, and if it should be then how often. There were a number of indicators contained in the form that did not have clear data sources at the health facility level (see box 8.1).

Box 8.1: Examples of indicators in AWP form that cannot be collected at health facility level

- Number of children <1 distributed with LLINs in endemic and epidemic districts
- Number of MDA receiving MDA schistosomiasis in endemic districts
- Number of emergency surgical procedures conducted within an hour
- Number of multi-disciplinary support supervision carried out
- Number of health facilities providing caesarean sections
- Number of health facilities with functional microscopes
- Number of quarterly review meetings held

One of the sub-county managers explained that these indicators were not straightforward but ‘required research’ to be completed. A manager at the national level explained that this form was not supposed to be completed on a monthly basis as it was meant to aid annual operational planning. The health workers complained that filling this form on a monthly basis unnecessarily increased their workload with some picking up on the anomaly, taking issue with several of the data reporting fields in the form which they recognized, could not reliably be filled with data collected at the health facility level. In trying to make sense of the anomaly, one of the health workers explained her understanding that the form had been introduced during preparation of annual work plans and had been retained by sub-county managers for their own

reporting needs. She argued that that even the name of the form implied that it was not supposed to be completed monthly.

“You see the name is annual work plan. So annual work plan is not monthly work plan... I think they realized that the tool would make it easier for them to enter data into the DHIS” Health worker, FC-N1

This view was supported by the sub-county manager responsible for the malaria programme who argued that data reported in this form was rarely used.

“honestly AWP I don’t understand why [it is completed] because it’s never referred to. It is something which is done on a yearly basis. And when it comes to analysis, we analyse for instance per LLIN distributed. You won’t look at AWP. You go to [MOH] 711 to check on what has been given” Sub-county Manager, SCA-MC

Despite these concerns, managers responsible for health information in the two sub-counties argued that the AWP form was meant to be completed at the health facility level on a monthly basis since it helped them monitor their annual targets on a monthly basis.

“Those people [who say it’s not a monthly tool] are not serious. You know AWP is an operational tool. We monitor our AWP on quarterly basis and you don’t need to wait for the whole quarter is when you give us the results... So if you monitor them on monthly basis you will know whether you are on track or not” Sub-county Manager, SCA-HO

The presence of the AWP form in the front-line health facilities, the lack of clarity regarding the exact utility of the form, whether it should be completed at the health facility level and at what frequency, illustrates how weak organizational management and poor communication can result in a proliferation of data collection tools whose roles are unclear; exacerbating the workload of front-line and sub-county health workers and

managers. This, together with duplication in the tools that were actually meant to be in the front-line facilities, has resulted in a huge data burden where manually filling the reporting forms is a tedious process. For instance, the MOH 105 reporting form contains about 63 fields, the AWP contains 71, and the MOH 711 contains over 300 data fields. Many of the health workers and their managers pointed to the need for integration of existing tools and indicators to eliminate unnecessary data burdens.

“I think the tools need to be integrated. Every day they keep adding new tools but they don’t take any away. When you look at the new tools that they add, they ask you to report the same things that you have been reporting in the other forms. Let’s say the CCC [HIV/AIDS] or even malaria reporting forms. Whatever you report on this form is what you report on the other form. So the [health records officer] will call you to ask you why data in [MOH 731] and [MOH 711] are inconsistent. So you ask yourself why they asked you to fill the same data in two different forms which are all sent to the same place” Health worker, FA-C1

Examples of some of the registers and reporting tools that were in use in the four facilities are shown in appendix 7. In each of the four health facilities in this study, there were 14 registers and 16 reporting tools that health workers were required to complete. Apart from standard MoH registers, there were additional programme specific registers and reporting tools that health workers also completed. A study conducted by Nyikuri et al (2015) to document the roles and challenges faced by frontline health facility managers on the Kenyan coast found that reporting burdens associated with accountability relationships was one of the key challenges faced by these managers. These managers described the amount of paper filling and reporting that they were required to do as ‘overwhelming’, ‘repetitious’, ‘confusing’, ‘tedious’, and ‘distracting’ (Nyikuri, Tsofa et al. 2015). Data burden associated with internal and external accountability demands is a key issue at frontline health facilities in many low income

countries which has the potential to distract health workers from service delivery (Oomman, Bernstein et al. 2008, George 2009, Nyikuri, Tsofa et al. 2015, Topp, Chipukuma et al. 2015) and contribute to poor data quality (Health Metric Network 2008).

An observation I made in all four facilities was that at the end of each month, service delivery slowed down as compilation of monthly reports took precedence. For example, in all four facilities, routine service delivery began later and also ended earlier than usual during the reporting period to give health workers time to concentrate on their reports, as one health worker explained.

“Normally we do the reports in the evening. That is why we prefer that we see patients at least by 3pm latest. So the remaining time you can use to do other things. Like preparing reports or organizing for clinics. From that time, we normally prefer that we only attend to emergency cases” Health worker, FA-

RO

To balance between routine service delivery needs and monthly reporting obligations, health workers adopted a range of coping strategies including: compiling their monthly reports between service delivery (i.e. while waiting for laboratory test results); arriving in the facility earlier or staying later than usual to complete their reports; or carrying facility registers and compiling their reports at home- a practice that may undermine the confidentiality of patient data recorded in these registers (chapter 6). Similar coping strategies have also been documented by Nyikuri et al (2015).

Such coping strategies were mainly driven by the perceived importance of submitting monthly reports as opposed to direct threats of sanctions. Throughout the fieldwork period, failing to report on time was a common occurrence in both sub-counties but I never observed a facility manager being sanctioned. For example, during one of the

preliminary feedback meetings that I held in this sub-county, I asked health workers to state what would happen if they failed to submit their monthly reports on time. None of the reasons listed touched on individual level sanctions for failure to report. Instead, their responses were mainly centred around the consequences of failure to submit their reports on drug supply, accountability for commodities, and knowledge about the disease (box 8.2).

Box 8.2 What happens if you don't report?

- There are chances of not receiving drug orders and thus a possible stock-out for a long time
- There will be no record of malaria cases managed during that month hence making it difficult to account for drugs used
- It becomes difficult to know the stock available & how much to order
- One cannot know malaria prevalence
- Surveillance will not be consistent
- We may never know malaria trends and impacts
- No supply of RDTs and AL
- It will make it very difficult to know the correct situation of malaria
- You will not get feedback on how you are performing

Note: Preliminary feedback meeting: 11th May 2016, lake region sub-county.

8.6 Summary

In this chapter, I have discussed various factors that shaped routine malaria data generation in the four health facilities and the two sub-counties. The findings discussed in this chapter have shown that the generation of routine malaria data is influenced by the broader context in which data collection, and service delivery in general, takes place. This broader context contains numerous challenges to routine data recording and reporting yet, despite these challenges, health workers employ various coping strategies that enable them to continue collecting and reporting their data as well as providing health services. For example, they use improvised tools when standard registers are unavailable, and informally shift certain tasks to lower cadres of staff to mitigate staff shortages. Sub-county managers also rely on the support of vertical programmes to

support various activities. As this chapter has demonstrated, challenges to malaria data generation are not simply disease specific, nor are they confined to the health management information system; they indicate general health system weaknesses as I discuss in my final chapter.

9 DISCUSSION AND RECOMMENDATIONS

9.1 Introduction

This thesis aimed to examine the processes, practices, and challenges of producing malaria data through the routine District Health Information Software (DHIS2) in Kenya. I used a primarily ethnographic approach to examine how routine malaria data are collected, collated, and reported at four frontline health facilities, and how these data are subsequently entered into the DHIS2 at two sub-county health records offices in Kenya. The ethnographic approach adopted in this study enabled me to develop an in-depth understanding of the broader context within which data for constructing these indicators were generated and how it influenced the process at the four health facilities and two sub-counties. The literature review in chapter 2 placed the interest and demand for malaria indicators in the historical and global context, while the document review presented in chapter 3 demonstrated how the rapid expansion of malaria indicators in Kenya mirrored the trend at the global level. In chapters 4 and 5, I provide details of the methods used and the sites in which the study took place. Chapters 6 and 7 describe the practices of data collection, collation and reporting, explore variations in the data collected across the various recording and reporting tools and examine the consequences for the data entered into the DHIS2. Factors influencing these practices and their outcomes are explored in chapter 8 along with comparisons of these findings with those from other studies within Kenya and elsewhere in sub-Saharan Africa.

In this final discussion chapter, I provide a summary of the key findings in relation to the objectives of the study and discuss key emerging themes in relation to the broader literature. The chapter has seven main sections. In section 9.2, I discuss the key findings from this study and present my revised conceptual framework. In section 9.3, I introduce the key themes emerging from the study; health systems functioning and relationships of power and contestation. In the following section (9.4) I draw on these two themes to

examine how they affect the processes and practices of producing malaria data through the routine District Health Information Software (DHIS2) in Kenya; first starting at ‘the top’ with an exploration of the influence of the global on the national; and next starting from the facility level moving upwards to the (sub)county levels and then up to the national and global level. In the fifth section I discuss the strengths and limitations of the study while the sixth section of the study recommendations for improving routine malaria data generation in Kenya. In the seventh and final section I provide a brief conclusion.

9.2 Summary of key findings

In this section, I provide a summary of the key findings from my study in relation to my first three objectives: to describe the processes of malaria indicator data generation (collection, management and reporting) at frontline health facilities, and at sub-county levels; to examine the outputs of data collection and reporting processes and describe the context, process and practices affecting malaria data quality; and to critically assess the factors influencing the production of malaria indicators at the health facility and sub-county levels. These findings are shown in table 9.1.

Table 9.1. Summary of key findings

Objective	Summary of key findings
<p>a) Describe the processes of malaria indicator data generation (collection, management and reporting) at frontline health facilities, and at (sub) county levels</p>	<ul style="list-style-type: none"> • Unclear or missing instructions in standard registers and reporting forms led to variations in recording & reporting practices • Poor design of data collection tools led to challenges in recording certain categories of data (e.g. clinical and confirmed malaria) • Stock-out of standard registers led to use of improvised tools which had implications for data quality • There were inadequate resources at the sub-county health records offices for data entry into the DHIS2 • Due to staffing challenges, data collection responsibilities were usually delegated to casual staff • Volunteers played a major role in data entry in both sub-counties
<p>b) Examine the outputs of data collection and reporting processes and describe the context, process and practices affecting malaria data quality</p>	<ul style="list-style-type: none"> • Discrepancies existed in malaria diagnosis data that were found in registers at health facility level although these were concealed in aggregated monthly reports • These discrepancies were mainly linked to patient management practices and use of inappropriate registers • There were inconsistencies between DHIS2 data and data recorded in paper reporting forms • The DHIS2 auto-corrected confusion around the correct interpretation of indicator reporting requirements and in so doing masked such confusions
<p>c) Critically assess the factors influencing the production of malaria indicators at the health facility and sub-county levels</p>	<ul style="list-style-type: none"> • Organization management problems led to stock out of tools, malaria commodities, and lack of support systems for data collection • Weak supply chain management led to stock-out of essential commodities and undermined data collection • Human resource shortages led to informal task shifting and use of volunteers to enter data • Poor design of data collection tools led to standardization challenges • Duplications associated with programme specific demands for data led to data burdens which affected service delivery

Using an ethnographic approach, I was able to both observe, and at times participate in, the processes of malaria data generation at frontline health facilities, and at sub-county levels. This allowed me to identify several key challenges in the collection and collation of routine data that were commonly found across all four health facilities; challenges

that have been widely reported in other studies investigating the quality of HMIS, as well as by studies investigating the quality of care provided at health facilities in Kenya and elsewhere in sub-Saharan Africa (Chilundo, Sundby et al. 2004, Mavimbe, Braa et al. 2005, Mphatswe, Mate et al. 2012, Ministry of Health 2014, Mubyazi, Byskov et al. 2014, Yukich, Butts et al. 2014, Gerrets 2015, Topp, Chipukuma et al. 2015, Manya and Nielsen 2016). These challenges include: staff shortages (Kinfu, Dal Poz et al. 2009, Ferrinho, Siziya et al. 2011, Wakaba, Mbindyo et al. 2014, Willcox, Peersman et al. 2015); use of unqualified/untrained staff to collect and report health data (Ochieng, Akunja et al. 2014, Topp, Chipukuma et al. 2015, Mijovic, McKnight et al. 2016); stock-outs of data collection and collation tools and malaria commodities (Chiba, Oguttu et al. 2012, Mubyazi, Byskov et al. 2014); inappropriate tools with inadequate instructions (Brieger 2010, Chiba, Oguttu et al. 2012, Hahn, Wanjala et al. 2012, Ledikwe, Grignon et al. 2014, Msukwa, Rawlins et al. 2014, Rawlins, Ngindu et al. 2014); and inadequate resources for effective supervision and feedback (Chaulagai, Moyo et al. 2005, Mavimbe, Braa et al. 2005, Ledikwe, Grignon et al. 2014). Despite these challenges, staff at facility and sub-county level were, in general, concerned to ensure that the data were collected, collated, submitted and entered into the DHIS2; developing a range of strategies to address the challenges they faced.

My study included an examination of the outputs of data collection and reporting processes at the four health facilities and compared them to the data entered into the DHIS2 (chapter 7). I also drew on my observations and interviews to describe the context, process and practices that were affecting the consistency and reliability of the malaria data captured in the DHIS2 (chapters 6 & 8). Concerns about the quality of health statistics produced through the routine health information system in sub-Saharan Africa are well recognized (Chilundo, Sundby et al. 2004, Mavimbe, Braa et al. 2005, Ronveaux 2005, Ndira, Rosenberger et al. 2008, Mate, Bennett et al. 2009, Gimbel, Micek et al. 2011, Maokola, Willey et al. 2011, Mphatswe, Mate et al. 2012, Yukich,

Bennett et al. 2012, Gerrets 2015) and in this study, the audit of facility registers showed that there were discrepancies in the malaria diagnosis and treatment data that were recorded in various registers (chapter 7). Several contextual factors were seen to influence these discrepancies. Firstly, variation in patient management practices, for example, attending to patients outside designated areas to manage workload, and the management of referral cases influenced how and where data were recorded (chapter 6). Secondly, as has been found in several other studies, casual staff and ‘volunteers’ were used to help fill staffing gaps (Lehmann, Van Damme et al. 2009, Ferrinho, Sidat et al. 2012, Mijovic, McKnight et al. 2016) with varied consequences for data recording and reporting practices (Ministry of Health 2014, Mpofu, Semo et al. 2014, Topp, Chipukuma et al. 2015). Finally, to cope with stock outs of data collection and reporting tools, health workers developed improvised tools which also had varied consequences for data recording. These discrepancies were hidden in aggregated monthly reports which also concealed underlying service delivery practices (such as clinical malaria treatment) that were inconsistent with best practices. Inconsistencies were also noted between DHIS2 data and data entered in various monthly reports, although the DHIS2 auto-corrected some of these errors thereby concealing such problems (Chaulagai, Moyo et al. 2005, Lungo 2008, Mate, Bennett et al. 2009, Githinji, Kigen et al. 2014, Githinji, Onyando et al. 2016). These data quality issues are not unique to this study, with similar data quality issues being captured in various national data quality audits and studies conducted in Kenya (Division of Malaria Control 2012, Division of Malaria Control 2013, National Malaria Control Program 2014, Githinji, Onyando et al. 2016).

Drawing on the findings from my empirical data collection activities, my original conceptual framework and the literature, I then critically assessed the factors that were influencing the production of malaria indicators at the health facility and sub-county levels. These factors, described in detail in chapter 8, are primarily not disease, or even HMIS specific but reflect broader health system constraints. For example, human

resource shortages necessitate informal task shifting and role sharing as a coping strategy. In addition, organizational management problems resulted in stock-outs of malaria commodities and reporting tools (chapter 5). Although stock-out of commodities may have worsened under decentralization (Tsofa, Goodman et al. 2017), such problems existed in Kenya prior to devolution (Kangwana, Njogu et al. 2009, Sudoi, Githinji et al. 2012, Barker, Mulaki et al. 2014) and are also common in other settings in sub-Saharan Africa (Hill, Hoyt et al. 2013, Thiam, Kimotho et al. 2013, Mikkelsen-Lopez, Shango et al. 2014, Rassi, Graham et al. 2016). A further broad contextual factor that influences the production of malaria indicators is a lack of funds to implement the support systems for data collection. This has in part been attributed to changes in government funding arrangements post devolution (Tsofa, Molyneux et al. 2017), although these and other authors recognise that funds were a problem even before devolution was implemented (Ndavi, Ogola et al. 2009, Luoma 2010). The sheer number of data collection and reporting forms present in the health facilities was also observed to influence the indicator production process. Such data burdens at front line health facilities have also been reported in several other studies (Chaulagai, Moyo et al. 2005, Shaw 2005, Garrib, Stoops et al. 2008, Ledikwe, Grignon et al. 2014, Nyikuri, Tsofa et al. 2015, Topp, Chipukuma et al. 2015). Overall, the analysis presented in chapter 8 and summarised here suggests that, in order to understand the micro processes of data collection, collation and reporting we need to look beyond individual factors affecting malaria related data or the wider HMIS and to include instead a broader health systems approach.

9.2.1 Revised conceptual framework

Based on these findings, I have revised my conceptual framework (see figure 9.1). The inside ring of the revised conceptual framework contains a summary of key findings from this study that are specific to routine malaria data generation at the health facility and sub-county level as depicted in the original conceptual framework. A key change

in the framework is the addition of the outer ring which shows that routine malaria data generation takes place in the context of wider health system challenges (e.g. organization management problems, weak supply chain management, financial constraints, and human resources shortages). Some of these challenges appear to have been exacerbated by political processes (rapid decentralization of health service management functions and sudden removal of user fee through a presidential decree) which occurred outside the health system but had a direct consequence on various health system building blocks (e.g. financing and human resource management). To cope with these challenges, health workers and their managers employed various coping strategies which ensured continuity in service delivery and kept the data pipeline flowing, but which had a range of implications for the outcomes of the process (see data quality box). These coping strategies were mediated by the interests, motivations, and relationships between those working within the entire system, not just the sub-system of routine health data generation.

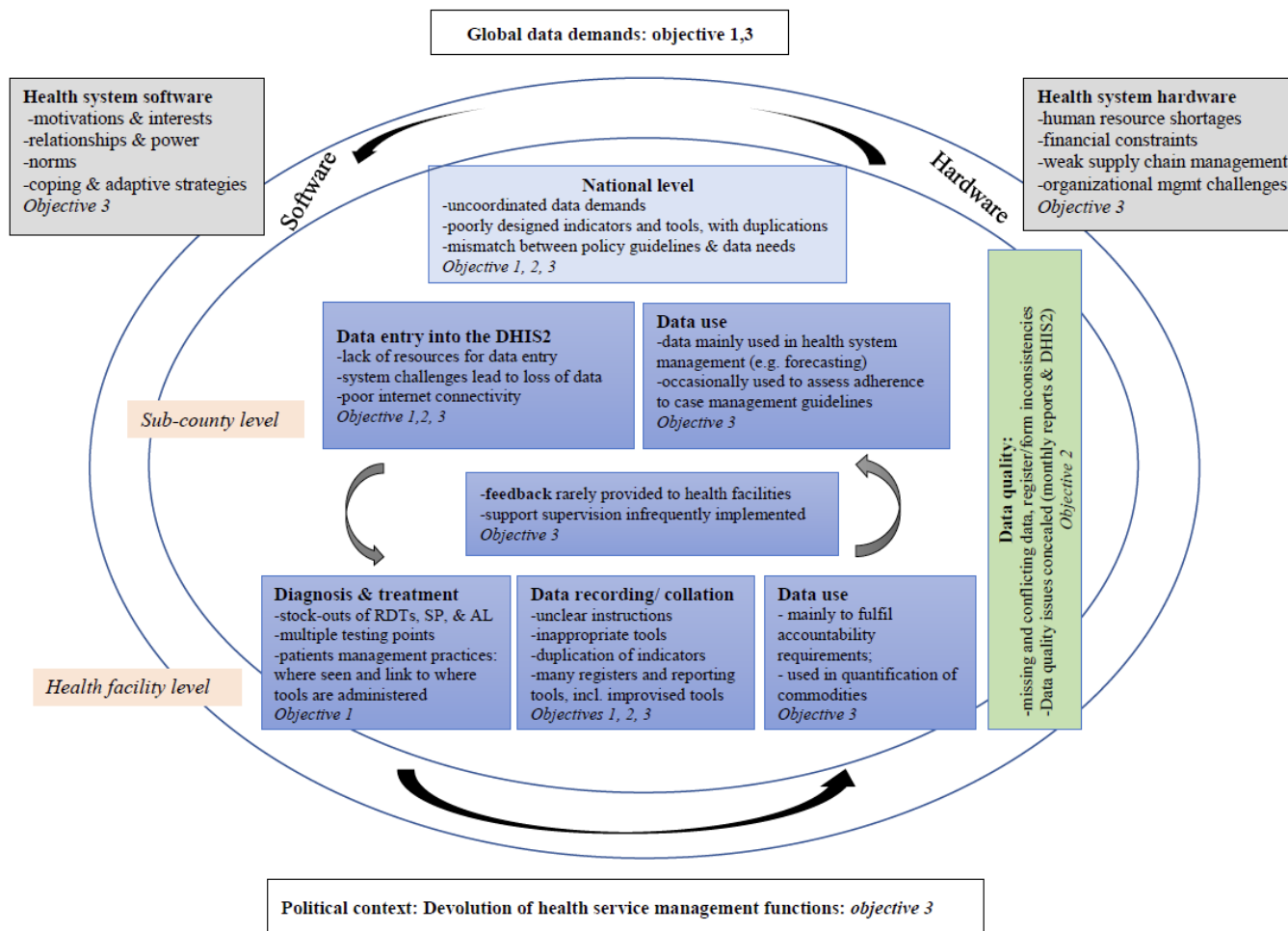


Figure 9.1 Revised conceptual framework

9.3 Key emerging themes

The revised conceptual framework illustrates the key broad theme that emerged during this study, which is the influence of the functioning of the health system and the broader national political context on national and local level malaria data generation. The framework also includes recognition of the role that power and relationships (health systems ‘software’, defined in more detail below) play in shaping responses to the health system and contextual challenges. In the subsequent discussion I draw on these themes to help interpret my findings and frame the discussion on the production of malaria indicators from routine data in Kenya. I start the discussion with a brief outline of the concepts underlying these two themes.

Health system approaches

Throughout the study it became clear that to understand the disease specific issues of interest, it was essential to understand how the broader health system context was influencing the data collection, collation and reporting practices observed. There are a wide range of approaches for describing and understanding the health system (World Health Organization 2007, De Savigny and Adam 2009, Sheikh, Gilson et al. 2011). In this discussion, I draw on Sheikh’s et al. (2011) conceptualisation of the health system to help explore how the broader context is central in influencing the production of routine malaria indicators (see figure 9.2). Sheikh et al.’s (2011) health systems frameworks posits that overall health system performance is influenced by the dynamic and non-linear interactions between systems ‘hardware’ (e.g. medicines and technology, organizational structure, service structure, and information systems) and systems ‘software’ (e.g. ideas and interests, relationships and power, and values and norms) of health systems actors (Sheikh, Gilson et al. 2011). In the discussion below I highlight how health workers and their managers used systems ‘software’ to address systems ‘hardware’ deficiencies, and in the process kept the system functional but with various outcomes for the quality of routine data produced.

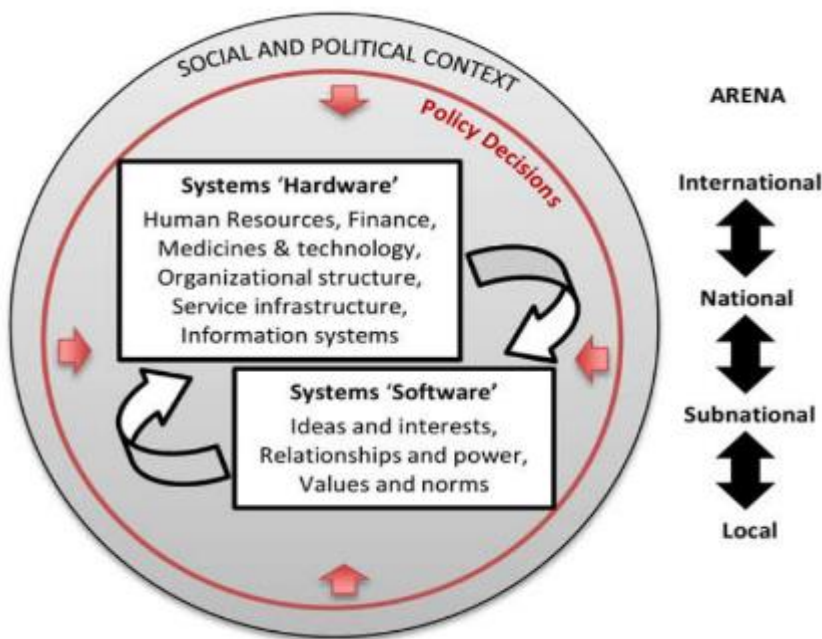


Figure 9.2 Sheikh's framework for understanding the health system

Power relationships and contestations

A second theme that emerged during the analysis and interpretation of the data is how different actors involved in malaria data generation at different levels, and in different ways, exercised their power to influence the process. 'Power' as an entity was not included as a node in the coding framework. However, during the subsequent mapping and interpretation of the data, the differentials in status among the staff at the health facilities and between staff at the different levels of the health system emerged as a key theme that helped to explain what was being observed. This in turn led to an investigation of the concept of 'power' and how it might be applied in this context. To understand how power is exercised, I draw on VeneKlesen & Miller (2002) who observe that power is both dynamic and multidimensional, changing according to context, circumstance, and interest. These authors identify four forms of power: *power over*; *power to*; *power with*; and *power within* (VeneKlasen and Miller 2002). See table 9.2.

Table 9.1 VeneKlesen & Miller's Forms of power

Forms of power	Definition
Power over	Involves taking power from someone else, then using it to dominate or to prevent others from gaining it (normally has negative connotations)
Power within	Has to do with a person's self-worth and self-knowledge (i.e. ability to recognize individual differences while respecting others)
Power to	Refers to the unique potential of every person to shape his or her life and world
Power with	Involves finding common ground among different actors and building collective strength.

During the subsequent discussion I draw on these concepts to describe how participant's enactments of these different forms of power influenced the practices of data collection, collating and reporting and the consequences for indicator production.

I start by discussing how global actors, who provide the bulk of funding for malaria control in Kenya, have power over the choices of malaria indicators and M&E activities at the national level. This is followed by a reflection on whether data burdens found in this study are occasioned by global data demands or organization management problems at the national level. The second section of the discussion examines specific issues that shaped malaria data generation at the sub-county and health facility level during my fieldwork period.

9.4 Towards a systems approach to understanding routine data quality

9.4.1 From global to national: the influences of global actors on national M&E choices

In the introduction and literature review I discussed how, over the last 20 years, indicators have become increasingly important globally as tools for monitoring disease trends, tracking the progress and impacts of public health interventions, and facilitating evidence based decision making (Boerma and Stansfield 2007, Zhao 2011, Gerrets

2015). In malaria control, much of the demand for such indicators has arisen from the major funders of malaria interventions such as the President's Malaria Initiative, the Global Fund and the Gates Foundation (Roll Back Malaria Partnership 2015, President's Malaria Initiative 2016, The Global Fund 2016). The results from this study suggest that while these global actors do not directly dictate which indicators should be included in malaria M&E frameworks, their reporting requirements exerted power over the choices of indicators included in Kenya's malaria M&E framework (refer to table 3.2, 3.3, & 3.6). This is perhaps not surprising since they are the organization that also occasioned the development of the first comprehensive M&E Plan (3.3.1). Because of their interest in performance monitoring and evaluation, these global actors have invested heavily in malaria surveillance and M&E systems in the country. Kenya's current M&E plan, the National Malaria Strategy, and the current Disease Surveillance Manual were all funded by global actors (Global Fund & USAID) who also provided technical support in their development. The data quality audit tools used by the NMCP and the national MoH were adapted from the Global Fund. Similarly, quality of care surveys which are implemented by the NMCP in collaboration with local research institutions are supported by the Global Fund (Juma and Zurovac 2011).

Potentially a fundamental reason for the concern of these global actors in ensuring effective M&E is linked to their role as the funders of many of the malaria control interventions in the country and demand for evidence to evaluate impacts of their funds (Nahlen and Low-Beer 2007, Warren, Wyss et al. 2013, de Jongh, Harnmeijer et al. 2014), and to sustain worldwide political and financial commitment for malaria control (Boerma and Stansfield 2007, Erikson 2012). For example, both the Global Fund and PMI produce routine reports which demonstrate coverage and impacts of various malaria interventions that they fund (Presidential Malaria Initiative 2015, The Global Fund 2016). Their roles in providing technical support and funding for M&E, as well as in funding the activities that are the focus of malaria surveillance, contribute to the

position where they wield considerable power over indicator choices and malaria M&E activities at the national level. By indirectly exerting their power over the selection of indicators that are included in Kenya's malaria M&E framework, they are tacitly influencing what gets counted and potentially, what receives attention both at the national as well as the local level (Plamondon, Hanson et al. 2008, Cavalli, Bamba et al. 2010). For example, the Global Fund and PMI fund the purchase of AL and RDTs in Kenya. The AL/RDT register was developed by the NMCP, with support from the Global Fund and PMI to collect consumption data of these two commodities. As noted in chapter 6, there are stringent guidelines regarding accountability for these externally funded commodities. The reporting of the data from the AL/RDT register is through the malaria commodity form which is submitted to the sub-district pharmacy office for entry into the DHIS2 (chapter 6 figure 6.5). This is different to all of the other monthly reporting forms which are submitted either to the sub-county records office or sub-county laboratory office. Two malaria indicators (*number of ACTs dispensed and malaria parasitological tests conducted*) reported to the Global Fund are generated using these data (The Global Fund Against TB 2016). However, currently in Kenya similar data (*number of parasitological tests conducted*) are also collected in integrated MoH register (Laboratory Register) and reporting forms (MOH 706 & MOH 705A/B forms). Likewise, Outpatient and Inpatient registers also collect data on the number of ACTs dispensed. In addition, the National Laboratory Programme have developed the MOH 643 reporting tool which collects data on the number of malaria tests conducted, despite the fact that the MOH 706 laboratory and malaria commodity forms are collecting similar data.

Duplications in routine malaria data: a global or a national problem?

Despite evidence suggesting that global actors do influence national M&E frameworks and choice of indicators, they do not explicitly exert overt power over these decisions. That is, they do not directly dictate to their funding recipients which indicators to list in

their M&E frameworks. In fact, both PMI and the Global Fund stress the need for an integrated malaria M&E framework so as to eliminate the unnecessary duplications that are associated with vertically funded programmes (McKinsey & Company 2005, Oomman, Bernstein et al. 2008, Mussa, Pfeiffer et al. 2013). None of them operates a stand-alone routine information system in Kenya. Three malaria indicators (*total reported cases; total number of reported deaths; and completeness of monthly reports*) included in PMI's annual operation plans are generated from DHIS2 data (Presidents Malaria Initiative 2017) although it was not possible for me to verify if these are retrieved directly from the DHIS2 by PMI or are reported by the NMCP. These data are obtained from existing MoH reporting forms. Likewise, the Global Fund relies on Kenya to furnish it with data on selected indicators as agreed in the performance framework signed by Kenya and the Global Fund (<http://globalfundkcm.or.ke/proposal/>). As noted above, there are only two malaria indicators that are generated using DHIS2 data that are routinely submitted to the Global Fund. However, while these data are reported through the DHIS2, they are generated at facility level and travel to the DHIS2 through a parallel route as described above.

In the health facilities and sub-counties involved in this study there were no stand-alone routine information systems but nonetheless, the data presented in chapter 6 shows that duplications still exist in the malaria indicators that are collected and reported routinely. Several studies have attributed such duplications to external accountability demands from vertical programmes (McKinsey & Company 2005, Aiga, Kuroiwa et al. 2008, Oomman, Bernstein et al. 2008). The results from this study suggests that some duplications have arisen in response to external accountability demands, e.g. the presence of the AL/RDT register and a specific register (Net pack register) which captures data on LLINs distributed in child welfare and antenatal care clinics for Population Services Kenya, (an international NGO that is responsible for social marketing and distribution of ITNs in Kenya) even though the same information is

collected in Antenatal Care and Child Welfare Clinic registers and reported in three MoH reporting forms (AWP, MOH 105, MOH 711). However, many of the duplications are not driven specifically by external accountability demands. Rather they are propagated by lack of harmonization of internal and external demands for data for M&E at the national level. When I asked a senior manager at the NMCP about the '*fever cases tested positive*' indicator that was included in the AWP reporting form, he was shocked that such an indicator even existed in the DHIS2. He explained to me that they (the NMCP) never used that indicator in any of their reports and that the '*person who added it was not serious*' since no register was designed to capture such information. I did not get a conclusive answer from national managers interviewed about the level or even frequency with which this form was supposed to be completed (chapter 8).

Furthermore, as described above, there is duplication in reporting the *number of parasitological tests conducted* which, in addition to the AL/RDT register, are also collected in integrated MoH register (Laboratory Register) and reporting forms (MOH 706 & MOH 705A/B forms). This duplication (particularly between the Malaria Commodity report, laboratory report and MOH 705A/B reports) points to lack of effective coordination between the NMCP, the HIS department, and the National Laboratory Programme. An assessment of human resource capacity conducted in 2013 found that the NMCP had a good skills-mix of staff but also noted capacity gaps in certain M&E areas (Ministry of Health 2014). To build NMCP capacity in malaria M&E, USAID-PMI has been sponsoring national managers to attend international training workshops (Garley, Eckert et al. 2016). Even if these workshops are effective in building M&E capacity within the NMCP, the tools for recording and reporting routine data in health facilities and at the sub-county levels are not the responsibility of the NMCP alone. The NMCP have to work in collaboration with other departments in the MoH.

Integrated MoH tools for collecting routine health data at health facilities are developed through a consultative process that takes into consideration the data needs of each MoH programme (chapter 3). However, there are certain programmes that are perceived to have more power over the standard process coordinated by the Health Information Systems department, and as such, are able to circumvent it and introduce their own registers and reporting tools (chapter 8, section 8.5). This appears to be the case with HIV/AIDS programme, which together with reproductive health and malaria, accounted for 41% of total expenditure on health in 2012-2013 (Ministry of Health 2015). While there are no parallel reporting systems for malaria data, there are many registers and reporting forms in health facilities which are driven by external accountability demands from other health programmes (chapter 5- table 5.3). It seems though that these additional tools are developed without proper scrutiny or due consideration of what is already collected hence leading to duplication of effort. Shaw et al. (2005) observes:

“[programme managers] in an effort to ensure that all angles of service delivery are taken into consideration often require large amounts of information for their specific programmes. Their primary concerns are their programme needs and little attention is given to the means of collecting this information or the needs of other programmes.” (Shaw 2005): pg. 632-633.

In addition to duplication of reporting, there was also evidence of redundancy, with some report forms (e.g. MOH 105 service delivery reporting) remaining as part of the monthly data reporting requirement at health facilities even though they had been replaced (chapter 8, section 8.5). To date, the MOH 105 service delivery reporting form has remained both in paper form and in the DHIS2. Online copies of this form in the DHIS2 show that data from all four facilities are still being entered but it is possible that the data fields in this form are being auto-completed using data obtained from other monthly reporting forms (chapter 6).

Previous assessments of Kenya's health information system have noted that lack of proper leadership and coordination at the national level is a major barrier to the effective implementation of various HIS policies and functions in the country (Blumhagen 2010, Luoma 2010). These assessments also found that the HIS department was underfunded and lacked the right skills mix required to coordinate and implement various HIS activities in the country. A more recent study found a shortage of ICT officers at the HIS department from where the DHIS2 is administered (Manya, Nielsen et al. 2016). These challenges may explain why the HIS department has been unable to effectively perform its oversight functioning of coordinating all health sector monitoring and evaluation activities hence leading to these fragmentations which, as the results of this study have shown, have a consequence for both routine data generation and service delivery.

In this section, I have discussed how external accountability requirements are potentially exerting power over national choices of malaria indicators that are collected and reported through the DHIS2. I have also highlighted how uncoordinated programme specific demands for data at the national level are potentially contributing to some of the duplications and data burdens that I discussed in chapter 8. In the next section, I shift my focus to the local level and discuss how health workers and their local managers cope with these challenges to keep the indicator production process alive.

9.4.2 At the local: generating routine data in a health system with weak systems 'hardware'

Managing at the health facility and sub-county level

The data presented in this study have demonstrated that routine malaria data generation at the health facility and sub-county levels took place in a difficult environment that was characterised by severe systems 'hardware' constraints such as: shortages of human

resources; stock-out of essential supplies; poorly designed tools; financial constraints; and sudden changes in government policies that disrupted operations at the sub-county and health facilities. While some of these challenges may have been exacerbated by decentralization, they are typical of primary health care service delivery and district health systems management in sub-Saharan Africa (Habte, Dussault et al. 2004, Walker and Gilson 2004, Lufesi, Andrew et al. 2007, Elloker, Olckers et al. 2012, Topp, Chipukuma et al. 2015). As Gilson et al. (2017) observes, “*these stresses occur at the same time in the same system, impacting on the same set of people*” (Gilson L , Barasa E et al. 2017). As this study has shown, these challenges had a direct influence not only on malaria data generation, but also on service delivery in general. Health workers and their managers had little or no power to influence many of the systems ‘hardware’ challenges (e.g. shortages of trained staff, lack of appropriate tools etc.) that they faced; but they drew on their interests and values (systems ‘software’) and exerted their ‘power with’ and ‘power to’ to develop a range of local coping strategies (e.g. informal task shifting and role sharing) that had a range of consequences for the outcome of the data collection process (chapter 7). These local coping strategies were motivated by the shared need to keep the system ‘functional’ but had unintended consequences in some instances. Within this context, two systems ‘hardware’ issues stood out as being central to the practices of malaria data recording and reporting at health facility and sub-district level. These were; a) human resources & their management; and b) components of the health information systems itself (the data collection tools; computerisation of the health information system; and poor use of data). These two components each contain elements of ‘task-shifting’ (from nursing to casual staff and in the computerization of the health information system). While this redistribution of tasks clearly entail shifting responsibilities it was not obvious that these shifts per se were resulting in feelings of disempowerment among health facility and sub-county staff. A more detailed study of these informal task shifting practices and their effects on the agency of health workers and sub-county staff would be necessary to investigate this issue further.

a) Human resources: capacity and management

Across all of the health facilities, facility managers and health facility management committees worked together (exerting their ‘power with’) to address staff shortages by spending their discretionary funds on employing casual staff. However, these casual staff were untrained, overworked, underpaid and rarely accorded an opportunity to attend sub-county level training. Although delegating data collection roles to them freed up time for health workers to concentrate on other service delivery areas, at times, what they recorded in registers did not accurately represent what nurses/clinical officers had written/not written in patients’ record books (chapter 8, section 8.2.1). Furthermore, the lack of training opportunities offered to these staff moved some of them to exercise their power to act by declining to provide certain services when they were denied these training opportunities (chapter 8, 8.2.1).

Casual staff were also poorly paid and often experienced salary delays which affected their morale. In response, some demonstrated their dissatisfaction, exercising their power to act through various strategies, such as delayed completion of reports and charging for services which should have been free; actions which had detrimental effects on malaria data generation. In two of the facilities the facility managers were proactive, and adopted a more hands on approach in dealing with various challenges in their facilities. For example, the manager of facility A exercised her power to act over a member of the casual staff who was accused of selling AL to patients and transferred him from the pharmacy to outpatient registration desk. Since these casual staff were employed in consultation with health facility management committees, this health worker lacked power to sack this casual staff. Similarly, this manager used her power to act and used funds from the Output Based Aid voucher programme to purchase SP for IPTp which they distributed to pregnant women for free. This local innovation enabled this facility to continue providing IPTp and as a result, kept their IPTp data active.

In facility C, one of the clinical officers working for HAWI NGO had a bad working relationship with nurses and the facility manager. After the facility manager's attempts to resolve this conflict internally failed, she reported the conflict to her sub-county bosses which resulted in a conflict resolution meeting at the health facility. However, this also failed to resolve the problem. The clinical officer's contract was never renewed. Instead a new clinical officer was posted to the facility and was quickly co-opted into routine service delivery. This manager had a very good working relationship with sub-county managers and was often invited to facilitate sub-county training or to supervise other sub-county wide activities. It is probable that she made use of these relationships to influence the decision not to renew the clinical officer's contract; a perception held by many of health workers in her facility. When malaria commodities were out of stock in her facility, she made use of her social networks and relationships with sub-county managers and other facility managers to borrow these commodities, a practice that provided a temporary relief to this problem.

At the sub-county level the resource constraints observed in this study, linked to 're-centralization' of financial management to the county level post devolution (Tsofa, Goodman et al. 2017) undermined the ability of the sub-county managers to implement various support systems for data collection (chapter 8, section 8.3.3). In response to this problem, these managers leveraged their relationships with vertical programmes to support monthly review meetings, supervision visits or printing of data collection tools, a coping strategy that has also been reported in a recently published study from Kenya and South Africa (Gilson L , Barasa E et al. 2017). These vertical programmes (e.g. HAWI) relied on DHIS2 data to fulfil their M&E requirements, so in an attempt to ensure that data collection and reporting were sustained they provided resources to the sub-county health records offices (chapter 5, section 5.4.2). In the lake region sub-county, these vertical programmes were also instrumental in organizing sub-county

level workshops which provided sub-county managers with a forum for providing updates to facility managers on various issues. However, as noted in chapter 8, their support was focussed on those vertical programmes which they were interested in. In this way, due to the human resource and financial constraints evident in the Kenya health system, these international NGOs are exerting direct ‘power over’ which data continue to be routinely collected and reported through the DHIS2 (Oomman, Bernstein et al. 2008). In the context of the ‘economy of scarcity’ (Sullivan 2011) at the sub-county level, this pattern which is less obvious may be continuously reinforced with potential negative implications at the local level (Mussa, Pfeiffer et al. 2013).

b) Health information system components

i) HIS: The importance of tool design

Although financial and human resources constraints created major challenges for effective data recording and reporting, the design of the registers themselves, and the framing of indicators in the monthly reporting forms, also caused problems for the indicator generation process. Lippeveld (2000) observes that “*the quality and ultimate use of the data collected through routine information systems will depend substantially on the relevance, simplicity and layout of the data collection instruments*” (Lippeveld T 2000).

During my fieldwork I found that missing or unclear instructions for data collection and reporting coupled with lack of training on the use of these tools led to variability in recording and reporting practices which undermined standardization and possibly contributed to some of the data quality issues described in chapter 7. Such issues have been reported in other studies from Kenya and elsewhere in sub-Saharan Africa (Chiba, Oguttu et al. 2012, Mubyazi, Byskov et al. 2014, Manya and Nielsen 2016). In addition, poor layout of outpatient registers made it difficult for health workers to segregate clinical and confirmed malaria cases. As noted in chapter 7, there were instances when

clinical malaria ‘disappeared’ in aggregated facility reports where they were all reported as confirmed malaria (Gerrets 2015). This problem possibly contributed to the misreporting of malaria cases that has been found in recent assessments of malaria data in the DHIS2 (Githinji, Onyando et al. 2016, Manya and Nielsen 2016). Although data quality audits conducted by the NMCP recommended training for health workers to eliminate these confusions (chapter 3), the findings of my study suggest that health workers’ inability to separate clinical from confirmed malaria cases are possibly caused by the poor design of the outpatient registers as opposed to a lack of ability to distinguish between clinical and confirmed malaria. These findings also point to a limitation of current data quality audit tools which are very focused on assessing the quantitative aspects of data quality, potentially failing to reveal the true causes of poor data quality. This possibility was also noted in a recent review of the data quality assessment methods employed in public health information systems (Chen, Hailey et al. 2014).

The recording and reporting tools that were in use at the frontline health facilities during this study were developed at the national level by managers who were focused to some extent on the demands from external funders yet largely oblivious to the service delivery or data collection realities on the ground (chapter 3, section 3.4.1). These managers used their power over the process to decide on indicators, data collection tools, and data collection procedures which health workers at the frontline were required to adhere to when collecting and recording data. However, how these tools were used or rules followed was dependent on health worker’s ‘power to’ (from VeneKleesen & Miller 2002) or their discretionary power, which refers to the *‘power exercised at the frontline by those whose actions (or inactions) cannot be fully controlled by central actors’* (Lehmann, Van Damme et al. 2009). For example, they used their power to act to determine which of these tools to use (e.g. decision not to use tally sheets in facility B, C & D); and what to record (e.g. OPD numbers not recorded in lab registers in all four facilities). Where reporting instructions were unclear or absent, health workers used

their power to act to decide on how to report such indicators (e.g. *fever cases tested positive*- chapter 6, section 6.3.1). What was counted and reported by health workers depended on localized understanding and interpretations of these indicators and reporting requirements which in some cases differed from the standard definition of the indicator. Similar issue of the influence of localized understandings and power to act have also been found in very different settings, like in a study of performance measures in UK hospitals (Dixon-Woods 2012). In the Kenyan context, managers at higher reporting levels only received aggregated monthly reports and so these local variations in recording and reporting practices remained concealed in facility records (Manya and Nielsen 2016). Local interpretations and subsequent variations in recording and reporting practices can only be revealed during DQAs or supervision visits to health facilities to review the original registers. My data have shown that such visits have become very irregular post decentralization, despite their widely reported positive effect on the outcome of the data collection process (Chaulagai, Moyo et al. 2005, Lowrance, Filler et al. 2007, Makombe 2008, Mphatswe, Mate et al. 2012). Even when such support visits were conducted I observed that the supervisors (managers) did not provide any mentorship or assistance (refer to 8.3.3 & box 7.3) with problem solving which could have resolved some of these confusions (Mavimbe, Braa et al. 2005, George 2009).

Some authors have argued that involving frontline staff in development of data collection and reporting tools can significantly improve the relevance and utility of these tools to data producers (Lippeveld, Sauerborn et al. 2000, Chaulagai, Moyo et al. 2005, Shaw 2005, Mutale, Chintu et al. 2013, Ledikwe, Grignon et al. 2014). The findings from this study would support this approach.

ii) The HIS: Computerization - not a panacea for routine health information system weaknesses

Over recent years one of the main interventions that has been implemented across many countries in sub-Saharan Africa in an attempt to improve the standard, completeness and timeliness of the reporting of routine health data has been to introduce computerisation of the HMIS at the sub-national level (Garrib, Stoops et al. 2008, Karuri, Waiganjo et al. 2014, Ledikwe, Grignon et al. 2014). My findings suggest that while computerization of routine health information systems may, as has been found in other studies, improve certain dimensions of data quality (e.g. timeliness and reporting rates) (Kiberu, Matovu et al. 2014, Githinji, Onyando et al. 2016, Many and Nielsen 2016), it does not address the fundamental causes of poor data quality that originate at the health facility level where data collection is entirely paper based (Chilundo, Sundby et al. 2004, Mate, Bennett et al. 2009, Maokola, Willey et al. 2011, Hahn, Wanjala et al. 2012, Githinji, Kigen et al. 2014, Hamainza, Killeen et al. 2014). Instead, data quality issues are masked in the aggregated reports that are entered into the DHIS2 (Maokola, Willey et al. 2011, Kiberu, Matovu et al. 2014). As Chaulagai et al. (2005) observe, managers and other DHIS2 users became ‘passive consumers of information’ whose quality or even source was unknown to them (Chaulagai, Moyo et al. 2005). Verifying the quality of data before entry into the DHIS2 might improve data quality, but this was rarely the case in either of the sub-counties involved in this study. Once the data were entered into the DHIS2, no follow up was made to check if what was entered into the DHIS2 accurately reflected what was contained in the paper forms (chapter 7, section 7.2b). These data quality problems became concealed in facility reports entered in the DHIS2 (Gerrets 2015, Githinji, Onyando et al. 2016).

Due in part to the shortage of health records and information officers in both sub-counties, a general problem in Kenya (Luoma 2010, Ministry of Health 2014) sub-county managers delegated most data entry responsibilities to volunteers. There was very minimal supervision of the data entry process by these managers who were generally absent from these officers due to other engagements. Due to lack of computers

at the lake region sub-county health records office for entering data into the DHIS, volunteers working in this office tapped onto existing relationship with vertical programme managers (specifically HAWI) and entered monthly reports from their offices. Compared to the sub-county health records office, HAWI offices were well resourced, illustrating the inequalities that exist between vertical programmes and district health systems in which they are embedded. Such differences were also evident at the health facility level in HAWI operated HIV/AIDS clinics that were well staffed, were well stocked, and also well equipped (Sullivan 2011). The decision by some of these volunteers to use their personal resources (e.g. mobile phone airtime and personal laptops) to enter these data is also an expression of their power to act (chapter 6). However, these volunteers also had their own intrinsic motivations (chapter 8). For example, to earn allowances, they attended workshops and took part in other sub-county wide activities during the day, then entered monthly reports into the DHIS2 in the evening or in between these workshops- in some cases, while under pressure to beat reporting deadline. It is probable that such practices may have contributed to some of the data entry errors that were noted in the DHIS2. While computerisation may have helped to regularize reporting, the HMIS does not stand alone in the health system and remains subject to the systems 'hardware' constraints of lack of financing and human resource shortages.

Manya et al. (2016) argue that increased access to data courtesy of the DHIS2 has transformed data managers '*from just data entry clerks to data analysts*' and that it has also '*exposed managers to data quality in the system*' hence enabling them to initiate '*mechanisms for improving data quality*' (Manya, Nielsen et al. 2016). However, the results of this study suggest otherwise. None of the health facility managers in the four study facilities had access to the DHIS2 due to lack of access to computers or limited computing skills, a situation that is common in Kenya and other countries in SSA (Garrib, Stoops et al. 2008, Ledikwe, Grignon et al. 2014). This may explain why some

of the errors discussed in chapter 7 went unnoticed for several months and only became apparent to sub-county and health facility managers (and health workers) when external audits of these data were conducted. For example, an assessment of malaria data reported through the DHIS2 conducted by Githinji et al in 2016 found that one hospital had reported over 3.9 million blood slides in a month which is unattainable (Githinji, Onyando et al. 2016), suggesting data entry errors (Ministry of Health 2014). The fact that such a huge abnormality stayed undetected for close to a year in the DHIS2 (by the time the study was conducted) and remained unchanged even after these anomalies were pointed out in national dissemination exercise (that brought senior managers from the NMCP, MoH, and county governments), is an indication of the lack of access to, and perhaps more importantly the use of these data at all levels. By the time of writing this thesis (10 months after the national dissemination workshop), these figures remained unchanged in the DHIS2. Data entry errors which I had personally fed back to responsible line managers also remained the same one year down the line. These norms of data use (or non-use) are discussed further below.

iii) The HIS: Poor use of data

Large amounts of routine data are generated and reported on at the front line health facilities in Kenya leading to a considerable data burden, a key issue for the health workers and their sub-county managers involved in this study (chapter 8). However, it became clear during my observations in all four facilities that beyond fulfilling their administrative accountability requirements, the use of these data in patient management, or even awareness of their potential utility for sub-county management teams in disease surveillance, was lacking. For example, health workers did not make any concerted effort to correctly and consistently record patients' village name and location which as some authors have suggested, can be useful information for local disease surveillance (Ohrt, Roberts et al. 2015). Such information might be especially useful in the coast region which has witnessed a remarkable decline in malaria prevalence over the past

decade and where a more targeted approach to malaria control may be appropriate (Bejon, Williams et al. 2010). Two potential reasons might lie behind the lack of interest among health workers in how the data might be used. First, is their lack of power to take any action based on the information potentially available in the data, and the fact that information flow was mainly unidirectional and health workers rarely received any feedback (chapter 8). The latter may have reinforced perceptions that these data were mainly intended for those higher up the reporting chain, and not for local use. Such perceptions have been reported in several studies from across sub-Saharan Africa (Mavimbe, Braa et al. 2005, Hahn, Wanjala et al. 2012, Mbachu, Uzochukwu et al. 2013, Ledikwe, Grignon et al. 2014). In addition to the information flow being primarily unidirectional, where data were provided by health workers to help inform the management of supplies (e.g. quantification of their malaria commodity needs on a quarterly basis) they rarely received the requested quantities since drug supply decisions were not determined by their needs per se, but by a combination of factors such as malaria endemicity and case load (Ministry of Health 2009). This method of supply chain management led to under supply (hence stock-outs) or over supply (hence waste of expensive drugs) leading health workers to question the justification for collecting these data. Again, this broader health systems 'hardware' issue had a significant effect on the motivation of health workers in their practices of malaria data recording and reporting. A senior manager at the national level acknowledged that while facility managers submitted the exact quantity of malaria commodities that they required for a specific period, it was impossible to supply them with these quantities due to logistical challenges associated with packaging these commodities. This leads to questions about the rationale of requiring these health workers to continue compiling and submitting these requests.

The second possibility for health workers' lack of interest in how the data they produce might be used is that accountability requirements are driving a focus on the quantifiable

measures of performance which, as some authors have argued, can shift the focus away from qualitative measures of performance (e.g. quality of treatments) which is equally important (Plamondon, Hanson et al. 2008, Badara Samb 2009, Kerouedan 2010, Cashin 2012, Gerrets 2015). Although my study was mainly focused on output indicators, there were issues around the quality of malaria tests (chapter 5, refer to box 5.1) that became submerged in aggregated statistics that were compiled in monthly reports despite their potential consequences on the generation of flawed indicators (Bowen and Kreindler 2008, Afrane, Zhou et al. 2013).

Although the focus of this study was at the health facility and sub-county levels, document reviews showed that only a small fraction of malaria data reported routinely through the DHIS2 were actually analysed and used by the NMCP. For instance, despite the two laboratory forms (MOH 643 and Laboratory report) collecting close to half of all malaria data that were reported in the DHIS2, these data were not used by the NMCP to generate several malaria surveillance indicators (*e.g. percentage of suspected malaria cases tested with a parasite based test*) (Surveillance Bulletin- Issue no 17 June 2016), due to concerns about low reporting rates of laboratory data in the DHIS2 (Githinji, Onyando et al. 2016). Instead, the NMCP obtained data from the e-IDSR system (see section 3.5.2) which has a much lower reporting rate than the DHIS2 (Surveillance Bulletin- Issue no 17 June 2016). Although the focus of this study was not on e-IDSR data collection and reporting practices, the results from this study have shown that malaria cases reported through the e-IDSR system originated from the same source (Laboratory register), were completed by the same people who experienced similar challenges, and as such, may not be of any better quality than malaria cases reported through the DHIS2. Informal conversations with participants at the health facilities and at the sub-counties suggest that, while they were aware of the existence of these two data streams, they were not aware that the NMCP used the data from the e-IDSR and not the DHIS2 when reporting several of the key malaria surveillance indicators.

Murray (2007) observes that data burdens can contribute to wastage of scarce resources especially when these data are not analysed and used for decision making (Murray 2007). The results of this study appears to suggest that indeed, this was the case. Dixon-Woods et al. (2012) argue that for health workers to value these data, data collection requirements need to be seen as legitimate and important for patient management and not simply an '*illegitimate response to a bureaucratic intrusion*' (Dixon-Woods 2012). The latter often appeared to have been the case in this study. Some authors have observed that having an '*essential dataset*' (Shaw 2005) (i.e. a set of the most important data elements selected from all vertical programmes) which prioritizes key health problems, national goals and strategies, and important management processes can significantly reduce data burden, improve data quality, and encourage data ownership and use for decision making (Bodart and Shrestha 2000, Chaulagai, Moyo et al. 2005, Shaw 2005, Mutale, Chintu et al. 2013). My thesis findings support this idea and suggest that the timing is right to introduce such an intervention. Increased decision space at the county level following devolution presents a window of opportunity for the restructuring of the HMIS as happened in South Africa where decentralization post-apartheid led to a complete reform of the country's health information system (Shaw 2005). To ensure that such an approach does not undermine national demands for data as Cibulskis (2005) cautions, Shaw (2005) recommends a '*hierarchy of information needs*' approach where the MoH develops its essential list of indicators for health sector monitoring. Depending on their information needs, counties, sub-counties, and health facilities could then add their own indicators to this essential dataset for local use (Shaw 2005).

In this section, I have discussed various challenges to routine malaria data generation at the health facility and sub-county levels. As this study has shown, most of the challenges encountered by health workers in routine malaria data generation at the health facility

level have their roots in wider system issues and at the national level where the framing of indicators and development of data collection and reporting tools takes place. Stock-out of malaria commodities (except SP for IPTp which is procured by the county government) for example point to weak supply chain management at national level, and duplication and use of redundant forms (e.g. MOH 105 service delivery form) illustrates capacity challenges at the MoH's Health Information Systems department charged with coordinating the development of indicators and reporting tools in the country. As noted in chapter 3, both the Global Fund and PMI have heavily invested in malaria M&E activities in the country. For example, 7% of Kenya's total grant funding for malaria control is meant to strengthen malaria M&E activities in the country. However, the challenges documented in this study suggest the effects of this funding are not being adequately felt at the levels where actual data collection and reporting takes place. Whether these resources are being used as intended is beyond the scope of this study. However, it is clear from this study that technical solutions alone (e.g. introducing the DHIS2) without the strengthening of organizational management at all levels will not be adequate.

Lessons learnt

The overall aim of this study was to critically examine how data for constructing global malaria indicators from routine data are produced at the health facility and sub-county level in Kenya. In a departure from most studies that have investigated the quality of routine health statistics reported through the HMIS, I employed an ethnographic approach to data collection which enabled me to gain a deeper understanding of processes and practices that shaped routine malaria data generation over an extended period of time in these four facilities. While my original conceptual framework developed after a synthesis of the literature suggested that malaria data generation processes at the health facility and sub-county levels was influenced by various technical, social, and organizational factors, the results of this study suggest that

challenges to routine malaria data generation were not HMIS or disease specific as some studies of routine health information systems in sub-Saharan Africa have suggested. Rather, limitations to routine malaria data generation in this setting reflected general health system constraints, some of which (e.g. removal of user fees or decentralization) were occasioned by political factors outside the health system. These challenges cannot therefore be addressed by HMIS or disease specific interventions per se as studies of routine health information systems in sub-Saharan Africa have always recommended. For example, changing the design of data collection tools (which was a problem in this study) and failing to address human resource management challenges may not improve the outcome of malaria data generation. As noted above, it requires effective organizational management and leadership at the national and county levels as well. More importantly, this study has demonstrated the importance of systems ‘software’ (power relationships and contestations, motivations and interests etc.) in shaping how those at the frontline of malaria data generation responded to various health system constraints and thereby kept the system ‘functional’.

9.5 Strengths and limitations of the study

As explained in chapter four, this study adopted a qualitative descriptive study design. A potential critique of the qualitative descriptive approach is that it risks being inadequately grounded in theory, and therefore generates results that are less generalizable than more theory driven approaches to qualitative inquiry (e.g. grounded theory and ethnography) (Neergaard, Olesen et al. 2009, Lambert and Lambert 2012). My aim at the onset of this study was to provide a rich description of processes, practices, and challenges involved in routine malaria data generation in a language that is as close as possible to participants’ experiences (Sandelowski 2000, Sandelowski 2010). I drew on theory in framing my research questions, and in analyzing participants’ experiences which supports my study’s contribution to analytical generalizability. This

was supported by a range of steps I took to build rigour into every step of the research process (Milne and Oberle 2005).

First, I used multiple data collection methods. This enabled me to triangulate data between sources (i.e. compare what I observed with what people told me they did). Triangulation was also realized by comparing and contrasting the views of interview respondents at various levels (health facility, sub-county, and national level) on specific issues (Mays and Pope 2000). Secondly, *member checking* (Milne and Oberle 2005) through feedback meetings also enhanced the validity of this study as participants had an opportunity to listen and provide feedback on whether my presentation reflected an accurate description and interpretation of the daily realities involved in malaria data generation (Norris 1997). Participants to these meetings were drawn from several health facilities that had not been directly involved in the study. Similarly, these meetings were also attended by sub-county managers who I had not formally interviewed during this study. These health workers and their managers made active contributions which added breadth to the findings of this study. Third, the use of quantitative data obtained from records reviews also strengthened my descriptive and interpretive validity (Neergaard, Olesen et al. 2009). I also held regular meetings with my supervisors where we discussed and deliberated on various steps and decisions taken throughout this research process. Fourth, I presented the findings of this study in various forums and received critical feedback from other researchers. Fifth, I reflected on my positionality in the overall research process and how this may have influenced the research process (Mays and Pope 2000, Milne and Oberle 2005).

However, a key limitation of this study was my inability to conduct more interviews with national managers and other global actors involved in malaria M&E. Specifically, interviewing national level actors would have provided me with an understanding of some of the factors that influence malaria M&E choices at the national level (e.g. which

indicators to include in malaria M&E Plans); what routine malaria data are exactly used for at the national level; and perceptions of national level actors of the utility and quality of routine malaria data. Similarly, interviewing global level actors would have provided me with an in-depth understanding of how global accountability demands shapes national M&E choices and practices. In addition, I did not conduct participant observations in all four facilities and the two sub-county health records offices. I relied on my research assistant's experiences, accounts, and interpretations of events to make meaning of what was going on in these study sites. While I had spent some time in facility D where she conducted these observations, and as such, was quite familiar with the set up and daily routines, I did not spend much time in facility A. This made it difficult to contextualize observation field notes from this facility since I was not very conversant with people, places, and routines in this facility. Nonetheless, her involvement in the overall research process added a layer of interpretation through deliberations on emerging themes. I also held feedback meetings with health workers from the two facilities where I presented to health workers the results of the study, hence improving my interpretive validity.

9.6 Recommendations

The final objective of this study was to: *'use the information gathered to make recommendations on how indicator production process using routine health systems can be improved'*. The results chapters of this study together with the discussion chapter shows that there is need to address a number of issues which are undermining routine malaria data generation at frontline health facilities and sub-counties.

One of the key issues that stood out in this study is the level of duplications in routine malaria indicators (and other indicators) that are collected and reported through the DHIS2. The results of this study suggest that these duplications are not necessarily

driven by external accountability demands but rather by uncoordinated data demands from various programmes at the national level. This points to weak organizational capacity by the ministry of health's Health Information Systems department which is charged with the responsibility of coordinating the development of an essential dataset at the national level. As such, strengthening the HIS department's capacity to coordinate health data collection activities in the country should be a priority intervention for both the national government and donors.

Another key issue that emerged in this study is the influence of tool design on malaria data generation. As the results of this study have shown, the inability of outpatient registers to separately record *clinical* and *confirmed* malaria cases appears to be a major problem that could possibly be contributing to misreporting of malaria cases as previous assessments of routine malaria data in Kenya have also reported. The most recent copies of Outpatient Morbidity reporting forms (online and paper reports) and Tally Sheets now have *suspected malaria cases*. However, outpatient registers are yet to be modified to collect these data. As the results of this study have shown, outpatient morbidity tally sheets are perceived to be impractical and cumbersome to use. Thus, adding this indicator in the reporting form and the tally sheets will not fully address the problem. There is need for policy makers to redesign Outpatient registers to distinguish between *clinical* and *confirmed* malaria cases and also to collect data on *outpatient suspected malaria cases*. There is also need to modify MOH 711 & AWP reporting forms (both paper and online forms) to capture IPTp3 data in line with the current IPTp3 policy. These data are currently being collected in the ANC register so this does not require modification. More importantly though, this study shows that there is need to include data producers from the frontline in the design of these tools as a way of making these tools more practical and relevant to their data demands. As I highlighted in the discussion section, decentralization of health service management functions presents an excellent opportunity to reflect on some of these issues. For instance, does it make sense

for ANC registers across the country to continue having the column for reporting IPTp yet the intervention is only delivered in 14 malaria endemic counties?

Another key issue that emerged during this study was the important role played by casual staff in health data collection and reporting. There appears to be no regulatory framework for this cadre of staff despite the crucial role they play in health service delivery in general. In the context of severe human resource shortages that exist in many frontline health facilities in the country, the role of this category of staff in service delivery in general appears indispensable. Thus, there is need for policy makers to develop an effective regulatory framework that clearly defines the roles of these staff so that they do not take up on tasks which are beyond their remit. More importantly, there is need to accord them training opportunities so as to strengthen their skills in health data collection and reporting and also improve their working environment and welfare which I found was a key demotivating factor that necessitated practices that undermined the data generation process.

Although the DHIS2 has been promoted as a possible solution to some of the challenges with routine health information system, this study has demonstrated that computerization of information systems in itself is not a cure for routine health information system weaknesses. Most of the observed data quality issues originate at the health facility level where data collection is entirely paper based. As this study has shown, these data quality issues are not deliberate, but a product of various health system constraints and coping strategies employed to respond to them. Thus introducing the DHIS2 without addressing the persistent problem of understaffing and human resource management problems at the health facility level cannot improve the outcome of malaria data generation. This study has also shown that there is need for investment on supporting infrastructure, equipment and human resources.

There is also need to provide sub-county health management teams with adequate resources to enable them discharge their duties effectively. These managers play a crucial role in ensuring that national level policies are translated and implemented as planned at the health facility level. Through support supervision, they can provide mentorship, inspire and motivate those at the frontline, and also support problem solving.

This study has also demonstrated that any efforts aimed at improving malaria data generation (and health data generation in general) must look beyond technical solutions. Such efforts must recognize the important role played by the ‘software’ elements of the system in addressing health system constraints and keeping the system functional. Thus interventions aimed at strengthening the process should create an enabling environment that can nurture relationships between system actors, encourage innovations, and increase their awareness of the importance of the data collection process. In addition, those working at the frontline should be equipped with necessary skills that can enable them to challenge inequalities in power relationship both locally and globally which as this study has shown, appears to contribute to some of the challenges.

9.6.1 Areas for further research

There are a number of issues emerging from this study that require further examination in future studies. These include:

- An in-depth examination of factors that influence Kenya’s decisions on which indicators to include in its M&E plans
- An investigation of power relationships and contestations that influence the selection of indicators and data collection methods at the national level.

Specifically, who are the actors driving the process? What are their interest?

Why/how do they influence the process?

- There is also need to examine who/what the data collected currently is used for at the county and national levels. Such an assessment would also include questions on perceptions of the value of malaria data collected and reported through the routine health information system.
- There is need for an in-depth investigation on how data burdens such as those documented in this study influences routine service delivery. Such studies could document in a structured manner, the amount of time that health workers spend in completing registers and reporting tools versus the amount of time they spend in routine service delivery.
- Of specific interest to me in the future is an exploration of ways through which routine malaria data can be used to improve disease surveillance at the local level.

9.7 Conclusion

The renewed global drive towards malaria elimination has reinvigorated the interest on routine health information system due to their potential to provide real time data for malaria surveillance, M&E, and health system management. However, as the results from this study have demonstrated, challenges to malaria data generation and reporting through the routine health information system persist. Most of these challenges are well recognised and have been the subject of many publications and discussions at the global, national and local levels. However, in a departure from most studies of routine health information systems which largely focus on an assessment of data quality, I adopted an ethnographic approach in this study which enabled me to develop an in-depth understanding of processes, practices, and other contextual factors that affect routine malaria data generation through the routine health information system. A key finding made possible through this approach is that challenges to routine malaria data generation

and reporting through the routine health information system are not disease specific; neither are they specific to malaria data generation or even the sub-system of routine health information; they are fundamentally entwined with the functioning of the health system. They are above all systemic. As such, disease specific or HMIS focused interventions are unlikely to improve the outcome of the data generation process if systems 'hardware' constraints (e.g. shortage of human resources, finances etc.) are not addressed. Any intervention that seeks to improve routine malaria data generation must look beyond malaria or HMIS and address broader contextual factors that influence the process. This study has also demonstrated the importance of systems' software (e.g. power relationships and contestations, motivations, and interests) in addressing some of the challenges experienced in routine malaria data generation and reporting through the routine health information systems. Although this study was based on only two sub-counties and four health facilities, the ethnographic approach adopted produced information such as the influence of data collection tools on malaria indicator data generation that may be applicable beyond Kenya. These findings offer the potential to develop a rapid assessment tool focussed on key health system elements (hardware and software) that could be applied to an assessment of the HMIS in additional in countries elsewhere in sub-Saharan Africa to assess the strength of the health system and its impact on the quality of data reported through the HMIS. Such information is essential if we are to move towards the goals of the Global Malaria Technical Strategy 2016-2030 in which malaria burden estimates can confidently be based on near real-time data rather than modelled estimates in order to identify gaps in malaria interventions coverage and where to intervene.

10 References

- Afrane, Y. A., G. Zhou, A. K. Githeko and G. Yan (2013). "Utility of health facility-based malaria data for malaria surveillance." *PLoS One* **8**(2): e54305.
- Agarwal, K., P. Alonso, R. M. Chico, J. Coleman, S. Dellicour, J. Hill, M. Majeres-Lugand, V. Mangiaterra, C. Menendez, K. Mitchell, E. Roman, E. Sicuri, H. Tagbor, A. M. van Eijk and J. Webster (2015). "Global Call to Action to scale-up coverage of intermittent preventive treatment of malaria in pregnancy: seminar report." *Malar J* **14**: 206.
- Aiga, H., C. Kuroiwa, I. Takizawa and R. Yamagata (2008). "The reality of health information systems: challenges for standardization." *Biosci Trends* **2**(1): 5-9.
- Amexo, M., R. Tolhurst, G. Barnish and I. Bates (2004). "Malaria misdiagnosis: effects on the poor and vulnerable." *The Lancet* **364**(9448): 1896-1898.
- Andrews, K. G., M. Lynch, E. Eckert and J. Gutman (2015). "Missed opportunities to deliver intermittent preventive treatment for malaria to pregnant women 2003-2013: a systematic analysis of 58 household surveys in sub-Saharan Africa." *Malar J* **14**(1): 521.
- Ansah, E. K., J. Reynolds, S. Akanpighiam, C. J. Whitty and C. I. Chandler (2013). "“Even if the test result is negative, they should be able to tell us what is wrong with us”: a qualitative study of patient expectations of rapid diagnostic tests for malaria." *Malaria journal* **12**(1): 258.
- Aqil, A., T. Lippeveld and D. Hozumi (2009). "PRISM framework: a paradigm shift for designing, strengthening and evaluating routine health information systems." *Health policy and planning* **24**(3): 217-228.
- Ayub Many, J. B., Lars Overland, Ola Titlestad, Jeremiah Mumo, Charles Nzioka (2012). National Roll out of District Health Information Software (DHIS 2) in Kenya, 2011 – Central Server and Cloud based Infrastructure. *IST-Africa 2012 Conference Proceedings*. P. C. a. M. Cunningham.
- Badara Samb (2009). "An assessment of interactions between global health initiatives and country health systems." *The Lancet* **373**(9681): 2137-2169.
- Baiden, F., A. Bawah, S. Biai, F. Binka, T. Boerma, P. Byass, D. Chandramohan, S. Chatterji, C. Engmann and D. Greet (2007). "Setting international standards for verbal autopsy." *Bulletin of the World Health Organization* **85**(8): 570-571.
- Barker, C., A. Mulaki, D. Mwai and D. Arin (2014). Devolution of Health care in Kenya: Assessing health system readiness in Kenya: a review of selected inputs, Health Policy Project, Futures Group.

Bausell, L. and L. Katherine (2014). Treatment Uptake and Availability of Antimalarial Drugs for Intermittent Preventative Treatment in Pregnant Women in Malawi. Arlington, Va.: USAID | DELIVER PROJECT, Task Order.

Bejon, P., T. N. Williams, A. Liljander, A. M. Noor, J. Wambua, E. Ogada, A. Olotu, F. H. Osier, S. I. Hay and A. Färnert (2010). "Stable and unstable malaria hotspots in longitudinal cohort studies in Kenya." *PLoS Med* **7**(7): e1000304.

Bhatt, S., D. Weiss, E. Cameron, D. Bisanzio, B. Mappin, U. Dalrymple, K. Battle, C. Moyes, A. Henry and P. Eckhoff (2015). "The effect of malaria control on *Plasmodium falciparum* in Africa between 2000 and 2015." *Nature* **526**(7572): 207-211.

Biesma, R. G., R. Brugha, A. Harmer, A. Walsh, N. Spicer and G. Walt (2009). "The effects of global health initiatives on country health systems: a review of the evidence from HIV/AIDS control." *Health policy and planning* **24**(4): 239-252.

Biruk, C. (2012). "Seeing like a research project: producing "high-quality data" in AIDS research in Malawi." *Med Anthropol* **31**(4): 347-366.

Blumhagen, D., Khan T, Ndungu M, Settimi S (2010). USAID Kenya: Assessment of National Monitoring and Evaluation and Health Management Information Systems The Global Health Assistance Project.

Bodart, C. and L. Shrestha (2000). Identifying information needs and indicators. *Design and implementation of health information systems*. Geneva: WHO. T.

Lippeveld, R. Sauerborn and C. Bodart. Geneva World Health Organization 49-71.

Boerma, J. T. and S. K. Stansfield (2007). "Health statistics now: are we making the right investments?" *The Lancet* **369**(9563): 779-786.

Bowen, S. and S. A. Kreindler (2008). "Indicator Madness: A cautionary Reflection on the Use of Indicators in Healthcare." *Healthcare Policy* **3**(4).

Braa, J., A. Heywood and S. Sahay (2012). "Improving quality and use of data through data-use workshops: Zanzibar, United Republic of Tanzania." *Bull World Health Organ* **90**(5): 379-384.

Brieger, W. (2010). "Before we count malaria out we must first learn to count." from http://africahealth.co.uk/articles/may_2010/Malaria_06.pdf.

Brown, A. D. and J. Veillard (2008). "Commentary: Indicators with a Purpose—Meaningful Performance Measurement and the Importance of Strategy." *Healthcare Policy* **3**(4): 49.

Brown, H. and M. Green (2015). "At the service of community development: the professionalization of volunteer work in Kenya and Tanzania." *African Studies Review* **58**(02): 63-84.

Bryce, J., F. Arnold, A. Blanc, A. Hancioglu, H. Newby, J. Requejo, T. Wardlaw and C. W. G. o. I. C. Measurement (2013). "Measuring coverage in MNCH: new findings, new strategies, and recommendations for action." PLoS Med **10**(5): e1001423.

Callaghan-Koru, J. A., A. A. Hyder, A. George, K. E. Gilroy, H. Nsona, A. Mtimuni and J. Bryce (2012). "Health workers' and managers' perceptions of the integrated community case management program for childhood illness in Malawi: the importance of expanding access to child health services." The American journal of tropical medicine and hygiene **87**(5 Suppl): 61-68.

Cashin, C. (2012). Comparison of the monitoring and evaluation system of the World Bank and the Global Fund. I. E. Group.

Cavalli, A., S. I. Bamba, M. N. Traore, M. Boelaert, Y. Coulibaly, K. Polman, M. Pirard and M. Van Dormael (2010). "Interactions between global health initiatives and country health systems: the case of a neglected tropical diseases control program in Mali." PLoS Negl Trop Dis **4**(8): e798.

Chan, M., Kazatchkine M, Lob-Levyt J, Obaid T, Schweizer J, Sidibe M, Veneman A, Yamada T (2010). "Meeting the Demand for Results and Accountability: A Call for Action on Health Data from Eight Global Health Agencies." PLOS Med **7**(1).

Chanda, E., J. Hemingway, I. Kleinschmidt, A. M. Rehman, V. Ramdeen, F. N. Phiri, S. Coetzer, D. Mthembu, C. J. Shinondo, E. Chizema-Kawesha, M. Kamuliwo, V. Mukonka, K. S. Baboo and M. Coleman (2011). "Insecticide resistance and the future of malaria control in Zambia." PLoS One **6**.

Chandler, C. I., C. Jones, G. Boniface, K. Juma, H. Reyburn and C. J. Whitty (2008). "Guidelines and mindlines: why do clinical staff over-diagnose malaria in Tanzania? A qualitative study." Malar J **7**: 53.

Chaulagai, C. N., C. M. Moyo, J. Koot, H. B. Moyo, T. C. Sambakunsi, F. M. Khunga and P. D. Naphini (2005). "Design and implementation of a health management information system in Malawi: issues, innovations and results." Health Policy Plan **20**(6): 375-384.

Chen, H., D. Hailey, N. Wang and P. Yu (2014). "A review of data quality assessment methods for public health information systems." Int J Environ Res Public Health **11**(5): 5170-5207.

Chiba, Y., M. A. Oguttu and T. Nakayama (2012). "Quantitative and qualitative verification of data quality in the childbirth registers of two rural district hospitals in Western Kenya." Midwifery **28**(3): 329-339.

Chico, R. M., S. Dellicour, E. Roman, V. Mangiaterra, J. Coleman, C. Menendez, M. Majeres-Lugand, J. Webster and J. Hill (2015). "Global Call to Action: maximize the public health impact of intermittent preventive treatment of malaria in pregnancy in sub-Saharan Africa." Malar J **14**: 207.

Chilundo, B., J. Sundby and M. Aanestad (2004). "Analysing the quality of routine malaria data in Mozambique." Malar J **3**: 3.

Cibulskis, R. E., P. Alonso, J. Aponte, M. Aregawi, A. Barrette, L. Bergeron, C. A. Fergus, T. Knox, M. Lynch and E. Patouillard (2016). "Malaria: global progress 2000–2015 and future challenges." Infectious diseases of poverty **5**(1): 61.

Cibulskis, R. E., M. Aregawi, R. Williams, M. Otten and C. Dye (2011). "Worldwide Incidence of Malaria in 2009: Estimates, Time Trends, and a Critique of Methods." PLOS Medicine **8**(12): e1001142.

Cibulskis, R. E., D. Bell, E.-M. Christophel, J. Hii, C. Delacollette, N. Bakyaite and M. W. Aregawi (2007). "Estimating trends in the burden of malaria at country level." The American journal of tropical medicine and hygiene **77**(6 Suppl): 133-137.

Coulibaly, Y., A. Cavalli, M. Van Dormael, K. Polman and G. Kegels (2008). "Programme activities: a major burden for district health systems?" Tropical Medicine & International Health **13**(12): 1430-1432.

County of Kilifi (2013). Kilifi County First Integrated Development Plan 2013-2017

County of Siaya (2013). Siaya County Integrated Development Plan 2013-2017

Creswell, J. W. (2012). Qualitative inquiry and research design: Choosing among five approaches, Sage publications.

Davis, K. E., B. Kingsbury and S. E. Merry (2012). "Indicators as a technology of global governance." Law & Society Review **46**(1): 71-104.

Davis, K. E. K., B. (2011). Indicators as interventions: pitfalls and prospects in supporting developing initiatives Rockefeller foundation.

de Jongh, T. E., J. H. Harnmeijer, R. Atun, E. L. Korenromp, J. Zhao, J. Puvimanasinghe and R. Baltussen (2014). "Health impact of external funding for HIV, tuberculosis and malaria: systematic review." Health Policy Plan **2013**: 5.

De Savigny, D. and T. Adam (2009). Systems thinking for health systems strengthening, World Health Organization.

de Savigny, D. and F. Binka (2004). "Monitoring future impact on malaria burden in sub-saharan Africa." Am J Trop Med Hyg **71**.

Division of Malaria Control (2010). 2010 Kenyan Malaria Indicator Survey. Nairobi Kenya DOMC, KNBS, ICF Macro.

Division of Malaria Control (2012). Malaria Data Quality Audit: Western Region, Bungoma County Findings and Data Collection Report. Nairobi, Kenya.

Division of Malaria Control (2013). Malaria Data Quality Audit: Busia County Report

Dixon-Woods, M., Leslie M, Bion J, Tarrant C (2012). "What Counts? An Ethnographic Study of Infection Data Reported to a Patient Safety Program." The Milbank Quartely **90**(3): 548-591.

Eisele, T. P., D. A. Rhoda, F. T. Cutts, J. Keating, R. Ren, A. J. Barros and F. Arnold (2013). "Measuring coverage in MNCH: total survey error and the interpretation of intervention coverage estimates from household surveys." PLoS Med **10**(5): e1001386.

Eisele, T. P., K. Silumbe, J. Yukich, B. Hamainza, J. Keating, A. Bennett and J. M. Miller (2013). "Measuring coverage in MNCH: accuracy of measuring diagnosis and treatment of childhood malaria from household surveys in Zambia." PLoS Med **10**(5): e1001417.

Eldridge, C. and N. Palmer (2009). "Performance based payment: some reflections on the discourse and unanswered questions " Health Policy and Planning **24**: 160-166.

Elloker, S., P. Olckers, L. Gilson and U. Lehmann (2012). "Crises, routines and innovations: the complexities and possibilities of sub-district management: leadership and governance."

Erhart, A., N. D. Thang, N. X. Xa, N. Q. Thieu, L. X. Hung, N. Q. Hung, N. V. Nam, L. V. Toi, N. M. Tung, T. H. Bien, T. Q. Tuy, L. D. Cong, L. K. Thuan, M. Coosemans and U. D'Alessandro (2007). "Accuracy of the health information system on malaria surveillance in Vietnam." Trans R Soc Trop Med Hyg **101**(3): 216-225.

Erikson, S. L. (2012). "Global health business: the production and performativity of statistics in Sierra Leone and Germany." Medical anthropology **31**(4): 367-384.

Eyobo, M. B., A. C. Awur, G. Wani, A. I. Julla, C. D. Remijo, B. Sebit, R. Azairwe, O. Thabo, E. Bepo, R. L. Lako, L. Riek and E. Chanda (2014). "Malaria indicator survey 2009, South Sudan: baseline results at household level." Malar J **13**: 45.

Ferrinho, P., M. Sidat, F. Goma and G. Dussault (2012). "Task-shifting: experiences and opinions of health workers in Mozambique and Zambia." Human Resources for Health **10**(1): 1-8.

Ferrinho, P., S. Siziya, F. Goma and G. Dussault (2011). "The human resource for health situation in Zambia: deficit and maldistribution." Human Resources for Health **9**.

Fottrell, E. (2009). "Dying to count: mortality surveillance in resource-poor settings." Global health action **2**.

Garley, A., E. Eckert, A. Sie, M. Ye, K. Malm, E. A. Afari, M. Sawadogo, S. Herrera, E. Ivanovich and Y. Ye (2016). "Strengthening individual capacity in monitoring and evaluation of malaria control programmes to streamline M&E systems and enhance information use in malaria endemic countries." Malaria Journal **15**(1): 1-8.

Garrib, A., N. Stoops, A. McKenzie, L. Dlamini, T. Govender, J. Rohde and K. Herbst (2008). "An evaluation of the District Health Information System in rural South Africa." S Afr Med J **98**(7): 549-552.

George, A. (2009). "‘By papers and pens, you can only do so much’: views about accountability and human resource management from Indian government health administrators and workers." The International journal of health planning and management **24**(3): 205-224.

Gerrets, R. (2015). Charting the road to eradication: health facility data and malaria indicator data generation in rural Tanzania. The World of Indicators. S. E. M. Richard Rottenburg, Sung-Joon Park and Johanna Mugler,. United Kingdom Cambridge Univeristy Press.

Gilson L , Barasa E, Nxumalo N, Cleary S, Goudge J, Molyneux S, Tsofa B and Lehmann U (2017). "Everyday resilience in district health systems: emerging insights from the front lines in Kenya and South Africa " BMJ Global Health.

Gimbel, S., M. Micek, B. Lambdin, J. Lara, M. Karagianis, F. Cuembelo, S. S. Gloyd, J. Pfeiffer and K. Sherr (2011). "An assessment of routine primary care health information system data quality in Sofala Province, Mozambique." Popul Health Metr **9**(12): 1478-7954.

Githinji, S., S. Kigen, D. Memusi, A. Nyandigisi, A. Wamari, A. Muturi, G. Jagoe, R. Ziegler, R. W. Snow and D. Zurovac (2014). "Using mobile phone text messaging for malaria surveillance in rural Kenya." Malar J **13**: 107.

Githinji, S., A. M. Noor, J. Malinga, P. M. Macharia, R. Kiptui, A. Omar, K. Njagi, E. Waqo and R. W. Snow (2016). "A national health facility survey of malaria infection among febrile patients in Kenya, 2014." Malar J **15**(1): 591.

Githinji, S., R. Onyando, E. Waqo, Soti. D, Rono. J, A. Buff, R. Snow and A. Noor (2016). Exploring routinely reported malaria data in Kenya; a data quality assessment, National Malaria Control Programme, . Nairobi.

Global Fund, PEPFAR, USAID, WHO, UNAIDS, Office of the Global AIDS Coordinator and Measure Evaluation (2008). Routine Data Quality Assessment Tool: Guidelines for Implementations for TB, HIV/AIDS & Malaria Programs

Gomez, P. P., J. Gutman, E. Roman, A. Dickerson, Z. H. Andre, S. Youll, E. Eckert and M. J. Hamel (2014). "Assessment of the consistency of national-level policies and guidelines for malaria in pregnancy in five African countries." Malar J **13**: 212.

Government of Kenya (2009). Access to Essential Medicines in Kenya: a health facility survey. M. o. p. h. a. s. Ministry of Medical services.

Government of Kenya (2009). Health Sector Health Information Systems Policy M. o. M. S. M. o. P. H. a. Sanitation. Nairobi.

Government of Kenya (2016). The Health Bill 2016, Kenya Gazette Supplement No. 44 of 2015.

Guyatt, H. L. and R. W. Snow (2004). "Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa." Clin Microbiol Rev **17**(4): 760-769, table of contents.

Gwyn, B. and H. Christopher (2006). "What's measured is what matters: targets and gaming in the English public health care system." Public administration **84**(3): 517-538.

Habicht, J. P., C. G. Victora and J. P. Vaughan (1999). "Evaluation designs for adequacy, plausibility and probability of public health programme performance and impact." Int J Epidemiol **28**.

Habte, D., G. Dussault and D. Dovolo (2004). "Challenges confronting the health workforce in sub-Saharan Africa." World Hospitals and Health Services **40**(2): 23-26.

Hahn, D., P. Wanjala and M. Marx (2012). "Where is information quality lost at clinical level? A mixed-method study on information systems and data quality in three urban Kenyan ANC clinics." Glob Health Action **6**: 21424.

Hamainza, B., G. F. Killeen, M. Kamuliwo, A. Bennett and J. O. Yukich (2014). "Comparison of a mobile phone-based malaria reporting system with source participant register data for capturing spatial and temporal trends in epidemiological indicators of malaria transmission collected by community health workers in rural Zambia." Malar J **13**: 489.

Hanefeld, J. and M. Musheke (2009). "What impact do Global Health Initiatives have on human resources for antiretroviral treatment roll-out? A qualitative policy analysis of implementation processes in Zambia." Human Resources for Health **7**(1): 8.

Health Metric Network (2008). Framework and Standard for country Health Information Systems World Health Organization.

Health Policy Project. (2017). "County profiles." Retrieved 22/5/2017, from <https://www.healthpolicyproject.com/index.cfm?id=kenyaCHFS>.

Herrera, S., E. Ivanovich, Y. Yé and A. Garley (2016). Monitoring and evaluation of malaria programmes: online course. M. Evaluation.

Hill, J., J. Hoyt, A. M. van Eijk, L. D'Mello-Guyett, F. O. Ter Kuile, R. Steketee, H. Smith and J. Webster (2013). "Factors affecting the delivery, access, and use of interventions to prevent malaria in pregnancy in sub-Saharan Africa: a systematic review and meta-analysis." PLoS Med **10**(7): e1001488.
<http://globalfundkcm.or.ke/proposal/> Kenya National Proposal to the Global Fund Round 2 proposal

<https://www.dhis2.org/>. "District Health Information Software (DHIS2),." from <https://www.dhis2.org/>

Idris, Z. M., C. W. Chan, J. Kongere, J. Gitaka, J. Logedi, A. Omar, C. Obonyo, B. K. Machini, R. Isozumi and I. Teramoto (2016). "High and Heterogeneous Prevalence of

Asymptomatic and Sub-microscopic Malaria Infections on Islands in Lake Victoria, Kenya." Scientific reports **6**.

Iley, K. (2006). "Malaria deaths are the hardest to count." Bulletin of the World Health Organization **84**(3): 165-166.

Jackson, T. (2005). "Why performance indicators have a place in health policy." HealthcarePapers **6**(2).

Jima, D., A. Getachew, H. Bilak, R. W. Steketee, P. M. Emerson, P. M. Graves, T. Gebre, R. Reithinger and J. Hwang (2010). "Malaria indicator survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions." Malar J **9**: 58.

Juma, E. and D. Zurovac (2011). "Changes in health workers' malaria diagnosis and treatment practices in Kenya." Malaria Journal **10**(1): 1.

Kamanga, A., P. Moono, G. Stresman, S. Mharakurwa and C. Shiff (2010). "Rural health centres, communities and malaria case detection in Zambia using mobile telephones: a means to detect potential reservoirs of infection in unstable transmission conditions." Malar J **9**.

Kamuya, D. M., S. J. Theobald, P. K. Munywoki, D. Koech, W. P. Geissler and S. C. Molyneux (2013). "Evolving friendships and shifting ethical dilemmas: fieldworkers' experiences in a short term community based study in Kenya." Developing world bioethics **13**(1): 1-9.

Kangwana, B. B., J. Njogu, B. Wasunna, S. V. Kedenge, D. N. Memusi, C. A. Goodman, D. Zurovac and R. W. Snow (2009). "Malaria drug shortages in Kenya: a major failure to provide access to effective treatment." The American journal of tropical medicine and hygiene **80**(5): 737-738.

Karema, C., M. W. Aregawi, A. Rukundo, A. Kabayiza, M. Mulindahabi, I. S. Fall, K. Gausi, R. O. Williams, M. Lynch, R. Cibulskis, N. Fidele, J.-P. Nyemazi, D. Ngamije, I. Umulisa, R. Newman and A. Binagwaho (2012). "Trends in malaria cases, hospital admissions and deaths following scale-up of anti-malarial interventions, 2000–2010, Rwanda." Malaria Journal **11**(1): 236.

Karuri, J., P. Waiganjo, O. Daniel and A. MANYA (2014). "DHIS2: The Tool to Improve Health Data Demand and Use in Kenya." Journal of Health Informatics in Developing Countries **8**(1).

Keating, J., T. P. Finn, T. P. Eisele, G. Dery, E. Biney, M. Kédoté, B. Fayomi and J. O. Yukich (2014). "An assessment of malaria diagnostic capacity and quality in Ghana and the Republic of Benin." Transactions of the Royal Society of Tropical Medicine and Hygiene: tru127.

Kenya National Bureau of Statistics (2011). Monitoring the situation of children and women: multiple cluster indicator survey Siaya, Kenya. UNICEF.

- Kenya National Bureau of Statistics (2012). 2009 Kenya population and housing census: Analytic Report on Population Projections. N. D. a. V. Ministry of State for Planning. Nairobi, Government of Kenya. **XIV**.
- Kenya National Bureau of Statistics (2014). Kenya Demographic and Health Survey 2014. Nairobi, Kenya.
- Kerouedan, D. (2010). "The Global Fund to fight HIV/AIDS, TB and Malaria 5-y: evaluation policy issues." Bulletin de la Societe de pathologie exotique (1990) **103**(2): 119-122.
- Kiberu, V. M., J. K. Matovu, F. Makumbi, C. Kyoziira, E. Mukooyo and R. K. Wanyenze (2014). "Strengthening district-based health reporting through the district health management information software system: the Ugandan experience." BMC Med Inform Decis Mak **14**: 40.
- Kinfun, Y., M. R. Dal Poz, H. Mercer and D. B. Evans (2009). "The health worker shortage in Africa: are enough physicians and nurses being trained?" Bull World Health Organ **87**.
- Kingori, P. and R. Gerrets (2016). "Morals, morale and motivations in data fabrication: Medical research fieldworkers views and practices in two Sub-Saharan African contexts." Social Science & Medicine **166**: 150-159.
- Kunimitsu, A. (2009). "The accuracy of clinical malaria case reporting at primary health care facilities in Honiara, Solomon Islands." Malar J **8**: 80.
- Laleman, G., G. Kegels, B. Marchal, D. Van der Roost, I. Bogaert and W. Van Damme (2007). "The contribution of international health volunteers to the health workforce in sub-Saharan Africa." Human Resources for Health **5**(1): 19.
- Lambert, V. A. and C. E. Lambert (2012). "Qualitative descriptive research: An acceptable design." Pacific Rim International Journal of Nursing Research **16**(4): 255-256.
- Larsen, D. A., Z. Chisha, B. Winters, M. Mwanza, M. Kamuliwo, C. Mbwili, M. Hawela, B. Hamainza, J. Chirwa, A. S. Craig, M. R. Rutagwera, C. Lungu, T. Ngwenya-Kangombe, S. Cheelo, J. M. Miller, D. J. Bridges and A. M. Winters (2015). "Malaria surveillance in low-transmission areas of Zambia using reactive case detection." Malar J **14**(1): 465.
- Ledikwe, J. H., J. Grignon, R. Lebelonyane, S. Ludick, E. Matshediso, B. W. Sento, A. Sharma and B. W. Semo (2014). "Improving the quality of health information: a qualitative assessment of data management and reporting systems in Botswana." Health Res Policy Syst **12**: 7.
- Lehmann, U., W. Van Damme, F. Barten and D. Sanders (2009). "Task shifting: the answer to the human resources crisis in Africa?" Hum Resour Health **7**: 49.

- Lippeveld T (2000). Routine data collection methods. Design and implementation of health information systems R. S. Theo Lippeveld, Claude Bodart. Geneva, World Health Organization.
- Lippeveld, T., R. Sauerborn and C. Bodart (2000). Design and implementation of health information systems, World Health Organization Geneva.
- Low-Ber, D., H. Afkhami, R. Komatsu, P. Banati, M. Sempala, I. Katz, J. Cutler, P. Schumacher, R. Tran-Ba-Huy and B. Schwartlander (2007). "Making performance-based funding work for health." PLoS Med **4**(8).
- Lowrance, D., S. Filler, S. Makombe, A. Harries, J. Aberle-Grasse, M. Hochgesang and E. Libamba (2007). "Assessment of a national monitoring and evaluation system for rapid expansion of antiretroviral treatment in Malawi." Trop Med Int Health **12**(3): 377-381.
- Lufesi, N. N., M. Andrew and I. Aursnes (2007). "Deficient supplies of drugs for life threatening diseases in an African community." BMC Health Services Research **7**(1): 86.
- Lungo, J. H. (2008). "The reliability and usability of district health information software: case studies from Tanzania." Tanzan J Health Res **10**(1): 39-45.
- Lungo, J. H. and F. Igira (2008). "Development of health information system in Zanzibar: practical implications." Journal of Health Informatics in Developing Countries **2**(1).
- Luoma, M., Doherty J, Muchiri S, Barasa T, Hofler K, Maniscalco L, Ouma C, Kirika R, Maundu J (2010). **Kenya Health Systems Assessments 2010**. MD: Health Systems 20/20 project, Abt Associates Inc.
- Makombe, S., Hochgesang M, Jahn A, Tweya H, Hedt B, Chuka S, Kwong-Leung Yu J, Aberle-Grasse J, Pasulani O, Bailey C, Kamoto K, Schouten EJ, Harries AD (2008). "Assessing the quality of data aggregated by antiretroviral treatment clinics in Malawi." Bulletin of the World Health Organization **86**: 310-314.
- Manya, A. and P. Nielsen (2016). "Reporting Practices and Data Quality in Health Information Systems in Developing Countries: An Exploratory Case Study in Kenya." Journal of Health Informatics in Developing Countries **10**(1).
- Manya, A., P. Nielsen and R. Pundo (2016). "Cloud Computing as a Catalyst for Integrated Health Information Systems in Developing Countries: Opportunities and Challenges."
- Maokola, W., B. A. Willey, K. Shirima, M. Chemba, J. R. Armstrong Schellenberg, H. Mshinda, P. Alonso, M. Tanner and D. Schellenberg (2011). "Enhancing the routine health information system in rural southern Tanzania: successes, challenges and lessons learned." Tropical Medicine & International Health **16**(6): 721-730.

Mate, K., Bennett B, Mphatswe W, Barker P, Rollins N (2009). "Challenges for Routine Health System Data Management in a Large Public Programme to Prevent Mother-to-Child HIV Transmission in South Africa." PLoS One **4**(5).

Mate, K. S., B. Bennett, W. Mphatswe, P. Barker and N. Rollins (2009). "Challenges for routine health system data management in a large public programme to prevent mother-to-child HIV transmission in South Africa." PLoS One **4**(5): e5483.

Matsuoka, S., H. Obara, M. Nagai, H. Murakami and R. Chan Lon (2013). "Performance-based financing with GAVI health system strengthening funding in rural Cambodia: a brief assessment of the impact." Health Policy Plan **2013**: 3.

Mavimbe, J. C., J. Braa and G. Bjune (2005). "Assessing immunization data quality from routine reports in Mozambique." BMC Public Health **5**: 108.

Mays, N. and C. Pope (2000). "Assessing quality in qualitative research." BMJ: British Medical Journal **320**(7226): 50.

Mbachu, C. O., B. S. Uzochukwu, O. E. Onwujekwe, A. L. Ilika and J. Oranuba (2013). "How do health workers perceive and practice monitoring and evaluation of malaria control interventions in South-east Nigeria?" BMC Health Serv Res **13**: 81.

McCoy, D., S. Bennett, S. Witter, B. Pond, B. Baker, J. Gow, S. Chand, T. Ensor and B. McPake (2008). "Salaries and incomes of health workers in sub-Saharan Africa." The Lancet **371**(9613): 675-681.

McKinsey & Company (2005). *Global Health Partnerships: Assessing country consequences*, Bill & Melinda Gates Foundation.

MEASURE Evaluation, USAID-PMI, Roll Back Malaria Partnership, UNICEF and WHO (2013). *Household Survey Indicators for Malaria Control*.

Meessen, B., A. Soucat and C. Sekabaraga (2011). "Performance-based financing: just a donor fad or a catalyst towards comprehensive health-care reform?" Bull World Health Organ **89**(2): 153-156.

Merry, E. S. (2011). "Measuring the world: indicators, human rights, and global governance." Current Anthropology **52**(S3): 000-000.

Mijovic, H., J. McKnight and M. English (2016). "What does the literature tell us about health workers' experiences of task-shifting projects in sub-Saharan Africa? A systematic, qualitative review." Journal of clinical nursing **25**(15-16): 2083-2100.

Mikkelsen-Lopez, I., W. Shango, J. Barrington, R. Ziegler, T. Smith and D. deSavigny (2014). "The challenge to avoid anti-malarial medicine stock-outs in an era of funding partners: the case of Tanzania." Malaria Journal **13**(1): 181.

Milne, J. and K. Oberle (2005). "Enhancing rigor in qualitative description." Journal of Wound Ostomy & Continence Nursing **32**(6): 413-420.

Ministries of Health (2009). *Health Sector Strategic Plan for Health Information System 2009-2014*. Nairobi.

Ministry of Health (2001). National Malaria Strategy 2001-2010. D. o. M. Control. Nairobi, Kenya.

Ministry of Health (2005). Reversing the Trends: The Second National Health Sector Strategic Plan of Kenya- NHSSP II 2005-2010. Nairobi.

Ministry of Health (2008). Health Sector Indicators & Standard Operating Procedures Manual for Health Workers Nairobi.

Ministry of Health (2009). Antimalarial Medicine requirement for July 2009- June 2010: reports of the drug supply committee of the Division of Malaria Control.

Ministry of Health (2009). Towards a Malaria Free Kenya: National Malaria Strategy 2009-2017. Division of Malaria Control. Nairobi, Kenya

Ministry of Health (2012). 2nd Indicators and Standard Operating Procedures Manual. Nairobi, Government of Kenya.

Ministry of Health (2012). Kenya Nursing Workforce Report : The Status of Nursing in Kenya. Nairobi.

Ministry of Health (2013). Malaria Surveillance and Response: A Comprehensive Curriculum and Implementation Guide- Participant's Manual. Nairobi.

Ministry of Health (2014). Data Quality Audit Report. M. o. H. A. P. Health Information System Monitoring & Evaluation. Nairobi.

Ministry of Health (2014). Diagnosis, Management and Prevention of Malaria: Participant's Manual for Health Workers Nairobi, Kenya.

Ministry of Health (2014). Health Sector Human Resources Strategy 2014 – 2018. Nairobi, Kenya

Ministry of Health (2014). Kenya Malaria Monitoring & Evaluation Plan 2009-2018. National Malaria Control Programme. Nairobi, Kenya.

Ministry of Health (2014). Malaria Surveillance and Response: A Comprehensive Curriculum and Implementation Guide- Participant's Manual. Nairobi.

Ministry of Health (2014). National Guidelines for the Diagnosis, Treatment and Prevention of Malaria in Kenya. D. o. M. Control. Nairobi

Ministry of Health (2014). Revised Kenya Malaria Monitoring and Evaluation Plan 2009-2018. Nairobi.

Ministry of Health (2014). Strategy for Community Health 2014-2019: Transforming health accelerarating the attainment of health goals.

Ministry of Health (2014). Towards a Malaria Free Kenya: Kenya Malaria Strategy 2009-2018. National Malaria Control Programme. Nairobi.

Ministry of Health (2014). Transforming Health: Accelerating attainment of Universal Health Coverage. Nairobi.

Ministry of Health (2015). Devolved HRM policy guidelines on human resources for health.

Ministry of Health (2015). National Health Accounts 2012/2013 Nairobi.

Ministry of Health (2016). The epidemiology and control profile of malaria in Kenya: reviewing the evidence to guide the future vector control. National Malaria Control Programme, Ministry of Health. Technical support provided by the LINK Project (London School of Hygiene and Tropical Medicine and the Information for Malaria (INFORM) Project, KEMRI-Wellcome Trust Research Programme), Nairobi, Kenya, April 2016. Nairobi.

Ministry of Health, M. o. P. H. S. (2010). Health Sector: Health Information System Policy. Ministry of Health. Nairobi.

Ministry of Public Health and Sanitation (2009). Kenya Malaria Monitoring and Evaluation Plan 2009-2017. Division of Malaria Control. Nairobi, Kenya.

Ministry of Public Health and Sanitation (2009). Kenya Malaria Programme Performance Review 2009. Division of Malaria Control. Nairobi.

Ministry of Public Health and Sanitation (2012). Technical Guidelines for Integrated Disease Surveillance and Response in Kenya Nairobi.

Mphatswe, W., K. S. Mate, B. Bennett, H. Ngidi, J. Reddy, P. M. Barker and N. Rollins (2012). "Improving public health information: a data quality intervention in KwaZulu-Natal, South Africa." Bull World Health Organ **90**(3): 176-182.

Mpimbaza, A., M. Miles, A. Sserwanga, R. Kigozi, H. Wanzira, D. Rubahika, S. Nasr, B. K. Kapella, S. S. Yoon and M. Chang (2015). "Comparison of Routine Health Management Information System Versus Enhanced Inpatient Malaria Surveillance for Estimating the Burden of Malaria Among Children Admitted to Four Hospitals in Uganda." The American journal of tropical medicine and hygiene **92**(1): 18-21.

Mpofu, M., B.-w. Semo, J. Grignon, R. Lebelonyane, S. Ludick, E. Matshediso, B. Sento and J. H. Ledikwe (2014). "Strengthening monitoring and evaluation (M&E) and building sustainable health information systems in resource limited countries: lessons learned from an M&E task-shifting initiative in Botswana." BMC public health **14**(1): 1032.

Msukwa, C., B. Rawlins and M. Drake (2014). "Review of monitoring of malaria in pregnancy through national health management information systems: malawi."

Mubi, M., D. Kakoko, B. Ngasala, Z. Premji, S. Peterson, A. Björkman and A. Mårtensson (2013). "Malaria diagnosis and treatment practices following introduction of rapid diagnostic tests in Kibaha District, Coast Region, Tanzania." Malaria journal **12**(1): 293.

Mubyazi, G. M., J. Byskov, P. Magnussen, I. C. Bygbjerg, J. N. Ijumba, M. Marero, L. E. Mboera, F. Molteni and P. Bloch (2014). "Health facility-based data on women receiving sulphadoxine-pyrimethamine during pregnancy in Tanzania: lessons to learn

from a cross-sectional survey in Mkuranga and Mufindi districts and other national survey reports." Reprod Health **11**(1): 6.

Murray, C. J., B. Shengelia, N. Gupta, S. Moussavi, A. Tandon and M. Thieren (2003). "Validity of reported vaccination coverage in 45 countries." Lancet **362**(9389): 1022-1027.

Murray, C. J. L. (2007). "Towards good practice for health statistics: lessons from the Millennium Development Goal health indicators." The Lancet **369**.

Mussa, A. H., J. Pfeiffer, S. S. Gloyd and K. Sherr (2013). "Vertical funding, non-governmental organizations, and health system strengthening: perspectives of public sector health workers in Mozambique." Human resources for health **11**(1): 26.

Mutale, W., N. Chintu, C. Amoroso, K. Awoonor-Williams, J. Phillips, C. Baynes, C. Michel, A. Taylor and K. Sherr (2013). "Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative." BMC Health Serv Res **13 Suppl 2**: S9.

Nahlen, B. L. and D. Low-Beer (2007). "Building to collective impact: the Global Fund support for measuring reduction in the burden of malaria." The American journal of tropical medicine and hygiene **77**(6 Suppl): 321-327.

National Malaria Control Program (2013). Kenya Annual Malaria Report July 2012-June 2013 Nairobi Kenya.

National Malaria Control Program (2014). Malaria Data Quality Audit: Meru and Tharaka Nithi Counties Report Naironi.

National Malaria Control Program (2016). Kenya Malaria Indicator Survey 2015 Nairobi.

National Malaria Control Program (2016). Malaria Surveillance Bulletins: Issue 1-17. Nairobi.

Ndavi, P. M., S. Ogola, P. M. Kizito and K. Johnson (2009). Decentralizing Kenya's Health Management System: An Evaluation. Kenya Working Papers No. 1., Calverton, Maryland, USA: Macro International Inc.

Ndira, S. P., K. D. Rosenberger and T. Wetter (2008). "Assessment of data quality of and staff satisfaction with an electronic health record system in a developing country (Uganda): a qualitative and quantitative comparative study." Methods Inf Med **47**(6): 489-498.

Neergaard, M. A., F. Olesen, R. S. Andersen and J. Sondergaard (2009). "Qualitative description—the poor cousin of health research?" BMC medical research methodology **9**(1): 52.

Nkumama, I. N., W. P. O'Meara and F. H. A. Osier (2017). "Changes in Malaria Epidemiology in Africa and New Challenges for Elimination." Trends in Parasitology **33**(2): 128-140.

- Noor, A. M., J. J. Mutheu, A. J. Tatem, S. I. Hay and R. W. Snow (2009). "Insecticide-treated net coverage in Africa: mapping progress in 2000–07." The Lancet **373**(9657): 58-67.
- Norris, N. (1997). "Error, bias and validity in qualitative research." Educational action research **5**(1): 172-176.
- Nyikuri M, Tsofa B, Okoth P, Barasa E and M. S. (2017). "“We are toothless and hanging, but optimistic”: Sub county managers’ experiences of rapid devolution in coastal Kenya." International Journal for Equity in Health **16**(1):113.
- Nyikuri, M., B. Tsofa, E. Barasa, P. Okoth and S. Molyneux (2015). "Crises and Resilience at the Frontline-Public Health Facility Managers under Devolution in a Sub-County on the Kenyan Coast." PLoS One **10**(12): e0144768.
- O’Meara, P., Mangeni JN, Steketee R, Greenwood B (2010). "Changes in the burden of malaria in sub-Saharan Africa." The Lancet **10**.
- Ochieng, B. M., E. Akunja, N. Edwards, D. Mombo, L. Marende and D. C. O. Kaseje (2014). "Perceptions of health stakeholders on task shifting and motivation of community health workers in different socio demographic contexts in Kenya (nomadic, peri-urban and rural agrarian)." BMC Health Serv Res **14**(Suppl 1): S4.
- Odhiambo-Otieno, G. W. (2005). "Evaluation of existing district health management information systems a case study of the district health systems in Kenya." Int J Med Inform **74**(9): 733-744.
- Odhiambo, F. O., K. F. Laserson, M. Sewe, M. J. Hamel, D. R. Feikin, K. Adazu, S. Ogwang, D. Obor, N. Amek, N. Bayoh, M. Ombok, K. Lindblade, M. Desai, F. ter Kuile, P. Phillips-Howard, A. M. van Eijk, D. Rosen, A. Hightower, P. Ofware, H. Muttai, B. Nahlen, K. DeCock, L. Slutsker, R. F. Breiman and J. M. Vulule (2012). "Profile: the KEMRI/CDC Health and Demographic Surveillance System--Western Kenya." Int J Epidemiol **41**(4): 977-987.
- Ohiri, K., N. K. Ukoha, C. W. Nwangwu, C. C. Chima, Y. K. Ogundeji, A. Rone and M. R. Reich (2016). "An Assessment of Data Availability, Quality, and Use in Malaria Program Decision Making in Nigeria." Health Systems & Reform **2**(4): 319-330.
- Ohrt, C., K. W. Roberts, H. J. Sturrock, J. Wegbreit, B. Y. Lee and R. D. Gosling (2015). "Information systems to support surveillance for malaria elimination." Am J Trop Med Hyg **93**(1): 145-152.
- Ollila, E. (2005). "Global health priorities – priorities of the wealthy?" Globalization and Health **1**:6.
- Oomman, N., M. Bernstein and S. Rosenzweig (2008). "Seizing the opportunity on AIDS and health systems." Washington, DC: Center for Global Development.

Open Data Kenya. (2017). "HIV/AIDS situation in Kenya." Retrieved 22/5/2017, from <http://blog.opendata.go.ke/hiv-situation-in-kenya/>.

Otten, M., M. Aregawi, W. Were, C. Karema, A. Medh in, W. Bekele, D. Jima, K. Gausi, R. Komatsu, E. Korenromp, D. Low-Beer and M. Grabowsky (2009). "Initial evidence of reduction of malaria cases and deaths in Rwanda and Ethiopia due to rapid scale-up of malaria prevention and treatment." *Malar J* **8**.

Otwombe, K. N., J. Wanyungu, K. Nduku and M. Taegtmeier (2007). "Improving national data collection systems from voluntary counselling and testing centres in Kenya." *Bull World Health Organ* **85**(4): 315-318.

Palinkas, L. A., S. M. Horwitz, C. A. Green, J. P. Wisdom, N. Duan and K. Hoagwood (2015). "Purposeful sampling for qualitative data collection and analysis in mixed method implementation research." *Administration and Policy in Mental Health and Mental Health Services Research* **42**(5): 533-544.

Pigott, D. M., R. Atun, C. L. Moyes, S. I. Hay and P. W. Gething (2012). "Funding for malaria control 2006-2010: a comprehensive global assessment." *Malar J* **11**.

Plamondon, K. M., L. Hanson, R. Labonte and S. Abonyi (2008). "The Global Fund and tuberculosis in Nicaragua: building sustainable capacity?" *Can J Public Health* **99**(4): 355-358.

Plamondon, K. M., L. Hanson, R. Labonté and S. Abonyi (2008). "The global fund and tuberculosis in Nicaragua: Building sustainable capacity?" *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*: 355-358.

PLoS Medicine Editors (2009). "Time for a "third wave" of malaria activism to tackle the drug stock-out crisis." *PLoS Med* **6**(11): e1000188.

Pope, C., S. Ziebland and N. Mays (2000). "Analysing qualitative data." *British medical journal* **320**(7227): 114.

President's Malaria Initiative (2016). A decade of progress: President's Malaria Initiative Tenth Annual Report to Congress

Presidential Malaria Initiative (2005). President's Malaria Initiative Monitoring and Evaluation Strategy 2005-2010.

Presidential Malaria Initiative (2015). PMI: Fighting Malaria and Saving Lives

Presidents Malaria Initiative (2009). Monitoring and Evaluation Indicators to be Used within The President's Malaria Initiative

Presidents Malaria Initiative (2017). Malaria Operational Plan FY 2017.

Rassi, C., K. Graham, P. Mufubenga, R. King, J. Meier and S. S. Gudoi (2016). "Assessing supply-side barriers to uptake of intermittent preventive treatment for malaria in pregnancy: a qualitative study and document and record review in two regions of Uganda." *Malar J* **15**(1): 341.

Rawlins, B., A. Ngindu and S. Kigundu (2014). Review of Monitoring of Malaria in Pregnancy Through the Health Management Information System: Kenya, USAID PMI, Maternal and Child Health Survival Program, .

Remme, J. H., F. Binka and D. Nabarro (2001). "Toward a framework and indicators for monitoring Roll Back Malaria." *Am J Trop Med Hyg* **64**(1-2 Suppl): 76-84.

Reyburn, H., R. Mbatia, C. Drakeley, I. Carneiro, E. Mwakasungula, O. Mwerinde, K. Saganda, J. Shao, A. Kitua, R. Olomi, B. M. Greenwood and C. J. Whitty (2004). "Overdiagnosis of malaria in patients with severe febrile illness in Tanzania: a prospective study." *BMJ* **329**.

Roll Back Malaria (2000). Framework for monitoring progress and evaluating outcomes and impact. Geneva, Switzerland, World Health Organization

Roll Back Malaria. (2013). "Refined/Updated GMAP Objectives, Targets, Milestones and Priorities Beyond 2011." Retrieved 29/10/2016, 2016, from <http://www.rollbackmalaria.org/files/files/gmap2011.pdf>.

Roll Back Malaria, M. E., USAID, UNICEF, World Health Organization, MACEPA, CDC, (2009). Guidelines for Core Population-Based Indicators. Calverton, MD.

Roll Back Malaria Partnership (2013). Monitoring and Evaluation Reference Group (MERG): Revised Terms of Reference based on review of Accountability Framework, and cross-comparison of TORs and best practices of other organizations.

Roll Back Malaria Partnership (2015). Action and Investment to Defeat Malaria 2016-2030. Geneva.

Ronveaux, O., Rickert, D., Hadler, S., Groom, H., Lloyd, J., Bchir, A., Birmingham, M. (2005). "The immunization data quality audit: verifying the quality and consistency of immunization monitoring systems." *Bull World Health Organ* **83**(7): 503-510.

Rottenburg, R., S. E. Merry, S.-J. Park and J. Mugler (2015). The world of indicators: The making of governmental knowledge through quantification, Cambridge University Press.

Rowe, A., Kachur SP, Yoon SS, Lnych M, Sluster L, Steketee RW, (2009). "Caution is required when using health facility-based data to evaluate the health impact of malaria control efforts in Africa." *Malaria Journal* **8:209**.

Rowe, A. K. (2005). "Should verbal autopsy results for malaria be adjusted to improve validity?" *International journal of epidemiology* **34**(3): 712-713.

Rowe, A. K., R. W. Steketee, F. Arnold, T. Wardlaw, S. Basu, N. Bakayita, M. Lama, C. A. Winston, M. Lynch and R. E. Cibulskis (2007). "Viewpoint: Evaluating the impact of malaria control efforts on mortality in sub-Saharan Africa." *Tropical medicine & international health* **12**(12): 1524-1539.

Sandelowski, M. (2000). "Whatever happened to qualitative description?" Res Nurs Health **23**(4): 334-340.

Sandelowski, M. (2010). "What's in a name? Qualitative description revisited." Res Nurs Health **33**(1): 77-84.

Savage, J. (2000). "Ethnography and health care." BMJ: British Medical Journal **321**(7273): 1400.

Scott, J. A. G., E. Bauni, J. C. Moisi, J. Ojal, H. Gatakaa, C. Nyundo, C. S. Molyneux, F. Kombe, B. Tsofa and K. Marsh (2012). "Profile: the Kilifi health and demographic surveillance system (KHDSS)." International journal of epidemiology **41**(3): 650-657.

Shaw, V. (2005). "Health information system reform in South Africa: developing an essential data set." Bulletin of the World Health Organization **83**(8): 632-636.

Sheikh, K., L. Gilson, I. A. Agyepong, K. Hanson, F. Ssenooba and S. Bennett (2011). "Building the field of health policy and systems research: framing the questions." PLoS Med **8**(8): e1001073.

Silverman, D. (2015). Interpreting qualitative data, Sage.

Snow, R. W. (2014). "Sixty years trying to define the malaria burden in Africa: have we made any progress?" BMC medicine **12**(1): 227.

Soleman, N., D. Chandramohan and K. Shibuya (2006). "Verbal autopsy: current practices and challenges." Bulletin of the World Health Organization **84**(3): 239-245.

Sridhar, D. and T. Tamashiro (2009). Vertical Funds in the Health Sector: Lessons for Education from the Global Fund and GAVI, United Nations Educational, Scientific and Cultural Organization (UNESCO).

Sserwanga, A., J. C. Harris, R. Kigozi, M. Menon, H. Bukirwa, A. Gasasira, S. Kakeeto, F. Kizito, E. Quinto and D. Rubahika (2011). "Improved malaria case management through the implementation of a health facility-based sentinel site surveillance system in Uganda." PLoS One **6**(1): e16316.

Stresman, G. H., A. Kamanga, P. Moono, H. Hamapumbu, S. Mharakurwa, T. Kobayashi, W. J. Moss and C. Shiff (2010). "A method of active case detection to target reservoirs of asymptomatic malaria and gametocyte carriers in a rural area in Southern Province, Zambia." Malaria Journal **9**(1): 265.

Sudo, R. K., S. Githinji, A. Nyandigisi, A. Muturi, R. W. Snow and D. Zurovac (2012). "The magnitude and trend of artemether-lumefantrine stock-outs at public health facilities in Kenya." Malar J **11**: 37.

Sullivan, N. (2011). "Mediating abundance and scarcity: implementing an HIV/AIDS-targeted project within a government hospital in Tanzania." Med Anthropol **30**(2): 202-221.

Thatte, N., H. D. Kalter, A. Baqui, E. Williams and G. Darmstadt (2009). "Ascertaining causes of neonatal deaths using verbal autopsy: current methods and challenges." *Journal of Perinatology* **29**(3): 187-194.

The Global Fund (2004). Monitoring & Evaluation Tool Kit: HIV/AIDS, TB & Malaria

The Global Fund (2006). Monitoring and Evaluation Tool Kit: HIV/AIDS, TB and Malaria.

The Global Fund (2011). Monitoring and Evaluation Toolkit: Malaria. .

The Global Fund. (2016). "Lives saved through the global fund partnership." from https://www.theglobalfund.org/media/1120/corporate_2016resultsreport_summary_en.pdf.

The Global Fund. (2017). "The Global Fund's Approach to Monitoring and Evaluation." from https://www.theglobalfund.org/media/5198/me_monitoringandevaluation_brochure_en.pdf.

The Global Fund Against TB, H. A. a. M. (2016). "Kenya Grant Performance Report: KEN-M-TNT." Retrieved 28th January 2017, 2017, from <http://www.theglobalfund.org/en/portfolio/country/grant/?k=5a2ae84a-edc6-4a5c-9b61-4e1555eb71df&grant=KEN-M-TNT>.

The World Bank. (2016). "Unemployment, youth total (% of total labor force ages 15-24) (modeled ILO estimate)." from <http://data.worldbank.org/indicator/SL.UEM.1524.ZS?locations=KE>.

Thiam, S., V. Kimotho and P. Gatonga (2013). "Why are IPTp coverage targets so elusive in sub-Saharan Africa? A systematic review of health system barriers." *Malaria Journal* **12**(1): 1-7.

Toda, M., I. Njeru, D. Zurovac, S. O. Tipo, D. Kareko, M. Mwau and K. Morita (2016). "Effectiveness of a Mobile Short-Message-Service–Based Disease Outbreak Alert System in Kenya." *Emerging infectious diseases* **22**(4): 711.

Tong, A., P. Sainsbury and J. Craig (2007). "Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups." *Int J Qual Health Care* **19**(6): 349-357.

Topp, S. M., J. M. Chipukuma and J. Hanefeld (2015). "Understanding the dynamic interactions driving Zambian health centre performance: a case-based health systems analysis." *Health policy and planning* **30**(4): 485-499.

Towett, P. and M. Kaseje (2016). "Assessment of the Capacity of Health Facilities to Provide Standard Comprehensive HIV/AIDS Care Services in Bomet sub-County in Kenya."

Trägård, A. and I. B. Shrestha (2010). "System-wide effects of Global Fund investments in Nepal." Health policy and planning **25**(suppl 1): i58-i62.

Tsofa, B., C. Goodman, L. Gilson and S. Molyneux (2017). "Devolution and its effects on health workforce and commodities management – Early implementation experiences in Kilifi County, Kenya." International Journal for Equity in Health. **16:169**.

Tsofa, B., S. Molyneux, L. Gilson and C. Goodman (2017). "How does decentralisation affect health sector planning and financial management? A case study of early effects of devolution on Kilifi County, Kenya." International Journal for Equity in Health **16:151**.

USAID-PMI (2017). President's Malaria Initiative Technical Guidance.

Vaismoradi, M., H. Turunen and T. Bondas (2013). "Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study." Nursing & health sciences **15**(3): 398-405.

Van der Geest, S. and K. Finkler (2004). "Hospital ethnography: introduction." Social science & medicine **59**(10): 1995-2001.

VeneKlasen, L. and V. Miller (2002). "Power and empowerment ‘.’" PLA notes **43**: 39-41.

Wagenaar, B. H., K. Sherr, Q. Fernandes and A. C. Wagenaar (2016). "Using routine health information systems for well-designed health evaluations in low-and middle-income countries." Health policy and planning **31**(1): 129-135.

Wakaba, M., P. Mbindyo, J. Ochieng, R. Kiriinya, J. Todd, A. Waudu, A. Noor, C. Rakuom, M. Rogers and M. English (2014). "The public sector nursing workforce in Kenya: a county-level analysis." Human Resources for Health **12**(1): 1-16.

Walker, L. and L. Gilson (2004). "'We are bitter but we are satisfied': nurses as street-level bureaucrats in South Africa." Social science & medicine **59**(6): 1251-1261.

Warren, A. E., K. Wyss, G. Shakarishvili, R. Atun and D. de Savigny (2013). "Global health initiative investments and health systems strengthening: a content analysis of global fund investments." Global Health **9**(1): 1744-8603.

Waweru, E., C. Goodman, S. Kedenge, B. Tsofa and S. Molyneux (2015). "Tracking implementation and (un)intended consequences: a process evaluation of an innovative peripheral health facility financing mechanism in Kenya." Health Policy and Planning **31**(2): 137-147.

Wilby, K. J., F. E. Kitutu and S. Boakye (2012). "Practice spotlight: volunteer pharmacists in sub-saharan Africa." The Canadian journal of hospital pharmacy **65**(3).

Willcox, M. L., W. Peersman, P. Daou, C. Diakit , F. Bajunirwe, V. Mubangizi, E. H. Mahmoud, S. Moosa, N. Phaladze, O. Nkomazana, M. Khogali, D. Diallo, J. De

Maeseneer and D. Mant (2015). "Human resources for primary health care in sub-Saharan Africa: progress or stagnation?" Human Resources for Health **13**(1): 1-11.

Willey, B. A., J. R. A. Schellenberg, W. Maokola, K. Shirima, M. Chemba, H. Mshinda, P. Alonso, M. Tanner and D. Schellenberg (2011). "Evaluating the effectiveness of IPTi on malaria using routine health information from sentinel health centres in southern Tanzania." Malaria journal **10**(1): 41.

Wilson, D. (2010). *Targets, Choice and Voice: Accountability in Public Service.*

Witter, S., A. Kusi and M. Aikins (2007). "Working practices and incomes of health workers: evidence from an evaluation of a delivery fee exemption scheme in Ghana." Human resources for health **5**(1): 2.

World Health Organization (1993). *Implementation of the Global Malaria Control Strategy: Report on a WHO study group on the implementation of the Global Plan of Action for Malaria Control 1993-2000.* Geneva.

World Health Organization (2000). "The Abuja declaration and the plan of action." An Extract from the African Summit on Roll Back Malaria, Abuja.

World Health Organization (2004). "Developing health management information systems: a practical guide for developing countries."

World Health Organization (2005). *Health and the Millennium Development Goals.*

World Health Organization (2006). "Communicable disease surveillance and response systems: guide to monitoring and evaluating."

World Health Organization (2007). "Everybody's business--strengthening health systems to improve health outcomes: WHO's framework for action."

World Health Organization (2007). *Malaria in Pregnancy: Guidelines for measuring key monitoring and evaluation indicators* Geneva.

World Health Organization (2008). *Task Shifting: national redistribution of tasks among health workteams: Global Recommendations and Guidelines.* Geneva, Switzerland.

World Health Organization (2008). "Training for mid-level managers."

World Health Organization (2008). *Training for mid-level managers: Module 4: support supervision.*

World Health Organization (2011). "Country health information systems: a review of the current situation and trends." Suiza: World Health Organization.

World Health Organization (2011). "Universal access to malaria diagnostic testing: an operational manual."

World Health Organization (2012). "Disease surveillance for malaria elimination: an operational manual." Disease surveillance for malaria elimination: an operational manual.

World Health Organization (2014). WHO policy brief for the implementation of intermittent preventive treatment of malaria in pregnancy using sulfadoxine-pyrimethamine (IPTp-SP). Geneva.

World Health Organization (2015). Global Technical Strategy for Malaria Elimination 2016-2030, Geneva.

World Health Organization (2015). WHO Global Malaria Programme: World Health Report 2015 Geneva.

World Health Organization (2016). World Malaria Report 2016. Geneva, Switzerland, WHO.

World Health Organization. (2017). "Malaria: Fact Sheet." Retrieved April 2017, from <http://www.who.int/mediacentre/factsheets/fs094/en/>.

Yukich, J. O., A. Bennett and A. Albertini (2012). "Reductions in artemisinin-based combination therapy after the nationwide scale up of routine malaria rapid diagnostic testing in Zambia." *AmJTrop Med Hyg* **87**.

Yukich, J. O., J. Butts, M. Miles, Y. Berhane, H. Nahusenay, J. L. Malone, G. Dissanayake, R. Reithinger and J. Keating (2014). "A description of malaria sentinel surveillance: a case study in Oromia Regional State, Ethiopia." *Malar J* **13**: 88.

Zhao, J., Lama M, Sarkar S, Atun R. (2011). "Indicators measuring the performance of malaria programmes supported by the Global Fund in Asia: progress and the way forward." *Plos One* **6**(12).

Zhao, J., Lama M., Sarkar S, Atun R. (2011). "Indicators measuring the performance of malaria programs supported by the global fund in Asia, progress and the way forward." *Plos One* **6**(12): 19.

11 List of appendixes

11.1 Appendix 1: Data quality audit tool

Data Verification and System Assessment Sheet - Service Delivery Point										
Date of Review:										
Service Delivery Point/Organization:										
Indicator(s) Reviewed:		1) Total Number tested for malaria, 2) Number tested positive for malaria, 3) Number tested for malaria by RDT, 4) Number tested for malaria by Microscopy, 5) Confirmed malaria cases under 5 years, 6) Confirmed malaria cases over 5 years, 7) Number of AL doses consumed, 8) Number of nets distributed to children under 1 year								
Office / Unit Reporting To:										
Documents Reviewed:										
Component of the M&E System		Answer Codes: Yes - completely Partly No - not at all N/A		REVIEWER COMMENTS (Please provide detail for each response not coded "Yes - Completely". Detailed responses will help guide strengthening measures.)						
Part 1: Data Verifications										
A - Documentation Review:										
Review availability and completeness of all indicator source documents for the selected reporting period.		Total Number tested for malaria	Number tested positive for malaria	Number tested for malaria by RDT	Number tested for malaria by Microscopy	Confirmed malaria cases under 5 years	Confirmed malaria cases over 5 years	Number of AL doses consumed	Number of nets distributed to children under 1 year	COMMENTS
1	Review available source documents for the reporting period being verified. Is there any indication that source documents are missing? If yes, determine how this might have affected reported numbers.									Please Provide a Comment.
2	Are all available source documents complete? If no, determine how this might have affected reported numbers.									Please Provide a Comment.
3	Review the dates on the source documents. Do all dates fall within the reporting period? If no, determine how this might have affected reported numbers.									Please Provide a Comment.
B - Recounting reported Results:										
Recount results from source documents, compare the verified numbers to the site reported numbers and explain discrepancies (if any).										
4	Recount the number of people, cases or events recorded during the reporting period by reviewing the source documents. [A]									
5	Copy the number of people, cases or events reported by the site during the reporting period from the site summary report. [B]									
6	Calculate the ratio of recounted to reported numbers. (A/B)									

11.2 Appendix 2: COREQ checklist

No. Item	Guide questions/description	Reported on section
Domain 1: Research team and reflexivity		
<i>Personal Characteristics</i>		
1. Interviewers	Which author/s conducted the interview or focus group?	Section 4.3.3;
2. Credentials	What were the researcher's credentials?	Section 4.3.3
3. Occupation	What was their occupation at the time of the study?	Section 4.3.3
4. Gender	Was the researcher male or female?	Section 4.3.3
5. Experience and training	What experience or training did the researcher have?	Section 4.3.3
<i>Relationship with participants</i>		
6. Relationship established	Was a relationship established prior to study commencement?	Section 4.3.3; 4.5
7. Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	Sections 4.6
8. Interviewer characteristics	What characteristics were reported about the interviewer? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	Section 4.6
Domain 2: Study design		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis</i>	Section 4.3
<i>Participant selection</i>		
10. Sampling	How were participants selected? <i>e.g. purposive, convenience, consecutive, snowball</i>	Sections 4.3.2
11. Method of approach	How were participants approached? <i>e.g. face-to-face, telephone, mail, email</i>	Section 4.3.2; 4.3.3
12. Sample size	How many participants were in the study?	Section 4.3.3
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
<i>Setting</i>		
14. Setting of data collection	Where was the data collected? <i>e.g. home, clinic, workplace</i>	Sections 4.3.1
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16. Description of sample	What are the important characteristics of the sample? <i>e.g. demographic data, date</i>	Chapter 5- (section 5.2)
<i>Data collection</i>		

17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Section 4.3.3
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Section 4.3.3
20. Field notes	Were field notes made during and/or after the interview or focus group?	Sections 4.3.3
21. Duration	What was the duration of the interviews or focus group?	Section 4.3.3
22. Data saturation	Was data saturation discussed?	
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Section 4.4.2
25. Description of the coding tree	Did authors provide a description of the coding tree?	Section 4.4.2
26. Derivation of themes	Were themes identified in advance or derived from the data?	Section 4.4.2
27. Software	What software, if applicable, was used to manage the data?	Section 4.4.2
28. Participant checking	Did participants provide feedback on the findings?	Section 4.3.3
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Chapters 5-8
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Chapters 5-8
31. Clarity of major themes	Were major themes clearly presented in the findings?	Chapter 5-8
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Chapter 5-8

11.3 Appendix 3: Observation protocol

A. Observation checklist for all service delivery areas: laboratory, pharmacy, outpatient clinics, and ANC clinics

1. Is the standard register available in the service delivery area?
2. Are there other registers that are also used to record data?
3. What data are recorded in these additional registers?
4. How frequently are they used?
5. Who is marking the register?
6. Is the person marking the register the same person who provided the service to the patient?
7. Apart from recording data what else do they do/other services do they provide?
8. Are the registers completed in real time?
9. Is the register marked by anyone else on this particular day?
10. Is the register being filled as per instructions?
11. Are all the required data fields in the register completed?
12. Are the records/markings in the register legible?

B. Outpatient departments

1. Where are patients seeking outpatient consultation services seen from?
2. Are there patients who are seen in other areas other than where the register is located?
3. Are malaria RDTs also conducted in the outpatient consultation clinic?
4. Are these data captured in outpatient registers?
5. Are tally sheets used to record outpatient morbidity data?
6. How are clinical, confirmed and suspected malaria cases recorded in the register?
7. Where do they get these data from?

C. Laboratory

1. Who is conducting malaria RDTs/microscopy in the laboratory?
2. How are malaria RDTs/microscopy tests recorded in the register?
3. Are test results recorded anywhere else?
4. Where are patients tested for malaria referred from?
5. Where are patients test results recorded?

D. Pharmacy

1. Who is responsible for dispensing treatments in the pharmacy?
2. Apart from standard registers, where else do they record details of malaria treatments dispensed?
3. What happens when AL is out of stock?

E. ANC clinic

1. Who is responsible for providing ANC services?
2. Where is IPTp provided from?
3. Where is the ANC register located?
4. Is IPTp recorded in mother's child booklets?
5. How is SP stock-out information recorded in the register/MCH booklet?

F. Data collation and reporting at the health facility level

1. Are standard reporting forms available (and in use)?
2. Are there other non-standard reporting forms which are completed at the health facility?
3. Who is responsible for compiling facility reports?
4. When does the process begin?
5. What does it involve?
6. Where do they get the data from?
7. Are there instructions for compiling monthly reports?
8. What are the common issues with the process?
9. When are these reports forwarded to the sub-county health records office?
10. Who forwards them?

11.4 Appendix 4: Coding framework

Name	
Whats the data for	<Internals\National\WNF NAT casemgt_DOMC 21> - § 1 reference coded [5.07% Coverage]
Support systems for data collection	Reference 1 - 5.07% Coverage
Stockouts of malaria commodities	<ul style="list-style-type: none"> <i>AWP- no of suspected fever cases tested positive for malaria- lack of awareness of this indicator at the national level and perception that the indicator may have been added by the MOH. There is no fever register 'this person was not serious'.</i>
Reporting practices	<Internals\Site A\WDI SA CMC.08> - § 3 references coded [4.21% Coverage]
Patient management practices	Reference 1 - 2.11% Coverage
IPT recording practices	R: tested positive for malaria. When you talk about tested positive for malaria it means the testing must have been done. Right? It is not just any suspected fever because if we say positive for malaria then it has been confirmed.
Influence of tools	Reference 2 - 1.01% Coverage
Unclear indicators_instructions	I: There is no indicator that captures data on suspected fevers
Total tested for malaria_mal TPR	R: I think it still talks about the confirmed.
Severe malaria	Reference 3 - 1.10% Coverage
Patients on AL	Number of fever cases tested positive for malaria? To me I think it is just confirmed malaria it cannot be anything else.
Malaria cases_idsr	<Internals\Site A\WDI SA HW.LT.20> - § 1 reference coded [0.54% Coverage]
LLINs_under 1	Reference 1 - 0.54% Coverage
IPT2_plus	R:I think suspected fever cases you will find in those reports indicated under 5 and over 5. You will find all those diseases there
Fever cases tested positive	<Internals\Site A\WDI SA HW.N1.01> - § 2 references coded [3.27% Coverage]
Children over 5 years treated for malaria	Reference 1 - 2.10% Coverage
Stockout of tools_improvised tools	I: You have never seen that?
Reporting tools	R: Yes
Registers_recording practices	
Inapplicable tools	
Duplications_indicators_tools	
Human resource factors	
Volunteering_motivations	
Staffing challenges	
Staffing shortages_Workload	
Role sharing n task shifting	
Staff producing malaria data	
Capacity	
Lack of preparation in data collection roles	
HR management problems	
DHIS2 issues	
Devolution influences	
Data Quality issues	
Community case mangmt_reporting challenges	

Case nodes
Free nodes
Tree node
Relationships
Node Matrices

Sources
Nodes
Classifications
Collections
Queries
Reports
Models

Name

- Community case mangmt_reporting challenges
- Data Quality issues
- Devolution influences
- DHIS2 issues
- Human resource factors
 - HR management problems
 - Lack of preparation in data collection roles
 - Staff producing malaria data
 - Capacity
 - Staffing challenges
 - Role sharing n task shifting
 - Casual staff
 - opening mechanisms to salary delays
 - no training opportunities
 - Staffing shortages_Workload
 - Volunteering_motivations
- Influence of tools
 - Duplications_indicators_tools
 - Data burdens n service delivery
 - Examples of duplications
 - Need 4 integration of tools
 - Why duplication
 - Inapplicable tools
 - Registers_recording practices
 - Reporting tools
 - Stockout of tools_improvised tools
 - Other non-standard Tools
 - Why improvise tools
 - Unclear indicators_instructions
 - IPTo recording_practices
- Human management practices
- Reporting practices
- Stockouts of malaria commodities
 - Stock-out of Lab reagents
 - Stockout of RDTs
 - Stock-out of SP
 - Stockout of tools
 - Stock-outs of AI

11.5 Appendix 5: KEMRI Ethics Review Approval Letter



KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840-00200, NAIROBI, Kenya
Tel (254) (020) 2722541, 2713348, 0722-205901, 0733-400003; Fax: (254) (020) 2722030
E-mail: director@kemri.org info@kemri.org Website: www.kemri.org

KEMRI/RES/7/3/1

**TO: GEORGE OKELLO,
PRINCIPAL INVESTIGATOR**

**THROUGH: DR. CHARLES MBOGO,
ACTING DIRECTOR, CGMR-C,
KILIFI**

Dear Sir,

RE: SSC PROTOCOL NO. 2772 (RESUBMISSION): THE INFLUENCE OF GLOBAL MALARIA INDICATORS ON HEALTH SERVICE PRACTICES, PRIORITIES AND POLICIES IN KENYA (VERSION 3.0_31032014)

Reference is made to your letter dated April 11, 2014. ERC Secretariat acknowledges receipt of the receipt of the revised proposal on 16th April, 2014.

This is to inform you that the Ethics Review Committee (ERC) reviewed the document submitted and is satisfied that the issues raised at the 225th meeting of the KEMRI ERC held on 18th March 2014 have been adequately addressed.

The study is granted approval for implementation effective this **24th April, 2014**. Please note that authorization to conduct this study will automatically expire on **April 23, 2015**. If you plan to continue with data collection or analysis beyond this date, please submit an application for continuing approval to the ERC Secretariat by **March 12, 2015**.

Any unanticipated problems resulting from the implementation of this protocol should be brought to the attention of the ERC. You are also required to submit any proposed changes to this protocol to the SSC and ERC prior to initiation and advise the ERC when the study is completed or discontinued.

You may embark on the study.

Yours faithfully,

EAB

**DR. ELIZABETH BUKUSI
ACTING SECRETARY,
KEMRI/ETHICS REVIEW COMMITTEE**





KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840-00200, NAIROBI, Kenya
Tel (254) (020) 2722541, 2713349, 0722-205901, 0733-400003; Fax: (254) (020) 2720030
E-mail: director@kemri.org info@kemri.org Website:www.kemri.org

KEMRI/RES/7/3/1

March 26, 2015

**TO: MR. GEORGE OKELLO,
PRINCIPAL INVESTIGATOR**

**THROUGH: DR. BENJAMIN TSOFA,
THE DIRECTOR, CGMR-C,
KILIFI**



Dear Sir,

**RE: SSC PROTOCOL No. 2772 (REQUEST FOR ANNUAL RENEWAL): THE
INFLUENCE OF GLOBAL MALARIA INDICATORS ON HEALTH SERVICE
PRACTICES, PRIORITIES AND POLICIES IN KENYA**

Thank you for the continuing review report for the period **24th April 2014 to 6th March 2015**.

This is to inform that during the 237th C meeting of the KEMRI/Scientific and Ethics Review Unit (SERU) held on the 27th of March, 2015, the Committee **conducted the annual review and approved** the above referenced application for another year.

This approval is valid from **April 24, 2015** through to **April 23, 2016**. Please note that authorization to conduct this study will automatically expire on **April 23, 2016**. If you plan to continue with data collection or analysis beyond this date please submit an application for continuing approval to SERU by **March 6, 2016**.

You are required to submit any amendments to this protocol and other information pertinent to human participation in this study to SERU for review prior to initiation.

You may continue with the study.

Yours faithfully,

**PROF. ELIZABETH BUKUSI,
ACTING HEAD,
KEMRI/SCIENTIFIC AND ETHICS REVIEW UNIT**





KENYA MEDICAL RESEARCH INSTITUTE

P.O. Box 54840-00200 NAIROBI - Kenya
Tel: (254) (020) 2722541, 254 (020) 2713349, 0722-205901, 0733-400003 Fax (254) (020) 2720030
Email: director@kemri.org info@kemri.org Website: www.kemri.org

KEMRI/RES/7/3/1

April 25, 2016

**TO: GEORGE OKELLO,
PRINCIPAL INVESTIGATOR**

**THROUGH: DR. BENJAMIN TSOFA,
DIRECTOR, CGMR-C,
KILIFI**

H
5/24/16
**DIRECTOR
CENTRE FOR GEOGRAPHIC MEDICINE
RESEARCH COAST**

Dear Sir,

**RE: SSC PROTOCOL NO. 2772 (REQUEST FOR ANNUAL RENEWAL): THE
INFLUENCE OF GLOBAL MALARIA INDICATORS ON HEALTH SERVICE
PRACTICES, PRIORITIES AND POLICIES IN KENYA**

Thank you for the continuing review report for the period **April 2015 to March 2016**.

This is to inform you that during the 250th Committee B meeting of the KEMRI Scientific and Ethics Review Unit (SERU) held on **20th April, 2016**, the Committee **conducted the annual review and approved** the above referenced application for another year.

This study is granted approval for continuation effective **April 24, 2016** through to **April 23, 2017**. Please note that authorization to conduct this study will automatically expire on **April 23, 2017**. If you plan to continue data collection or analysis beyond this date, please submit an application for continuation approval to SERU by **March 12, 2017**.

You are required to submit any amendments to this protocol and other information pertinent to human participation in this study to the SERU for review prior to initiation.

You may continue with the study.

Yours faithfully,

DR
Evans
**DR. EVANS AMUKOYE,
ACTING HEAD,
KEMRI SCIENTIFIC AND ETHICS REVIEW UNIT**

RECEIVED
04 MAY 2016
DIRECTOR'S OFFICE

In Search of Better Health

11.6 Appendix 6: Informed consent forms

Study title: The influence of global malaria indicators on health service practices, priorities and policies in Kenya.

Institutional	Individuals
<i>Institution lead</i> KEMRI-Wellcome Trust Research Programme	Mr. George Okello Dr. Caroline Jones Dr. Abdisalan Noor Dr. Sassy Molyneux
<i>Other institutions</i> Amsterdam Institute of Social Science Research, University of Amsterdam	Dr. Rene Gerrets

Who is carrying out this study and what is it about?

This study is being conducted by the Kenya Medical Research Institute (KEMRI). KEMRI is a government organisation that carries out medical research to find better ways of preventing and treating illness in the future for everybody's benefit. Sometimes research involves only asking patients, community members or health providers questions about what they know, feel or do. All research at KEMRI has to be approved before it begins by committees in Kilifi, a national scientific committee and an independent national ethical review committee. These committees make sure that every research study is important, and that participants' safety and rights are respected.

In this research, we want learn more about the way that malaria information are collected, managed, reported on and used at health facilities and by Ministry of Health managers at county and national levels. We also want to understand how the current changes in local government have affected this process. This information is important to ensure that malaria monitoring activities are as effective and useful as possible in future.

Why do you want to talk to me and what does it involve?

As the person involved in recording, managing and reporting malaria and other health information in this health facility, we are interested in understanding your views and experiences of these processes. To do this, we would like to:

Spend some time with you in the clinic/office to observe how you collect, manage and report on malaria information.

Interview you for approximately one hour at a time and place that is convenient for you. We would like to ask you a number of questions about the information normally collected for malaria, based on your general knowledge, experiences and views.

During interviews, you do not need to discuss any information that you are uncomfortable sharing. The discussions, interviews and observations will take a place at a time that is convenient for you. No one else will be present unless you would like someone else there.

If you agree, discussions and interviews will be audio-recorded to assist later in fully writing up the information. No one will be identified by name on the audio recordings.

Are there any disadvantages or advantages to me taking part?

The discussions/interviews will take approximately one hour of your time. You are free to stop the interview/ observations or leave the study at any point if you feel this is necessary. You are also free not to answer any question you feel uncomfortable with. Observations may also make you a bit uncomfortable. You are free to mention when you feel uncomfortable with the researchers presence.

There are no personal benefits to taking part, but your responses will form the basis of recommendations for improving practices in relation to malaria indicator data production and reporting in Kenya.

Who will have access to the information I give?

Only individuals directly involved with this research will have access to your information. All audio-recordings and interview transcripts will be stored securely in locked cabinets and on password protected computers only accessible to concerned research staff. Every participant will be assigned a unique identifier to preserve anonymity. We will not share any information about you or about any other research participant beyond a few individuals directly involved in the study.

What will happen if I refuse to participate?

All participation in research is voluntary. You are free to decide if you want to take part or not. If you do agree you can change your mind at any time without any consequences.

What if I have any questions?

You are free to ask me any question about this research. If you have any further questions about the study, you are free to contact the research team using the address below:

Mr. George Okello, KEMRI- Wellcome Trust Research Programme

P.O.Box 230, Kilifi. Telephone: 0721 336923

If you want to ask someone independent anything about this research please contact:

Community Liaison Manager, KEMRI – Wellcome Trust Research Programme

P.O.Box 230, Kilifi. Telephone: 0723342780 or 041 7522063

Or

The Secretary – KEMRI Ethics Review Committee

P. O. BOX 54840-00200, Nairobi,

Tel number: 020 272 2541 Mobile: 0722205901 or 073340000

CONSENT FORM- Frontline health workers

I have had the study explained to me. I have understood all that has been read and had my questions answered satisfactorily

Yes (please tick) I agree to be observed

Yes (please tick) I agree to be interviewed

Yes (please tick) I agree for the interview to be audio-recorded

I understand that I can change my mind at any stage and it will not affect me or my work in any way.

Signature: _____ Dat _____

Participant Name: _____ Time: _____
Name (please print name)

I certify that I have followed the study SOP to obtain consent from the participant. She/he apparently understood the nature and the purpose of the study and consents to the participation in the study. She/he has been given opportunity to ask questions which have been answered satisfactorily.

Signature: _____ Dat _____

Designee/investigator's Name _____ Time _____
(please print name)

Signature: _____ Dat _____

Witness's name: _____ Time: _____
(please print name)

THE PARTICIPANT SHOULD NOW BE GIVEN A SIGNED COPY

11.7 Appendix 7: Data collection Registers & reporting tools

a) MOH 204A: Outpatient Register: Under Five Years

Date	OPD No.	CWC Number	Revisit	Full Names	Age	Sex	Village / Estate / Landmark	Telephone Number	Weight	Height	Temp	Danger signs	Duration of Illness	Diagnosis/ classification	Given: 1=ORS 2=Zinc 3=Vit A	HIV: 1=Counsel led 2=Tested	HIV- status: 1=Known positive 2=Positive this visit 3=Negative 4=Unknown	Nutrition Status: 1=Nutrition education 2=Nutrition supplement s	Treatment / Prescription Number	Follow-up (Y/N)	Amount charged	Receipt Number	Referrals: 1=From Other HF 2=To Other HF 3= From CU 4=To CU	REMARKS
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

	Male:	Female:
No. of New patients:		
No. of Re-attendants:		

Given	NO:
ORS	
Zinc	
Vit A	

Referrals	From Other Health Facility	
	To Other Health Facility	
	From Community Unit	
	To Community Unit	

Total No. followed-up: _____

b) MOH 204B: Outpatient Register: Over Five Years

Date	OPD No.	Re-visit	Full Names	Age in Years	Sex	Village / Estate / Landmark	Telephone Number	Weight	Height	Visual Acuity * RE(Right Eye) LE (Left Eye)	HIV: 1-Counselled 2-Tested	HIV-Status: 1-known positive 2-not tested 3-negative 4-Unknown	Nutrition Status: 1-Nutrition education 2-Nutrition supplements	Diagnoses	Treatment / Prescription Number	Amount Charged	Receipt Number	Referrals: 1=From Other HF 2=To Other HF 3= From CU 4=To CU	Remarks
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T

	Male:	Female:
No. of New patients:		
No. of Re-attendants:		

Referrals	From Other Health Facility	
	To Other Health Facility	
	From Community Unit	
	To Community Unit	

Total No. followed-up: _____

c) MOH 240: Laboratory Register

Date	OPD / IP / Ref. No.	Lab. No.	Re-visit No.	Full Names	Age in Years	Sex	Village / Estate / Landmark	Telephone Number	Clinical Diagnosis	Prior Treatment	Type of Specimen	Condition of the specimen	Investigation required	Date Sample collected	Date Sample received	Clinician Name	Date Sample Analysed	Results	Date Results dispatched	Amount Charged	Receipt Number	1=From Other HF 2=To Other HF 3= To reference units	Comments	Name of analysing Officer	Signature	
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	

No. of Routine tests: _____

No. of Special tests: _____

d) MOH 405: Antenatal Care Register (page 1)

Date	New ANC No.	Re-Att (ANC No.)	No. of visits (1st, 2nd, TT plus (boosters)	Full Names	Age	Phone Number	Marital Status: 1=Married 2=Widowed 3=Divorced 4=Single 5=Separated	Village / Estate / Landmark	Parity	Gravidae	LMP	EDD	Gestation age (weeks)	weight (kg)	Height (Centimetre)	BIP	Breast examination (Y/N)	Hb	RPR/VDRL Pos/Neg (ONLY those tested during this visit)	HIV- Status: 1-Known positive 2-Positive this visit 3-Negative 4-Unknown
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U

Total New Clients: _____
 Total Revisit Clients: _____
 Total Completed 4th Antenatal Visit: _____

Number issued with Iron: _____
 Number issued with Folic: _____
 Total women done breast examination: _____
 Total women given exercise: _____
 No of adolescent 10-17 years presenting with pregnancy: _____

Total Tested for Syphilis: _____
 Total +ve (Syphilis): _____

MOH 405: Antenatal Care Register (page 2)

Received HIV results? (Y/N or NA-Not applicable)	screened for TB? (Y/N)	Other Medical Conditions (use codes from cover page)	Cotrimoxazole given? (Y/N)	Dose of TT Given (e.g. TT1, TT3, Plus)	Given Iron supplementation? (Y/N)	Given Folic (Y/N)	Given IPT (Dose 1, 2, etc.)	ART Eligibility assessed through:		Started on ART in ANC	Received ARV prophylaxis Mother? (Y/N)	Received ARV prophylaxis Baby? (Y/N)	Received LLITN? (indicate the visit No.)	Counselled on? use key provided at the bottom of the page	Additional Treatment given for? Use key provided	Partners: 1=C, 2=T, 3=R	Partners status: 1=P, 2=N	HIV+ Partners Referred for follow-up? (Y/N)	ANC Exercise given (Y/N)	Referrals: 1=FROM other HF 2=TO other HF 3= FROM CU 4=TO CU	Remarks	
								WHO Stage (1,2,3,4,)	CD4 Counts													
V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AR	

No. given IPT 1: _____
 No. given IPT 2: _____
 No. of clients received ITN: _____
 No. Counsellor for HIV: _____
 No. Tested for HIV: _____
 No. found HIV +ve: _____

No. assessed for ART eligibility - WHO: _____
 No. assessed for ART eligibility - CD4: _____
 No. started on ART: _____
Do not count those staged through WHO if they have a CD4 value to avoid double counting

No. of clients issued with preventive ARVs: _____
 No. of infant nevirapine issued: _____
 No. of Partners Counsellor for HIV: _____
 No. of Partners Tested for HIV: _____
 No. of partners HIV +ve: _____

Key on Counselling 1= Birth Plan, 2= Danger signs, 3 = FP, 4 = HIV, 5= Supplemental feeding 6=Breast Care, 7=Infant feeding 8= ITN Use and 9=STIs/RTIs
Key on Treatment 1 = Hypertension, 2=Diabetes, 3=Epilepsy, 4=Malaria in Pregnancy (MIP)

Referrals	
From other Health Facility	
To other Health Facility	
From community Unit	
To Community Unit	

e) MOH 505: Child Welfare Clinic Register

Date	Serial number (New Visit this year)	Revisit this Year (Y/N)	CWC No.	Full Names	Age	Sex	Sub Location	Village / Estate / Landmark	Telephone number	Weight in Kg	Under-weight (Y/N)	Over-weight (Y/N)	Obese (Y/N)	Height / Length in cm	Standa (Y/N)	MUAC	Vit A Supplementation (12-59 months) (Y/N)	Dewormed (Y/N)	Exclusive Breast feeding (0-6 months) (Y/N)	Any Danger signs this visit	Any Disability? (Y/N)	Type of Follow-up 1= Maramus 2= Kwashiorkor 3= Malnutrition 4= others	Referrals: 1=FROM other HF 2=TO other HF 3= FROM CU 4=TO CU	Remarks
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y

Total New Clients: _____
 Total Re-visits: _____

Total No. issued with LLTNs: _____
 Total No. Under 1 yr issued with LLTNs: _____

Total underweight: _____
 Total Referrals: _____
 Total Stunted: _____

f) Malaria Commodities Daily Activity register

Republic of Kenya - Ministry of Health					Artemether - Lumefantrine (Doses)												
Artemether - Lumefantrine & Malaria RDTs Daily Activity Register					Test	AL 6's	AL 12's	AL 18's	AL 24's								
The total quantities of drugs dispensed are counted per page.					30	0	25	30	10								
Balance previous page																	
Receipt Date	21/3/2012				Quantities of AL (Treatment Doses) and RDTs (Tests) Received from Store												
Reference Number	SI/100,511/211, 511/150,511/200				40	0	30	0	30								
Total Stock of AL & RDTs Available on this page					70	0	55	30	40								
Date	IP / OP Number	Weight Category(Tick)				Test type					G	Quantities Dispensed					
		5-14	15-24	25-34	35+	Test not done	Microscopy		RDTs								
							Pos	Neg	Pos	Neg	Inv						
03/02/2012	2333		X			X											
03/02/2012	2345				X	X	E		X								
03/02/2012	2350			X							X						
03/02/2012	2351										X						
03/02/2012	2351		X						X								
03/05/2012	2369	X							X								
03/05/2012	2378	X						X									
03/05/2012	2387				X												
03/05/2012	2396				X												
03/05/2012	2405			X					X								
03/05/2012	2414			X					X								
03/05/2012	2423			X					X								
03/05/2012	2423	X				X											
03/05/2012	2429	X				X											
03/08/2012	2434	X				X											
03/08/2012	2438							X									
03/08/2012	2443										X						
03/08/2012	2447										X						
03/08/2012	2452										X						
03/08/2012	2456										X						
Total		H	5	2	4	3	4	2	2	6	5	1	J	0	3	5	3.25
					I TOTAL RDTs DONE					12							
					Total stock available less quantity issued)					58	0	52	25	36.75			

g) MOH 706 Laboratory Reporting Form

MINISTRY OF HEALTH
Laboratory Tests Data Summary Report Form

MOH 706

Revised Oct 2014

MFL Code: _____ Facility Name: _____ County: _____ Sub County: _____

Report period: Month _____ Year _____

N/B: INDICATE 'N/S' Where there is no service

1. URINE ANALYSIS		
	Total Exam	Number Positive
1.1 Urine Chemistry		
1.2 Glucose		
1.3 Ketone		
1.4 Protein		
1.5 Urine Microscopy		Number Positive
1.6 Pua cells (>5/hpf)		
1.7 S. haematobium		
1.8 T. vaginalis		
1.9 Yeast cells		
1.10 Bacteria		

2. BLOOD CHEMISTRY			
Blood Sugar Test	Total Exam	Low	High
2.1 Blood sugar			
2.2 OGTT			
2.3 Renal Function Test			
2.4 Creatinine			
2.5 Urea			
2.6 Sodium			
2.6 Potassium			
2.7 Chloride			
2.8 Liver Function Test			
2.9 Direct bilirubin			
2.10 Total bilirubin			
2.11 ASAT (SGOT)			
2.12 ALAT (SGPT)			
2.13 Serum Protein			
2.14 Albumin			
2.15 Alkaline Phosphatase			
2.16 Lipid Profile			
2.17 Total cholesterol			
2.18 Triglycerides			
2.19 LDL			
Hormonal Test	Total Exam	Low	High
2.20 T3			
2.21 T4			
2.22 TSH			

3. PARASITOLOGY		
Malaria Test	Total Exam	Number Positive
3.1 Malaria BS (Under five years)		
3.2 Malaria BS (5 years and above)		
3.3 Malaria Rapid Diagnostic Tests		
Stool Examination		Number Positive
3.4 Taenia spp.		
3.5 Hymenolepis nana		
3.6 Hookworm		
3.7 Roundworms		
3.8 S. mansoni		
3.9 Trichuris trichiura		
3.10 Amoeba		

4. HAEMATOLOGY			
Haematology tests	Total Exam	HB <5 g/dl	HB between 5 and 10 g/dl
4.1 Full blood count			
4.2 HB estimation (other techniques)			
4.3 CD4 count		Number <500	
Other Haematology tests	Total Exam	Number Positive	
4.4 Sickling test			
4.5 Peripheral blood film			
4.6 BMA			
4.7 Coagulation profile			
4.8 Reticulocyte Count		High	
4.9 Erythrocyte Sedimentation rate			
Blood Grouping		Number	
4.10 Total blood group tests			
4.11 Blood units grouped			
Blood safety		Number	
4.12 Blood units received from blood transfusion centre			
4.13 Blood units collected at facility			
4.14 Blood units transfused			
4.15 Transfusion reactions reported and investigated			

5. BACTERIOLOGY			
Bacteriological Sample	Total Exam	Total Cultures	No. Culture Positive
5.1 Urine			
5.2 Pua swabs			
5.3 High Vaginal Swabs			
5.4 Throat swab			
5.5 Rectal swab			
5.6 Blood			
5.7 Water			
5.8 Food			
5.9 Urethral swabs			
Bacterial enteric pathogens	Total exam	Number Positive	
5.10 Stool Cultures			
Stool isolates		Number positive	
5.11 Salmonella typhi			
5.12 Shigella - dysenteriae type I			
5.13 E. coli O 157:H7			
5.14 V. cholerae O1			
5.15 V. cholerae O139			
Bacterial meningitis	Total exam	Number positive	Number Contaminated
Bacterial Meningitis			
5.16 CSF			
Bacterial meningitis Serotypes		Number positive	
5.17 Neisseria meningitidis A			
5.18 Neisseria meningitidis B			
5.19 Neisseria meningitidis C			
5.20 Neisseria meningitidis W133			
5.21 Neisseria meningitidis X			
5.22 Neisseria meningitidis Y			
5.23 N. meningitidis (indeterminate)			
5.24 Streptococcus pneumoniae			
5.25 Haemophilus influenzae (type b)			
5.26 Cryptococcal Meningitis			
Bacterial Pathogens from other types of specimen			
5.27 B. anthracis			
5.28 Y. pestis			

AMBULAN (BOK) ONLY			
DOB	Public Road	Private	NDO

6. HISTOLOGY AND CYTOLOGY		
	Total exam	Malignant
Smears		
6.1 PAP smear		
6.2 Touch preparations		
6.3 Tissue impressions		
Fine Needle Aspirates	Total exam	Malignant
6.4 Thyroid		
6.5 Lymph nodes		
6.6 Liver		
6.7 Breast		
6.8 Soft tissue masses		
Fluid Cytology	Total exam	Malignant
6.9 Ascitic fluid		
6.10 CSF		
6.11 Pleural fluid		
6.12 Urine		
Tissue Histology	Total Exam	Malignant
6.13 Cervix		
6.14 Prostate		
6.15 Breast tissue		
6.16 Ovary		
6.17 Uterus		
6.18 Skin		
6.19 Head and Neck		
6.20 Dental		
6.21 GIT		
6.22 Lymph node tissue		
Bone Marrow Studies	Total Exam	Malignant
6.23 Bone marrow aspirate		
6.24 Trephine biopsy		

7. SEROLOGY		
Serological Test	Total Exam	Number Positive
7.1 WDR		
7.2 TPHA		
7.3 ABOT		
7.4 HIV		
7.5 Drucella		

8. SPECIMEN REFERRAL TO HIGHER LEVELS		
Specimen referral	No. of specimens	No. of results received
8.1 CD4		
8.2 Viral load		
8.3 BD		
8.4 Discordant/Discrepant		
8.5 TB Culture		

h) MOH 705A Outpatient Summary Sheet: Under Five Years

OUT PATIENT SUMMARY SHEET UNDER 5 YEARS																															MOH 705A		
DISEASES (New Cases Only)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Totals	
1 Diarrhoea																																1	
2 Tuberculosis																																	2
3 Dysentery (Bloody diarrhoea)																																	3
4 Cholera																																	4
5 Meningococcal Meningitis																																	5
6 Other Meningitis																																	6
7 Neonatal Tetanus																																	7
8 Poliomyelitis (AFP)																																	8
9 Chicken Pox																																	9
10 Measles																																	10
11 Hepatitis																																	11
12 Mumps																																	12
13 Suspected Malaria																																	13
14 Confirmed Malaria (only Positive cases)																																	14
15 Urinary Tract Infection																																	15
16 Typhoid fever																																	16
17 Bilharzia																																	17
18 Intestinal worms																																	18
19 Malnutrition																																	19
20 Anaemia																																	20
21 Eye Infections																																	21
22 Other Eye conditions																																	22
23 Ear Infections/ Conditions																																	23
24 Upper Respiratory Tract Infections																																	24
25 Asthma																																	25
26 Tonsillitis																																	26
27 Pneumonia																																	27
28 Other Dis. Of Respiratory System																																	28
29 Mental Disorders																																	29
30 Dental Disorders																																	30
31 Jiggers Infestation																																	31
32 Diseases of the skin																																	32
33 Chromosomal abnormalities (e.g. Downs, Edwards syndrome, etc)																																	33
34 Congenital Anomalias																																	34
35 Poisoning																																	35
36 Road Traffic Injuries																																	36
37 Other Injuries																																	37
38 Sexual Assault																																	38
39 Burns																																	39
40 Snake Bites																																	40
41 Dog Bites																																	41
42 Other Bites																																	42
43 Diabetic																																	43
44 Epilepsy																																	44
45 Other Convulsive Disorders																																	45
46 Newly Diagnosed HIV																																	46
47 Brucellosis																																	47
48 Rickets																																	48
49 Cardiovascular conditions																																	49
50 Violence related injuries																																	50
51 Cerebral Palsy																																	51
52 Autism																																	52
53 Other Central Nervous System Conditions																																	53
54 Trypanosomiasis																																	54
55 Kala-azar (Leishmaniasis)																																	55
56 Dracunculiasis (Guinea Worm)																																	56
57 Yellow Fever																																	57
58 Viral Haemorrhagic Fever																																	58
59 Plague																																	59

i) Outpatient morbidity summary sheet: Over Five Years

DISEASES (New Cases Only)		OUT PATIENT SUMMARY SHEET OVER 5 YEARS																															MOH 7050				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		Totals			
1	Diarhoea																																	1			
2	Tuberculosis																																		2		
3	Dysentery (Bloody diarrhoea)																																		3		
4	Cholera																																		4		
5	Meningococcal Meningitis																																		5		
6	Other Meningitis																																		6		
7	Typhus																																		7		
8	Poliovirus (APP)																																		8		
9	Cholera Po																																		9		
10	Malaria																																		10		
11	Hepatitis																																			11	
12	Mumps																																			12	
13	Suspected Malaria																																			13	
14	Confirmed Malaria (only Positive cases)																																			14	
15	Malaria in pregnancy																																			15	
16	Typhoid fever																																			16	
17	Sexually Transmitted Infections																																			17	
18	Urinary Tract Infection																																				18
19	Herpes																																				19
20	Intestinal worms																																				20
21	Scarlet fever																																				21
22	Anemia																																				22
23	Eye infections																																				23
24	Other eye conditions																																				24
25	Ear infections																																				25
26	Upper respiratory tract infections																																				26
27	Asthma																																				27
28	Influenza																																				28
29	Lower LRTI of respiratory system																																				29
30	Abortion																																				30
31	UTI of urogenital & chlamydia																																				31
32	Hypertension																																				32
33	Mental Disorders																																				33
34	Dental Disorders																																				34
35	Diabetes Mellitus																																				35
36	Diseases of the skin																																				36
37	Arthritis, joint pain etc.																																				37
38	Poisoning																																				38
39	Head Trauma Injuries																																				39
40	Other Injuries																																				40
41	Central Aneurysm																																				41
42	Various related injuries																																				42
43	Burns																																				43
44	Crush Inj.																																				44
45	Other Inj.																																				45
46	Other Inj.																																				46
47	Stroke																																				47
48	Epilepsy																																				48
49	Recently diagnosed HIV																																				49
50	Alzheimer's																																				50
51	Cardiovascular conditions																																				51
52	Central Nervous System conditions																																				52
53	Overweight (BMI >30)																																				53
54	Musculoskeletal conditions																																				54
55	Fracture (with injury)																																				55
56	Fracture																																				56
57	Physical Disability																																				57
58	Hypertension																																				58
59	Stroke (Ischaemic)																																				59
60	Uncontrolled Diabetes (HbA1c)																																				60
61	Yellow Fever																																				61
62	Viral Haemorrhagic Fever																																				62
63	HIV/AIDS																																				63

k) Health Facility Monthly Summary Report for Malaria Medicines

**MINISTRY OF HEALTH
HEALTH FACILITY MONTHLY SUMMARY REPORT FOR MALARIA MEDICINES**

Province: _____ District: _____

Facility Name: _____

Facility Type: Level 2 Level 3 Level 4 Level 5 Level 6

Period of Reporting: Beginning: _____ Ending: _____
(Day/Month/Year) (Day/Month/Year)

Drug name	Basic Units	Beginning Balance	Quantity Received this period	Total Quantity (dispensed)	Losses (Excluding Expiries)	Positive Adjustments	Negative Adjustments	Physical Count	Quantity of Expired Drugs	Medicines with 6 months to Expiry	Days Out of Stock	Adjusted Consumption to be filled by DPP
		A	B	C	D	E	F	G	H	I	J	
Antimalaria Drugs												
Artemether-Lumefantrine 20/120 Tabs	5a											
Artemether-Lumefantrine 20/120 Tabs	5b											
Artemether-Lumefantrine 20/120 Tabs	5c											
Artemether-Lumefantrine 20/120 Tabs	5d											
Quinine Tabs (200mg)	Tab											
Quinine Tabs (300mg)	Tab											
Quinine inj (600mg/2ml)	Amp											
Sulphadoxine Pyrimethamine	Tab											
Aresunate Injection	Amp											
RDTs	Tests											

Patients on AL by Weight Band Summary Report

5-14 kgs 15-24 kgs 25-34 kgs 35+ kgs

Number of days facility did NOT have ANY of the AL Packs:

Number of Pregnant women receiving IPTp:

Comments (Including explanations of losses and adjustments): _____

Results	Microscopy	RDT	Totals
Positive			
Negative			
Invalid			
Totals Tested			
Not tested			

Report Prepared by: _____ Name of Reporting officer _____ Signature _____ Date: _____ Designation _____

Contact Telephone: _____

Report reviewed by: _____ District Pharmaceutical Facilitator _____ Signature _____ Date: _____ Designation _____

Contact Telephone: _____

To be Submitted to the District Pharmaceutical Facilitator by the 5th Day of Every Month

m) Annual Work Plan Service Delivery Report

SERVICE DELIVERY SUMMARY FOR AWP 1			
CITY	SUB-COUNTY	Pg. 1	
CITY	MONTH	YEAR	
1. Community organizations that support the Department's strategic plan			
NIC's pregnant women receiving pre-conception AWP's to reduce risk of mother to child transmission (MCTC)			
Number of pregnant women receiving TT2 Plus immunization			
Number of pregnant women smoking IPT2 in endemic and - endemic districts			
Children under 1 year of age fully immunized			
Children under 15 infected with Long Lasting Insecticide Treated Nets (LLITNs) in endemic and endemic districts			
Number of pregnant women delivered with Long Lasting Insecticide Treated Nets in endemic and endemic districts			
Number of persons receiving MCA for arboviruses in endemic districts			
Number of TB patients completing treatment			
Number of TB Patients tested for HIV			
Number of newly diagnosed TB cases			
Number of eligible HIV clients on ARVs			
Number of under five years treated for diarrhoea			
Number of adult age children dewormed			
2. Women, youth, men and children in high Communicable Diseases			
Number of adult HIV clients with Daily Mean Index (DMI) more than 40			
Number of women of Reproductive Age screened for Cervical cancer			
Number of new Outpatients with mental health conditions			
Number of new Outpatients hospitalized with high blood pressure			
Reduce the number of violence and injuries			
Number of new roadblock cases which led to gender based violence			
Number of new roadblock cases attributed to Road Traffic Accidents			
Number of new roadblock cases attributed to other causes			
Number of Patients with mental health conditions (MHC) under health			
3. People with disabilities and older			
Number of pregnant women attending at least 4 ANC visits			
Number of women of reproductive age (WRA) receiving family planning (FP) commodities			
Number of pregnant women getting iron supplements			
Number of Diabetes diagnosed by skilled attendants in health facilities			
Number of children Under 5 dying in health facility			
Number of Fresh still births in the facility			
Number of Family Maternal Deaths			
Number of surgical still babies reported			
Number of Patients with 8 health related to community link			
Number of Newborns with low birth weight (LBW - less than 2,500 grams)			
Number of Children under 5 years attending Child Welfare Clinics for growth monitoring (new cases)			
Number of households provided with health promotion messages			
Number of Cases tested by HIV			
4. Adolescent girls and young women (AGYW)			
Number of Children under 5 years attending Child Welfare Clinics who are under weight			
Number of Children under 5 years attending Child Welfare Clinics who are stunted			
Number of Households with functional toilets			
Number of Households with hand washing facilities			

SERVICE DELIVERY SUMMARY FOR AWP 1			
E. Access			
36	Number of new Outpatients (males)		Number
40	Number of new Outpatients (female)		Number
41	Number of inpatients (admissions) Under 5		Number
42	Number of inpatient (admissions) Over 5		Number
F. Quality and safety of care			
43	Number of Emergency surgical cases operated on within one hour		Number
44	Number of fevers treated positive for malaria (confirmed malaria)		Number
45	Number of Maternal deaths averted		Number
46	Total inpatient days		Number
G. Efficient service delivery systems that maximizes health outcomes (including Community link indicators)			
47	Number of Patients referred to facility, to Community link		Number
48	Quarterly Community dialogue days held		Number
49	Number of Hospital Therapeutic committee meetings held		Number
50	Number of clinical audit meetings held		Number
51	Number of patients hospitalized within 48 hours		Number
52	Number of maternal support group/entry lists carried out		Number
53	Number of health officers received training		Number
54	Number of health officers with training certificate		Number
H. Comprehensive leadership that delivers on the health agenda			
55	Number of quality improvement projects completed		Number
56	Number of monthly/quarterly health management committee meetings held		Number
57	Number of health officers with training certificate		Number
58	Number of health officers with training certificate		Number
I. Adequate medicines, medicines, stocked and utilized, with social and financial risk protection assured.			
59	Number of quality improvement projects completed		Number
60	Number of health officers with training certificate		Number
61	Number of health officers with training certificate		Number
62	Number of health officers with training certificate		Number
63	Number of health officers with training certificate		Number
64	Number of health officers with training certificate		Number
65	Number of health officers with training certificate		Number
J. Adequate health information, for evidence based decision making			
66	Number of health officers with training certificate		Number
67	Number of health officers with training certificate		Number
K. Universal access to essential health products and technologies			
68	Number of health officers with training certificate		Number
L. Adequate and appropriate health infrastructure			
69	Number of health facilities providing essential services		Number
71	Number of health facilities with functional technologies		Number

Completed by: _____ Date: _____