



**CAPSTONE PRACTICUM REPORT**

**Assessment of HMIS Data Accuracy in Health Facilities in Kigali between October and  
December 2016**

By

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## DECLARATION

I, Sangano Justin, in line with the UGHE Honor Code, hereby declare that the practicum capstone report has been written by me without any external unauthorized help, that it has been neither presented to any institution for evaluation nor previously published in its entirety or in parts. Any parts, words or ideas, of the report, however limited, which are quoted from or based on other sources, have been acknowledged as such without exception.

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Date: \_\_\_\_\_

## **DEDICATION**

I dedicate my work to my family and many friends. A special feeling of gratitude to my loving wife Sandra Umutoni, my daughter Oriana Iliza Sangano, my mother, sisters brother, and my in-law families whose words of encouragement and push for tenacity ring in my ears.

## **ACKNOWLEDGEMENTS**

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Besides that, I would like to thank all my classmates for their support, insightful comments and encouragement.

### **Abbreviated terms**

DDDM:	Data Driven Decision Making
GDP:	Gross Domestic Product
HIV:	Human Immunodeficiency Virus
HMIS:	Health Management Information System
MOH:	Ministry of Health
USD:	United States Dollar
U.S:	United States
WHO:	World Health Organization

### **Key definitions**

Health facilities include District Hospitals, Public Health centers and Private Clinics

## **Abstract**

**Background:** Resources available for healthcare worldwide are scarce, especially in developing countries. To make appropriate and informed decisions to allocate the limited resources, proper use of data is both necessary and critical. In Rwanda HMIS data are collected by health facilities each month. The accuracy of HMIS reports may not be precise and thus can potentially negatively affect the management in decision making. This study aimed to measure the accuracy of HMIS data in health facilities in Kigali city.

**Methods:** The study took place in three district hospitals and six randomly selected health centers in Kigali. Twenty-four HMIS indicators were chosen based on top five diseases with the highest burden in Rwanda. Verified data were collected by the project team and were used to compare against the reported data to calculate the accuracy.

**Results:** The overall accuracy in nine health facilities was 85%. Accuracy in district hospitals (89%) was higher compared to health centers (84%).

Among the 24 HMIS indicators, four achieved 100% accuracy. Eight achieved an accuracy rate of 90-99%; five had accuracy of 80-89 %; five had accuracy of 70-79%; two had accuracy below 60%

**Conclusion:** The results of our study showed the health data quality in health facilities of Kigali city was generally better than some countries, but it was still low compared to the recommended WHO standard. The data quality audit visits conducted twice per year by the Ministry of health in Rwanda may be attributed to the improved data quality.

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## **CHAPTER ONE: INTRODUCTION**

The World Health Organization defines identification, collection, analysis, interpretation, and reporting of data as important components of primary health care delivery systems (Logrillo, 1989). Data are necessary to effectively carry out the planning, management, direction, and evaluation of health care programs. However, often this component is neglected by health care deliverers for various reasons, including the demands required to provide adequate health care services in a particular area.

In Rwanda, HMIS data are collected and reported from the intermediate level (district hospital) to the central level through Rwanda Health Information System (RHMIS). Data on service delivery are collected using registers and compiled in hard copies; from these reports data are entered into a computer in HMIS. There are some challenges that occur during this process, such as delays in reporting, incompleteness and low accuracy of reported data. To address these problems, the Ministry of Health decided to roll out the Integrated Supportive Supervision and Data Quality Audit (ISS & DQA) program to improve reporting quality. The ISS & DQA is conducted biannually; it involves field visits from central level (MoH and RBC) to the district hospitals and two randomly selected health centers. The district hospital, in turn, conducts the same auditing visits for the remaining health centers within a catchment area to assess the reporting quality. The ISS & DQA aims to assess quality of health care services provided, identify gaps and provide technical support; provide constructive feedback and recommendations to site-level staff; and to improve the data quality reported in HMIS. (Rwanda Ministry of Health, 2013). However, the ISS & DQA visits provide feedback to the health facilities based on the quality of reports they observe, but

the actual level of the accuracy of data in the report is not measured. As a result, the HMIS data accuracy in the health facilities in Kigali city is unknown. This project aimed to compare the accuracy of HMIS data in the computer system with the data collected from registers and medical files.

**Problem statement:**

The accuracy of HMIS data collected from health facilities in Kigali was unknown.

**Objective:**

To measure the accuracy of reported HMIS data collected in health facilities in Kigali between October and December 2016.

**Project beneficiaries:**

All health facilities participating in this project as well as the HMIS team will benefit from the findings of this project: by knowing the accuracy of HMIS data in health facilities in Kigali, stakeholders can design interventions to improve it.

**Organization of the report:**

This report is divided in to six chapters. The first chapter discusses the introduction of the study including the background, the problem statement, the study objectives, settings and study beneficiaries. Chapter two provides a literature review on the importance of data-driven decision-making process in allocating health care resources, particularly in developing countries, the importance of data quality, the use of health management information system in Rwanda.

Chapter three describes the study design and methodology, including the sample, data collection and analysis instruments, and methods as well as ethical consideration. Chapter four describes the key findings of the study summarized around key themes guided by the literature review. Chapter five presents the results and compares them to findings in other low-income and high-income countries. The last chapter presents recommendations and conclusions.

## **CHAPTER TWO: LITERATURE REVIEW.**

### **Health care resources in developing countries**

Resources available for healthcare worldwide are scarce, especially in developing countries. In 2016, average health expenditure per capita was approximately 12 USD in developing countries; just 0.1% of the average health expenditure per capita in developed countries, which was estimated at around 9,146 USD (Morris, 2016). In most low-income countries, the average health expenditure is about 5.7% of gross domestic product (GDP), compared with an average of 12.3% GDP in high-income countries (World Bank, 2016). Often, the low level of expenditure does not meet the needs of the population (WHO, 2010). Apart from shortages in monetary resources, low- and middle-income countries also face shortages in human resources for health care. On average, there are 2.3 health workers per 1000 people in Africa and 4.3 in South East Asia. In Europe and America, there are 18.9 and 24.8 per 1000 population, respectively (WHO, 2006).

### **Data-driven decision making**

To make appropriate and informed decisions to allocate the limited resources, proper use of data is necessary and critical (Pfeffer & Sutton, 2006). Using data as evidence to systematically inform decision data-driven decision making (DDDM) has become an essential process in many countries and industries (Pfeffer & Sutton, 2006). DDDM has been used in the field of education, and studies have shown that DDDM can result in higher student scores, more appropriate policy making, better teacher performance, and lower dropout rate (Mandinach, 2012a; Park & Datnow, 2016). The same approach has been adopted in business (Davenport, 2013), health care

(Mick, 2011; Pfeffer & Sutton, 2006; Raab, 2006) and in public health (Courtenay-quirk, Spindler, Leidich, & Bachanas, 2016; J., A., & S., 2012; Quirk C 2016, Braa J 2012, Holmes 2012, Nutley T 2013, Rankin K 2012). Many countries have adopted DDDM training to improve capacity in various areas (Courtenay-quirk et al., 2016). From improving maternal and child health in U.S (Rankin, Kroelinger, Rosenberg, & Barfield, 2012); improving data quality in the national Health Management Information System (HMIS) in Zanzibar (Braa, Heywood, and Sahay 2012); facilitating ministry decisions in Kenya (Nutley, McNabb, and Salentine 2013), to developing HIV programs in Republic of South Africa, Swaziland, Tanzania, Zambia, Zimbabwe. (Holmes et al. 2012).

The DDDM is a systematic use of data from collection, to analysis, to examination, to interpretation. The type of data used to inform decision making can include instructional, administrative, financial, personnel, transportation, welfare, health, demographic, perceptual, behavioral, process, and other kinds of data (Mandinach, 2012b). In health care, the healthcare resource allocation changed the focus from cost reduction to value gained. Performance of health care is measured and monitored through all kinds of outcome data; the data is used to determine the value and in turn, becomes a key determinant of the distribution of health funding (Beck, Seeliger, & Kriegl, 2015)

In order to make better and more effective decisions, reliable data is needed. The process of producing reliable data in healthcare depends on elements such as governance where information is recognized as a property; patient matching, where error and duplicate rates are

monitored and remediated; identification and authentication of all authors contributing to an entry; a process for amendments and record corrections; and adequate audit trail functionality (Embury, 2013). It is important to note that established policies, procedures, and staff education must exist for these processes to achieve and maintain a high level of compliance (Embury, 2013). Creating systems that produce reliable data is an important first step for the management of limited health resources.

Often, however, health care deliverers neglect to collect data due to various reasons, including the demands required for providing adequate health care services in a particular area (Woodall, Borek, & Parlikad, 2013). This results in bad data quality, and consequently impacts the management of health program (Woodall, Borek, & Parlikad, 2013). Therefore poor data quality impacts the quality of health programs. An estimated 5% of data in healthcare organization are found to be of bad quality (Redman, 2001) and it costs more than 10% of healthcare organization resources (Malcom, 1998).

### **Data quality**

Data is at optimum quality when it meets six main criteria: accuracy, completeness, consistency, integrity, timeliness, and conformity (Askham et al., 2013). Accuracy is the degree to which data correctly reflects the real-world object; completeness which is defined as expected comprehensiveness; consistency means data across all systems reflects the same information and are in sync with each other; integrity means validity of data across the relationships and ensures that all data in a database can be traced and connected to other data; timeliness

references whether information is available when it is expected and needed; and conformity means nothing will be recorded more than once based upon how that thing is identified (Askham et al., 2013).

### **Health management information system**

In health facility settings, clinical and management data on health indicators are being routinely collected. The Health Management Information System (HMIS) is a method to track certain elements of service quality that could be used to improve patient satisfaction with health services (Shaikh & Rabbani, 2005). Health Management Information System (HMIS) is the primary tool used to collect data for health planning and evaluation in most of countries (Archangel & Abcouwer, 2007; Kerr, Norris, & Stockdale, 2007; Nisingizwe et al., 2014). The objective of the HMIS is to record health event information and check the quality of services at different levels of health care. Collected HMIS data can be used to enhance patient satisfaction through improved communication and enhanced provider sensitivity towards patients, and it can promote community awareness about the quality of services, resulting in overall better utilization of services in the health system (Archangel & Abcouwer, 2007; Kerr et al., 2007; Nisingizwe et al., 2014).

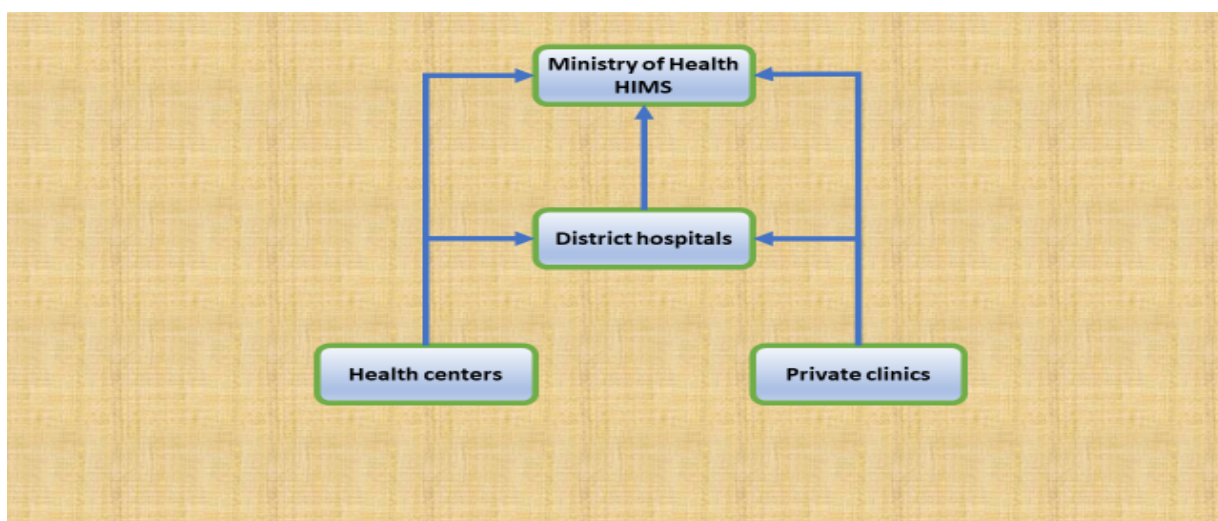
In Rwanda, the Ministry of Health developed the Health Management Information System (HMIS) in 2008 to support health service providers and departments to collect and assimilate data at all levels. By 2011, over 600 health facilities and over 60,000 community health workers were involved in reporting HMIS data to the Ministry of Health (Rwanda Ministry of Health, 2013).

The HMIS system was created to consolidate and incorporate many reporting systems into one comprehensive monthly reporting. The system includes both routine and non-routine work data that are consolidated through a monthly reporting template (Rwanda Ministry of Health, 2013). Information collected from the health facility is compiled via paper records and entered into an electronic system and sent to district and central levels (Rwanda Ministry of Health, 2013). The electronic system at the Ministry of Health aggregates the data and generates reports to provide national information on health in the country (Rwanda Ministry of Health, 2013). In Rwanda, the data managers at district hospitals and health centers are responsible for ensuring that all reports have been entered into the HMIS database by the 10th of each month (Rwanda Ministry of Health, 2013).

The data for HMIS in health facilities in Rwanda is collected through a combination of paper and electronic procedures. At the service delivery point (health centers and district hospitals), data are recorded using a variety of registers and patient record forms (Rwanda Ministry of Health, 2013). Health workers from each department record data on a daily basis using registers and patient files (Rwanda Ministry of Health, 2013). At the end of each reporting period, the head of each department compiles data from these registers and patient files with the assistance of the data manager; hard copy reports are then generated. If the health center has a computer and internet access, the data are entered directly into the national database by the 10<sup>th</sup> of the month by the data manager (Rwanda Ministry of Health, 2013). If a health center does not have a computer or internet access, then a paper copy of the reporting forms is sent to the district hospital, where the data manager enters the data for all facilities without computers (Rwanda Ministry of Health, 2013).

Data evaluation happens at the district and central level. Once data are in the database, the District Data Manager and Monitoring & Evaluation Officer review the data for data quality issues, extreme values, and missing data (Rwanda Ministry of Health, 2013). They communicate any issues with the relevant stakeholders such as administrative district authorities and faith-based, civil society, and non-government organizations in the district (see Figure 1 for the HMIS data flow). Feedback reports are generated by the MOH for the district hospitals, and in turn, the district hospitals generate feedback reports for the health centers between the 15th and the end of each month (Rwanda Ministry of Health, 2013). Compilation of data from all districts is done by HMIS unit within MOH, and this unit is responsible for maintaining a national database of health statistics (Rwanda Ministry of Health, 2013). The HMIS unit uses the database to create the annual health bulletin and to provide any kind of information that may be needed by other health programs within the Ministry of Health or by other stakeholders. The data may also be used for measuring disease trends and for decision-making.

Figure 1: HMIS Flowchart



Since the HMIS data is a key data source to guide decision making at facility and government levels in Rwanda, the quality of data is important. Few studies have been devoted to exploring HMIS data accuracy in Rwanda.

## CHAPTER THREE: METHODS

### Setting

The study took place in the health facilities in Kigali city. Kigali was chosen because it has the highest population density of all cities in Rwanda (National Institute of Statistics of Rwanda, 2012). Data were collected at two levels of health facilities: district hospital and health center. Kigali city consists of three districts: Gasabo, Nyarugenge and Kicukiro. The hospitals in each district are similar: they are urban and serve almost the same population. The health centers are the subunits of the district hospitals and provide services to similar populations, but they offer a smaller package of services compared to district hospitals. One district hospital and 2 public health centers were selected in each district and are listed in table 1.

Table 1: Health facilities included in the study

<b>District</b>	<b>District hospital</b>	<b>Health center</b>
<b>Nyarugenge</b>	Muhima District hospital	Muhima Health center Kabusunzu Health center
<b>Kicukiro</b>	Masaka District hospital	Gikondo Health center Gahanga Health center
<b>Gasabo</b>	Kibagabaga District hospital	Remera Health center Kinyinya Health center

## **Design**

This study utilized a retrospective cross-sectional study design. Data were collected through reviewing patient registers, patient charts, and HMIS reports.

## **Sample**

### Inclusion criteria:

For a health facility to have been included in the study it must be located in Kigali, be a public health facility, be a district hospital or a health center, and have been functional during the 3 months of the study (October- December 2016).

### Exclusion criteria:

Any private health facility and teaching hospital were excluded from this study.

### **Sample size:**

All HMIS reports between the month of October and December 2016 from three district hospitals (Kibagabaga District hospital, Muhima District hospital and Masaka District hospital) and six public health centers (Muhima Health center, Gitega health center, Remera Health center, Kinyinya Health center, Gikondo health center, Gahanga Health center) were included in the study sample.

## Measures

24 indicators were selected to compare the HMIS report accuracy against the patient files/registers data. These 24 indicators from HMIS data were chosen based on top five diseases with the highest burden as classified by World Health Organization in Rwanda, and for each disease two indicators were randomly chosen. In each health facility 24 indicators were verified from 10 different service delivery points:

1. Number of Malaria cases confirmed simple (not pregnant)
2. Number of Malaria cases confirmed with minor digestive symptoms (not pregnant)
3. Number of Malaria (presumptive all cases)
4. Number of Ear infections
5. Number of Refractive error
6. Number of Dental caries
7. Number of Epilepsy
8. Number of Hypertension
9. Number of Asthma
10. Number of Diabetes - Type 1
11. Number of Diabetes - Type 2
12. Number of Diabetes gestational
13. Number of Women screened for cervical cancer
14. Number of Screened for malnutrition (Total)
15. Number of Malnourished (Total)
16. Number of Malnutrition acute severe (without complications)

17. Number of Malnutrition acute severe (with complications)
18. Number of Malnutrition acute moderate (with complications)
19. Number of Underweight moderate
20. Number of Malnutrition chronic severe (stunting)
21. Number of Malnutrition chronic moderate (stunting)
22. Number of Referred to outpatient malnutrition program
23. Plasmodium (POSITIVE)
24. Plasmodium (NEGATIVE)

The data extracted from the HMIS (reported data) were compared to the data extracted from registers and medical files in health facilities (verified data). If any discrepancy between reported data and verified data, that indicator was considered inaccurate. The accuracy was calculated as a percentage as the difference between the verified value and the reported value, divide by the verified value.

## **Tools**

The data for the 24 indicators were extracted from the HMIS online platform for the months of October, November and December 2016. The source data for the same 24 indicators were extracted health facility reports and patient files/registrars.

The data extracted from the HMIS online platform and the source data from the patient files and registers were put in a data collection tool side by side to compare accuracy (appendix 1).

## **Data management and analysis**

The reported and verified data were entered into an excel spreadsheet to calculate the accuracy.

Descriptive statistics were used to describe the accuracy of the indicators.

## **Ethical Considerations**

Personal information:

The study did not involve collecting patient personal information. The information extracted from HMIS online platform was aggregated data and the source information from patient files and registers did not include any personal identifiers. All data were aggregated to calculate the value of the indicators.

Assessment of risks to participants:

The only potential risk of this project was if data reported was found to be inaccurate, it could potentially cause embarrassment or professional disciplinary actions against the data collectors in the health facilities or affect the reputation of the health center. To minimize this risk, dissemination of results focused on enabling quality improvement rather than punitive action.

Information and consent process:

The project did not involve interaction with human subjects as only secondary data were analyzed. Permissions from health facilities and MOH were acquired prior to data collection. No monetary or in-kind compensation were given to health facilities for participation in this project.

Safekeeping of data:

Data collected were stored on a password-protected computer with no identifiable information. The data were only shared with the UGHE team for technical assistance with analysis. All data for this project will be destroyed after 10 years of collection.

## CHAPTER FOUR: RESULTS

This study was conducted to assess the accuracy of HMIS data in three district hospitals and six health centers. The data of twenty-four (24) HMIS indicators extracted from HMIS online platform were compared with data collected in health facilities. The results found the overall accuracy in nine health facilities in Kigali city was 85%. Average accuracy in district hospitals (89%).

Among all three district hospitals, Muhima district hospital had the highest accuracy with 97%, followed by Kibagabaga district hospital with 94%. The lowest was Masaka district hospital with 75%.

Among the six health centers, Muhima health center had the highest accuracy with 94% and Remera health center had the lowest accuracy with 74%. One health center was in the 91% - 100%, three health centers had 81% - 90%, and two health centers had accuracy lower than 80% (Table 2).

Table 2: Accuracy in district hospitals and health centers

Health facility type	Health facility	Accuracy	Overall accuracy
District hospital	Masaka DH	75%	89%
	Kibagabaga DH	94%	
	Muhima DH	97%	
Health center	Remera HC	74%	84%
	Kinyinya HC	79%	
	Gikondo HC	81%	
	Kabusunzu HC	86%	
	Gahanga HC	89%	
	Muhima HC	94%	
		Overall	85%

Among the 24 indicators of HMIS evaluated, four had accuracy of 100% across all health facilities. Eight had overall accuracy of 90-99%; five had accuracy of 80-89 %; five had accuracy of 70-79%; two had accuracy below 60% (Table 3).

The four indicators with an accuracy of 100% in all health facilities were gestational diabetes; women screened for cervical cancer; moderate acute malnutrition (with complications) and chronic severe malnutrition (stunting).

The two indicators that were below 60% accuracy were ear infection and screened for malnutrition (total).

Table 3: Indicator accuracies by health facility type

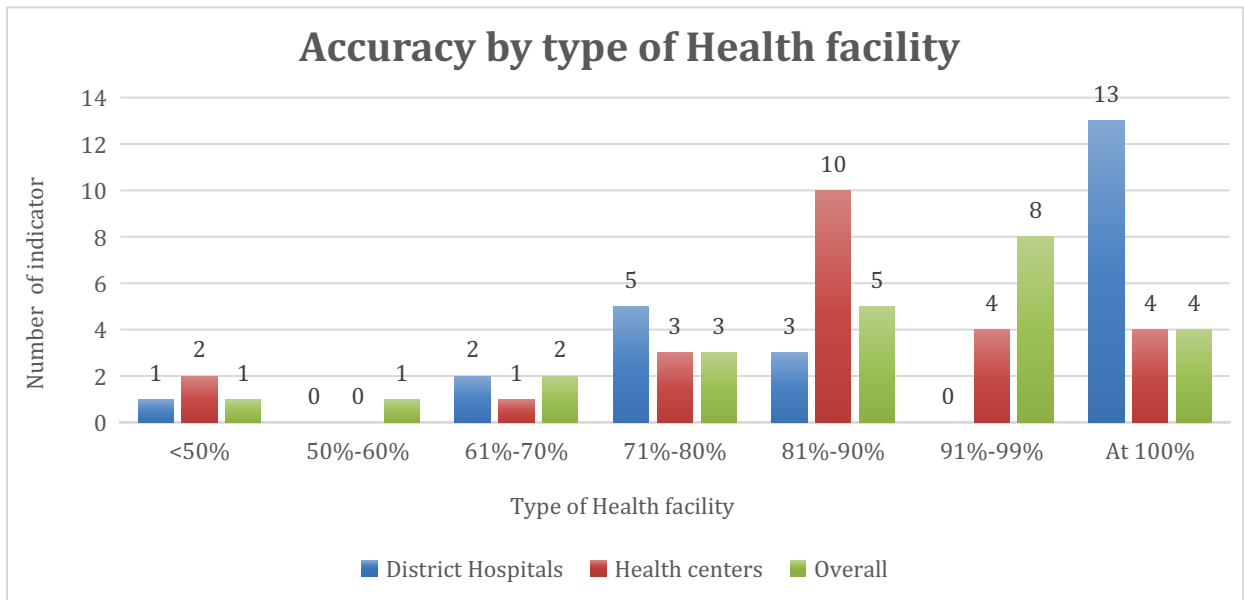
Indicators	Accuracy rate		
	District Hospital	Health center	Overall
Ear infection	100%	17%	44%
Screened for malnutrition (Total)	67%	44%	52%
Hypertension	44%	83%	70%
Malnourished (Total):	78%	67%	70%
Malnutrition acute severe (without complications)	67%	78%	74%
Malnutrition acute moderate (without complications)	78%	72%	74%
Asthma	89%	72%	78%
Malaria confirmed simple (not pregnant)	89%	83%	85%
Diabetes - Type 2	89%	83%	85%
Plasmodium (POSITIVE)	78%	89%	85%
Epilepsy	78%	94%	89%

Plasmodium (NEGATIVE)	78%	94%	89%
Malaria confirmed with minor digestive symptoms (not pregnant)	100%	89%	93%
Dental caries	100%	89%	93%
Diabetes - Type 1	100%	89%	93%
Referred to outpatient malnutrition program	100%	89%	93%
Malaria (presumptive all cases)	100%	94%	96%
Refractive error	100%	94%	96%
Underweight moderate	100%	94%	96%
Malnutrition chronic moderate (stunting)	100%	94%	96%
Diabetes gestational	100%	100%	100%
Women screened for cervical cancer	100%	100%	100%
Malnutrition acute moderate (with complications)	100%	100%	100%
Malnutrition chronic severe (stunting)	100%	100%	100%

District hospitals had more indicators with higher accuracy. On 24 indicators evaluated in district hospitals, 13 indicators were at 100% accurate in all three district hospitals across three months of the study, three indicators were 81%-90% accurate; five were 71%-80% accurate; two were 61%-70% accurate and one indicator was less than 50% accurate (Figure 2).

In contrast, in health centers, of 24 indicators evaluated four were 100% accurate in all nine health facilities across three months of the study, six were 91%-99% accurate; eight were 81%-90% accurate; three were 71%-80% accurate; one was 61%-70% accurate; and two indicators were less 50% accurate (Figure 2).

Figure 2: Accuracy by type of health facility



## CHAPTER FIVE: DISCUSSION

This study intended to measure the accuracy rate of the HMIS reporting at the health facilities within Kigali city as well as the causes of such inaccuracy. The results of our study showed the overall accuracy of health indicators reported in HMIS was 85% across all 3 district hospitals and 6 health centers studied; which is lower than the WHO recommended standard of 95% (Thomas C. Redman, 2001). Interestingly, our study results showed the accuracy in Rwanda HMIS reporting, although lower than the WHO recommended target, is higher than it is in some high-income countries. A study conducted in Taiwan on the accuracy of data reported for diabetes showed the overall accuracy of 74.6% (Lin, Lai, Syu, Chang, & Tseng, 2005); while another study conducted in the USA on the accuracy of hospital claims data was 78.2% (Fisher et al., 1992). Despite the nature of data reported in these studies were different. Note that in high-income countries, accuracy measured was also looking on the accuracy of diagnosis this may explain the low accuracy.

Similar studies about health data reporting accuracy in low-income countries are scarce compared to studies in high-income countries; a few studies have been conducted in South Africa, Kenya, Malawi, Peru and Uganda (Mphatswe et al., 2012). The results of this study showed the data reporting accuracy in Rwanda was higher than in many other low-income countries.

In South Africa, a study was conducted on the improvement of data quality reported from Prevention of Mother to Child Transmission (PMTCT) clinics. The study implemented an intervention of conducting data quality audit visits to the health facilities and the results of the intervention were measured. The evaluation showed the data accuracy of reported data in the

PMTCT clinics improved from 37% pre-intervention to 65% post-intervention (Mphatswe et al., 2012). Even after implementing an intervention, the data accuracy was still lower than our study.

The Data Quality of Audits (DQA) combined with supportive supervision conducted in all health facilities countrywide by the Ministry of Health on biannual basis could have improved the data accuracy of HMIS in Rwanda. There is no study conducted in Rwanda about the effect of DQA on data accuracy; but one study was found conducted in South Africa. The study results showed DQA could improve the data accuracy. The data accuracy significant increase from 37% to 65% within three DQA visits ( $P < 0.0001$ ) (Mphatswe et al., 2012). Rwanda the Integrated Supportive Supervision coupled with Data Quality Assessment, (ISS/DQA) has been adopted as an improvement measurement framework and a key enabler to achieve the sustained quality of care provided to Rwandan population in the Health Sector Strategic Plan III (HSSPIII) of the Ministry of Health (MOH) – such effort could have been contributed to the high accuracy of HMIS data compared to other countries.

Another study was conducted in Peru to assess the timeliness and data quality of an electronic disease surveillance system. A data quality audit was implemented as an intervention and found decreased reporting errors from 7.1% to 2% while phone calls to remind for reporting didn't improve the accuracy of data. (Huaman et al., 2009). In Malawi, the accuracy of data aggregated by antiretroviral treatment clinics was only 40% (Huaman et al., 2009).

Another study was conducted in Kenya to improve the data collection system from Voluntary Testing and counseling clinics (VCT clinics). Although the study didn't precisely measure the accuracy rate, it found that there was a large amount of missing data in the Kenya national VCT

database. The study highlighted the use of different data collection tools as a possible reason for bad data quality (Nutley, McNabb, & Salentine, 2013). In contrast, the HMIS data flow in Rwanda is standardized using the HMIS reporting forms (HMIS, 2013). Standardized reporting tools may contribute to improvements in data quality. Any data collection process that involves using different reporting tools could be complicated; and any complicated process of reporting could lead to reporting errors and reduce data accuracy.

Although the accuracy of health data in HMIS was higher compared to other countries; there was a variation between the accuracy of reported data in district hospitals and health centers. The overall accuracy in districts hospitals was 89%, higher than the accuracy in health centers of 84%. From the observations we conducted in the health centers and district hospital, we found the possible reason for the lower accuracy in health center was due to data entry error - more data entry errors occurred in health centers compared to the district hospital. There are differences in the processes of data reporting in HMIS between the district hospital and health centers. In the district hospital, data were compiled from primary sources, which are registers and medical files into one HMIS monthly Monitoring and Evaluation Officer (M&E Officer) and the approval of the director of the hospital entered report form on paper by the data manager, and then the data into the computer online HMIS platform after verification. In health centers, the step of verification was missing. After compiling the data from different services, the data manager at a health center entered the information in the computer; there was no Monitoring and Evaluation Officer in a health center to verify the data (HMIS, 2013). Lack of a designated staff member to verify the accuracy of data in health centers could help explain the lower accuracy rate compared to district hospitals where there was a designated person to verify data before

submitting to HMIS. The situation is similar to the study conducted in Kenya on VCT data quality - the shortage of staff in integrated VCT clinics caused less accurate data reporting compared to the stand-alone VCT clinics where they had sufficient staff dedicated to data reporting (Nutley et al., 2013).

The results of our study not only found variations among health facilities but also among indicators at a single health facility. Some literature suggests that indicators which were funded (HIV, Malaria and TB indicators are considered to disburse fund by global fund) were better reported than non-funded ones (Mphatswe et al., 2012). However, such a difference was not found in our study. Some well-funded indicators such as malaria indicators, which were funded by The Global Fund against HIV, TB and Malaria showed no difference compared to other non-funded indicators. Further study should be conducted to investigate the variations among indicators.

This study has some limitations. This study only measured the data accuracy. Other dimensions of data quality such as timeliness and completeness were not included in this study. A future study combining these other dimensions should be conducted. The study also compared data from registers to data reported in HMIS therefore errors made in filling out registers or medical files were not captured and this may lower the accuracy, and it is another limitation of the study

The small sample size was a limitation of this study. Only nine health facilities were included in this study and the study results could not represent the situation in the country.

The study measured only three months of data and did not look at the root causes of data accuracy; these also make limitations of the study.

While conducting this study, we encountered a few challenges. In order to assess the accuracy of data, we had to access the primary data sources such as registers and medical files. Frequently, they were being used at the time we conduct our study, causing interference to their daily work of the staff at the health facilities. There were times that we had to wait for hours to gain access to those sources of data.

We could only find a limited number of studies that were dedicated to data quality in low-income countries. The few that are available were mostly only for HIV indicators. The paucity of published studies made comparison challenging.

## **CHAPTER SIX: CONCLUSION AND RECOMMENDATION**

This study was conducted to measure the accuracy of HMIS data reported by health facilities in Kigali city. The results of our study showed the health data quality in health facilities of Kigali city was generally better than some other countries, whether in high-income countries or low-income countries but it was still low compared to the recommended WHO standard. The data quality audit visits conducted twice per year by the Ministry of Health in Rwanda likely help to improve data quality; as similar improvements were shown in South Africa by implementing similar data quality audits.

Harmonized data collection tools used in health facilities could also help to improve the data reporting quality. The HMIS data collection tools are harmonized.

The presence of Monitoring and Evaluation officer in district hospitals to verify data before submitting them to HMIS may be important for ensuring data accuracy. It is recommended the health centers should have this position.

We recommend to Ministry of Health to continue to conduct the biannual data quality audits and promote the harmonization of data collection tools in health facilities. We recommend considering appointing an M&E officer in health centers to help improve and maintain the quality of data.

Finally, a study on HMIS data quality should be conducted countrywide to measure the quality of data, to find causes of bad quality of data and to document best practices.

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**APPENDIX 1. DATA COLLECTION TOOLS FOR HEALTH FACILITY**

Identification	
<b>Health Facility Identification</b>	
1. Facility Name	
2. Catchment Area Population	
3. District	
4. Province	

Outpatients consultation		5 to 19 years Verified		5 to 19 years Reported		20yrs and above Verified		20yrs and above Reported	
		M	F	M	F	M	F	M	F
#	Indicators								
1	Malaria confirmed simple (not pregnant)								
2	Malaria confirmed with minor digestive symptoms (not pregnant)								
3	Malaria (presumptive all cases)								
4	ear infection								

Eye and oral diseases: New cases													
#	Indicators	0-19 y Verified		0-19 y		20-39 y Verified		20-39 y Reported		40+y		40+ y Reported	
								M	F	M	F	M	F
5	Refractive error												
6	Dental caries												

Mental Health																									
		New cases												Old cases											
		0-19 Verified		0-19 Reported		20-39 Verified		20-39 Reported		40 + Verified		40 + Reported		0-19 Verified		0-19 Reported		20-39 Verified		20-39 Reported		40 + Verified		40 + Reported	
#	Indicator	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
7	Epilepsy																								

Chronic Diseases																									
		New Cases												Old Cases											
		0-19		0-19		20-39		20-39		40 +		40+		0-19		0-19		20-39		20-39		40+		40+	
		Verified		Reported		Verified		Reported		Verified		Reported		Verified		Reported		verified		Report		verifi		Report	
#	Indicators	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
8	Hypertension																								
9	Asthma																								
10	Diabetes - Type 1																								
11	Diabetes - Type 2																								
12	Diabetes gestational																								

Cancer screening			
#	Indicator	Verified	Reported
13	Women screened for cervical cancer		

Nutrition Screening																	
#	Indicators	EPI- Vaccination						IMCI - PCME						> 5-14 years		15 + years	
		0-6 days		7 days- 8 weeks		>2 - 59 months		0-6 days		7 days- 8 weeks		> 2 - 59 months					
		Verified	Reported	Verified	Reported	Verified	Reported	Verified	Reported	Verified	Reported	Verified	Reported	Verified	Reported	Verified	Reported
14	Screened for malnutrition (Total)																
15	Malnourished (Total):																
16	Malnutrition acute severe (without complications)																
17	Malnutrition acute severe (with complications)																
18	Malnutrition acute moderate (without complications)																
19	Malnutrition acute moderate (with complications)																
20	Underweight moderate																
21	Malnutrition chronic severe (stunting)																
22	Malnutrition chronic moderate (stunting)																
23	Referred to outpatient malnutrition program																

**Laboratory**

		Results				Total	
Indicator		Positives		Negatives			
#	Blood Smears	Verified	Reported	Verified	Reported	Verified	Reported
24	Plasmodium						