



**ANALYSING PATIENT INFORMATION FLOW IN HOSPITAL AS A FACTOR TO A
LONG WAITING TIME.**

CASE STUDY: UNIVERSITY TEACHING HOSPITAL OF KIGALI

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Master of Health Informatics**

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By

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**A dissertation submitted in partial fulfilment of requirements for the Award of Master of
Science in Health Informatics.**

**In the College of Medicine and Health Sciences,
School of Public Health
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Kigali, July 2016

DECLARATION

I, UWERA THAOUSSI, do hereby declare that all the work presented in this dissertation is my own original work unless otherwise acknowledged. It has never been presented either in part or in full for publication or award of a degree in any university. I, therefore, present it for the award of Master of Science in Health Informatics of University of Rwanda, College of Medicine and Health Sciences, School of Public Health, Department of Health Informatics.

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Date.....

DEDICATION

I dedicate this work to my dear husband Jean d'Amour MUZIKI and my lovely family members.
Thank you for being patient with me throughout the time of my study.

ACKNOWLEDGMENT

I wish to acknowledge with profound gratitude my supervisors, NSEREKO Etienne and Dr.NIYOYITA Jean Paul for their tireless support they have provided to me during the preparation and execution of this work.

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Am also very grateful to the staff of radiology and emergency departments at University Teaching Hospital of Kigali (UTHK) and all the respondents who took part in this study

I would like to most sincerely thank my classmates for the moral support and encouragement that they accorded to me during the programme.

Finally, I am indebted to my family for their love, patience, and support during the entire time of my studies.

May God bless you all

LIST OF ACRONYMS AND ABBREVEATIONS

AHRQ: Agency for Healthcare Research and Quality

ED: Emergency Department

EHRs: Electronic Health Records

EMRs: Electronic Medical Records

IOM: Institute of Medicine

IT: Information Technology

UTHK: University Teaching Hospital of Kigali

NHS: National Health Service

OPD: Outpatient Department

ABSTRACT

This study was conducted primarily to analyse the patients' information flow in hospital as a factor to a long waiting time at Kigali teaching hospital. The reason is that the government of Rwanda has provided effort to make healthcare services more accessed but it has been remarked that there are still gaps in different hospitals. We can give an example of UTHK where patients are still experiencing delay during the health care process. So, our research interrogated whether the problem is based on patient information flow or other factors. To achieve research objectives, we followed a methodological approach and collected data from 365 patients who were selected basing on scientific techniques. Key informants namely 15 medical staff and 3 electronic medical records system administrators (ICT staff) were questioned. Each category of the population had its own questionnaires in order to obtain various responses from the participants. In summary, three themes were explored: challenges in healthcare process due to patients' data flow, bottlenecks in patients' information flow and plausible strategies for existing bottlenecks in patients' information flow.

Overall, the majority of the patients wait a long time to get healthcare services they need. 101 patients (27.54%) revealed that they spend 2 to 3 hours to get services they wanted whereas (42.75) waited more than three hours. This long waiting leads the patient to be unhappy and hopeless hence their level of satisfaction becomes nil. Different places where patients spend more times than other places have been highlighted. As such the department of emergency, pharmacy and cashier are noted. For the department of radiology, two places were also pointed out: consultation and cashier. Different reasons were developed for this long waiting. These include demeaning the patients, poor customer care; physicians being busy with other businesses and less care about the job. Others include a big number of patients compared to existing medical staff, insufficient materials and the use of multiple information record systems that report the same patient information. The real factors associated with this long waiting are the following: slow in treatment process, staff not responding on time and long patient queue. Some strategies were proposed to deal with the problem. Those are for instance improving customer care, increasing the number of medical staff, reward and compensation, materials and dispensation and provision of drugs on time. Planning regular training for staff members may be also helpful.

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OPERATIONAL DEFINITIONS

Electronic Health Records: “is a systematic collection of electronic health information about individual patients or populations. It is a record in digital format that is theoretically capable of being shared across different health care settings”. (Bercovitz et al., 2013)

Electronic Medical Records system: “An application environment composed of the clinical data repository, clinical decision support, controlled medical vocabulary, order entry, computerized provider order entry, pharmacy, and clinical documentation applications. This environment supports the patients electronic medical record across inpatient and outpatient environments, and is used by healthcare practitioners to document, monitor, and manage health care delivery within a care delivery organization.”(Analytics, 2006)

Flow: “The term ‘flow’ describes the progressive movement of people, equipment and information through a sequence of processes. In healthcare, the term generally denotes the flow of Patients between staff, departments and organizations along a pathway of care”(THE HEALTH FOUNDATION, 2013)

Health IT: “is information technology applied to health and health care. It supports health information management across computerized systems and the secure exchange of health information between consumers, providers, payers, and quality monitors.”(Wikipedia, 2016)

Section waiting time: This is time the patient spends waiting to receive a service at a specific service point within the clinic.

Total waiting time: This is the sum of all the section waiting times.

Waiting time: This is the time that patients spend waiting to receive a service

CHAPTER I: GENERAL INTRODUCTION

1.1. Introduction

This proposal presents a preliminary analysis of patient information flow in emergency and radiology departments in Kigali university teaching hospital. Analysis is for the interest and importance for a better understanding of the causes of patient long waiting in aforementioned departments. The study tends to measure the patient waiting time and identify the possible bottleneck in patient information flow that contributes to the delay in healthcare delivery. We will analyze the factors affecting patient information flow and finally propose the strategies to resolve the identified problems.

1.2. Background of study

In healthcare, the information flow is a critical factor in providing efficient patient care and billing for services rendered during the patient visit. Therefore, the process of admission, treatment, billing services and discharging the patient requires different departments to work hand in hand for performance of different roles and responsibilities and all should be done in the best interest of the patient (Foundation & Report, 2006). When defining a delay during treatment, Lambert, et al. study reminded that a delay in treatment is when patients fail to get treatment be in the form of a medication, lab test, physical therapy treatment or any kind of treatment that had been ordered for them in the time frame in which it was supposed to be delivered. This would also apply to not being able to get an initial appointment or follow up appointment in a timely manner. The same reference added that it is a form of diagnostic error that may result in patient harm or death. And that for health care organizations and providers, it is a missed opportunity (Lambert et al., 2009).

In the US, the office of health information Technology noted that Electronic Health Records have the ability to exchange health information electronically which can help to provide higher quality and safer care for patients while creating tangible enhancements for organization (HealthIT.gov, 2014).

Even if various authors are unanimous in terms of the benefits of sharing patients' data for speeding up healthcare services, there still exists a big challenge in provision of quick services because in many hospitals as observed, patients are still waiting for a long time to get services they need. Taking account of the foregoing, the Research done by Faria & Amaral has shown that delays in discharge occurred in 60 % of 207 hospital admissions in the *Hospital das Clínicas* and in 58.0% of 188 hospital admissions in the *Hospital Odilon Behrens*. Delays in hospital discharge occur in the majority of hospitals (rates vary between 13.5% and 62.0%) (Faria & Amaral, 2014). As it was noted in this research, both hospitals showed a high percentage of delay in hospital discharge. The delays were mainly related to processes that could be improved by interventions of care teams and managers. The impact on mean length of stay and hospital occupancy rates was significant and troubling in a scenario of relative shortage of beds and long waiting lists for hospital admission. In general, a delay is remarkable in some hospitals worldwide during the process of admission, billing care services, discharging and treatment. In 2015; the Joint Commission's Office of Quality and Safety analyzed 73 sentinel events that were the result of delays in treatment; 48 of these events resulted in death of the patient, 522 sentinel events were due to delays in treatment, with 415 of these events resulting in patient death, 77 resulting in permanent loss of function, and 24 resulting in unexpected additional care or extended stay (The Joint Commusion, 2015).

In Africa, A study of patient satisfaction with health services in Uganda in 2013 found that patients wait for up to 3 hours in public facilities before they are served. This was longer than recommended time of one hour (Conrad, 2015). Such notes are here to testify how the problem of delay in health care services is alarming even if health informatics was introduced to enhance healthcare system. Waiting time in outpatient departments has become a problem in healthcare settings all over the world (Kelaniya, 2014). Various studies on reducing patient waiting time were focusing on improving outpatient daily consultation and appointment scheduling rule (Shang F, et al. , 2011), (Kaandorp, et al. 2007), (Klassen, 2009), and others focused on number and schedule of providers especially physicians (Wijewickrama and Takakuwa, 2008), (Günel MM, 2010) most of these studies designed new system for patient waiting time improvement based on the researcher observation. In difference to this study was conducted in emergency and radiology departments which are very known to be very busy and no new system has been developed. Based on observation of the existing system and data collected from participants, we

analyzed the patient information flow to find out the real factors that associated to the long waiting then provide strategies for process improvement which will have great impact on reducing patient waiting time.

1.3. Problem statement

Nowadays, information technology is being used in different domains of daily life for the purpose of improving services delivery. In health care field, e-health systems have been adopted in different countries of the world to improve health care delivery by reducing at the same time the cost and the time. By putting a big emphasis on our country, Hamish Frasier et al. (2008) noted that Health information technology in Rwanda is a quickly growing industry with many committed stakeholders, including the Government of Rwanda (GoR), several nongovernmental organizations (NGOs), and private sector partners. Particularly in the areas of electronic health records and national reporting system, Rwanda has been a pioneer in national initiatives to integrate technology into its expanding health care system. Where the private market has not emerged, the Government has provided significant support to help these fledging industries. As a result, Government is significantly involved in all major initiatives and emerging technologies.(Hamish, 2008)

In the US, the office of health information Technology noted that Electronic Health Records have the ability to exchange health information electronically which can help to provide higher quality and safer care for patients (HealthIT.gov, 2014). A study done reported that hospitals with greater numbers of IT applications were significantly more likely to have desirable quality outcomes (Menachemi, 2008)

Despite the effort provided by the government of Rwanda to make health care services more accessed, it has been remarked that there are still gaps in different hospitals. Here, we can give an example of UTHK where patients are still experiencing delay during the health care process. Our research study will interrogate whether the problem is based on patient information flow or other factors. This drives us to conduct a study on analysis of patient information flow to find out the real factors contributing to the delay in healthcare delivery.

1.4. Objectives

1.4.1. Main objective

The primary aim of this work is to analyze patient's dataflow in hospital as a factor of long waiting time by studying at the same time the system interoperability and interconnection between hospital services where patients pass throughout from entry to exit.

1.4.2. Specific objectives

This research project has the following research objectives:

- To highlight how patients' data flow affects them in seeking healthcare services
- To identify the possible bottlenecks in patient information flow that can contribute to prolonged waiting time for health care delivery
- To suggest strategies to overcome challenges hindering patients' data flow in seeking healthcare services

1.5. Research questions

- To what extent does patients' data flow affect them in seeking healthcare services?
- Are there any bottlenecks in information flow that contribute to health care delivery delay?
- What are the plausible strategies to overcome challenges hindering patients' data flow in seeking healthcare services?

1.6. Significance of the study

The bottleneck in patient information flow can be a source of patient long waiting time. Considering the challenges related to IT adoption in health care settings and based on evidence showing that hospitals with greater numbers of IT applications were significantly more likely to have desirable quality outcome (Menachemi, 2008) (England et al., 2000). There is a need of shared patient data between hospital services to reduce patient waiting time.

1.7. Subdivision of the project

The project is divided into the following main parts: chapter one is general introduction. Information in this chapter covers the background to the study, problem statement, objectives,

research questions and subdivision of the study. Chapter two is a literature review: which is an analytical section of literature and gives mainly the background of patient information flow and its role in healthcare delivery. Chapter three is the methodology which shows us the study design, study area, sampling methods, data collection procedure, data analysis tools, and ethical consideration. Chapter four concerns data presentation and interpretation of the study results.

CHAPTER II: LITERATURE REVIEW

Introduction

In this second chapter, we have reviewed the key concept of our work “*waiting time*” in order to facilitate our future readers. We also reviewed the various theoretical considerations developed by other researchers in the domain of research subject. Briefly, theories of this chapter have turned on the concept of waiting time.

2.1. Concept of waiting time

Waiting time is an important determinant of quality services as it is noted that in health care provision ‘delays are expensive, not only in terms of direct costs incurred, but also in terms of the potential costs of decreased patient satisfaction and adverse outcomes’ (HAUSSMANN, 1970) . Waiting time studies have been done in settings such as specialized clinics like child health, maternal health clinics and medical clinics for priority conditions such as Acquired Immune Deficiency Syndrome, elective surgery clinics such as those dealing with organ transplant and other cosmetic surgery clinics and general outpatients’ clinics.

With the challenge to deliver high quality services with limited resources(HAL et al., 2001) health care systems have placed greater emphasis on the efficient utilization of the resources. Therefore, one of the most important operational issues in health care delivery involves increasing utilization and access by minimizing the delays in delivery.

Research shows that in the most Outpatient department of the teaching hospitals, patients experience longer waiting times to get examined or diverted to private health facilities due to overcrowding (reaches capacity) thereby reducing healthcare access to the public, and increasing operational cost to hospitals because of the associated inefficiencies.

2.2. Background of waiting time in healthcare

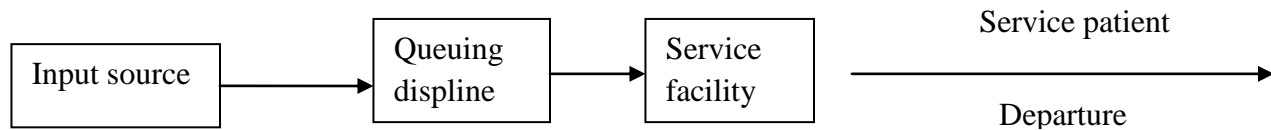
Over the years, healthcare organization and processes have been viewed within the context of queuing systems in which patients arrive, wait for service, obtain service, and then depart

(FOMUNDAM, S. & HERMANN, 2007). Queuing theory was originally developed by French mathematician S.D. Poisson (1781- 1840), is usually used to define a set of analytical techniques in the form of closed mathematical formulas to describe properties of the processes dealing with scenarios of congestions and blockages (Amero et al, 2004). Therefore, it seems very logical to view the services or operations of Outpatient department as a queuing system: patients needing the services of the units wait in a queue to be served and leave the system after service.

2.2.1 Basics of Queuing Theory

The basic structure of the queuing model can be separated into input and output queuing system (Hillier and Lieberman, 2005). The simplest queuing model is called single–server single queue model as illustrated in figure 1. Single–server model has a single server and a single line of patients (Krasewski and Ritzman, 1998). It is a situation in which patients from a single line are to be served by a single service facility or server, one after the other.

Figure 1: Basic Queuing Process



Source:(OBAMIRO, 2010)

2.2.2. Description of the Outpatient Department patient queuing model (Input and output process)

Input process is known as the arrival process. These Patients enter the queuing system and join a queue to be served. A patient in the queue is selected for service by some rules known as the queue discipline. The required service is then delivered to the patient by the service mechanism, after which the patient leaves the queuing system (Hillier and Lieberman, 2005). The provision of services using certain rule and discharge of patients is referred to as output process.

2.2.2.1. Arrival

Although most analytical queuing models assume a constant patient arrival rate, many healthcare systems have a variable arrival rate. In some cases, the arrival rate may depend upon time but be independent of the system state. For instance, arrival rates change due to the time of day, the day

of the week, or the season of the year. In other cases, the arrival rate depends upon the state of the system (SAMUEL, F. & JEFFREY, 2007).

2.2.2.2. Waiting Line or Queue

A waiting line or queue occurs when patients wait before being served because the service facility is temporarily engaged. A queue is characterized by the maximum permissible number of patients that it can contain. Queues are called infinite or finite, according to whether this number is infinite or finite (Hillier and Lieberman 2001). An infinite queue is one in which for all practical purposes, an unlimited number of patient can be held there. Unless specified otherwise, the adopted queuing network model in this study assumes that the queue is an infinite queue.

2.2.2.3. Queue Discipline

The queue discipline refers to the order in which members of the queue are selected for service (Hillier and Lieberman, 2001). In most healthcare settings, unless an appointment system is in place, the queue discipline is either first-in-first-out or a set of patient classes that have different priorities (as in an emergency department, which treats patients with life threatening injuries before others). Studies (SIDDHARTAN et al., 1996) propose a priority discipline for different categories of patients and then a first-in-first-out discipline for each category. They find that the priority discipline reduces the average waiting time for all patients: however, while the waiting time for higher priority patients reduces, lower priority patients endure a longer average waiting time.

2.2.2.4. Service Mechanism

According to Mosek and Wilson (2001), service mechanism describes how the patient is served. In a single server system each patient is served by exactly one server, even though there may be multiple servers. In most cases, service times are random and they may vary greatly. The service mechanism also describes the number of servers. The first patient from the common queue goes to the server who becomes free first (Medhi, 2003).

- **Single-server, Multiple-phases System**

With this system, there is still a single queue but patients receive more than one kind of service before departing the queuing system as shown in figure 2. At hospital outpatient department, patients first arrive at the registration desk, get the registration done and then wait in a queue to

2.3. Factors associated with waiting time in a health facility

2.3.1. Patient flow

Patient flow represents the ability of the healthcare system to serve patients quickly and efficiently as they move through stages of care. Blockage in the flow can increase waiting and through put time creating a negative effect on the quality of service delivery (VOS, et al., 2007). When patient flow is handled well, it is represented by short wait at registration, examination, diagnostic testing, pharmacy and discharge(BELSON, 2010.) .Thus, improving patient flow is one way of improving healthcare services.

2.3.2. Operational efficiency

Once a health care facility has an understanding of its patient flow, these flows can be used to improve the facility's operation(CÔTÉ, 2000). Therefore, efficient patient flow may be a key to achieve operational efficiency in the outpatient department (KUNDERS, 2004). According to (WANYENZE,et al., 2010) a number of factors can influence efficiency and the emergence of bottleneck in health care operation during examining operational efficiency with regard to patient flow. These factors include the volume of patients seen on the daily basis, the types of patient seen in terms of stage of care, clinic policies on frequency of patient visits, the type of provider who they should see, the size and composition of the providers and the staffing model.

2.3.3. Physical design

The physical environment greatly affects the quality, efficiency, and efficacy of healthcare delivery in outpatient settings (A.I.A., 2004). To appreciate this concept, it is important to understand the journeys that patients make through the department. Patient environment can best be studied from the ordinary experience. Physical experience can be affected by the way in which spaces are connected, the changes of direction imposed by the circulation system, the creation of room sequences, the distribution of branching points, the availability of alternative routes, and the relations of visibility between and across spaces(PEPONIS, J. & ZIMRING, 1996).

Studies show that hospital design coupled with walking distances and common journeys affects access to every department (WANYENZE et al.,2010) with a direct impact on the movement of

patients, staff, and supplies (HFM, 2011). Therefore controlling movement in terms of; the number of changes in direction needed to access different service points from the main entrance, the distance and number pit stops (treatment rooms), would ensure less use of time on walking to locate service points. Therefore, physical accessibility is an important factor for optimizing patient flow; and to achieve operational efficiency.

2.3.4. Emergence of bottlenecks in Outpatient departments

Patients are attended to in various units within the hospital system but almost invariably a high percentage of out-patients visit the hospital pharmacy unit for their drug needs (MARGARET, O. A. & WILSON, 2003). Most patients follow a single file from registration to examination but as soon as they leave the doctors' consulting clinics or examination room, they are either sent back and forth for further investigation to the laboratory or radiology units at various times. This generates a random arrival rate at the pharmacy, where the dispensing activities take place sequentially (MARGARET, O. A. & WILSON, 2003). Queues form when the rate of patient arrival at the any service point is greater than the service rate.

According to Wanyenze et al. (2010) a number of factors can influence efficiency and the emergence of bottlenecks in health care operations. These factors include the volume of patients seen on the daily basis, the types of patient seen in terms of stage of care or illness, clinic policies on frequency of patient visits, the type of provider who they should see, the size and composition of the providers and the staffing model. Other factors identified by (MARJORIE, 2008) include:

High Workload: If staffs are overworked, then patients have to wait longer as staffs have too many patients to attend to. This can be solved by decreasing service times (if they are too long); or by providing more staff if service times are appropriate or low; or by shifting staff from facilities with a low workload.

Patients turn up in batches: If many patients arrive at the same time then most of these patients would have to wait a long time as the staff member would be busy seeing the patients who were first in the batch and the rest would be waiting. So if 20 Patients arrive at the same time then the first patient would wait zero minutes if the health centre were empty and the second patient

would wait for the time it took the staff to see the first patient (let's say 7minutes), but the 20th patient would have to wait for the other nineteen to be seen, which would be 19 times 7 minutes or a wait of 103 minutes. A Big Batch is defined as twice as many patients arriving in a time-period than can be seen in that time-period.

Lack of efficiency: Patients may not effectively be attended to because much as staff members are present at the service point they are busy with something else: such as administrative work, preparation or teaching.

A logistical problem: Patients may be waiting to be seen and staff is available to see patients; However, due to a lack of equipment, rooms or other logistical needs, staff is unable to attend to the patients. There was staff present but patients waiting and the staff questionnaire shows there is a shortage of equipment or rooms.

Flow problems: Staff is available to see patients and patients are at the facility but they are being delayed at some other service point. There was staff present but no patients however patients are waiting long at a prior service point.

Queuing problems: This occurs when patients are attended to by staff in an illogical order, i.e. the patients are not attended to in the order that they arrive at the service point. This means that those who arrive first are not seen first, but are made to wait while others are seen before them. Illogical queuing (jump queue) has a large effect on individual patient waiting times.

2.3.5. Staff scheduling

Several studies concerning scheduling for healthcare clinics have been directed at patient scheduling (Wijewickrama and Takakuwa, 2008). Authors have addressed scheduling staff in meeting patient demand while keeping patient arrivals unchanged. (S. Verma and A. Gupta, 2013) has examined the working of outdoor patient departments in a general hospital. The author found out that there was a need to change the way activities were performed and also suggested ways of measuring process oriented performance of Outdoor Patients Department. For solving nurse rostering problems, (Chih-Chung Lo, 2012) designed an intelligent decision support system, based on guidelines of Service-Oriented Architectures (SOA), the author claims

to schedule nurse's activities with high flexibility. (E. Cervesato et al., 2014) has developed a computer system for cardiologist scheduling. The system provides equal assignment of Cardiologists to each type of shift with uniform like distribution, avoiding immediate repetition of the same shift.

2.3.6. Patient appointment

As for patient appointment, Yan and Tang have proposed a sequential appointment scheduling method that balances the benefits of clinic and patients' satisfaction considering patient choice. It determines the optimal booking number of patients and optimal scheduling time for each patient to maximize the profit of the outpatient clinic over a session-day (Chongjun Yan and Jiafu Tang, 2014). The profit considered in this paper is the total revenue of all arriving patients minus the cost of waiting time, idle time and overtime, which not only considers the rewards from booking decision, but also precisely formulates the charge on service process depending on scheduling. Similarly, Yan et al. derived solution approaches for outpatient appointment schedule problem with routine and urgent patients under deterministic service time considering no-show probability to minimize a weighted sum of average waiting time, idle time and overtime (C. Yan et al., 2013). In the same way N. L. Ma et al. has used data analytics to identify pattern of non availability of scheduled patient, and has also developed a statistical model to predict the probability of that "non-availability" (N. L. Ma, S. Khataniar, 2014).

Though we have a common objective with the mentioned authors, our study is different from the mentioned ones in a way that we study the patient information flow (not scheduling). Our work is different from others in a way that the structure of our respective organizations is different.

2.4. Impact of waiting time on Patients' satisfaction

All studies in this context showed that there is negative relationship between long waiting time and patients' satisfaction and almost all articles used quantitative method to evaluate that relation, such as direct patient interview, survey or filling feedback. Most of these studies were followed by statistical analysis to compare the results before and after applying a change in healthcare organizations.

According to study done by Harnett *et al.* (2010) to improve efficiency and patients' satisfaction in a preoperative evaluation clinic in US, 872 patients questionnaires were distributed in two time periods. As result the waiting time was significantly dropped from 92 ± 10 minutes to 42 ± 5 minutes with significant improvement in patients' satisfaction with minimal cost impact as result from the alteration(Harnett, et al., , 2010). Another study done in Nigeria by Umar *et al.*, 2011 about patient waiting time in tertiary health institution, to assess their satisfaction. It showed, most of patients waited more than one hour to be seen by the doctors while only (31%) stayed less than an hour and out of them around (70%) were satisfied. However, the majority of patients (45%) were dissatisfied with the services because of the long waiting time (Umar, I., Oche, M.O. & Umar, 2011) Waiting time was measured in both articles and was linked to patients' satisfaction which was estimated by distributing questionnaires.

The difference in the current study is we will analyze the cause of delay throughout patient data flow between the hospital services by using mixed methods then we will provide the simulation model for improving the patient flow by considering health informatics as the key solution.

2.5. Improving patient waiting time

As Jess White (2015) said, patients sometimes wait hours for treatment. To provide better care to patients, it's crucial to reduce their wait times at the hospital, particularly in the emergency department (ED). It's no secret that patients who are seen quickly have better outcomes than those who have to wait a long time. With many conditions, such as heart attacks and strokes, every second is critical to a patient's survival and chance at recovery.

Although it's a tough task, there are certain steps hospitals can take to improve patient wait times (White, 2015). The Institute of Medicine (IOM) recently released a report about wait times in health care. The report contains a detailed overview of the problem and how hospitals can solve it. The IOM suggests that hospitals should take a page from other industries in the private sector to make a big difference in wait times, taking such concepts as lean management and Six Sigma and applying them to health care. The idea is to address some of these problems by boosting efficiency and without sacrificing care quality.

With that goal in mind, hospital executives should try four key strategies when attempting to improve patient wait times:

- ❖ Revamp the front-line scheduling process. Scheduling surgeries and other non-life-threatening procedures should take supply and demand into account. Patients should be scheduled for these procedures on days where the hospital's less likely to have a spike in patient volume due to a busy evening in the emergency.
- ❖ Make reduction of wait times a part of the hospital's culture. Healthcare executives must make wait times a priority in their facility. This means they must implement specific policies designed to address problems that can lead to increased wait times, including staffing policies. They must also commit to regularly evaluating their hospitals' work flow and be willing to invest in solutions to speed up care delivery, including automated systems designed to streamline scheduling.
- ❖ Incorporate patient preferences. Scheduling should be focused on patients, not providers. So it's important for hospitals to reach out to find out what kinds of changes would best suit patients' needs. Some hospitals have given patients access to systems where they can make their own ED appointments for less-critical issues – or they'll give patients an estimated wait time over the phone before they arrive so they can make other arrangements, if necessary.
- ❖ Consider alternate methods of care delivery. To ease the burden of high wait times, hospitals can try treating patients in various ways. Telemedicine may be one solution for emergency department patients with less serious issues. Hospitals may also partner directly with nearby urgent care clinics and other healthcare entities so they can provide patients with an alternative to the emergency department to lower their wait time.

Conclusion

In this second chapter, different theories related to our work were reviewed. The situation was clarified. The next chapter will discuss the methodology used to study this situation.

CHAPTER III: METHODOLOGY

3.1. Study area

This study was conducted at University Teaching Hospital of Kigali (UTHK) which is one of the biggest hospitals in Kigali. It is a referral hospital with specialized services, a hospital where remote hospitals send complex cases for specialized care. The hospital counts many departments, to mention some; it has the department of Gynaecology/ obstetrics, paediatrics, surgery, emergency and others. The focus was in emergency and radiology departments.

3.2. Study design

With the aim of identifying factors associated to extended waiting time to the hospital, a mixed method (quantitative and qualitative) was used in data collection on the flow of information from entry point to the time of exit in radiology and emergency units.

3.3. Study population

The target population in this study was made of patients from radiology and emergency department at University Teaching Hospital of Kigali (UTHK) and staff from all necessary unit connected to emergencies and radiology department (medical imaging radiographers, emergency nurses and ICT staff).

3.3.1. Sample size and sampling strategies

To estimate the sample size, the waiting time in radiology and emergency departments is used as outcome measurements. But, by the time being there is no local study that reported the waiting time in any of the aforementioned departments at UTHK. In the region, one study done in Uganda (Mulago Hospital), reported that 39.5% of patients complained that they have been waiting longer than four hours (Nabbuye et al., 2011). Therefore, basing on the literature available in the region, we were hypothesizing that 39% to be the proportion of patient who waited for long time. And basing on the formula by (Rosner, 2011) the sample size is estimated as the follow:

$$n = \frac{(z_{1-\alpha/2})^2 p(1-p)}{d^2}$$

Where n stands for sample size, $z_{1-\alpha/2}$ stands for z score at 95%,

p Stands for the proportion of the patients who will wait for more than 3 hours

and d^2 stands for marginal error.

$$n = \frac{(1.96)^2 \cdot 39(0.61)}{0.05^2} = 365$$

3.3.2. Inclusion criteria

In this study inclusion criteria was based on three categories of participants: patients, medical staff and Electronic Medical Records system administrators. On the patient's side, the ones from 13 years onwards, who came to UTHK for looking for healthcare services in Emergency and radiology department, were concerned by our study. They would participate voluntarily at the study and sign consent form. On the other side, we were included electronic medical records system administrators and medical staff who completed probation period and signed consent form.

3.3.3. Exclusion criteria

We excluded Patients who were identified by the reception nurse as too ill. Children below 13 years old were excluded also because they are handled in the children /pediatric section and this section has a different arrangement compared to adults section. They were excluded also the patients who were refused to sign consent form. Staff members who have not attained a six months' experience were considered to be in the probation period and were excluded in the study. Besides, staff members who refused to sign consent form were excluded.

3.3.4. Sampling Procedure

In this study, three samples were needed; the first sample of interest was made of patients who visited both aforementioned departments for health care services. Another sample was came from medical staff (doctors, nurse) working in those departments and who record patients information in EMR. The third is the IT system administrators. According to the reports, 50 to 100 patients are enrolled in the department at daily basis. So, we were surveyed the first 40 patient's respondents each day until we get a total sample size. And in this study we involved 1 research assistant who helped us to collect data on patient data flow between hospital services and waiting time to identify the possible cause and bottleneck contributing to the extended

waiting time. The sampling strategies for medical staff were based on none probability (purposive) sampling and the same was applied for IT system administrators.

3.4. Study variables

3.4.1. Measures (description of the main variables)

First of all, the questions were probed on socio-demographics variables (age, sex, place of residence, entry time, consultation time, exit time and outcome which were determine the time a patient spent to get health care services) and relation between patients' data flow and waiting a long time to get treatment. Secondly, there were questions on bottlenecks in information flow that could contribute to health care delivery delay and plausible strategies to overcome them if any.

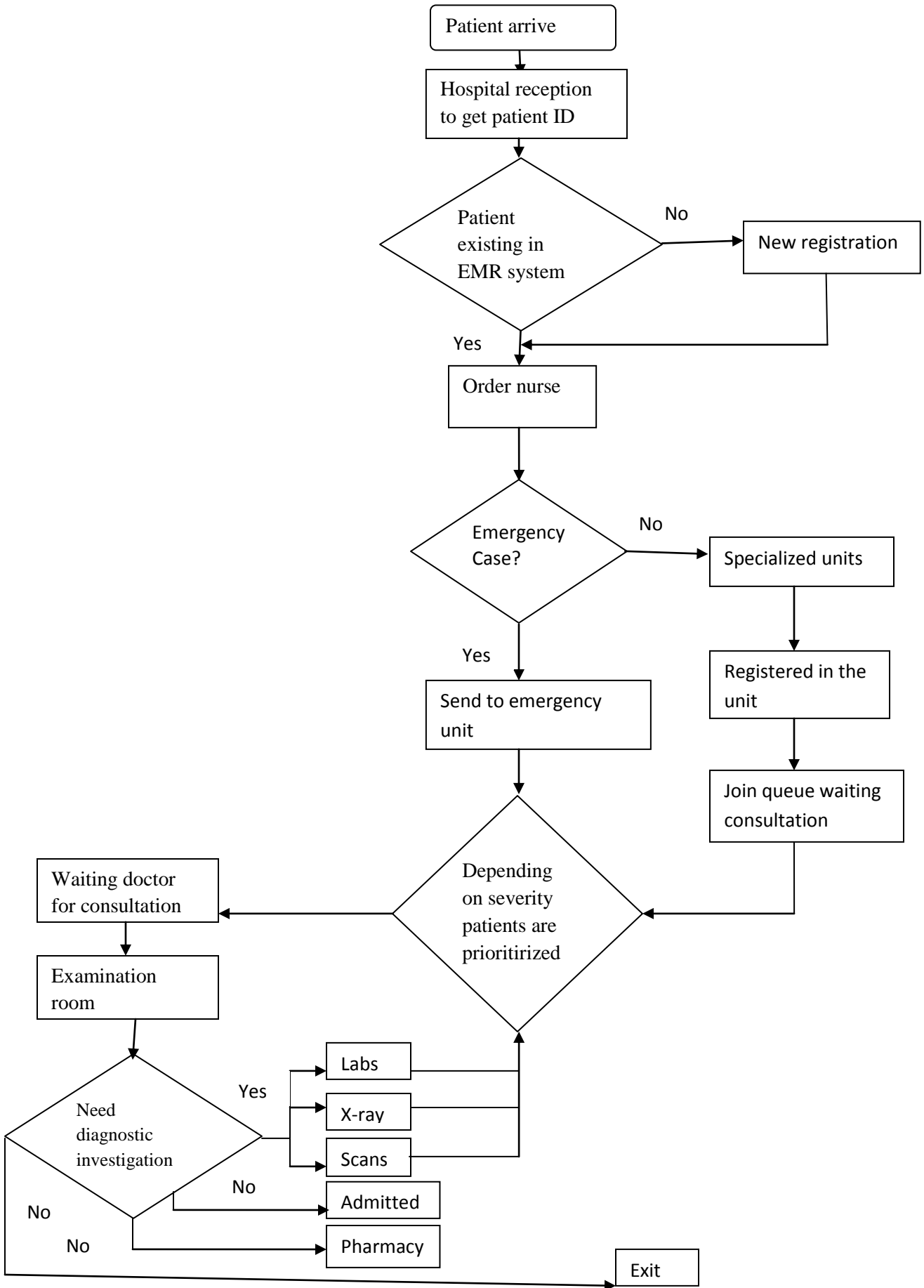
3.4.2. Explanatory variables

Information flow: this variable was assessed by a checklist on system interoperability between units. Interoperability is illustrated on the diagram 2. Other explanatory variables are socio-demographics information.

3.4.3. Outcome variable

In this study the outcome variable is the mean waiting time. It was computed by summing up the total time spent in different units until the health care service is delivered.

Figure 3: General Hospital patient information flow



3.5. Data Collection Tool development

Data were collected via the interviewer administered structured questionnaire. The questionnaire were written in English and Kinyarwanda since all respondents were not literate. to collect data on information flow as a factor of a long waiting time, the researcher used a guided structured interview to patients and to the staff to capture their views about patient's information flow and the cause of delay in health service. a question about bottlenecks as also asked to patients participated in the research. To collect information on ICT tools used to interconnect departments and speed up flow of information, the researcher was observed the technical capability necessary to linkup the units and make easy the flow of patients' information across different units that need to use them timely.

- **Data collection procedure**

As our study is concerned with the patients come to the emergency and X-rays, meaning sick patients, to manage well the issue of patients' health without disrupting, we were pay a attention on inclusion and exclusion criteria. Briefly, all the patients noted by the nurse participant to be too ill like the ones who were in coma or other possible cases highlighted by the same nurse participant were excluded from the study. As the investigation was not done in one day, the research team were organized themselves to reach to those patients without disrupting them depending on their current status. The data collection was done in normal working days from 8:00AM - 5:00 PM.

3.6. Potential risks and benefits

There are no known risks associated with participating in this research. The information provided by the respondents helped to identify the bottlenecks in patients' data flow that contribute to health care delivery delay; there was therefore a plan of plausible strategies accordingly.

3.7. Cost and compensation

There was no expected cost to people participated in this study and no financial compensation wi provided to them. Participation was voluntary.

3.8. Confidentiality

Information that participants provided in this investigation was stored in computer and accessed only by the researcher. The name of respondents has never appeared in this report only codes are used for the purpose of reporting the results from the research. All information are kept confidential.

3.9. Analysis

In this research, the quantitative method of data analysis was used because the questionnaires used as instruments of data collection that could easily provide necessary information in numbers. After collecting data, computer software (SPSS) designed for data analysis was used. To have this done, data were first entered in excel worksheet which could directly save them and organize them in a good manner. Then, they were exported in SPSS version 20 where they were analyzed. Data summary on socio-demographics characteristics were presented with frequency tables and percentages. To identify independent predictors a multiple logistic regression model was computed.

3.10. Ethical Consideration

The study protocol was submitted to the University of Rwanda, College of Medicine and Health Sciences Institution Review Board (IRB) for review and ethical clearance approval. Then after a permission to collect the data was provided to the researcher from the University Teaching Hospital of Kigali (UTHK) research committee after reviewing the proposal;

Conclusion

The methodological guidelines have been widely discussed in the previous chapter. The next step is to present results analysis of the data collected from the field. The results of research conducted on the field are presented in the next chapter.

CHAPTER IV: RESULTS

Introduction

This chapter presents results on patient's dataflow as a factor of long waiting time at University Teaching Hospital of Kigali (UTHK). The present chapter categorizes, interprets and analyses the data that was gathered using the questionnaire. As we mentioned before, the study was carried out in University Teaching Hospital of Kigali (UTHK) which is one of the biggest hospitals in Rwanda. It was chosen as an area of study because it is a referral hospital with specialized services, a hospital where remote hospitals send complex cases for specialized care. The sample size used in the analysis was 365 patients from radiology and emergency departments, 15 medical staff and 3 electronic medical records system administrators (ICT staff).

4.1. Identification of the respondents

4.1.1. Social demographic characteristics of the patients

Characteristics of patient's respondents include five variables namely: sex, age, residence, entry time, consultation time and exit time. As indicated in the previous table 1, the total number of patients' respondents was 365. They were followed passing through reception or their waiting benches. 47% were males whereas 52% were females. 76% went to radiology whereas 24% percent went to emergency department. 8% were young adults aged between 16-20, 17% percentage were adults aged between 21-25, 26% patients were aged between 26-30, 37% were aged between 31-39 whereas 9% of patients were aged 50 and above. 58% of patients respondents were from out of the city of Kigali whereas 41% were from provincial districts. On one hand, 69% of patients arrived before 8:00 a.m, but only 17% patients were consulted by 9:00 a.m whereas 52% left were consulted after 9:00 a.m. On the other hand, 30% patients arrived after 8:00 a.m, but only 16% patients were consulted in one hour later whereas 13% left were consulted after one hour. From the total number of 365 patients surveyed, 11% went back to their respective families between 10:00-12:00 a.m, 36% joined back their families between 12:00-5:00 p.m whereas 52% patients were not yet served by 5:00 p.m.

Table 1: Distribution of the patients by social demographic characteristics

Patient characteristics	Frequency	Percentage (%)
Respondent's sex		
Male	175	47.94
Female	190	52.06
Age		
16-20	32	8.76
21-25	63	17.26
26-30	98	26.85
31-39	138	37.81
50 and above	34	9.32
Current place of residence		
Outside Kigali	212	58.08
Within Kigali	153	41.92
Entry time: part I		
Before 8:00	254	69.58
Consultation time		
Before 9:00	64	17.54
After 9:00	190	52.05
Entry time: part II		
After 8:00	111	30.42
Consultation time		
Within one hour	61	16.72
After one hour	50	13.69

Exit time		
10:00-12:00 a.m	42	11.51
12:00-5:00 p.m	132	36.16
After 5:00 p.m	191	52.33

Moreover, 15 medical staff members were surveyed: these were composed by 8 males and 7 females. 4 among them are A1 holders and 11 are A0 holders. Emergency nurses are 8 whereas radiologists are 7. Regarding experience, 9 staff medical members have experience between 1-5 years, 3 medical staff members have experience between 6-10 years. Other 3 staff members have experience from 11 years and above. Finally, 3 male Electronic Medical Records system administrators were surveyed. One of them holds masters degree in Health Informatics whereas two others left hold bachelor's degree in computer science.

4.1.2. Data from the questionnaire addressed to the patients

- **Purpose of this visit**

Answers for this question varied: 25 percent of the patients revealed that they came for review, 58 percent of the patient noted to be referred whereas 16 percent noted for walk-in in hospital.

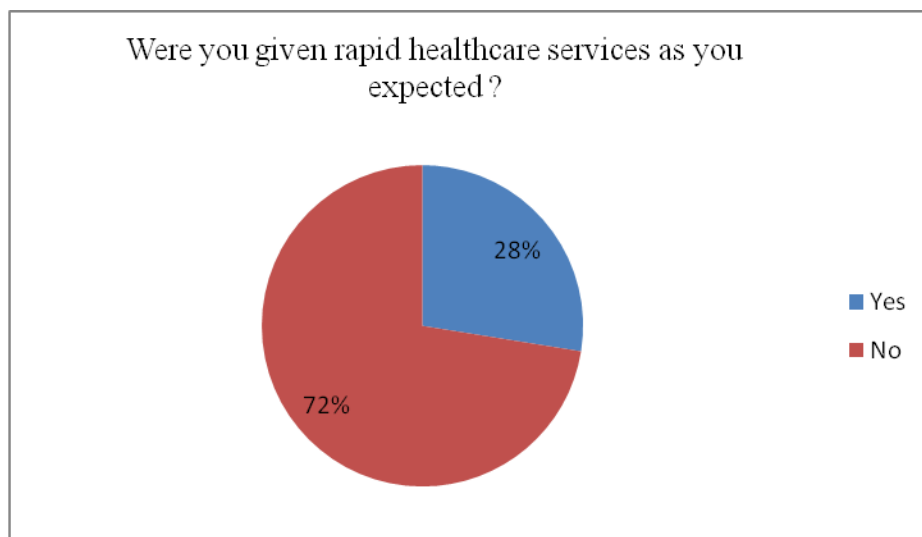
Table 2: Purpose of this visit

Purpose of this visit	Frequency	Percentage (%)
Review	93	25.47 %
Referred	214	58.64 %
Walk-in	58	15.89%

- **Healthcare services process and reason of delay**

Regarding healthcare services process and reason of delay, 27.54 percent of the patients said that they received rapid healthcare services whereas 72.46 percent said that they did not. When asked the root cause of delay in treatment process, patients who did not receive rapid healthcare services noted that the reasons are several and various: delay in treatment process, few healthcare providers, Staff failing to respond in time, a long queue, poor communication, favouritism etc.

Figure 4: Healthcare services delivered and reason of delay



- **Average waiting time for seeing the physician and receiving the treatment**

In the present study, a significant gap was discovered in the subjective waiting time for seeing the physician and receiving the treatment. 108 patients (29.71%) reported total waiting time was around 1 hour, 101 patients (27.54%) spent 2 to 3 hours in their visit while the majority of them (42.75%) waited more than three hours in the hospital as presented in Table 2.

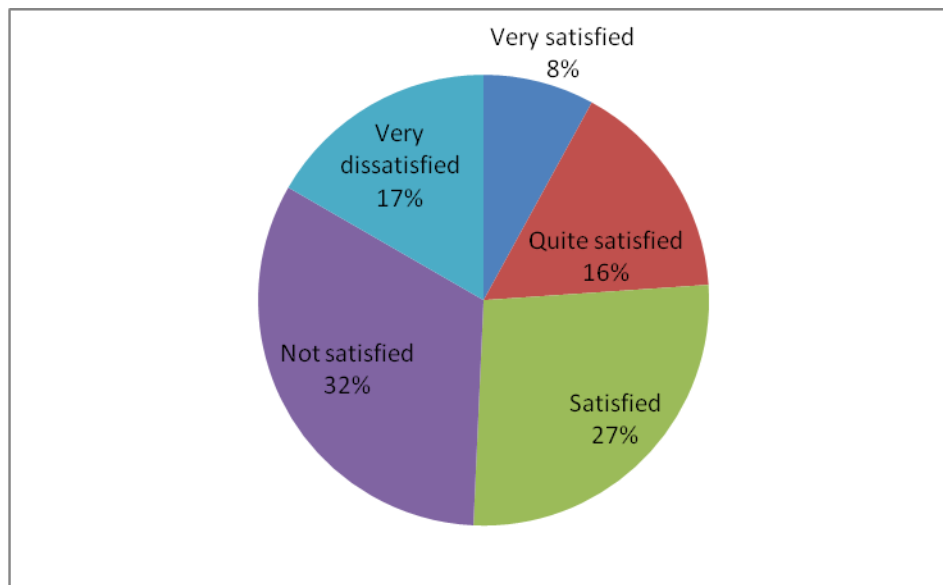
Table 3: Total waiting time patients spent in Hospital

Total time spent to see a physician	Frequency	Percentage (%)
One hour	108	29.59
2 to 3 hours	101	27.68
More than three hours	156	42.73

Source: our research, June 2016

- **Patients' satisfaction with waiting time and delivered services**

The present questionnaire revealed the level of satisfaction of the patients vis-à-vis waiting time and delivered services. Only 29 patients were very satisfied (7.94%), 58 patients (15.89%) were quite satisfied, 98 patients (26.84%) were satisfied, and the most of the patients (32.62%) or 119 patients were not satisfied at all while 61 patients (16.71%) were very dissatisfied.

Figure 5: Patients' satisfaction with waiting time and delivered services

- **Patients' recommendations vis-à-vis improvement of health care services delivery**

Patients gave different suggestions for the purpose of improving health care services delivery in University Teaching Hospital of Kigali (UTHK). These include: improving the way consultation

is done, delivering quick services especially to provide examination results on time, improving customer care, increasing the number of medical staff, controlling well phone calls and chats during work etc.

4.1.3. Data from the questionnaire addressed to the medical staff members

All medical staff members (100%) noted that they receive a big number of patients compared to existing medical staff. 80% of them reminded that they use Electronic Medical Record System when managing patients' data. However, all of them (100%) stated that their daily work situation doesn't facilitate them to provide rapid services to patients. So, few healthcare providers and a big number of patients were discovered as the main root causes of this problem of poor healthcare services. To overcome this challenge, the following strategies were proposed by medical staff members. These include: increasing medical staff members, remuneration, materials and providing drugs on time by CAMERWA. Finally, we remind ourselves that the use of existing Electronic Medical Record System is still low because 84.62 % of medical staff members are not familiar with it. Despite this, most of key informants (57.14%) noted that the use of electronic medical record system is good among medical staff members.

4.1.4. Data from the questionnaire addressed to electronic medical records system administrators

It was revealed by 3 key informants that existing Electronic Medical Record System currently used in University Teaching Hospital of Kigali is called "Open Clinic" and is shared in all hospital units. However, only medical staff members between 25- 50 % uses existing Electronic Medical Record System. This showed that 66.67% of medical staff don't use the EMR which is also increase prolonged waiting of patients in different services. The EMR itself doesn't have problem only unnecessary updates which disturb the users. Three Challenges is discovered in existing Electronic Medical Record System usage: the low level of medical doctors/nurses to use the EMR and lack of EMR technical/ maintenance supporter when needed and frequently cut-off Local Area Network. As noted by 3 key informants, regular trainings are required to regulate such problems in the near future.

4.2. Discussion of results

4.2.1. Challenges in healthcare process due to patients' data flow

As we know the government of Rwanda has made more effort to make health care services more accessed, however our study showed that there are still problems whereby patients experience a long time to get healthcare services. Some of them insisted on bad healthcare services they were given and this was confirmed by 72.46 percent of the whole population. They added that they did not receive rapid healthcare services. As waiting time increased, they became more unhappy and hopeless. This impacted on their level of satisfaction whereby the most of the patients (32.60%) or 119 patients were not satisfied at all while 60 patients (16.43%) were very dissatisfied. Here, we can remind ourselves that the majority of the patients (42.73) waited for more than three hours and this is alarming situation which requires immediate actions for saving the lives of the clients who join University Teaching Hospital of Kigali (UTHK).

Taking account of the foregoing, 101 patients (27.68%) revealed that they spent 2 to 3 hours in their visit and this time is far from a normal period of one hour of waiting services as recommended by Uganda Ministry of Health., 2004 (HEALTH OF HEALTH, 2004). So, we can compare the results of our study with results from satisfaction survey study carried out in the general outpatient department of Mulago hospital which found that the waiting time for majority of the patients (39.5%) was at waiting more than 4 hours (Nabbuye et al., 2011)

4.2.2. Bottlenecks in patients' information flow

We can define a bottleneck as a delay in one stage of a process that makes the whole process take longer. So, there are different places where the patients spend more times than other places. In department of emergency, 365 patients are unanimous that pharmacy and cashier are two places where patients spend unexpected time. For department of radiology, two places were also pointed out: consultation and cashier. On this point, we wanted to know from the patients what they think are the main root causes of spending a lot of time in the mentioned placed and different reasons were highlighted: demeaning the patients, poor customer care, only one X-ray machine is functional, staff being occupied with other businesses less minding about the job.

Medical staff members agree with the patients on waiting a long time to receive treatment. So, they gave their own root causes such as a big number of patients compared to existing medical staff (this was confirmed by 100% of medical staff members surveyed), few healthcare providers, insufficient materials and insufficient drugs from the suppliers. Electronic medical records system administrators confirm also that there few healthcare providers who are not stable to work for Hospital. The majority of physicians are candidate specialists who rarely use electronic medical record hence health care services don't reach the patients as soon as possible. Electronic medical records system administrators added that Hospital uses many systems of information record such as open clinic, HMIS, Canreg. These report the same patient information and cause delay in healthcare process. Researches similar to ours have found that the main causes for waiting a long time are due to operational inefficiencies in the process of service delivery (Wanyenze et al., 2010), (Nabbuye et al, 2011), staff shortage and a high patient load (Tacher, 2005)

4.2.3. Plausible strategies for existing bottlenecks in patients' information flow

Quantity of hours that patients wait to be received by physicians is one factor which can make hospitals and health centres loose trust from their clients. This long waiting can be interpreted by the patients or other clients waiting for service as obstacles which could stop them from obtaining services they deserve. This long waiting can impact on other programmes that the patients had in mind hence different things can be paralyzed at the same time due to waiting unexpected time. Long waiting can be therefore a source stress for both patients and physician who is supposed to provide healthcare services. So, different measures are to be taken and implemented to deal with the raised issue. As suggested by the patients, the way consultation is done today should be improved by reducing the time the patients spend on waiting benches. It was remarked that healthcare services are very slow, so there should be quick services especially to provide examination results on time and improvement of customer care in order to direct well the patients to appropriate services rather than letting them struggle themselves to look for the places where different departments are located. Increasing the number of medical staff and controlling well phone calls and chats during work are other solutions generated by the patients. On the side of medical staff members, different measures should be quickly taken. These include: increasing staff members, salaries and remunerations, materials and provision of drugs

on time by CAMERWA. Regular trainings are needed on the side of electronic medical records system administrators to deal with unnecessary update which disturbs the normal functioning of the system and other technical problems.

Conclusion

The last chapter (chapter four) focused on data presentation and interpretation of the study results. It was remarked that the majority of the patients (42.73) waited more than three hours in University Teaching Hospital of Kigali (UTHK) to get healthcare services. As noted by the patients, some of the root causes are delay in treatment process, few healthcare providers, poor communication and favoritism. On the side of medical staff members, they noted that few healthcare providers and a big number of patients are the main root causes of this problem of waiting a long time for healthcare services. To overcome this challenge, the following strategies were proposed by the participants: improve the way consultation and customer care is done, build capacity of district hospitals, increasing the number of medical staff, etc.

GENERAL CONCLUSION AND RECOMMENDATION

By way of conclusion, it behoves us to look back on the achievements of this work from its objectives and results. The primary aim of this work was to analyze patient's dataflow in hospital as a factor of long waiting time by studying at the same time the system interoperability and interconnection between hospital services where patients pass throughout from entry to exit. This study has shown that majority of the patients wait a long time to get healthcare services they need. 101 patients (27.68%) revealed that they spend 2 to 3 hours to get services they wanted whereas (42.73) waited more than three hours. This long waiting lead the patient to be unhappy and hopeless hence their level of satisfaction becomes nil.

Different places where the patients spend more times than other places have been highlighted. In department of emergency, pharmacy and cashier are noted. For department of radiology, two places also were pointed out: consultation and cashier. Different reasons were developed for this long waiting. These include demeaning the patients, poor customer care; physicians are busy with other businesses and do not care about the job. Others are a big number of patients compared to existing medical staff, insufficient materials and the use of many systems of information record that report the same patient information. Among those factors, the 3 main real significant factors of long waiting has been found: Slow treatment process, Staff timely response, Long queue.

To face the issue mentioned above, different solutions were suggested: improve the way consultation is done today, providing quick services especially to provide examination results on time, improvement of customer care in order to direct well the patients to appropriate services rather than letting them struggle themselves to look for the places where different departments are located. Build capacity of district hospitals: it was observed that many patients come to attend at University Teaching Hospital of Kigali while their illnesses can be cured on district hospital level. Increasing the number of medical staff and controlling well phone calls and chats during work are other proposed solutions. Other plausible solutions are the following: increasing salary, materials and providing drugs on time. Planning regular trainings on the use of electronic medical records system for medical staff members may be also helpful.

Recommendations

At the end of this study, it is very crucial to provide recommendations whose implementation would contribute to solve the problem of long waiting time at University Teaching Hospital of Kigali (UTHK) and deal with bottlenecks which motivate to the prolonged waiting.

During conducting this research, there were complaints from physicians about few health workers compared to the big number of the patients, insufficient salary, few materials and drugs in Hospital. So, Ministry of Health should take into considerations the mentioned issues because they lead to poor health care services and long waiting. It was also remarked that a big queue of patients is increased by a certain number of patients whose diseases would be treated at District Hospitals level so coming to referral Hospital (UTHK) was seen like increasing a number of patients and long waiting. For this reason, there would be capacity building of District hospitals for the purpose of raising their confidence and after these District hospitals will deal effectively with different cases referred to University Teaching Hospital of Kigali (UTHK) for no clear reasons.

In the present research, we have realized that the majority of physicians rarely use electronic medical record hence health care services don't reach the patients as soon as possible. So, there would be a massive sensitization on the benefits of using electronic medical record and make sure this is expanded in all department of University Teaching Hospital of Kigali (UTHK). This is because electronic medical record improves diagnosis and treatment. It was shown that it reduces significantly errors within personal health records. It also makes fast healthcare and decision making responses from assigned medical professionals.

Recommendation for further study

The recommendation for further research is first of all to do analysis on measurement of approximate time in each step of healthcare services. Secondly, working on analysis of patients' information flow using computer simulation model and providing new data flow approach. Then, the results from that study can primary satisfy the patient's vis-à-vis healthcare process and secondly help physicians to communicate to the patient approximate time he/she will spend to get required services.

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APPENDIX I: CONSENT FORM

a. Explanation

Dear Respondent,

My name is UWERA Thaoussi , I am a student pursuing a Masters degree in Health Informatics at University of Rwanda, College of Medicine and Health Sciences, school of public health . I am conducting a study entitled “*Analysis of Patient Information Flow in Hospitals as a Factor of a Long Waiting Time: Case of Kigali University Teaching Hospital*” I need your support by helping me to answer this questionnaire. The information given shall be used purely for an academic purpose with a high degree of confidentiality. Feel free therefore to give your views and opinions on this subject of research.

b. Risks and benefits

There are no known risks associated with participating in this research. The information provided by the respondents will help to identify the bottlenecks in patients’ data flow that contribute to health care delivery delay; there will be therefore a plan of plausible strategies accordingly.

c. Cost and compensation

There is no expected cost to people participating in this study and no financial compensation will be provided.

d. Right to participate or withdraw

Participation in this study is voluntary, you have right to participate or not. If you choose not to be part of this study no consequences for that. If you agree to participate in this study, you will be requested to sign the consent form to confirm your participation.

e. Confidentiality

Information that participants will provide in this investigation will be stored in computer and accessible only by the researcher. The name of respondents will never be appeared in any report

only codes will be used for the purpose of reporting or publication. All information will be kept confidential.

-Any questions don't hesitate to contact Mrs UWERA Thaoussi email: tuwera@ur.ac.rw, telephone: 0788229321

f. Consent

I confirm that the purpose of this study and my role have been well explained to me by Mrs UWERA Thaoussi. I agree to the conditions explained and give consent to be included.

Signature / Umukono.....

Date / Itariki.....

Thank you / Murakoze.

INYANDIKO YO KWEMERA KUGIRA URUHARE MU BUSHAKASHATSI

I. INTANGIRIRO

Nitwa UWERA Thaoussi , ndi umuneyshuli muri Kaminuza y'u Rwanda,Mu shuli ry'ubuvuzi n'ubumenyi mu by'ubuzima, niga mu cyiciro cya gatatu mu bijyanye n'ikorabuhanga mu by'ubuzima. Ndimu gukora ubushakashatsi bufite umutwe ugira uti *“Isesengura ry'inzira z'amakuru y'umurwayi mu Bitaro nk'imwe mu mpamvu zitera umurwayi gutegereza umwanya munini kwa Muganga ,mu Bitaro bya kaminuza by'I Kigali”*nkaba nkeneye ubufasha bwanyu,kandi amakuru muzatanga azaguma kuba ibanga

II.

INGARUKA NDETSE N'INYUNGU

Nta ngaruka zituruka kukuba wagize uruhare muri ubu bushakashatsi .Ikindi ni uko ibizava muri ubu bushakashatsi byazafasha mu gutuma serivise kwa muganga zitangwa neza kurushaho

III. IGIHEMBO

Kugira uruhare muri ubu bushakatsi nta gihembo kizahabwa uwagize uruhare muri ubu bushakashatsi ,kandi nta n'ikiguzi kizasabwa uwo ariwe wese uzabugiramo uruhare.

IV. UBURENGANZIRA BWO KUGIRA URUHARE CYANGWA KWIKURA MURI UBU BUSHAKASHATSI

Kugira uruhare muri ubu bushakashatsi ni ubushake ,uramenyeshwako ufite uburenganzira bwo kugira uruhare muribwo ndetse no kuba wabwivanamo igihe cyose waba ubishatse ,kandi bikaba nta ngaruka iyo ariyo yose byakugiraho .

V. IBANGA RY'AMAKURU

Amakuru yose uzatanga azaguma ari ibanga ,akazakoreshwa gusa ku bushakashatsi kandi nta zina ry'uwabgizemo uruhare rizigera rishyirwa ahagaragara

VI. KWEMERA KUGIRA URUHARE

Uwemeye kugira uruhare muri ubu bushakashatsi ,abigaragaza ashya umukono kuri iyi nyandiko ,Niyo mpamvu Njyewe (Ntazina ushyiraho) maze gusobanukirwa n'ibijyanye n'ubu bushakashatsi ,nta gahato nemeye kugira uruhare rwange ntanga amakuru akenewe .

Umukono

**APPENDIX II: QUESTIONNAIRE FOR THE PATIENTS/ IBIBAZO
BY'UBUSHAKASHATSI KUBARWAYI**

SECTION I: Social-demographics characteristics

IGIKA 1: Amakuru ajyanye nimyirondoro

1. Date: /Itariki://
2. Sex/ Igitsina : Male /Gabo Female/ Gore
3. Age/ Imyaka yusubiza
4. Current place of residence / Aho utuye
District / Akarere :
Sector/ Umurenge
Cell / Akagali... ..
Village/ Umudugudu
5. Entry time / isaha wahagereye
6. Consultation time / isaha waboneye muganga
7. Exit/ igihe wahaviriye

SECTION II : Questions

IGIKA CYA 2: Ibibazo / Turabasaba gusubiza ibibazo byose . Murakoze

1. What is the purpose of this visit? / Niyihe mpamvu mwaje kwivuza ? (Hitamo igisubizo kimwe)
 Review/ Nagarutse kongera kwivuza
 Referred\Noherejwe niringi vurira kwivuza hano
 Walk-in/ Naje kwisuzumisha bwa mbere
2. Were you given rapid healthcare services as you thought? /Ese servisi mwahawe yihuse nkuko mwabitekerezaga?
Yes/ Yego No/ Oya
- 3.If 'No', what do you think is the main reason? / Niba igisubizo cyo hejuru ari "Oya" niyihe mpamvu ubona yaba yatumye serisi wahawe itihuta?
 Delay in treatment process / Inzira bicamo ngo wivuze iratinda

- Few healthcare providers / abaganga nibake
- Staff failed to respond in time / Abaganga ntibatanga ubufasha ku gihe
- There was a long queue / Hari umurongo munini wabarwayi bategereje
- Poor communication / ihanahana makuru ritagendaneza
- Others. Specify / niba hari ikindi kivuge

.....,,

2. How long did it take you to get services you wanted? (select one) / Hashize igihe kingana iki kugirango uhabwe servisi wifuzaga? (hitamo igisubizo kimwe)

- During one hour / isaha imwe
- Between two and three hours / hagati yisaha imwe n'abiri
- Above three hours / hejuru y'amasaha atatu

3. How satisfied are you with the way services were delivered to you? (select one)/Nikurugero rungana iki wanyuzwe na servisi wahawe ?(hitamo igisubizo kimwe)

- Very satisfied / Nanyuzwe cyane
- Quite satisfied / Nanyuzwe murugero
- Satisfied / Nanyuzwe
- Not satisfied / ntabwo nanyuzwe
- Very dissatisfied / sinishimiye uburyo nahawe servisi

6. What would you recommend vis-à-vis services you were given? / Niyihe nama watanga ukurikije uburyo wahawe servisi?

.....

.....

.....

Murakoze.

**APPENDIX III: QUESTIONNAIRE FOR MEDICAL STAFF/ IBIBAZO
BY'UBUSHAKASHATSI KUBAGANGA**

SECTION I: Social-demographics characteristics

IGIKA 1: Amakuru ajyanye nimirondoro

1. Date / Itariki://

2. Sex // Igitsina : Male /Gabo Female/ Gore

3. Qualification /Amashuri wize:

4. Occupation / akazi ukora:

5. Experience / Imyaka umuze mukazi :

SECTION II: Questions

IGIKA 2: Ibibazo

We would like ask you to answer all questions. Thank you / Turabasaba gusubiza ibibazo byose . Murakoze

1. Based on your experience, do you receive a big number of patients compared to existing medical staff? / Ugendeye kuburambe ufite mukazi , ubona mwakira umubare munini wabarwayi ugereraniye nabaganga bahari?

Yes / Yego No / Oya

3. Do you use Electronic Medical Record System when managing patients' data? / Mukoresha ikoranabuhanga mukubika no guhererekanya amakuru yabarwayi?

Yes /Yego No / Oya

4. Does your daily work situation facilitate you to provide rapid services to patients? /ubona uburyo ukoreramo bukorohereza gufasha abarwayi nkuko bikwiriye?

Yes /Yego No / Oya

5. If 'No', what is the main root cause of this problem? (select one) /Niba igisubizo cyo hejuru ari "Oya" niyihe mpamvu ubona yaba ibitera?

- Existing electronic medical record system is not effectively shared in all services /Ikoranabuhanga ntabwo rigera muri servisi zose
- Few healthcare providers / Abaganga nibake
- Staff fails to respond in time / Abaganga ntibatanga ubufasha ku gihe
- There is a big number of patients / Umubare munini wabarwayi baza kwivuza
- Poor communication / Ihanahana makuru ritagendaneza
- Others. Specify / Niba hari ikindi kivuge

.....

6. What can be done to provide as soon as possible healthcare services to the patients joining your department? / Muri servisi ukoramo ubona hakorwa iki kugirango servisi zihabwa abarwayi zihute?

.....
.....

7. Is there anything further that you feel is important?" / Hari ikindi kintu kingenzi twibagiwe wavuga?

.....
.....
.....

Murakoze.

**APPENDIX IV: QUESTIONNAIRE FOR IT SYSTEM ADMINISTRATORS / IBIBAZO
BY'UBUSHAKASHATSI KU BAKOZI BASHINZWE IKORANABUHANGA**

SECTION I: Social-demographics characteristics

IGIKA 1: Amakuru ajyanye nimyirondoro

1. Date / Itariki://

2. Sex / Igitsina : Male /Gabo Female/ Gore

3. Qualification /Amashuri wize:

4. Occupation / akazi ukora:

5. Experience / Imyaka umuze mukazi :

SECTION II: Questions

IGIKA 2: Ibibazo

We would like ask you to answer all questions. Thank you / Turabasaba gusubiza ibibazo byose . Murakoze

1. Is existing Electronic Medical Record System shared in all hospital services? /Ese ikoranabuhanga mukoresha muguhanahana amakuru yabarwayi rigera muri servisi zose zibitaro?

Yes / Yego

No /Oya

2. How could you rate the use of existing Electronic Medical Record System by medical doctors? / Ugereranije abaganga bitabira gukoresha iryo koranabuhanga kurugero rungana iki?

Less than 25 % / Minsi ya 25 kwijana

25- 50 % / Hagati ya 25 na 50 kwijana

50- 75 % / Hagati ya 50 na 75 kwijana

Above 75% / Hejuru ya 75 kwijana

3. Have you ever discovered any challenges within this existing Electronic Medical Record System? / Hari ibbibazo cyangwa imbogamizi mwabonye iri koranabuhanga mukoresha rifite?

Yes / Yego

No / Oya

4. If ‘Yes’ / Niba igisubizo cyo hejuru ari”Yego”

(a) What are they? / Vuga ibyo bibazo cyangwa imbogamizi

.....
.....
.....

(b)What should be done to overcome these challenge / Ubona hakorwa iki kugirango ibyobibazo biri mwikorabuhanga bikemuke?

.....
.....
.....

5. Do you have any further comments on patients’ information flow? / Hari ikindi wavuga kubijyanye nuburyo amakuru y’abarwayi ahererkanwa muri servisi zibitaro?

.....
.....
.....

Murakoze.



College of Medicine and Health Sciences
School of Public Health

OFFICE OF THE

RECOMMENDATION

This is to testify that **Mrs Thaoussi UWERA** with registration number **216336104** is a last year student in Master's of Science in Health Informatics at the University of Rwanda, College of Medicine and Health Sciences, school of Public Health, during the academic year 2015- 2016. The student is doing research for final thesis titled: "Analysis of Patient Information Flow in Hospitals as a Factor of a Long Waiting Time : Case of Kigali University Teaching Hospital ".

Any assistance rendered to him/her is highly appreciated

Yours sincerely,

Done at Kigali, on 30th March, 2016.

Pro De Umubyeyi
Acting Dean



Prof. Manasse NZAYIRAMBAHO

Acting Dean

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 5/May/2016

UWERA Thaoussi
School of Public Health, CMHS, UR

Approval Notice: No 191 /CMHS IRB/2016

Your Project title *“Analysis of Patient Information Flow in Hospitals as a Factor of a Long Waiting Time: Case of Kigali University Teaching Hospital”* has been evaluated by CMHS Institutional Review Board.

Name of Members	Institute	Involved in the decision		
		Yes	No (Reason)	
			Absent	Withdrawn from the proceeding
Prof Kato J. Njunwa	UR-CMHS	X		
Prof Jean Bosco Gahutu	UR-CMHS		X	
Dr Brenda Asimwe-Kateera	UR-CMHS	X		
Prof Ntaganira Joseph	UR-CMHS		X	
Dr Tumusiime K. David	UR-CMHS	X		
Dr Kayonga N. Egide	UR-CMHS		X	
Mr Kanyoni Maurice	UR-CMHS	X		
Prof Munyanshongore Cyprien	UR-CMHS	X		
Mrs Ruzindana Landrine	Kicukiro district		X	
Dr Gishoma Darius	UR-CMHS	X		
Dr Donatilla Mukamana	UR-CMHS		X	
Prof Kyamanywa Patrick	UR-CMHS		X	
Prof Condo Umutesi Jeannine	UR-CMHS		X	
Dr Nyirazinyoye Laetitia	UR-CMHS		X	
Dr Nkeramihigo Emmanuel	UR-CMHS		X	
Sr Maliboli Marie Josee	CHUK	X		
Dr Mudenge Charles	Centre Psycho-Social	X		

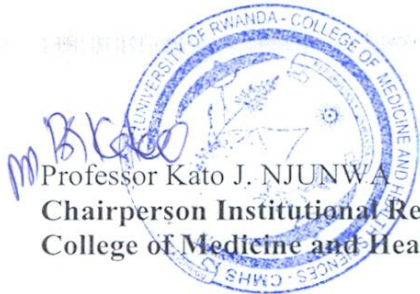
After reviewing your protocol during the IRB meeting of where quorum was met and revisions made on the advice of the CMHS IRB submitted on 5th May 2016, **Approval letter has been granted to your study.**

Please note that approval of the protocol and consent form is valid for **12 months.**

You are responsible for fulfilling the following requirements:

1. Changes, amendments, and addenda to the protocol or consent form must be submitted to the committee for review and approval, prior to activation of the changes.
2. Only approved consent forms are to be used in the enrolment of participants.
3. All consent forms signed by subjects should be retained on file. The IRB may conduct audits of all study records, and consent documentation may be part of such audits.
4. A continuing review application must be submitted to the IRB in a timely fashion and before expiry of this approval
5. Failure to submit a continuing review application will result in termination of the study
6. Notify the IRB committee once the study is finished

Sincerely,



Professor Kato J. NJUNWA
**Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR**

Date of Approval: The 5th May 2016

Expiration date: The 5th May 2017

Cc:

- Principal College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate studies, UR



**CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL**

Ethics Committee / Comité d'éthique

May 23, 2016

Ref.: EC/CHUK/093/2016

Review Approval Notice

Dear Uwera Thaoussi,

Your research project: "Analysis of patient information flow in Hospital as a factor of a long waiting time: Case of Kigali University Teaching Hospital."

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 23/05/2016 to evaluate your protocol of the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your protocol.

You are required to present the results of your study to CHUK Ethics Committee before publication.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

Dr Rulisa Stephen
The President, Ethics Committee
University Teaching Hospital of Kigali



<<University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations>>.

B.P. :655 Kigali- RWANDA www.chk.rw Tél. Fax : 00 (250) 576638 E-mail : chuk.hospital@chukigali.rw



CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

Department of Clinical Research
CHUK

Details of the researcher:

Date 23.5.2016

Name: UWERA

First name: Thaoussi

Occupation: Student

Department/ Institution:

Telephone number:

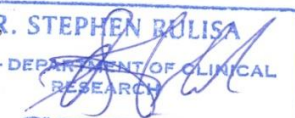
Email:

Data Access Form

Please authorize Mr/Mrs/Dr/Prof. UWERA Thaoussi

conducting a study entitled Analysis of patient information
flow in Hospital as a factor of a long waiting
time: Case of Kigali University Teaching Hospital
 to collect data from Archives

N.B: You are requested to present your results to Research Department after your study.

Faithfully, **DR. STEPHEN RULISA**
 HEAD - DEPARTMENT OF CLINICAL
 RESEARCH

CHUK Dr Stephen Rulisa

Head of Department of Clinical Research