



UNIVERSITY of  
RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF HEALTH SCIENCES

**REDUCING LONG WAITING TIME FOR ROOT  
CANAL TREATMENTS AT THE UNIVERSITY OF  
RWANDA POLYCLINIC**

A dissertation submitted in partial fulfillment of the requirements for award of Master of  
Hospital and Healthcare Administration (MHA)

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**Kigali, September 2019**

**SUPERVISOR’S DECLARATION:**

I hereby declare that this capstone entitled “**Reducing long waiting time appointments for Root Canal Treatments (RCTs) at University of Rwanda Polyclinic**” to the best of my knowledge was carried out, prepared and conducted under my direct supervision in accordance with the degree regulations.

It represents the original work of the candidate and the contribution made to the study by me, by other members of the supervisory team, by other members of staff of the University and by others was consistent with normal supervisory practice and external contributions to the research were acknowledged.

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**CANDIDATE’S DECLARATION**

I hereby declare that this capstone entitled “**Reducing long waiting time appointments for Root Canal Treatments (RCTs) at University of Rwanda Polyclinic**” is my original work and has never been submitted and presented in any University or in any other High Learning Institution. Any contribution made by others is explicitly acknowledged in this study report.

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## **DEDICATION**

I dedicate this capstone to;

My wife Stéphanie KABASINGA

My children;

Audrick M. H. RUGERO,

Audrey Reina M. RUMULI

Odilo M. C. REBERO, and

Audri Lorris M. RUKUNDO

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May God bless all of you abundantly.

## **ABSTRACT**

**Background:** Reducing the patients' appointment waiting times has been a concern for healthcare provision, especially in developed countries. Waiting time is an indicator of health system responsiveness and is used to measure of access to health care and the performance monitoring of healthcare institutions in service delivery. Interventions addressing the patient waiting time are scarce in sub-Saharan Africa including Rwanda.

**Objective:** Conducted at the Dental Clinic of University of Rwanda Polyclinic, this intervention aimed to reduce long appointment waiting times for the Root Canal Treatments from 20 to seven days between July to December 2018.

**Methodology:** A pre- and post- intervention study was conducted from January 2018 to December 2018. The study analyzed the root causes of the long waiting times for patients undergoing the root canal treatments (RCTs). This analysis was followed by an intervention to reduce the waiting times for the RCTs. The intervention consisted of rescheduling the duty roster with introducing evening shifts. Data were extracted from the Open Clinic Software to Microsoft Excel and SPSS for analysis. Descriptive statistics such as mean, standard deviation, median, IQR and frequency polygons helped to summarize data. We assessed the average or median waiting times, the number of patients attending the UR Polyclinic and the number of RCTs cases during both study periods.

**Results:** Generally, the average appointment waiting times for RCTs significantly decreased from 18.32 ( $\pm 14.91$ ) days in pre-intervention period to 5.7 ( $\pm 6.97$ ) days in the post-intervention period ( $t=13.93$ ,  $df=626$ ,  $p<0.001$ ). Furthermore, the monthly median number of patients who attended the UR Polyclinic significantly increased from 1,081.50 (IQR=414) during the pre-intervention to 2,298 (IQR=441) during the post-intervention period ( $p=0.002$ ). Finally, the monthly median number of RCTs cases significantly increased from 42 (IQR=53) (pre-intervention) to 201.5 (IQR=63) for post intervention ( $p=0.002$ ).

**Conclusion:** Rescheduling the Staff duty roster in the Dental Clinic of the UR Polyclinic significantly reduced the waiting appointment times for the patients undergoing the RCTs. This resulted in the increment of the number of patients attending the clinic in general and the number of RCTs cases in particular. Other dental clinics would embrace this intervention to improve the RCTs services accessibility.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

BDS:	Bachelor of Dental Surgeon
BLS:	Biomedical Laboratory Services
BOD:	Board of Directors
BTC:	Belgium Technical Cooperation
CDC:	Centre for Diseases Control and Prevention
CHUK:	Centre Hospitalier Universtaire de Kigali (Kigali University Teaching Hospital)
Df :	Degrees of freedom
CMHSBD:	College of Medicine and Health Sciences Business Development
GP BDS:	General Practitioner Bachelor's in Dental Surgery
HRM:	Human Resource Management
HR:	Human Resource
IQR:	Interquartile Range
KFH:	King Faisal Hospital
KHI:	Kigali Health Institute
KHIBD:	Kigali Health Institute Business Development
MDS:	Master's in Dental Surgery
MIS:	Medical Imaging Services
MT:	Management Team
OECD:	Organization for Economic Co-operation and Development
RCT:	Root Canal Treatment
RMH:	Rwanda Military Hospital
SPSS:	Statistical Package for Social Sciences
T:	t-statistic
UR-CMHS:	University of Rwanda College of Medicine and Health Sciences

## DEFINITION OF KEY TERMS USED IN THE STUDY

<b>Term</b>	<b>Definition</b>
Root canal treatment	Root canal treatment is a series of treatment sequence whereby an infected tooth pulp is treated and decontaminated from future infections. <sup>1</sup> The treatment process consist of removing damaged structures, cleaning, decontamination of the hollows with small files and irrigating solutions, and the filling of the decontaminated canals. <sup>2, 3</sup>
Waiting list	Long waiting time for healthcare has consequences. A waiting list contains the number of patients waiting for a procedure at a healthcare institution. <sup>4</sup> The purpose of the waiting list is to record and monitor patients that need an appointment to a hospital. <sup>5, 6</sup>
Waiting time	Waiting time is the length of time a patient wait for admission, or appointment from the time of their referral. <sup>4, 7</sup> Patient waiting time is the amount of time a patient attends between consultation and treatment. <sup>8</sup> For this study, waiting time refers to the amount of time between two successive appointments for the root canal treatment service at the dental clinic of the UR Polyclinic.
<b>Open Clinic</b>	OpenClinic is a medical software used to capture patients' information through the patients flow: registration, Billing, treatment, and appointment.
<b>Bachelors of Dental Therapist</b>	These are technical dental clinicians who underwent a training program that lasts for four years. They provide the general dental healthcare.

<b>Bachelors of Dental Surgeon</b>	These are dental surgeons that underwent the program of general medicine before furthering their dental trainings. They provide dental services such as RCT, dental prostheses, and others.
<b>Master of Dental Surgeon</b>	These are specialized dental surgeons who provide highly specialized dental treatments such as orthodontics, maxillofacial surgery, dental implants, etc.
<b>Duty roster</b>	This is a schedule which assigned tasks, and shifts (such as the evening shifts) to the BDS and BDT at the UR Polyclinic/dental clinic.

## **CHAPTER ONE: GENERAL INTRODUCTION**

### **1.1 Background of the study**

Globally, waiting time has been a concern for health care providers and health systems managers. Reducing long waiting times for elective procedures constitutes a major health concern in developed countries.<sup>9</sup>

Waiting times are associated with patients' health outcomes and the later may worsen if patients wait for too long.<sup>10</sup> Furthermore, waiting time affects the use of health services, the patients willingness to return to clinics, as well as the continuity of care.<sup>11</sup>

Timeliness of healthcare services remains one of the six main pillars to achieve patients satisfaction and remain competitive for a health system.<sup>8, 11</sup> The literature indicate that prolonged waiting times cause poor patients' satisfaction.<sup>8, 11, 12</sup> Waiting time is regarded as an important factor for healthcare delivery and a valuable tool to assess patient satisfaction.<sup>11</sup>

This study was conducted to reduce long waiting time appointments for Root Canal Treatments (RCTs) at the University of Rwanda College of Medicine and Health Sciences Polyclinic. The RCT is a specialized dental treatment.

#### **1.1.1 Study setting**

The clinic started in 2007 at former Kigali Health Institute (KHI); current UR Nyarugenge Campus located in Nyarugenge District; Kigali City behind SONARWA and Marriot Hotel, on KN 67<sup>ST</sup>. It was a clinical placement setting of dental students and due to the increasing demand of dental health care services, the clinic started to receive patients as any other dental clinic around the country.



In 2011, the KHI noted recommendation of Auditor General Office to have a separate administration for clinical services to the community from teaching wings that is beneficial for patients, students and UR as well.

Thus in October 2011, KHI decided to create a managing company of the clinic, named Kigali Health Institute Business Development Limited (KHIBD Ltd) and report to KHI as its business wing.

In September 2014, the former dental clinical placement got operating license to work as a private Polyclinic, named University of Rwanda, College of Medicine and Health Sciences Polyclinic (UR-CMHS Polyclinic), while the company became University of Rwanda College of Medicine and Health Sciences Business Development Limited (UR-CMHSBD Ltd).

In June 2019; the managing company was upgraded to University level and its name changed to University of Rwanda Holdings Group Limited (UR-HG Ltd); while the Polyclinic was named “University of Rwanda Polyclinic (UR-Polyclinic)”. The Polyclinic extended its activities by creating branches in UR Remera campus, Gasabo District, city of Kigali as well as in UR Rusizi campus, Rusizi District in the western province of Rwanda.

The UR Polyclinic is now providing following six health care services as follows:

- (i) Dental services
- (ii) Physiotherapy services
- (iii) Medical Imaging Services (MIS)
- (iv) Biomedical Laboratory Services (BLS)
- (v) Ophthalmology services, and
- (vi) Optical Laboratory services.

The study was conducted in the UR Polyclinic specifically in the Dental clinic. In terms of logistics, the dental clinic has six dental chairs for the private wing.

With regard to the staff, the UR Polyclinic has 31 full-time employees. These employees are distributed as follows:

- (i) 11 administrative staff;
- (ii) Five support staff;
- (iii) Four dental therapists;
- (iv) Three chairside assistants;
- (v) Two physiotherapists;
- (vi) Two ophthalmic Clinical Officers;
- (vii) Two dispatching room Officers;
- (viii) Two-part-time Bachelor of Dental Surgeons (BDS) and;
- (ix) Three part-time Masters in Dental Surgery (MDS).

The study focused on improvement of waiting time appointments for RCTs using available resources as described above. The strategy or intervention to create full time accessibility of RCT service was to revise the duty roster and introduce RCTs evening shifts.

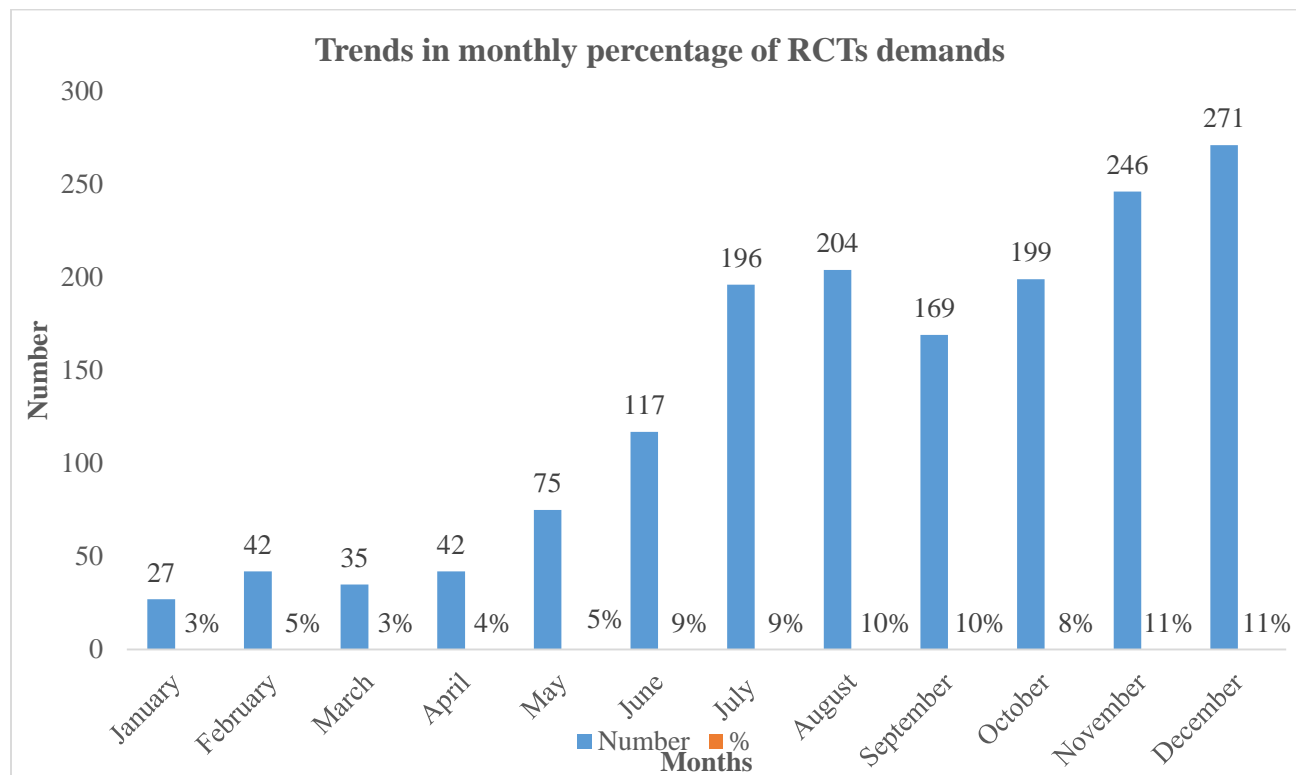
### **1.1.2 Information related to Study**

Root Canal Treatment (RCTs) is preferable treatment to extractions and prosthesis, because it is more esthetic and economic. The dental health care services are in infant stage in Rwanda. There is subsequently insufficiency of full service provision while there is a high demand of dental care services. At UR-Polyclinic this scenario affects strongly the average waiting time appointments with dental surgeons as well as average time to accomplish Root Canal Treatment (RCT).

In the first semester of the year 2018 regarded as the pre-intervention period, the average appointment waiting time with a dental surgeon for RCT was approximately twenty (20) days for 338 patients (Table 1.1). This appointment time should however be fixed at the same day of patient's visit or within seven days depending on her/his clinical conditions. At the dental clinic, the total time for the RCT is around 34 days. This period includes 14 days between three RCTs visits.

**Table 1. 1: Number of RCT and average waiting time for the pre-intervention period**

<b>S.N</b>	<b>Months</b>	<b>Total RCT Patients</b>	<b>Period Average Waiting time/per Patient (Days)</b>
1	January	27	25
2	February	42	22
3	March	35	19
4	April	42	27
5	May	75	20
6	June	117	4
<b>Total</b>		<b>338</b>	118
<b>Pre-intervention average waiting time</b>			20



**Figure 1. 1: Trends in RCTs demand**

## 1.2 Problem statement

There is long waiting time appointment with a dental surgeon for Root Canal Treatment (RCT) at UR Polyclinic. Waiting times have become a measure of access health care services and the key performance monitoring of healthcare institutions in service delivery.<sup>4</sup> In addition, waiting time is one of the considerations of the World Health Organization (WHO) to measure how responsive is a health system.<sup>8</sup>

Reviewed literature indicate variations in the average waiting times for different elective services.<sup>9,</sup>

<sup>13, 14</sup> Depending on the available development technology for the RCT, this treatment can be done at first visit. However, there patients that can wait and make three visits for a complete treatment.

However, the literature does not clearly indicate the standard waiting time for the RCT.

The review of UR-Polyclinic database through open clinic software showed that; per average patients waited 20 days before meeting dental surgeon for Root canal treatment. This review showed further that the UR Polyclinic received on average 45 patients per day during the pre-intervention period.

### **1.3 study objectives**

#### **1.3.1 Main objective**

To improve patients' appointment waiting times for RCTs treatments and subsequently increase the demand for healthcare services offered by the dental clinic of the University of Rwanda Polyclinic.

#### **1.3.2 Specific objectives**

The following were the specific objective of the study:

- To reduce Root Canal Treatments average waiting time appointments from 20 days to seven from July to December 2018 in Dental Clinic of the University of Rwanda Polyclinic
- To increase the demand for RCTs at the Dental Clinic of the UR Polyclinic

### **1.4 Study hypothesis**

#### **Primary hypothesis:**

The null and alternative hypothesis for the waiting time is as follows:

- Null hypothesis: The revision of the duty roaster will not reduce the waiting time of patients attending dental clinic services in the UR polyclinic

- Alternative hypothesis: The revision of the duty roster will reduce the waiting time of patients attending dental clinic services in the UR polyclinic

### **Secondary hypotheses**

For the number of patients attending the dental clinic for the RCTs the following are the null and alternative hypotheses:

- Null hypothesis: the number of RCT patients before and after revision of duty roster is the same
- Alternative hypotheses: the number of RCT patients before and after revision of duty roster is different

For the total number of patients attending the UR Polyclinic the following are the null and alternative hypotheses:

- Null hypothesis: the number of patients attending the UR Polyclinic before and after revising the duty roster is the same.
- Alternative hypothesis: the number of patients attending the UR Polyclinic before and after revising the duty roster is different.

### **1.5 Justification of the study**

This study was conducted with the aim of addressing lengthy patients' waiting times for patients attending the Dental clinic for the RCTs. This derived from patients' claims about the waiting times for this elective dental procedure. In addition, this intervention study aims to fill the gap in literature related to management of appointment waiting times for the RCT in Sub-Saharan Africa, specifically at the UR Polyclinic in Rwanda.

### **1.5.3 Insufficiency of specialized Clinics for RCTs**

There is a limited number of clinics providing the RCT around the UR Polyclinic and in Rwanda in general. The UR-CMHSBD Ltd Annual reports 2016<sup>15</sup> and 2017<sup>16</sup> stipulated; that Health facilities which provide specialized dental care like RCT are still few (not more than ten) and all are concentrated in the City of Kigali. These include UR-CMHS Polyclinic, Pineda Clinic, Legacy Clinic, KFH, and RMH<sup>17</sup> to name a few.

Therefore, this study is significant at internal and external levels. At internal level, the study will help the polyclinic to reduce the problem of RCTs long waiting time of appointments, thus improve oral health service and save teeth/life of patients while at external level, the study will make awareness to investors, professionals and/or other stakeholders to invest in this field both in towns and in rural area.

### **1.5.4 Waiting time at Dental Clinic of UR-Polyclinic**

From 2013 up to now in routine staff meetings organized weekly on Monday, Thursday and Friday, verbal and written patients claims (Suggestion box) as well as BOD resolutions (023/2013, 030& 033/2014, 068/2016, 002& 0011/2017), highlighted the issue of “Long waiting time of RCT appointments”. Thus, key participants are patients (Via suggestion box review) and Polyclinic Management (Staff meetings minute, BOD resolutions). It is in this regard that after brainstorming, the long waiting time of RCT appointments problem was found to be a priority in dental clinic. Full time provision of RCT treatment by reviewing duty roster with introduction of evening shifts are the key factors to reduce average number of RCT waiting time appointments at the University of Rwanda Polyclinic. Furthermore, as far as financial performance concern, the increase in number of patients would lead to in net profit after tax (UR-CMHSBD Ltd Annual Financial report

2018).

According to the patients' perceptions about the RCTs services 19 out of 29 of all patients' claims collected from 2014 up to 2017 are about long waiting time appointments with a dental surgeon. Basing on the frequency and impact of the problems identified, and as per priority, long waiting time (65%), poor communication (21%), and non-conducive environment (14%) were respectively determined as major problems.

## **1.6 Organization of the capstone**

The study is organized into six chapters; chapter one is composed of the background of the study and introduces the polyclinic setting, problem statement, magnitude of the problem, objective of the study, and justification of the study. Chapter two is the literature review and contains meaning and status of long waiting time appointment, importance and strategy of reducing long waiting time appointment of RCTs.

Chapter three presents the methodology which dealt with, study design, root cause analysis, data collection methods and identification of root causes, monitoring and evaluation of indicators, data analysis procedure and ethical considerations. Chapter four is about results on implementation and presents the process indicator, comparison of waiting time appointments pre and post duty roster revision for Root Canal Treatments (RCTs) in dental clinic. Chapter five includes discussion of results obtained in comparison with various studies done on long waiting time in health facilities worldwide, and in Rwanda.

Also it presents the challenges, limitations identified during intervention implementation and provides solutions. Finally, chapter six provides solutions and proposes the way forward for future researchers.



## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1. Introduction**

Long waiting times at the University of Rwanda Polyclinic has been reported as a problem, especially in the root canal treatment. In addition to defining key words, this work provide a brief literature review related to the magnitude of the waiting time for healthcare in dental therapy, related interventions and their results, as well as the limitations of the presented literature.

### **2.2 The need for the RCTs**

The prevalence of dental caries is increasing. If the disease is not well managed, it might lead to loss of teeth that will subsequently require a prosthesis to fill the gap. The RCT is the technique that is not only convenient or esthetic but also economic compared to dental prosthesis<sup>18</sup>. Therefore making it the most preferred technique by many patients. The increase in demand is obvious in Rwanda in general and at UR Polyclinic specifically. According to the database of the OpenClinic GA, an increment of 5% for new cases has been observed between 2016 and 20176.

### **2.3 Increasing demand for RCTs**

Referring to the clinical data from medical software used by the polyclinic (Open Clinic); during pre-intervention period which is first semester of 2018; the average number of RCT patients was 1 out of 20 patients. For example, there were 5% new cases while the average appointment time of RCT was up to 20 days.

As time was going by during the study period, RCTs demand was between 3 and 9% during the pre-intervention period (January-June 2018. This demand increased from 8% in July 2018 to 11% in December 2018.

## **2.4 Little focus on RCT waiting times**

Root canal therapy (RCT) is a dental procedure to preserve teeth that have lost their vitality and restore their function. RCT involves four phases namely removal of decayed dentine and necrotic pulp tissue; cleaning and shaping of the root canal; obturation of the root canal system; and finally the restoration of tooth function using a filling or crown.<sup>19</sup> RCT is performed by a competent dental surgeon in a single or in three to four appointments, each of this phases lasts for 30-90 minutes.<sup>20</sup>

The appointment are scheduled four to seven days apart and longer intervals have been associated with failure of the procedures. In human-resource-constrained settings, appointment intervals may be extended from seven to ten days depending on the availability of competent personnel. Therefore, patients are subject to prolonged periods with pain or on analgesics and antibiotics to control pain and infection, which may result in increased risk of patient dissatisfaction with care.<sup>21-</sup>

23

Long waiting time affect negatively the patient's health status.<sup>24</sup> Long appointment intervals for RCT have been associated with failures in procedures and patients dissatisfaction with care.<sup>21, 25,</sup>  
<sup>26</sup> Delays in healthcare can also affect the healthcare provider.<sup>7</sup>

There are several factors responsible for delays of appointments in RCT. These include, but not limited to, lack of competent human resource, lack of required resources, scheduling conflicts on both the clinician and patient side, financial, administrative or geographical barriers to the healthcare delivery system.<sup>25, 27, 28</sup>

Waiting times for general healthcare services in Malaysia is beyond two hours from registration to getting the prescription slip, and fifteen minutes only of contact with medical personnel.<sup>29</sup>

In 23 OECD countries, patients waiting times vary widely between 25 to 86 days for elective surgery, 31 to 178 days for total hip replacement, and 18 to 112 days for cataract.<sup>30</sup>

Waiting times for root canal treatment has not been widely reported in literature. In OECD countries, waiting times have been reported for a number of services on elective surgery, with root canal treatment excluded.<sup>9, 30</sup> Those services are: hip replacement, knee replacement, cataract surgery, vaginal hysterectomy, prostatectomy, cholecystectomy, inguinal and femoral hernia, percutaneous transluminal coronary angioplasty (PTCA) and coronary bypass.<sup>9</sup> Furthermore different interventions have been conducted to improve the root canal treatment.<sup>2</sup> However, no intervention addressing the patient waiting time in the root canal treatment has been identified in sub-Saharan Africa, and in Rwanda in particular.

## **2.5 Consequences of long waiting times**

Long waiting times have several implications for both patients and healthcare provision sides.<sup>31, 32</sup>

Waiting times are used as a means to sustain equilibrium between the demand for and supply of healthcare.<sup>31</sup> Long waiting times can induce patients to seek treatment in private sector, to give up treatment, which may result in reduction of the demand for public treatment.<sup>10</sup> For the purpose of quality improvement, waiting time is measured as an indicators of patients satisfaction.<sup>11</sup> Actual waiting time is negatively associated with patient satisfaction.<sup>12, 33, 34</sup> Furthermore, long waiting times cause to prospectively buy private health insurance and joint the private sector. High waiting times also cause providers to work harder to achieve set target and the spirit of altruistic concern<sup>10</sup>. Long waiting times may also worsen the patients' health outcomes and reduce the treatment efficacy.<sup>10</sup>

There is a number of scenarios related to waiting for treatment and patient's health status.<sup>32</sup> The following scenarios are presented: improvement of patient's health status while waiting; stability of patient's health while waiting for treatment; deterioration of patient's health status while waiting, with a reversible health loss; patient's health status is affected while waiting, and the recovery time is prolonged; and deterioration of patient's health while waiting, with an irreversible health loss.

In terms of costs, the relationship between waiting time and cost may have several forms. The cost may remain stable, increase, or decrease with waiting time.<sup>32</sup>

## **CHAPTER THREE: METHODOLOGY**

### **3. 1. Study design**

This was a pre- and post- interventional study in nature, and was conducted in the dental clinic of University of Rwanda Polyclinic (UR Polyclinic), from January 1<sup>st</sup> 2018 to December 31<sup>st</sup> 2018. The pre-intervention started from January 1<sup>st</sup>, to June 29<sup>th</sup>, 2018. The training and preparation of duty roster were real activities of intervention that consisted of rescheduling the duty roster. This intervention period took place on June 30 and July 2<sup>nd</sup>, 2018. The post intervention period extends between July 3<sup>rd</sup> and December 31<sup>st</sup>, 2018.

As improvement study, it analyzed and compared the appointment waiting time, RCT patients number and total number of patients before and after revision of duty roster with introduction of evening shifts in June 2018.

### **3. 2. Root cause analysis**

To effectively explore the causes of “RCT long waiting time appointments” at the University of Rwanda Polyclinic (UR Polyclinic); the data from routine staff meetings were collected and analyzed to identify and determine root cause of “RCT long waiting time appointments”.

#### **3.2.1 Collection of possible roots causes**

The morning staff meetings of every Mondays, Thursdays and Fridays were the basis of finding out the different root causes. The aim of these meetings is to discuss services challenges encountered and suggest relevant solutions to these challenges. The perusal of 45 meeting minutes served as the source of root causes for RCT long waiting time appointments. These meeting minutes were analyzed to identify possible causes.

### **3.2.2 Verification/test of possible root causes using data collected**

By further crosschecking of morning staff meetings minute from January to June 2018, 13 possible root causes were tested by their weight/rank using the tally sheet in order to identify the real root cause.

### **3.2.3 Identification of real root cause**

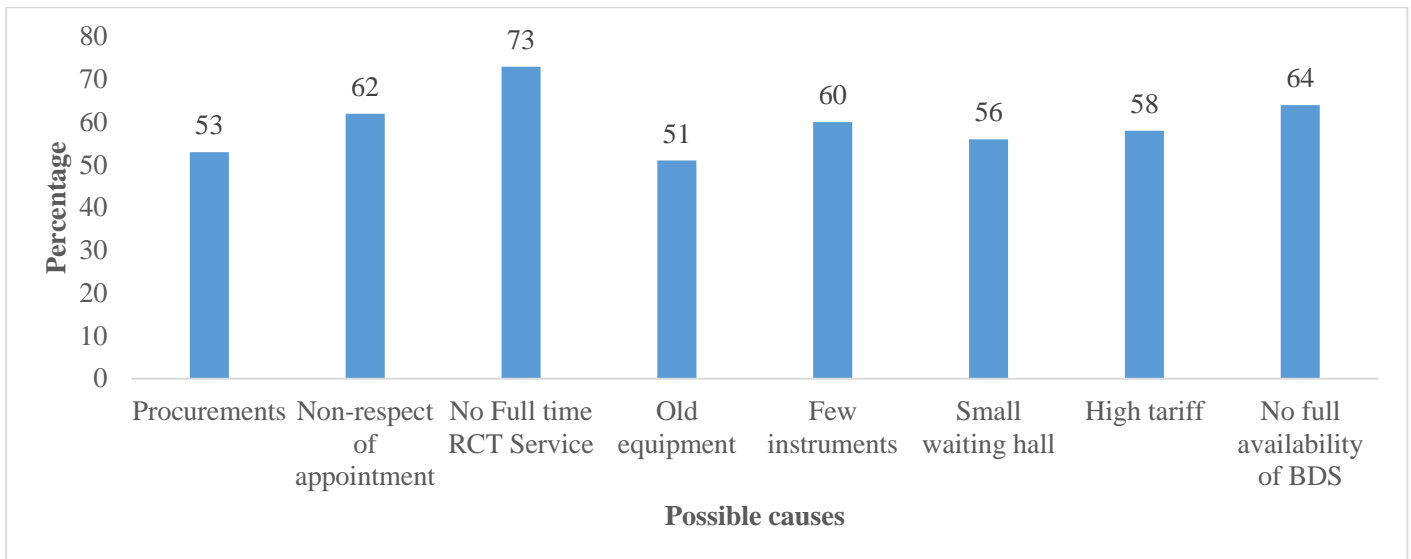
The real root cause was identified among most causes repeated in 45 staff morning meetings during the first semester of year 2018. The frequency and percentage of each possible cause was calculated and reported (Table 3.1). The frequency of each possible cause as well as the explanation of each cause were used to identify real root causes. Thus, the possible causes with a frequency of 50% and higher were accepted in consideration of their explanations as most possible causes. The tally sheet, the frequency table, the pareto and fishbone diagrams were used as follows:

**Table 3. 1: Frequency of possible causes (n=45)**

Possible cause	Frequency	Percentage (%)	Explanation	Accept/Reject
Lack of equipment/instruments procedure	12	27	Although instruments are sufficiently available, Some instruments procedures are displayed in sterilization room. This cannot effect waiting time.	Reject
<b>Consumables procurement delays</b>	24	53	<i>Delays of procuring consumables was noted. These delays lead to the postponement of RCTs appointment.</i>	<b>Accept</b>
X-Ray taking takes long	16	36	This cannot affect patients appointments.	Reject
<b>Non respect of appointments by patients</b>	28	62	<i>Patients who miss their appointment prolong their waiting time for RCTs.</i>	<b>Accept</b>
Few chairside assistants	8	18	There few assistant but the clinic use interns. This may not affect waiting time for RCTs.	Reject
Delay of insurers authorization	5	11	Authorization expires within one month. Thus this does not affect RCTs waiting time.	Reject
<b>No permanent/full time RCT services</b>	33	73	<i>RCTs services were provided only three out of six days a week. This affects the waiting time</i>	<b>Accept</b>
Small treatment rooms/wings	2	4	Even tough rooms are small, but they accommodate patients, doctor and chairside assistant.	Reject
<b>Old equipment/dental chairs</b>	23	51	<i>Dental chairs are old-model and some of them are being under maintenance, which may cause the postponement of the appointments.</i>	<b>Accept</b>
<b>Few instruments</b>	27	60	<i>Medical instruments have no spare parts to meet RCT patients' needs</i>	<b>Accept</b>
<b>Small waiting hall</b>	25	56	<i>Since the hall is small, RCTs appointment are planned per day.</i>	<b>Accept</b>
<b>High tariff/expensive treatment</b>	26	58	<i>Some patients miss their appointments because of high tariffs, this may cause the postponement of appointments.</i>	<b>Accept</b>
<b>No full availability of BDS</b>	29	64	<i>Only part-time BDS worked three out of six days</i>	<b>Accept</b>

Source: Secondary data from Polyclinic records: Minutes of Morning staff meeting 1<sup>st</sup> semester 2018

### 1.2.4 Pareto diagram



**Figure 3. 1: Frequency of possible causes for long time RCT appointment**

Source: Primary data from meetings minute records

### 3.2.5 Fishbone diagram

The stated eight possible causes selected are analyzed under headings of people, environment, process/policy and equipment for fishbone diagram purpose (Figure 3.2).

#### 3.2.5.1 People

With regards with people, the non-respect of appointment by patients was due the financial reasons or simply to their availability. For example, some students who did not obtain the permission from their respective schools to attend the dental clinic. Furthermore, the partial availability of BDS was due to the scarcity of BDS on the Rwandan market. The UR Polyclinic had two part-time BDSs while the dental clinic 338 RCTs patients, which gives a ratio of one BDS for 169 RCT patients, for the pre-intervention period.



### **3.2.5.2 Environment**

Concerning the environment, the dental clinic had a small waiting hall. The UR Polyclinic facilities were initially conceived and designed for teaching. This room could not accommodate the average of 45 patients per day during the pre-intervention..

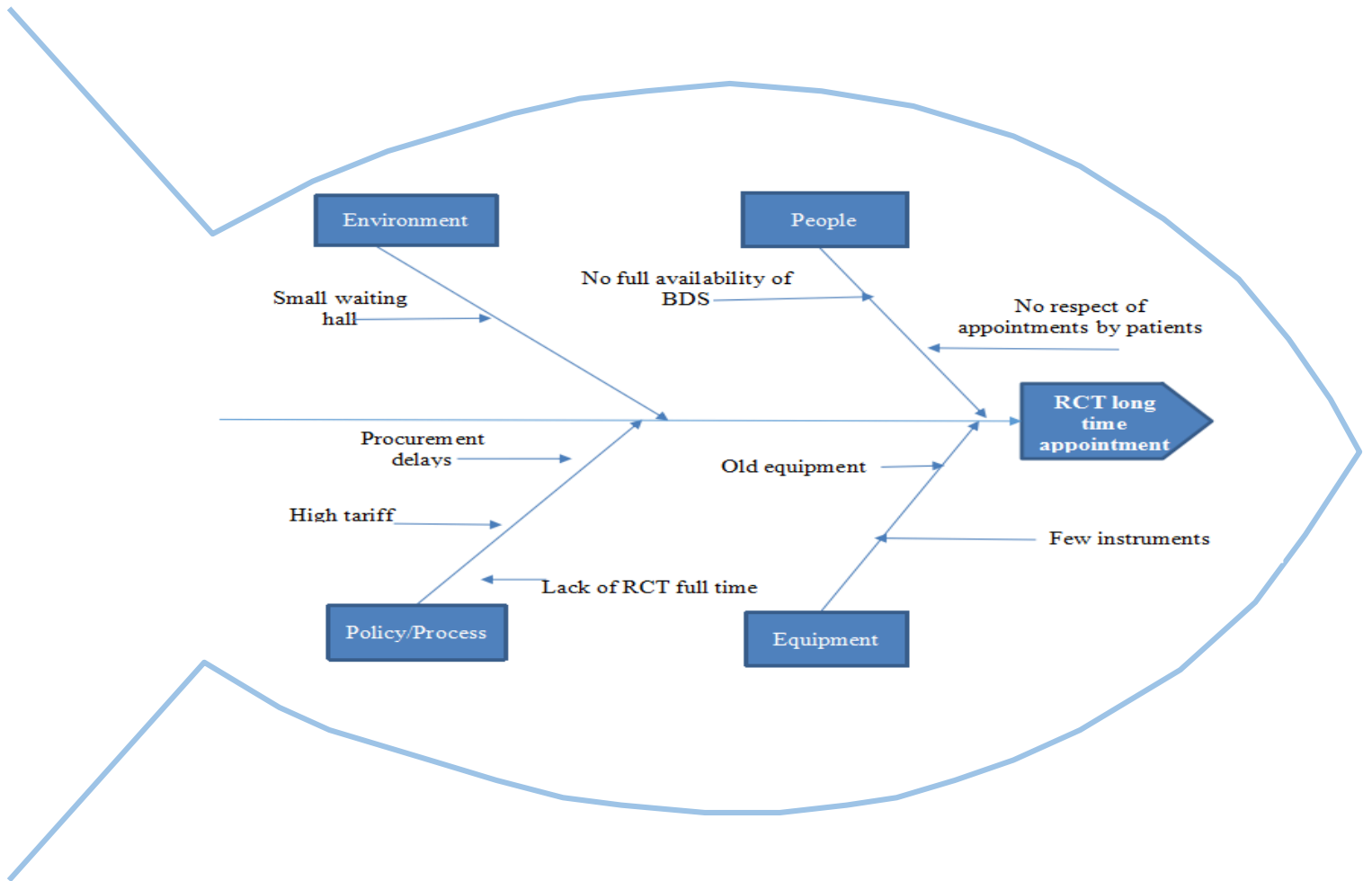
### **3.2.5.3 Process or policy**

In terms of processes, delays due to the procurement procedures hindered timely reception of instruments and consumables. The procurement office was advised to have framework contracts with suppliers. Furthermore, in terms of high tariffs, RCTs are specialized treatments that require advanced procedures which are expensive. The lack of RCT full time was another possible cause for delayed RCTs. RCTs services were provided three out of six days a week.

### **3.2.5.4 Equipment**

Problems related to equipment consisted of old equipment and few instruments. Most of the UR Polyclinic equipment consisted of donations from the Rotary International, the Centre for Diseases Control and Prevention (CDC), as well as the Belgium Technical Cooperation (BTC). These donations have been in use for more than ten years ago. The UR Polyclinic was advised to make a replacement plan in their future budgets. Regarding the instruments, the UR Polyclinic had sufficient instruments but these instruments were mismanaged and/or damaged due to their low quality or sharing with students.

Figure 3. 2: Fishbone diagram adapted from literature.<sup>35-37</sup>



### **3.2.6 Real root cause of RCT long waiting time appointment**

The above root cause analysis done through steps of; collection of possible roots causes, verification/ test of each possible cause, and identification of real cause;

It was concluded that the real root cause of RCT long waiting time appointment at UR Polyclinic is lack of permanent/ full time service since it has got high score of 73%.

### **3.3 Intervention**

#### **3.3.1 Staff-proposed solutions**

Among different alternative solutions/ interventions highlighted in the minutes of morning staff meeting, the following are four main interventions which used to be proposed by staff especially coordinators, thus are analyzed below to:

- (i) Improve scheduling duty roster of BDS and clinicians;
- (ii) Carrying out a recruitment process of full time dental surgeon;
- (iii) Payments of additional work services for BDS
- (iv) Partnership with other clinics for RCTs patients management

#### **3.3.2 Comparative analysis**

A comparative analysis of possible solutions/ intervention was conducted. This analysis involved purposively selected staff and management members of the dental clinic at the UR Polyclinic. An interview guide was presented to representative sample of 20 staff out of 33. This sample consisted of three dental therapists, five doctors, three administrative staff, two support staff, all seven members of the clinic management team.

The decision matrix table was constituted from data analysis which consisted to average score given by interviewees to each criteria for each intervention.

Four criteria of impact, feasibility, cost and time were evaluated using a Likert scale with five categories, ranging from 5- most ideal- to 1 – least ideal. For the criteria of impact and feasibility, high scores were attributed to big impact and big feasibility. For the criteria of cost and time, high scores were given to low cost and short time.

Then the total was done out of 20, in order to rank four selected interventions as depicted in Table 3.3.

**Table 3. 2: Decision Matrix**

Possible intervention/solution	Impact	Cost	Time	Feasibility	Total
Rescheduling duty roster of BDS	5	4	3	4	16
Employment of full time BDS	5	1	1	2	9
Payments of additional work services for BDS	2	3	2	4	11
Partnership with other clinics for RCTs patients	3	2	1	2	7

### 3.3.3 Selection of best interventions / solutions

The rescheduling the duty roster of BDS was selected as best intervention with a score of 16 since it would have a big impact at low cost within a short time of implementation (one day). The employment of full time BDS scored nine. This employment is difficult since BDS are scarce on the market. Thus the feasibility score of 2. The RCTs-patient ratio was 169 for one BDS at UR Polyclinic. The payment of RCT fees in instalments is highly feasible since RCTs are mostly

performed in different visits. The payment per visit would facilitate patients without any risk to the UR Polyclinic. The equipment replacement plan in future budget has big impact and is imperative for the continuity of RCT services

### **3.3.4 Implementation**

#### **3.3.4.1 Detailed list of tasks/activities**

Given that the best intervention is “rescheduling duty roster of doctors and clinicians”; the revision of duty roster was carried out through the process of the following steps/activities as shown in UR Polyclinic procedure manual<sup>4</sup>:

- 1. Training on preparation of duty roster:** training of coordinator and his/her assistant on how to prepare and revise duty roster (appendices 3 and 4). This activity was completed on June 30<sup>th</sup>, 2018 by the researcher.
- 2. Preparation of duty roster:** this is recall of the need and reinforce the intervention by taking such resolution. This preparation was completed by the clinic coordinator on July 2<sup>nd</sup>, 2018.

The training and preparation of duty roster were real activities of intervention that consisted of rescheduling the duty roster. This intervention period took two days, while following activities were carried out during the post-intervention period, which was from July 3<sup>rd</sup> to December 31<sup>st</sup>, 2018.

- 3. Adoption and use of revised duty roster:** after getting and adapting ideas of staff; the revised duty roster which include evening shift was used as implementation/intervention to provide full time RCTs services and reduce waiting time appointment

- 4. Monitoring and evaluation:** the pilot monthly use was evaluated and discussed with staff to see impact and adjustments to be made if any before being definitively used as clinical methods of preparing duty roster.

### 3.3.4.2 Time required/ Used for each task

Table 3.4 provide a description of activities, related responsible people, the sequence of tasks and time for each schedule activity. The activities included the management team meeting resolution, the preparation of a training on the duty roster, pilot-test of the duty roster, as well as the monitoring and evaluation of the activities. Furthermore, the Table 3.4 indicates the order in which activities were carried out with their respective estimated periods.

**Table 3. 3: Time sequencing and responsible people for activities**

No.	Activities/Tasks	Responsible person	Sequence the tasks/activities	Time (in days/months)
1	Duty roster preparation training	Researcher	June 30, 2018	1 day
2	Preparation of duty roster	Coordinator	July 2 <sup>nd</sup> , 2018	1 day
3	Adoption and use of revised duty roster	Clinic coordinator	July – December	6 months
4	Monitoring and evaluation	Researcher and clinic coordinator	July – December	6 months

**Source:** Author making reference to UR Polyclinic procedure manual

### 3.3.5 Evaluation

The following table highlights the evaluation plan by providing the process and outcome indicators, how they were calculated, who measured them, where to obtain related information, and how frequent to measure these indicators. The process indicator was the waiting time for RCTs. The outcome indicators included the number of RCT patients and the total number of patients

**Table 3. 4: Evaluation plan**

Indicator	Definition (Pre-intervention)	Who	Where to get info	When
<b>Process (Secondary)</b>				
Waiting time for RCTs (days)	20	Clinic Coordinator	Notice board	July-Dec.
<b>Outcome (Primary)</b>				
Number of RCT patients	338	Customer care	Appointment books & open clinic database	July-Dec.
Total number of patients	6,606	Data collector	Open clinic software	July-Dec.

**Source:** Author

### 3.4 Measurement of indicators

#### 3.4.1 Data extraction and management

Data were extracted from the OpenClinic software used by the UR Polyclinic to record all patients received from January 2018 up to December 2018 and treated during pre-intervention and post-intervention periods. After extraction, data were imported in MS Excel. The Statistical Package for Social Sciences (SPSS Version 21) was then used to perform necessary data analysis for the pre- and post- intervention periods.

### **3.4.2 Measures**

The waiting time was measured by considering the number of days between consultation and the first visit dates to the dental surgeon for RCT. The monthly average waiting time per patient was obtained by dividing the total waiting time by the number of patients. For the whole pre- and post-intervention periods, the overall average waiting times were computed by adding up the monthly waiting times and divided by six months.

The total number of patients received by the UR Clinic was also recorded for the pre- and post – intervention periods. Therefore, the mean number of total patients for pre- and post-intervention periods was also computed. From this number of patients, RCTs patients were screened and recorded for the purpose of measuring their waiting times. The mean number of RCTs patients for pre- and post-intervention periods was computed and compared.

### **3.5 Data analysis procedures**

Descriptive statistics including means and frequency polygons, median and interquartile range (IQR) were used to summarize pre- and post- intervention data. Independent samples t-test allowed to compare the pre- and post-intervention average waiting times. The Mann-Whitney U Test was used to compare the average number of RCTs patients, and the average number of patients who attended the UR Polyclinic. The significance level was set at  $p \leq 0.05$ .

### **3.6 Ethical considerations**

This study was granted an ethical clearance by the Institutional Review Board (IRB) of the University of Rwanda College of Medicine and Health Sciences (appendix 3). In addition, the top management of the UR Polyclinic granted the permission to access the UR Polyclinic data and to conduct the whole study with the Polyclinic Staff members.



The coordinator of the Polyclinic cooperated with the researcher. Prior to involving the Polyclinic staff, participants were provided with the study information and were requested to consent for the study. Participants were assured about the anonymity of their answers and strict confidentiality regarding participation and publication were emphasized. They were also told that participating would neither affect their clinical work nor their performance on duty. No single staff member of the UR Polyclinic refused to participate despite the fact that the response rate was not full. Forty patients' claims were collected from the suggestion box and were anonymously analyzed.

## **CHAPTER FOUR: RESULTS OF IMPLEMENTATION**

This chapter presents the results for both pre- and post-intervention periods. It is important to remind that the pre-intervention was conducted from January to June 2018 (six months), and the post-intervention started in July 2018 and ended in December 2018 (six months as well). For both periods, this chapter presents the results on the number of RCTs patients, the waiting time and total number of patients that attended the UR Polyclinic.

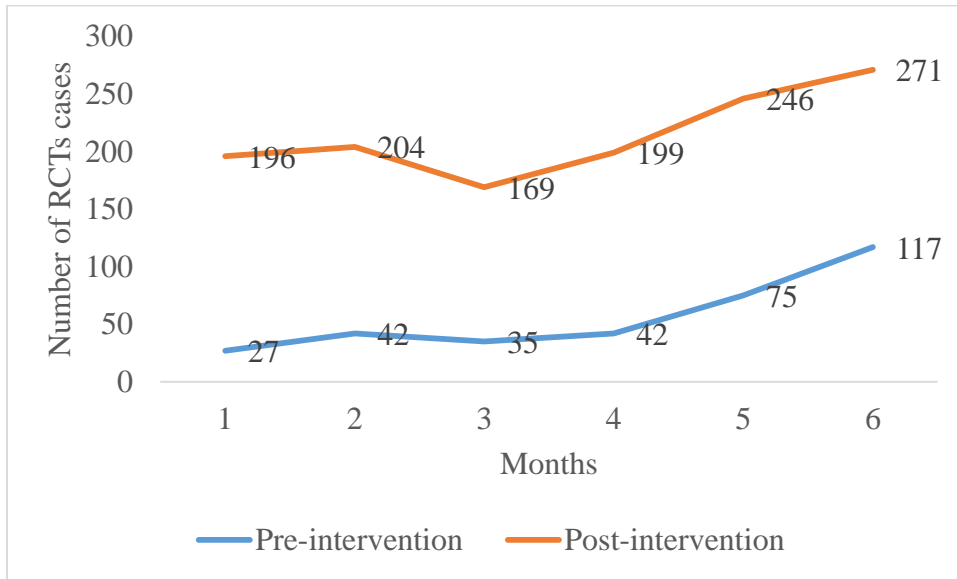
### **4.1 Number of RCTs patients**

The pool of RCT patients get consultations from the dental therapists who make the first assessment of the patients and referred to the BDS for the RCT. The number RCT patients impacts on RCT waiting time appointments. The more RCT patients referred, the longer the waiting time will be, as long as this service is not provided on full-time basis.

Data in Figure 4.1 indicate trends in RCTs cases. For the pre-intervention period, RCTs cases increased from 27 during the first month (January 2018) to 117 in the sixth month (June 2018) of observation. For the post-intervention period, RCTs cases increased from 196 in the first month (July) of intervention to 271 in the last month (December 2018) of observation.

Overall, during the pre-intervention period, the median number of patients for RCTs was 42 (IQR=53) while this median was 201.5 (IQR=63) for the post-intervention period.

The Mann-Whitney U Test revealed that the number of RCT patients was statistically significant different for the pre- and post- intervention periods ( $p=0.002$ ) (Appendix 5).



**Figure 4. 1 Trends in RCTs**

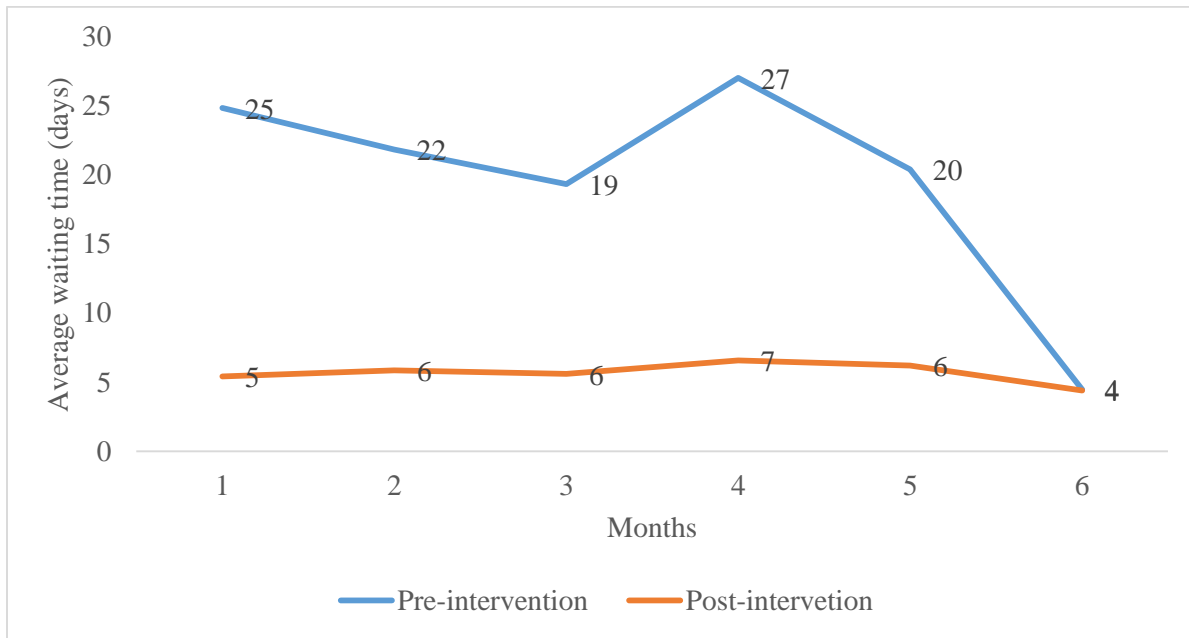
**4.2 Appointment waiting time for RCTs**

The appointment waiting time for this study was the number of days between consultation by a dental therapist and RCT by BDS. This appointment waiting times depends on the number of RCT patients and the patient’s clinical conditions.

In addition to the number of RCTs patients, the appointment waiting time for RCTs was also recorded for the pre-and post-intervention periods. Trend in the monthly mean waiting times are displayed in Figure 4.2. It is depicted that the average waiting times varied between four days and 7 days during the post-intervention period.

The post-intervention waiting time varied between four (minimum) and seven days (maximum) during the six months’ post-intervention. For the pre-intervention period, the average waiting time decreased from 25 to 19 days for the first three months. However, the waiting time had an upward trend in the fourth months of pre-intervention and suddenly decreased to 4 days during the sixth month of pre-intervention. This decrease was due to the pilot test of a revised duty roster. Overall,

the appointment waiting time significantly decreased from 18.32 ( $\pm 14.91$ ) days in pre-intervention period to 5.7 ( $\pm 6.97$ ) days in the post-intervention period ( $t=13.93$ ,  $df=626$ ,  $p<0.001$ ) (Appendix 6).



**Figure 4. 2: Monthly average waiting times (in days) for the pre- and post- intervention periods**

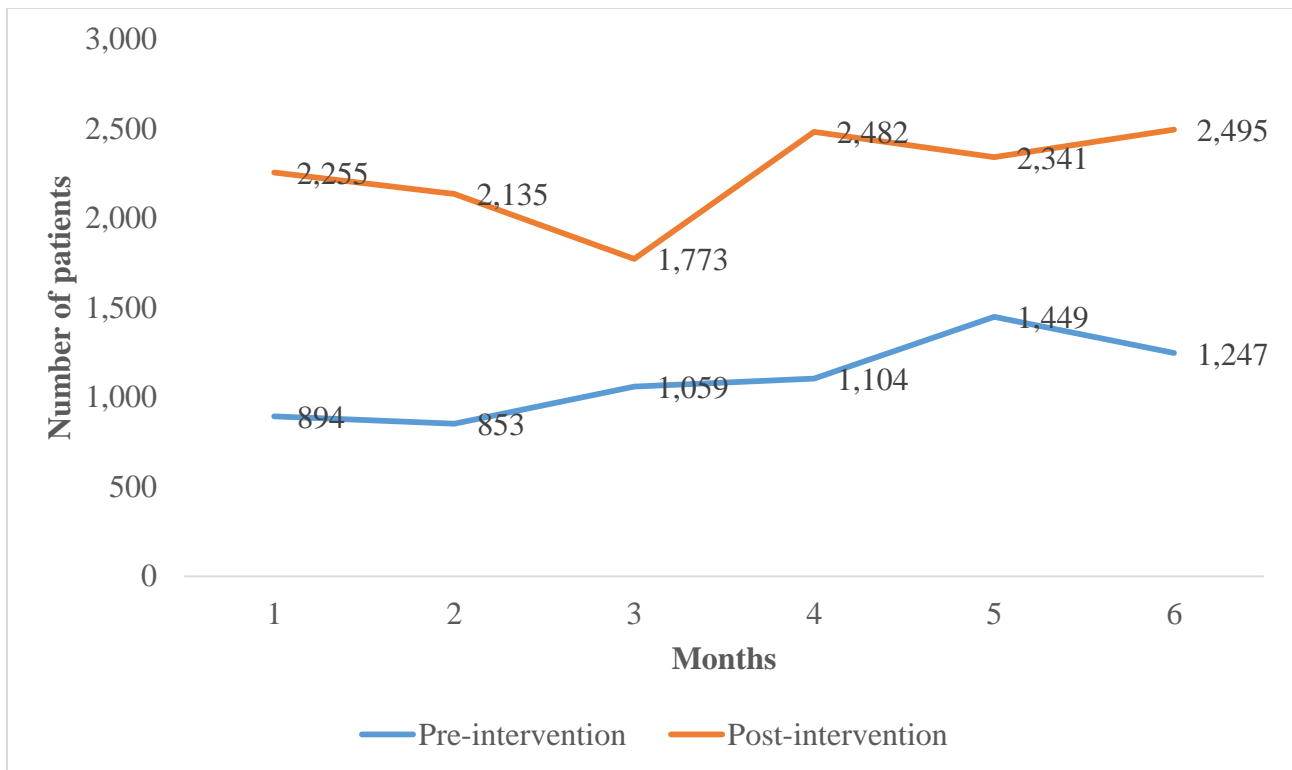
### 4.3 Total number of patients

This is the pool of all patients that entered the dental clinic. The number of these patients would determine the number of RCT cases and would affect the appointment waiting time for the RCTs.

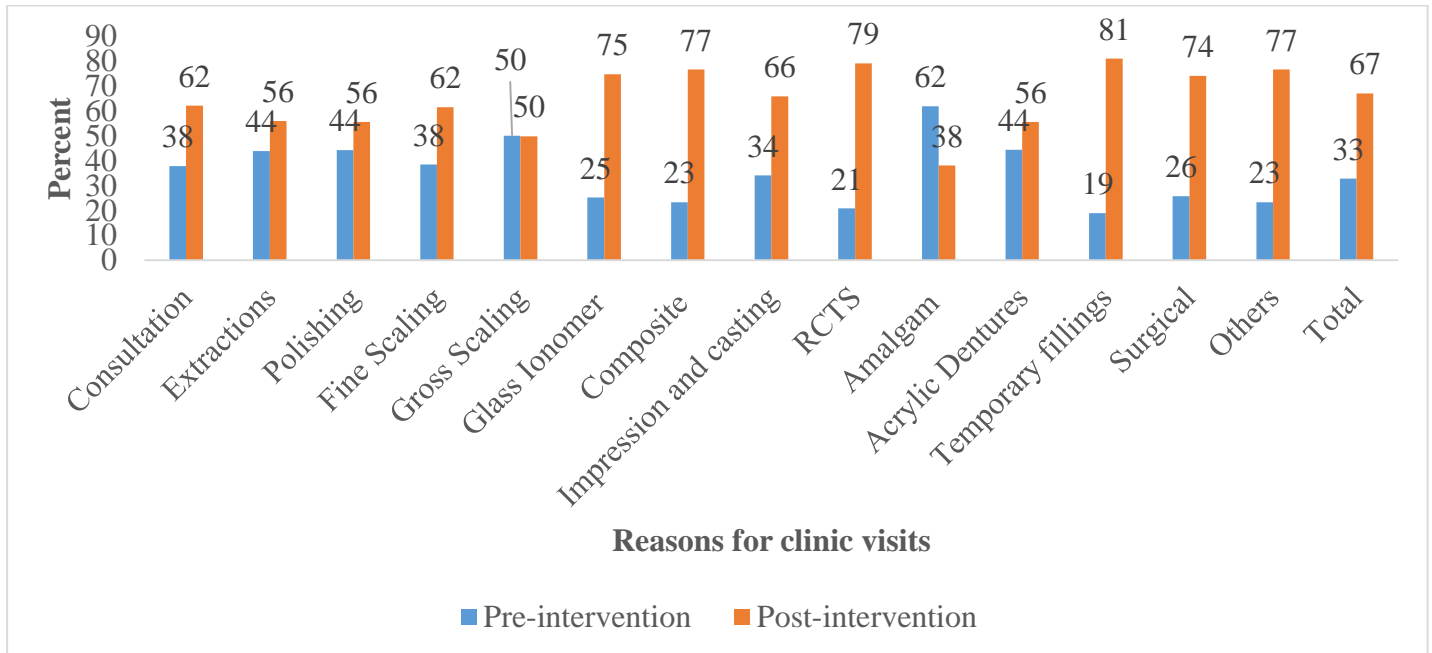
Figure 4.3 depicts the trends in the total number of patients that attended the UR Clinic. For the pre-intervention period, only between 853 and 1,449 patients attended. However, during the post-intervention period, this number of patients attending tremendously varied between 1,773 to 2,495.

Overall, the median number of patients who attended the UR Clinic was 1,081.50 (IQR=414) and

2,298 (IQR=441) respectively for the pre-and post-intervention periods. The number of patients stratified according to the diagnosis or procedures needed is depicted in Figure 4.4. Generally, this number increased for all procedures during post-intervention period, except for amalgam. The Mann-Whitney U Test revealed that this increase of the number of patients during the post-intervention period was significant ( $p=0.002$ ) (Appendix 7).



**Figure 4. 3: Trends in the number of patients that attended (See Appendix 8 for *Others*)**



**Figure 4. 4: Number of patients stratifies per the reasons for clinic visits**

#### 4.4 Conclusion

This chapter presented the results of pre- and post-intervention periods on the RCTs appointment waiting times at the UR Clinic. The results indicate that the median number of RCTs significantly increased from 42 (IQR=53) to 201.5 (IQR=63) patients respectively for the pre-intervention and the post-intervention periods. Furthermore, the appointment waiting time significantly decreased from 18.32 ( $\pm 14.91$ ) days during the pre-intervention to 5.7 5.7 ( $\pm 6.97$ ) days during the post – intervention period. Finally, there was a statistically significant increase of the median total number of patients received by the UR Clinic from 1,081.50 (IQR=414) to 2,298 (IQR=441) respectively for the pre-intervention and post-intervention periods.

## **CHAPTER FIVE: DISCUSSION**

This chapter discusses the achievements of the intervention aiming at reducing the appointment waiting time for the RCT at the dental clinic of the UR Polyclinic. In addition, the chapter discusses the basis of the intervention improvement, as well as the intervention related challenges.

### **5.1 Factors contributing to the success of the intervention**

The intervention successfully decreased the waiting times for RCTs at the Dental clinic of the UR Polyclinic. This success was due to the increase of accessibility of services at the dental clinic of the UR Polyclinic. The number of days for RCTs were increased from three days to six days a week. In addition, this intervention resulted in more options in terms of time whereby evening shifts were introduced to provide more RCTs services.

Three successes were achieved by this intervention. The first success was the significant reduction of the median waiting time for the RCTs from 18.32 ( $\pm 14.91$ ) days between January and June 2018 (pre – intervention) to 5.7 ( $\pm 6.97$ ) days between July and December 2018 (post – intervention). The Institute of Medicine (IOM) recommends a waiting time of 30 minutes of their appointment time.<sup>11</sup> Compared to other services, this average waiting time is shorter. Waiting times are generally far longer for elective services other than the RCT in the Organization for Economic Cooperation and Development (OECD) countries.<sup>9</sup> For example, real waiting times for selected surgery data in Spain were found to be 331, 35, and 137 days respectively for cholecystectomy, carpal tunnel release and inguinal/femoral hernia repair.<sup>38</sup> The Spain official data on waiting times related to these services are respectively 83, 68 and 73 days.<sup>38</sup> For the total knee replacement, the median waiting times are 73 and 266 days respectively for patients with short and non-fixed waiting

times.<sup>39</sup> For the cataract extraction and hysterectomy, the median waiting times were 84 and 48 days in Australia in 2008/2009.<sup>13</sup>

In contrast, waiting times in emergency services are shorter compared to the waiting time for elective services. In Iran, the waiting time is estimated in minutes rather than in days. For example, in hospital emergency departments, the mean waiting time is  $5.9 \pm 0.6$  minutes from arrival to visit by physician.<sup>40</sup> However, the waiting time for a first specialist consultation is  $99.3 \pm 32.8$  minutes.<sup>40</sup> In Vietnam, an average waiting time of 42.05 minutes was recorded in 2015 at an outpatient clinic of central surgical hospital.<sup>41</sup>

The second achievement of the intervention was the significant increment of the number of patients treated for RCTs from 42 (IQR=53) to 201.5 (IQR=63) respectively for the pre- and post-intervention periods. Finally, the intervention resulted in a highly significant increase in the median total number of patients attending the clinic from 1,081.50 (IQR=414) patients (pre-intervention) to 2,298 (IQR=441) patients (post -intervention). Studies have indicated the existence of a relationship between the waiting time and the clinic or hospital attendance, as those who expect to wait for long choose not to attend.<sup>42</sup> Other studies have shown a negative correlation between waiting time and patient willingness to return to clinic.<sup>11</sup> In this study, the number of those who attended for the RCT and other services in general increased with reduced waiting times. During the pre-intervention period, the waiting time was around 20 days with 338 RCTs and 6,606 total patients. While during the post-intervention period, the waiting time became six days with 1,285 RCTs and 13,481 total patients.



## **5.2 Basis of improvements**

Among other factors the improvement in appointment waiting time was resulted from the provision of the RCT services the full time i.e. nine (9) hours per day, six (6) days a week, without counting the evening shifts, which strengthened the maximization of time of RCTs.

In addition to the provision of service at full-time basis, the increased number of BDS was also important factor in this regards. RCTs is not provided by many clinics due to the high input cost such as labor, consumables, instruments and equipment costs.

Furthermore, the review of duty roster to allow provision of RCT service all time played an important role in reducing the appointment waiting time for RCTs and quality of services at UR Polyclinic in general.

## **5.3 Challenges encountered during implementation**

During implementation of this project, there were no material problems since all necessary preparation was done and all stakeholders were well informed before, however we can state the following few challenges: delayed responses, absence of recruited staff, and changing duty rosters.

### **5.3.1 Delayed responses**

Even if the project was conducted at an academic Polyclinic of the University, it was noted that the culture of research and understanding its impact are not entrenched in the participants' practices. Responses were not timely given by respondents from staff members and the management team. In addition, although participants were provided with the project information before enrolment to the project, some of the participants were reluctant to participate and had doubts about the confidentiality and anonymity of their answers. This reluctance delayed the

process of information gathering and data analysis. We require more effort to sensitize the clinic community to respond and provide information needed by researchers timely and promptly.

In order to speed up the research process and obtain information timely, the researcher kept on reminding and explaining to respondents about the importance of the project.

### **5.3.2 Clinical attendance**

Duty roster at UR-CMHS Polyclinic are done every week and communicated early to the clinical staff. These duty rosters were supposed to remain stable and be followed throughout the whole week during this research. However, some of the duty rosters used to change during the study period due to absence of Doctors or patients themselves, and could negatively affect the results, especially when patients do not turn up on appointment dates.

## **CHAPTER SIX: RECOMMENDATIONS AND CONCLUSION**

This chapter provides the conclusion, formulates some recommendations and suggest needs for further research in the study area.

### **6.1 Conclusion**

The UR-CMHS Polyclinic is one of few dental clinics that provide specialized treatments like RCTs in Rwanda. This study analyzed the problem of long appointment waiting time and recommended interventions of reviewing the duty roster and introducing evening shifts at UR Polyclinic. The intervention was conducted in two phases, pre- and post- intervention, each of which lasted for six months between January and December 2018. The intervention significantly reduced the RCTs waiting times from 20 days to six days. Furthermore, the intervention resulted in a significant increase in the number of RCTs patients and the overall number of patients that usually attend the UR Polyclinic.

If other factors remain constant “*Ceteris parbus*”, the study project demonstrated that even with few resources problems can be solved. It is a matter of how managers handle problems, since with existing human resource of four dental therapists and two-part time BDSs as well as six treatment wings reduced the appointment waiting time from average of 20 days before intervention to 6 days after intervention just be revising duty roster to increase accessibility time of RCTs.

## **6.2 Recommendations**

The following are recommendations towards the University of Rwanda:

- To initiate and train more dental surgeons (specialists) in order to reduce the RCT BDS-patient ratio and improve service accessibility for RCTs.
- To replace old equipment in due time. This will ensure the continuity of RCTs service delivery by the UR Polyclinic.

### **Recommendation for practice**

- In line with reducing the waiting time and increasing the patients' satisfaction, we recommend that other clinics and health care institutions in Rwanda reschedule their duty rosters.
- To facilitate the RCTs services affordability by initiating the payment of RCTs in payment by visit.

## **6.3 Further research**

This intervention of rescheduling duty roster reduced the waiting time for RCT from 20 to five days per RCTs patients. Further researchers would:

- Analyze and recommend interventions to reduce more this appointment waiting time for RCT and other specialized services at UR Polyclinic.
- Assess the impact of long waiting times on the patients' satisfaction, the costs related to patients' long waiting times, as well as the impact of these long waiting times on patients health outcomes at the UR Polyclinic.
- Assess the revenues that are due to these increments at the UR Polyclinic and countrywide.

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## **APPENDICES**

### **Appendix 1: Interview guide**

Dear Dr./Mme/Sir

As a student in Masters of Hospital and Health Care Administration (MHA) program at University of Rwanda, one of requirements of this program is to carry out an improvement study in course of paper titled Scientific Problem Solving (SPS). It is in that view my study called **“REDUCING LONG TIME APPOINTMENT FOR ROOT CANAL TREATMENTS (RCTs) AT UR-CMHS POLYCLINIC”** is being carried out.

As discussed in our morning meetings and at other different occasions, we noted the long-time of RCT as the main problem caused primarily by the lack of full/permanent time RCT service delivery.

Again from the morning meeting minute’s analysis, we noted different proposals as solutions to the problem of long time RCT appointments, among them solutions selected are presented in this interview guide for selection of best one solution to be implemented.

The data collected will be treated in strict confidentiality and will be used exclusively for the above stated purpose. Thus we request you to feel free and respond to the following few questions with objectivity.

**INTERVIEWEE IDENTIFICATION**

**1. Specialisation or Position? Circle the appropriate one and add your Names**

a. Doctor /

b. Administrative staff /

c. Member of Management team/

**2. How long have been you at UR-CMHS Polyclinic? (eg: 3 years)**

.....

**QUESTIONS**

**1. Initiating the rescheduling duty roster of party time dental surgeons can be a solution to RCT long time appointment.**

- Ticket (√) in appropriate square for ranking its **impact** (more impact; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (√) in appropriate square for ranking its **feasibility** (more feasible; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (√) in appropriate square for ranking its **Cost** (more expensive; low rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (√) in appropriate square for ranking its **Time taking** (more time; low rank)

Good	Average	Acceptable	Not bad	Bad

## 2. Employment of full time dental surgeon doctor

- Ticket (√) in appropriate square for ranking its **impact** (more impact; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (√) in appropriate square for ranking its **feasibility** (more feasible; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (√) in appropriate square for ranking its **Cost** (more expensive; low rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (√) in appropriate square for ranking its **Time taking** (more time; low rank)

Good	Average	Acceptable	Not bad	Bad

### 3. Payments of additional work services for BDS

- Ticket (✓) in appropriate square for ranking its **impact** (more impact; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (✓) in appropriate square for ranking its **feasibility** (more feasible; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (✓) in appropriate square for ranking its **Cost** (more expensive; low rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (✓) in appropriate square for ranking its **Time taking** (more time; low rank)

Good	Average	Acceptable	Not bad	Bad

### 4. Partnership with other clinics for RCTs patients

- Ticket (✓) in appropriate square for ranking its **impact** (more impact; high rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (✓) in appropriate square for ranking its **feasibility** (more feasible; high rank)

Good	Average	Acceptable	Not bad	Bad

--	--	--	--	--

- Ticket (✓) in appropriate square for ranking its **Cost** (more expensive; low rank)

Good	Average	Acceptable	Not bad	Bad

- Ticket (✓) in appropriate square for ranking its **Time taking** (more time; low rank)

Good	Average	Acceptable	Not bad	Bad

Thank you for your contribution in this study. ■

## Appendix 2: Gantt chart format for the project plan

Tasks	RESPONSIBLE	Timetable and sequence						
		June	July	August	September	October	November	December
Duty roster preparation training*	Researcher							
Preparation of duty roster**	Clinic coordinator							
Adoption and use of revised duty roster	Clinic coordinator							
Monitoring and evaluation	Management team							

**Note:** \* The training was organized for one day of June 30, 2018.

\*\*The duty roster preparation was done one day of July 2<sup>nd</sup>, 2018

## Appendix 3: Ethical clearance



UNIVERSITY of  
RWANDA

COLLEGE OF MEDICINE AND HEALTH SCIENCES  
DIRECTORATE OF RESEARCH & INNOVATION

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### CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 12/06/2019  
Ref:CMHS/IRB/273/2019

MUGESERA Narcisse

Master of Hospital and Healthcare Administration,  
School of Health Sciences, CMHS, UR

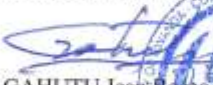
Dear MUGESERA Narcisse,


**RE: ETHICAL CLEARANCE**

Reference is made to your application for ethical clearance for the study entitled *"Reducing long time appointment for Root Canal Treatments (RCTs)."*

Having reviewed your application and been satisfied with your protocol, your study is hereby granted ethical clearance. The ethical clearance is valid for one year starting from the date it is issued and shall be renewed on request. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

  
Professor GAHUTU Jean Bosco  
Chairperson Institutional Review Board,  
College of Medicine and Health Sciences, UR



Cc:

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



**Appendix 4: Sample duty roster for the pre-intervention period**

TIME	WING	FEB-2018/ WEEK 3					
		MONDAY 2/19/2018	TUESDAY 2/20/2018	WEDNESDAY 2/21/2018	THURSDAY 2/22/2018	FRIDAY 2/23/2018	SATURDAY 2/24/2018
7H 30 -12H 00	ONE(1)	BDT1		BDT1	BDT1	BDT1	BDT1
13H 00-17H 30	ONE(1)	BDT1		BDT1	BDT1	BDT1	BDT1
7H 30 -12H 00	TWO(2)	BDT2	BDT2		BDT2	BDT2	
13H 00-17H 30	TWO(2)	BDT2	BDT2		BDT2	BDT2	
7H 30 -12H 00	THREE(3)			BDS2			
13H 00-17H 30	THREE(3)			BDS2			
7H 30 -17H 30	FOUR(4)		BDS1				BDS1
7H 30-17H 30	FOUR(4)		BDS1				BDS1
7H 30 -12H 00	FIVE(5)	BDT3	BDT3	BDT3		BDT3	BDT3
13H 00-17H 30	FIVE(5)	BDT3	BDT3	BDT3		BDT3	BDT3
7H 30 -12H 00	STUDENT W. FRONT						
13H 00-17H 30	STUDENT W. FRONT						
7H 30 -12H 00	STUDENT W. MIDDLE						
13H 00-17H 30	STUDENT W. MIDDLE						
17H 30-20H 30	STUDENT W. BEHIND						
	STUDENT W. BEHIND						
	OFF		BDT1	BDT3	BDT2		
	OFF						
	LEAVE						
	LEAVE						
	PERMISSION						
	PERMISSION						
	SICKNESS						
	STERILISATION	BDT4	BDT4	BDT4	BDT4	BDT4	

**BD51:** Bachelor's Dental Surgeon who provided RCTs on Tuesdays and Saturdays  
**BD52:** Bachelor's Dental Surgeon who provided RCTs on Wednesdays  
**BDT:** Bachelor's in Dental Therapy who made consultations and provide general dental treatment

PREPARED BY: DENTAL COORDINATOR

## Appendix 5: Sample duty roster for the post-intervention period

TIME	WING	JULY-2018/WEEK 3					
		MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		7/16/2018	7/17/2018	7/18/2018	7/19/2018	7/20/2018	7/21/2018
7H 30 -12H 00	ONE(1)	BDT 1	BDT 1	BDT 1	BDT 1	BDT 1	BDT 1
13H 00-5H 30	ONE(1)	BDT 1	BDT 1	BDT 1	BDT 1	BDT 1	BDT 1
7H 30 -12H 00	TWO(2)	BDT2	BDT2	BDT2	BDT2	BDT2	BDT2
13H 00-5H 30	TWO(2)	BDT2	BDT2	BDT2	BDT2	BDT2	BDT2
7H 30 -17H 00	THREE(3)	BDS 1	BDS 1			BDS 1	BDS 1
13h00-17h30				BDS 1			BDS2
17H 00-20H 30	THREE(3)	BDS2		BDS2		BDS2	
7H 30 -17H 00	FOUR(4)		BDS2				BDS2
17H 00-20H 30	FOUR(4)	BDS1	BDS1	BDS1	BDS1	BDS1	BDS2
7H 30 -12H 00	FIVE(5)	BDT3					BDT2
13H 00-5H 30	FIVE(5)						BDS1
7H 30-17H 30	SIX(6)				BDS1		BDS2
7h300-17h30							BDS2
17H 00-20H 30		BDT3	BDT3	BDT3	BDT4	BDT4	
7H 30 -05H30	OFF						
	OFF						
7H 30 -12H 00	LEAVE	BDT4	BDT4	BDT4	BDT4	BDT4	
13H 00-5H 30	OUTREACH						
7H 30 -5H 30	PERMISSION						
	PERMISSION						
7H 30 -17H 30	SICKNESS						
7H 30 -12H 00	STERILISATION						
14H-16H00	STERILISATION						

**BDS1 & BDS2:** Bachelor's Dental Surgeon who provided RCTs from Monday to Saturdays including evening shifts

**BDT:** Bachelor's in Dental Therapy who made consultations and provide general dental treatment

PREPARED BY: DENTAL COORDINATOR

**Appendix 6: Comparisons of the number of RCT for pre- and post-intervention periods: SPSS analysis outputs**

**Hypothesis Test Summary**

	<b>Null Hypothesis</b>	<b>Test</b>	<b>Sig.</b>	<b>Decision</b>
<b>1</b>	The distribution of Total number of root canal treatment is the same across categories of Study period.	Independent-Samples Mann-Whitney U Test	.002 <sup>1</sup>	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

<sup>1</sup>Exact significance is displayed for this test.

**Appendix 7: Average waiting time for the pre- and post-intervention periods**

**Group Statistics**

	Study period	N	Mean	Std. Deviation	Std. Error Mean
Waiting time in days	Pre-intervention	130	18.323	14.9123	1.3079
	Post-intervention	498	5.711	6.9766	.3126

**Independent Samples Test**

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Waiting time in days	Equal variances assumed	123.301	.000	13.933	626	.000	12.6122	.9052	10.8347	14.3898
	Equal variances not assumed			9.379	144.040	.000	12.6122	1.3447	9.9543	15.2702

**Appendix 8: Total number of patients for the pre- and post-intervention periods**

**Hypothesis Test Summary**

	<b>Null Hypothesis</b>	<b>Test</b>	<b>Sig.</b>	<b>Decision</b>
<b>1</b>	The distribution of Total number of patients received is the same across categories of Study period.	Independent-Samples Mann-Whitney U Test	.002 <sup>1</sup>	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

<sup>1</sup>Exact significance is displayed for this test.

**Appendix 9: sample of patient’s complaint form**



The management of UR- CMHS Polyclinic would like to give you this form which could be filled in terms of appreciating or complaining about the service given to you. Your observations/comments will help us to improve on our services:

If there is any appreciation or complaint in our services, please fill this form to show it:

Date:

1. Choose one from the table below by ticking:

Appreciate	
Complaint	

2. Choose what you want to comment about (Circle or tick one from the table below)

Customer care	Keeping appointment	Waiting time	How were you treated	Payment procedures	Toilet	Others

3. Briefly describe your complaint or appreciations (Summarize).

.....

.....

.....

.....

4. Use this space below if you have any other suggestion.

.....

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.....

.....

**Thank you**

**Appendix 10: Other reasons for patients' clinic visits (See Figure 4.4)**

<b>Other reasons for patients' clinic visits</b>
Desensitization
Appliance
Night Guards per arch
Peri-apical X-rays
Adjustments
Replacement lost bracket (each)
Fraenectomy
Inter-maxillary fixation
Crown and bridges
Reduction of Dental alveolar fracture (Splinting)
Orthopantomogram(OPG) X-rays
Non vital bleaching
Blood Sugar
Creatinine
Dry Socket Dressing
Incision & Drainage of dental-alveolar abscess
Post Core Build Up
Soft tissue Injury Repair
Stainless Steel Crown (Pediatric)
Topical Fluoride Therapy