ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY

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ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY

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DECLARATION

I declare that this Dissertation contains my own work except where specifically acknowledged.

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Signed……..
Date……..

CERTIFICATION

This is to certify that this research work entitled

"Assessment of knowledge, attitude and practice of dental professionals towards teledentistry" is an original work, proposed and conducted by Julienne MURERE REHE as a result of her academic efforts, and was done under my supervision.

Prof. KATO Njunwa
Date: May 20th 2015

DEDICATION

I dedicate this work to:

God my Saviour, who enabled me to reach this success,

My mother for her love and kindly nurturing that have supported me in my life,

All people who have contributed to the success of this work.

AKNOWLEDGEMENT

I am greatly thankful to my God for His salvation.

I would like to express my thoughtful thanks to the Ministry of Education and UR-CMHS administration especially the staff of Health Informatics program for their support and collaboration towards completion of this valuable degree.

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ABSTRACT

Introduction: The capabilities of information technology have advanced in these years. Electronic information together with telecommunication technology has allowed increase of health care services at distance. Most developing countries have started to use telemedicine as a mean to overcome challenges related to shortage of specialists, lack of infrastructures, limited clinical services and inexperienced primary health care providers. Likewise, dentistry faces problems related to shortage of dental specialists, access, cost, efficiency and quality of dental services. Those obstacles might be overcome with the use of teledentistry technology. Currently, the use of teledentistry is still low in developing countries. In Rwanda the state of teledentistry is undocumented. Without knowledge and positive attitude of dental practitioners towards teledentistry, it will not be easy to implement teledentistry innovations.

Aim: The aim of this study is to assess the knowledge, attitude and practices of dental professionals towards teledentistry.

Methodology: A cross-sectional study was conducted in Kigali-Rwanda on 157 dental professionals. A census method was used to collect data on the assessment of knowledge, attitude and practices of dental professionals towards teledentistry. A standardized questionnaire which was adapted to local context was used to collect data. Data was collected to dental clinics or academic institution where authorization data was granted and 103 dental professionals responded to the questionnaire. STATA, version 13 was used for data coding and analysis. Descriptive statistics, one way ANOVA and Fisher exact tests were performed to analyse data.

Results: Majority of respondents had good knowledge (88%) and positive attitude (88%) towards the benefits and application of teledentistry. However the practice of teledentistry being done by dental professionals is still at low level where only seven (6%) of dental professionals are using videoconference for health related purpose intercommunication. Also only 13(12.6%) and eight (7.8%) were sharing digital x-ray and digital photographs as a reason of intercommunication respectively. The knowledge, attitude and dairy internet access were statistically significant with practice ($p < 0.05$).

Also knowledge of dental professionals towards the benefits and application of teledentistry was statistically associated to their attitude towards the benefits and application of teledentistry ($p<0.05$).

Conclusion: The results revealed that dental professionals are knowledgeable and have positive attitude towards teledentistry. Again, dental professionals overall believe that teledentistry is good and it has to be integrated into the current dental practice. However, the practice of teledentistry is still at low level comparing to other advanced applications of teledentistry done in other areas. To bring dental practice at another level in areas like dental education, dental research, community outreaches, and dental health care delivery and so on, there is a need to use the opportunities provided by teledentistry technology.

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LIST OF SYMBOLS AND ABBREVIATIONS

ANOVA : Analysis of Variance

CD-ROM : Compact Disc - Read Only Memory

CHUK : Kigali Teaching Hospital

DCC : Dental Consultancy Center

Dr : Doctor

DUET : Dental Undergraduate Education by Teleconferencing

HIV/AIDS : Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome

HMIS : Health Management Information System

MH : Muhima Hospital

ICT : Information and Communication Technology

KAP : Knowledge, Attitude and Practice

PC : Personal Computer.

PROVIDENT : Postgraduate Regional Online Videoconferencing in Dentistry

RMH : Rwanda Military Hospital

RWFS : Rwandan Francs

TB : Tuberculosis

TV : Tele-Vision

UR-CMHS : University of Rwanda- College of Medicine and Health Sciences

VCR : Video Cassette Recorder.

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CHAPTER 1: INTRODUCTION

1.1 DEFINITION OF KEY TERMS PERTINENT TO THE STUDY

A dental professional: A dental professional is any of many professionals supporting or involved in dentistry like for example dentists, dental students, dental educators, dental assistants and dental technicians (Ozkan Ata, & Ozkan, 2009).

Attitude: Attitude is defined as a person's general feeling about an issue, object or person and it's linked with the person's knowledge, values, beliefs and emotions (Launiala, 2009).

Knowledge: Knowledge is one's capacity of understanding, imagining or perceiving things. The assessed degree of knowledge helps to know the area of efforts for information and education (Stop TB Partnership (World Health Organization, 2008);Chien-Yun, Wan-Fei, Yu-Hsi, & Chia-Hung, 2011).

Knowledge is based on scientific facts and truth while beliefs refer to traditional ideas which form obstacles to practices (Launiala, 2009)

Practice: Practices are the actions done in response to stimulus and which are observable. The practice indicates what knowledge and habit work together(Stop TB Partnership (World Health Organization), 2008; Chien-Yun et al., 2011).

Teledentistry: Teledentistry is a combination of telecommunication technology, internet and dentistry (Sanjeev, & Shushant K, 2011). Teledentistry involving, dental education, public awareness, assistance of general dentists with specialty work, the exchange of clinical information and images over remote distances for dental consultation and treatment planning in the same manner as telehealth and telemedicine (Nutalapati et al. 2011; Khan & Omar 2013). Teledentistry has the ability to improve access to oral healthcare, improve the delivery of oral healthcare, and lower its costs. It also has the potential to eliminate the disparities in oral health care between rural and urban communities (Nutalapati et al. 2011; Khan & Omar 2013).

Telehealth: Telehealth is defined as the provision of health care services using telecommunication technologies at distance with the goal to allow continuing education, research, exchanging necessary information for diagnosis and treatment, predict and prevent diseases from occurring (Costa, Silva, & Pereira, 2011).

Videoconference: A videoconference is a live connection between people in separate locations for the purpose of communication, usually involving audio and often text as well as video. At its simplest, videoconferencing provides transmission of static images and text between two locations. At its most sophisticated, it provides transmission of full-motion video images and high-quality audio between multiple locations (Wrucke & Higgs, 2013).

1.2 BACKGROUND TO THE STUDY.

Oral health disparities are a global issue with most dental specialists located in urban areas. Limited number of dental professionals in rural area leaves people without access to quality dental care in those areas (Berndt, Leone, & King, 2008). Information technology has allowed quick and efficient information transmission. The development of communication programs has allowed global society, electronic interconnection and with no boundary (Costa et al., 2011). In the health sector, several technological methods referred to as telehealth, are being used and allow the interaction between patients and healthcare providers at a distance in different areas (Costa et al., 2011).

The goal of telehealth is broad and it allows continuing education, research, exchanging of necessary information for diagnosis, treatment, and to predict and prevent diseases from occurring. Additionally, telehealth is considered to be a new tool to overcome cultural, social economic and geographic barriers. Its primary benefits include improved primary health care, access to health care, increased availability of resources for education and health professional information (Costa et al., 2011).

Most low income countries have started to use telehealth as a mean to overcome challenges related to shortage of specialists, lack of infrastructures, limited clinical services and inexperienced primary health care providers. Telehealth technologies have increasingly been put into practice in dentistry since it was first launched in 1994 in the provision of oral health services and it is known as teledentistry (Glassman, Helgeson, & Kattlove, 2012). It is believed that teledentistry will reduce the problems related to shortage of dental specialists, access, cost, efficiency and quality of dental services (Nagarajappa et al., 2013).

Several studies recognize teledentistry as a mean of sharing records between dental practitioners and a screening tool to determine the urgency of need for dental treatment. It is also a means to facilitating collaboration between geographically distributed dental practitioners and to allow both real time and store and forward teledentistry applications to help in triage, diagnosis and referral of patients (Nagarajappa et al., 2013). The role of teledentistry is also to reduce the gap between the increased population demand for better oral health care and existing financial resources.

New innovations in research are also increasing in dentistry and such innovations are coming through teledentistry (Sanjeev, & Shushant K, 2011). However, the research in teledentistry has lagged behind when compare with general medicine (Mihailovic, Miladinovic, & Vujicic, 2011). The studies conducted in teledentistry, were mainly done in developed countries thereby leaving a wide gap in knowledge in low income countries (Mariño & Ghanim, 2013).

Rwanda, in its vision 2020 aims, strongly to consider Information and Communication Technology (ICT) as enabler and key driver for broad socio-economic development in the areas of healthcare, education and knowledge based society (Ignace Gatare, 2011). Shortage of dentists and dental therapists, with those available numbering only 92 for 10 million people, however, remains a challenge to be addressed on all fronts (Seymour et al., 2013). Fortunately, Rwanda has been a pioneer in national initiatives to integrate technology into its expanding health care system. Open Medical Record System (OpenMRS) that tracks patient-level data, TRACnet and TRACPlus which are a comprehensive data entry, storage, access, and sharing system created in Rwanda by the Treatment and Research AIDS Center (TRAC) which on monthly basis monitors infectious diseases including Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS), tuberculosis (TB), and Malaria, drug , medical supply management system, Management Information Systems (HMIS) which integrate data collection, processing, reporting, and use of the information for programmatic decision-making, E-Learning that use ICT in instruction of certificate level (A2) nurses to upgrade to Advanced Diploma (A1) level and Telemedicine (Frasier, May, & Wanchoo, 2008). Although teledentistry initiatives have already started in Rwanda, there is no documented evidence showing the how effectively it is utilised, and obstacles faced.

1.3 PROBLEM STATEMENT

According to Jain and colleagues, teledentistry is known as a good tool to reduce the shortage of dental specialist, the isolation of peers, the cost of dental services ,the time and work used to deliver oral healthcare services and to improve dental education (Jain et al., 2013) . In order to transform the way dental practice is being done and improve the access to high quality dental care for underserved, there is a need to adopt opportunities and innovations provided by teledentistry technology. While a number of low income countries have documented limited knowledge and unfavourable attitude regarding benefits and applications of teledentistry technology in dental practice (Nagarajappa et al. 2013) no such a study has been conducted in Rwanda to establish the status of utilization and acceptability of Teledentistry.

The purpose of the current study was therefore to explore the knowledge, attitude and practices of dental proffessionals towards teledentistry in Kigali, Rwanda so as to contribute information needed in planning for the dental professional development in teledentistry implementation.

1.4 OBJECTIVES

1.4.1 MAIN OBJECTIVE

To assess the knowledge, attitude and practices of dental professionals towards teledentistry in Rwanda.

1.4.2 SPECIFIC OBJECTVES

i. To determine the knowledge and attitude of dental professionals in Kigali towards the benefits and applications of teledentistry.
ii. To identify the perceived challenges of dental professionals in Kigali to the use of teledentistry
iii. To identify teledentistry practices of dental professionals in Kigali.

1.4.3 STUDY QUESTIONS

What is the knowledge and attitude of dental professionals in Kigali towards the benefits and applications of teledentistry?

What are the perceived challenges of dental professionals to the use of teledentistry?

What teledentistry practices that is being done by dental professionals in Kigali?

1.5 RATIONALE

In Rwanda there is no documented evidence showing the extent of utilization of teledentistry so far. It is believed that the results of this study showing the knowledge, attitude and practices of dental professionals in teledentistry, will serve as baseline information to be used by government and institutions to develop programs to raise awareness of uses and benefits of teledentistry among dental practitioners aiming at implementation of teledentistry technology. Through this research planners and policy makers in Rwanda may be informed on the strategy to change the way oral health services and dental education are provided aiming at reduction of burden of oral diseases in Rwanda through teledentistry implementation.

1.6 SUBDIVISION OF THE STUDY

This work is composed of introduction, literature review, methodology, results presentation, results discussion, the list of references and annexes. The introduction consists of definitions of key terms, background, problem statement, objectives, research questions and subdivisions of the work. The literature review covers the applications of teledentistry, the benefits of teledentistry, Videoconference as a medium of teledentistry and a conceptual framework regarding knowledge, attitude and practices of teledentistry. The methodology involves the study area, study design, study population, sample size, sampling strategy, data collection methods and procedures, data analysis, problem and limitation of the study and ethical considerations. The results presentation consists of tables showing the study results while results discussion consists of discussions based on the findings in relation to other researches done and literatures. This study is finally ended by a list of references and annexes.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter describes the trends and challenges in teledentistry as reported in different publications reviewed. The utility of teledentistry is explored in terms of knowledge, acceptability and practice among the dental professionals as reported so far.

2.2 TYPES OF TELEDENTISTRY

Teledentistry is divided into two forms which are real time consultation or two-way interactive and store and forward teledentistry. In real time consultation, dentists and their patients in different locations can consult in real-time through videoconference (Rao et al. 2012; Panat et al. 2012). In store and forward teledentistry, the gathered and stored information (patient history, digital photographs, digital x-ray images radiographs, computed tomography scan, magnetic resonance imaging, etc.) can be transferred to consulting location (Rao et al. 2012; Panat et al. 2012).

2.3 APPLICATIONS OF TELEDENTISTRY

Teledentistry can be used in every branch of dentistry like dental consultation, maxillofacial surgery, endodontic, orthodontics, prosthodontics, periodontics, paediatrics and preventive dentistry, oral medicine and diagnosis (Nagarajappa et al., 2013). A study by (Ozkan Ata, & Ozkan, 2009) in Turkey showed that the majority (80%) of dental practitioners consider teledentistry to be potential and reported that teledentistry has to be integrated into the current dental practice.

2.3.1 Tele-consultation in dentistry.

Tele-consultation in dentistry has been shown to be a rapid, effective, high quality and a reliable method of resolving clinical doubts of a therapist and also to confirm his firm decisions. Tele-consultation in dentistry should enter everyday clinical practice and become a routine tool in all disciplines of dentistry, aiming to prevent doctors' mistakes, to improve general health care, and improve cost-effectiveness of treatment (Perić et al., 2012).

2.3.2 Teledentistry in oral medicine

Different researches have shown teledentistry to be very important in oral medicine. Teledentistry has been shown to be quite useful in diagnosis and management of oral diseases. It enables dental practitioners to make sound decisions regarding management of oral diseases and referral to appropriate dental specialists (Mihailovic et al. 2011; Panat et al. 2012a). Teledentistry enables adequate consultation with colleague of the same or different specialties distance apart. Based on its ability to provide high resolution image, teledentistry provides high quality consultation of oral lesions (Torres-Pereira et al., 2008)

Figure 2.1: Giant cell epulis.

The image in figure 2.1, shows a diagnostic agreement of giant cell epulis done through tele-consultation and the treatment of this lesion agreement was surgical removal (Mihailovic et al., 2011).

2.3.3 Teledentistry in radiology

The role of teledentistry in radiology is to transmit radiological images of patients (e.g. MRIs, CTs, x-rays) from two different locations with the intention to share studies with physicians and other dental health professionals. This technique is increasingly becoming important in dentistry not only because it allows the radiologists to provide services from different locations to the patients, but also in that it allows specialists to be available all the time (Panat et al., 2012).

2.3.4 Teledentistry in orthodontic.

Teledentistry in orthodontics has been shown to have immense role in reducing malocclusions (Mihailovic et al. 2011; Panat et al. 2012).

Teledentistry allows general dental practitioners to easily consult orthodontists for advice and to treat a large number of patients with orthodontic problems (Panat et al., 2012). Another role of Teledentistry in orthodontics is to allow the production of a digital study model from impression taken by orthodontists through a system known as OrthoCAD system. OrthoCAD system provides a highly accurate digital model of patient's teeth. This model can be used by an orthodontist from anywhere at any time to electronically review a malocclusion case and show a simulation of the smile before, during or after the treatment. This method is beneficial as it reduces the cost for processing and storage of study models (Mihailovic et al., 2011).

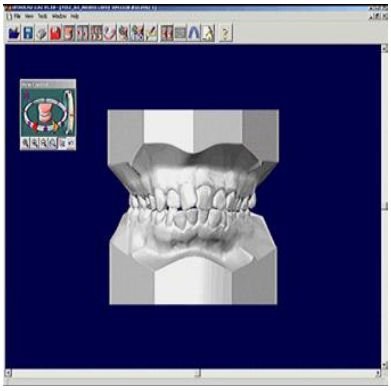

Figure 2.2: A 3D digital model.

The image shown in figure 2.2 indicates a 3D digital model provided by an OrthoCAD system.

2.3.5 Teledentistry in endodontics.

Poorly diagnosed or treated peri-apical lesions lead to complications which may cause the loss of teeth. Through teledentistry, dentists who are not specialists in endodontic may serve a big number of teeth with endodontic problem (Mihailovic et al., 2011).

Dentists located in remote area may successfully diagnose different endodontic pathologies and provide treatments of those pathologies on time. This is beneficial to patients as it reduces the visit costs and prevents the complications associated with treatment delay (Panat et al., 2012).

2.3.6 Teledentistry in prosthodontics.

With aid of videoconference as a medium of teledentistry, a dental practitioner located in rural area can diagnose and make a treatment plan for a patient in need of oral prosthetic appliances. Through two systems known as CAD /CAM (Computer -Aided Design/ Computer -Aided Manufacture), individual dental crowns, dental onlays and inlays and bridge up to three units can be done (Panat et al., 2012; Perić et al., 2012).

2.3.7 Teledentistry in periodontics.

Teledentistry has been found to be efficient for diagnosis and follow up of patients in need of periodontal surgery. The study of periodontal patients done by US army has shown that patients in need of periodontal surgery were identified through teledentistry and sent to Fort Gordon, Georgia for surgery with a periodontist. Most of patients (above 93%) were satisfied with periodontal services done to them through teledentistry and they saved the transport expenses to go back to Fort Gordon, Georgia located to a distance above 100 miles for follow up (Panat et al., 2012).

2.3.8 Teledentistry in oral and maxillofacial surgery.

Teledentistry has been shown to be efficient in diagnosis, analysis and treatment plan of oral and maxillofacial cases. Different studies have emphasized the role of teledentistry in supporting the placement of dental implant (Mihailovic et al., 2011). Teledentistry has also been shown to be efficient in diagnosis and establishing appropriate treatment for impacted wisdom teeth (Mihailovic et al., 2011)

2.3.9 Teledentistry in paediatrics and preventive dentistry.

In order to ensure the good oral health for children, there is a need for schools and child care centres to utilize teledentistry for early screening of dental problem before they become emergencies, they also need to provide urgent care to already existing oral problems and connecting children and their parents to the appropriate health and social services (Chhabra et al. 2011). Teledentistry is of extreme importance in screening of early childhood caries and in categorizing the high risk or low risk patients. Intra oral camera easily helps in examination and detection of such caries (Panat et al., 2012).

2.3.10. Teledentistry in dental education.

Teledentistry can be used as a good tool for education for undergraduate students, post-graduate students and continuing updates for dental practitioners (Nagarajappa et al. 2013; Reynolds et al. 2008). With the availability of videoconference technology students and educators can interact and get feedback from evaluation of patient information (Nagarajappa et al., 2013).

The patient cases can be examined at the students place and the same case can be discussed in deep after all the clinical data have been gathered and shared with educators or other experienced people without the patient being present. This is very helpful for both students and dental practitioners as it improve the students' interest and offer new learning opportunities for both dental students and dental practitioners (Nagarajappa et al., 2013).

In addition teledentistry has the potential to increase the number of dental specialist trainees and specialists in areas where population are dispersed (Ignatius, Mäkelä, Happonen, & Perälä, 2006).The results of a pilot study by (Ignatius et al., 2006) suggested videoconference to be very suitable for long distance learning in dentistry.

2.4. VIDEOCONFERENCING IN DENTAL EDUCATION

In dentistry, videoconferencing method has been integrated as a core method of dental education and training at all level.

Videoconferencing can be enhanced by its ability to link to others ICT components such as PCs or Laptop, CD-ROMs, VCRs to help visual or oral teaching aids. Point-point, word processing and other teaching materials can be shared with all participants in a videoconference (Reynolds et al., 2008).

For situation ranging from small meeting of about four people up to audience into lecturer theatres, the possible components of a videoconference include PC technology, set top boxes, control units, standard TV sets, flat screen or twin screen and incorporation of videoconferencing into integrated audio-visual facilities.

Once these equipments are in place, a dental practitioner can perform dental services such as dental education and training, remote patient diagnosis, monitoring and so on (Reynolds et al., 2008).

As shown by many projects like The PROVIDENT (Postgraduate Regional Online Videoconferencing in Dentistry) and DUET (Dental Undergraduate Education by Teleconferencing) videoconference plays an important role in undergraduate, postgraduate and CPD education in dentistry. Through videoconference dental students can benefit from a wide range of expertise, knowledge and real-life experience of dental practice (Reynolds et al., 2008).

2.5 BENEFITS OF TELEDENTISTRY

Teledentistry has been shown to have endless potential. As shown by (Jain et al., 2013), teledentistry is well known as useful tool to increased patient access to dental care, improved quality of care and the cost effectiveness. In dental field, teledentistry contribute to the reduction in peer isolation and increased specialist support. Again due to teledentistry, general dentists are able to send multimedia patients' records to dental specialists, often enabling the specialists to make a diagnosis and plan a treatment without having to see the patient in person. Many literatures have also emphasized the role of teledentistry in improvement of diagnostic services and communication with the insurance industry and dental laboratories (Reynolds et al., 2008; Rao et al., 2012).

.Teledentistry also contribute a lot in long distance clinical training and continuing education, screening and serve as a solution for underserved and people in rural areas (Jain et al., 2013). Teledentistry is beneficial as it decreases the time and work required to store or to retrieve the patient, it avoids loads of papers and files with patient records. Teledentistry also provide better image quality and less patient exposure to rays. Teledentistry can also allow a dentist to provide supervision to a health care auxiliary like nurses, dental hygienists or dental assistants to provide a direct patient care in remote area. Another benefit of teledentistry is to allow a direct patient care through robotic technology (Rao et al., 2012) .

2.6. CONCEPTUAL FRAMEWORK FOR THE PRESENT STUDY

The conceptual framework used in the present study has been adapted from the KAP model which has been used for innovation diffusion theory by scholars and has integrated innovation adoption in 3 phases which are knowledge, Attitude and practice. It states that the learning knowledge of the learner affects his attitude, while the learning attitude affects the actions (Chien-Yun et al., 2011).

Other studies have shown that knowledge may directly affect the attitude and practice and the attitude will directly affect the practice but the degree to which knowledge affects practice through attitude is better than that of knowledge affects practice directly (Greenhalgh et al. 2004; Chien-Yun et al. 2011). On the other hand, (Greenhalgh et al., 2004) in their reviewed study of innovation diffusion theory, have shown that the awareness about the benefits of innovation, the positive perception about the use of such innovation and the task performance of users from such innovation will contribute a lot to its easy adoption.

The Knowledge, attitude and actions can be affected in a sense that new innovation is likely to be adopted in different ways depending on characteristics of adopters. (Robinson, 2009) stated that the adoption of innovation is related to the needs of deferent users.

Depending on their tendency to adopt innovation, (Robinson, 2009) states that the users are categorized as Innovators (people who spend much energy and time developing new ideas); Early adaptors (people who play an important role to the use of innovations at its early stage like leaders in the community); Early majority (people who are not leaders and it take them some time to adopt the innovation due to fear of time they can spend on the innovation); Late majority(people who don't have access to communication channel to be aware of new innovation, as they lack mass media communication, they only wait till innovation is closer to them and it has been used by a potential party of the community) and Laggards (people who don't have access to either mass media or interpersonal communication. They usual use innovation already abandoned).

The KAP model used for the present study is very important to gather information on what is known, believed and done in relation to teledentistry.

The data collected from KAP survey are essential for planning and implementation of the work (Stop TB Partnership (World Health Organization), 2008.

CONCEPTUAL FRAMEWORK

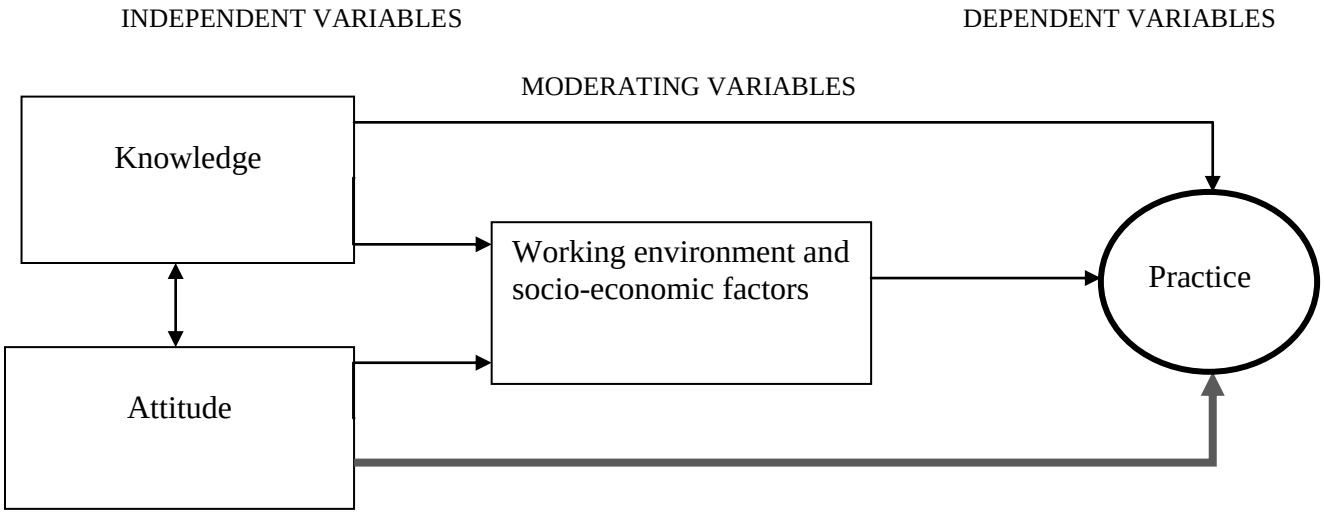

Figure 2.3: Conceptual framework of KAP Model.

The current conceptual framework has been adapted from (Jain et al., 2013). The KAP model adapted to current study is mainly focusing on variables to be studied in the present study. They include independent variables highlighting the aspects of interests related to knowledge and attitude in teledentistry technology. These include the knowledge and attitude about the benefits and applications of teledentistry. The second element summarizes the dependent variable which is practice about teledentistry .

According to the literature, attitude directly depends to previous knowledge that a subject has while practice depends to knowledge and attitude. But the degree of effect that attitude has on teledentistry practice is better than that of knowledge (Jain et al., 2013). For the purpose of the present study, attitude in teledentistry highlights the thoughts of dental professionals regarding the benefits and applications of teledentistry and their perceived challenges to the use of teledentistry. Teledentistry practice describes mainly the use of computers and internet for health related purposes, the people they interact with, the means of intercommunication and the reason for intercommunication.

Control factors that may hinder dental practice include working environmental factors such as lack of electricity, lack of internet connection etc, and social economic factors which includes but not limited to lack of infrastructures, financial problem and so on.

For the present study, this model will help to gather information about dental professionals 'knowledge, attitude and practices about teledentistry and to identify where the gaps are. This may then help to take informed decision regarding the implementation of teledentistry programs in Rwanda.

CHAPTER 3: METHODOLOGY.

3.1. INTRODUCTION.

The methodological part of the present study is describing the study area, study design, study population, sample size, sampling strategy, data collection methods and procedures, data Analysis, problems, limitation and ethical consideration.

3.2. STUDY AREA.

The study was conducted in different public and private dental clinics or institutions found in Kigali city, i.e. University of Rwanda- College of Medicine and Health Sciences (UR-CMHS) both dental clinic and school of dentistry; Kigali Teaching Hospital (CHUK), Rwanda Military Hospital (RMH), Muhima Hospital (MH), Faith dental clinic, African Dental Aid (ADA) clinic.

3.3 STUDY DESIGN.

A cross-sectional study using quantitative method was used to assess the knowledge, attitude and practices of dental professionals towards teledentistry. Cross-sectional studies are carried out at a specific point in time. They are usually conducted to estimate the prevalence of the outcome of interest for a given population, commonly for the purposes of public health planning (Levin, 2006).

3.4 STUDY POPULATION.

Dental professionals working or studying in Kigali city were considered in this study.

3.5 SAMPLE SIZE.

All 157 dental professionals found in Kigali city were considered for the study.

3.6 SAMPLING STRATEGY.

We used a census method for dental professionals in Kigali city. A census method is a technique where data is collected from the whole population rather than a sample (Pooja Rani ,2012; Tongco, 2007).

3.7 DATA COLLECTION METHODS AND PROCEDURES.

A self administered structured questionnaire with open ended and closed questions was used to collect data regarding knowledge, attitude and practices of dental professionals towards teledentistry. The questionnaire was designed in English. The questionnaire was adapted, validated and modified from questionnaires of similar studies found in the literature (Cooper & Engeswick, 2007; Nagarajappa et al. 2013; Ozkan Ata, & Ozkan, 2009). A pilot study with 10 students and five dental practitioners was done prior to the study to pre-test the questionnaire. The aim of the pilot study was to ensure the validity and liability of the questionnaire and to measure the understanding of participants to ensure the acceptability of the questionnaire and the language clarity. The researcher provided information sheet for both students and dental practitioners before they answered the questionnaire.

3.8 DATA ANALYSIS.

Data was analysed using statistical software STATA version 13. The response format was based on 5-Point Likert scale for knowledge and attitude. Level of significance was fixed at $p \leq 0.05$. Frequencies, means and standard deviations as part of descriptive statistics were used to describe the data. One way ANOVA and Chi-square test were performed to assess whether the knowledge and attitude varies according to socio-demographic characteristics or to each other and to assess their relationship with practice. Tables were used to present the results.

3.9 PROBLEMS AND LIMITATION OF THE STUDY.

3.9.1 Problems of the study.

During the study the research encountered the problem of getting permission letter to collect data for some sites because there was no research ethical committee in those areas. Another problem was dental professionals working in more than one dental clinic. We considered only one site for those people to avoid the duplication of data.

3.9.2 LIMITATIONS OF THE STUDY.

Due to limited fund, the study was conducted in Kigali city and may not be generalized to the whole country.

3.10 ETHICAL CONSIDERATION.

The scientific and ethical approval for conducting the research was granted by UR- CMHS Ethical Committee. Likewise, permission to collect data was obtained from different sites where data were collected. Informed consent form was signed by each participant willing to participate before answering the questionnaire. The participation in the study was on voluntary basis and confidentiality of the identity of the participants was assured by using codes instead of real names of participants on the questionnaire.

CHAPTER 4: RESULTS

4.0. INTRODUCTION.

In this chapter, results are presented regarding the assessment of knowledge, attitude and practices of dental professionals in Kigali city. A standard questionnaire was used to collect data and 103 respondents completed the questionnaire. The questionnaire was not answered by all targeted people because some areas did not give the permission letters to collect data. The data were analysed with STATA version 13.

The results of the present study are presented in three themes to respond to the study objectives. The present chapter highlights the general profile of the study respondents, followed by results on reported knowledge and attitude about the benefits and applications of teledentistry, and lastly a summary of the practices of dental practitioners towards teledentistry.

4.1. SOCIO-DEMOGRAPHIC PROFILE OF THE STUDY RESPONDENTS.

Socio-demographic information is presented in table 4.1. The findings revealed that majority of the study respondents 75(72.8%) fell between 20-35 age groups while people above 40 were only six (5.8%) as shown in the table 4.1. The level of education revealed that majority of respondents 98 (95.1 %) were dental professionals without post graduation, while only five (4.9%) had had post graduation. The results also revealed that majority101 (98%) of respondents accessed internet in general.

Table 4.1: Socio-demographic characteristics of dental professionals (N=103)

DEMOGRAPHIC DATA	N	%
Age of dental professionals		
20-30	75	72.8
30-40	22	21.4
>40	6	5.8
Sex		
Male	57	55.3
Female	46	44.7
Qualification		
Dental professionals without post graduation	98	95.2
Dental professionals with post graduation	5	4.9
Place of work		
Private sector	12	11.7
Public sector	91	88.3
Working experience (in Years)		
<5	78	75.7
5-10	16	15.5
>10	9	8.7
Internet access (in general)		
Yes	101	98
No	2	2
Internet access for health related purpose(in hours)		
<2	43	41.75
>=2	57	55.34
Missing	3	2.91

4.2. FREQUENCY OF KNOWLEDGE AND ATTITUDE OF DENTAL PROFESSIONALS ABOUT BENEFITS AND APPLICATION OF TELEDENTISTRY.

Regarding the knowledge of dental professionals about benefits and application of teledentistry, respondents have shown greater knowledge. Majority of them agreed with the given items of benefits and application of teledentistry at a high percentage as shown in Table 4.2. Regarding the attitude of dental professionals, majority of dental professionals showed positive attitude at a high percentage regarding the items of benefits and application of teledentistry. However about 46 (44.7%) of respondents disagreed with the item “I think teledentistry can reduce the costs of dental services and 43(41.7%) disagreed with the item “I think that dental examination done through teledentistry is as accurate as face to face consultation as shown in Table 4.2.

Table 4.2: Frequency of knowledge and attitude of dental professionals towards the benefits and application of teledentistry.

KNOWLEDGE ABOUT TELEDENTISTRY BENEFITS AND APPLICATIONS	PROPORTION		
	Agree N (%)	**Neutral N (%)**	**Disagree N (%)**
Knowledge about teledentistry concept	99 (96.1)	4(3.9)	0 (0)
Use in every branch of dentistry	92 (89.3)	5(4.85)	6 (5.83)
Use for education and training of primary healthcare dentists.	88 (85.44)	8(7.77)	7 (6.8)
decreasing the isolation of dental practitioners by providing peer contact specialist	86 (83.5)	11(10.68)	6(5.83)
Useful in diagnosis and management of oral diseases	87 (84.5)	11(10.68)	5 (4.85)
Useful in early and easy consultation of oral- facial disorders with specialists.	88 (85.4)	7(6.8)	8 (7.77)
Make sound decisions regarding management of oral diseases and referral to appropriate dental specialists.	90 (87.4)	10(9.71)	3 (2.91)
Prevents doctors' mistakes and improves cost-effectiveness of dental treatment.	77 (75)	15(14.56)	11(10.68)
Used as a good tool for education to undergraduate students, post-graduate students and continuing updates for dental practitioners.	95 (92.2)	7.6.8)	1 (0.97)
Increase the number of dental specialist trainees and specialists in areas where population are dispersed.	83 (80.6)	12(11.69)	8 (7.77)
ATTITUDE ABOUT TELEDENTISTRY BENEFITS AND APPLICATIONS			
Teledentistry can save me time.	82 (79.6)	12(11.69)	10(9.71)
Teledentistry can save me money.	71 (69)	17(16.50)	15 (14.56)
Using teledentistry, I will be able to monitor my patient's condition well.	80 (77.7)	12(11.65)	11 (10.68)
Teledentistry can provide me a good understanding of the patient`s oral health problem over the internet.	83 (80.6)	11(10.68)	9 (8.74)
Teledentistry will be a standard way of oral health care delivery	77 (75)	16(15.53)	10 (9.71)
Teledentistry is a convenient form of oral health care delivery which makes dental examination easier	76 (73.8)	19(18.45)	8(7.77)
Teledentistry can be an addition to the regular care we provide.	79 (76.70)	18(17.48)	6(5.83)
I think dental examination done through teledentistry is as accurate as face to face consultation	60 (58.3)	19(18.45)	24 (23.3)
I think teledentistry can reduce the costs of dental services	57 (55.3)	19(18.45)	27 (26.21)
I think through videoconference (a medium of teledentistry) students can be educated and staff be trained effectively	94(91.2)	8(7.77)	1(0.97)
Overall believe of dental professionals about teledentistry benefits and application	97(94.2)	21(20.30)	30(29.13)

4.3: FREQUENCY OF PERCEIVED CHALLENGES TO THE USE OF TELEDENTISTRY

Majority of participants 78(75.8%) agreed that in Rwanda, major challenges in teledentistry use are illiterates, population below the poverty line and lack of infrastructures. The big number of participants 83(80.6%) think that lack of awareness about teledentistry benefits and applications by dental professionals will be barriers to its use. However a large number of participants showed a negative attitude for some statements regarding perceived challenges to the use of teledentistry. Many respondents 52 (50.5%) thought that teledentistry can violate the patient privacy. About 50 (48.5%) were worried about data entry mistakes. Forty one 41(40%) of dental professionals can't trust teledentistry equipments to work and 47 (45.6%) think that teledentistry equipment will be difficult for them to use.

Table 4.3: Frequency of perceived challenges to the use of teledentistry

PERCEIVED CHALLENGES TO THE USE OF TELEDENTISTRY	PROPORTION		
	Agree N (%)	**Neutral N (%)**	**Disagree N (%)**
I think teledentistry can violate the patient's privacy.	52 (50.5)	21(20.39)	30(29.13)
I am worried about data entry mistakes.	50 (48.5)	31(30.10).	22(21.36)
I can't trust teledentistry equipment to work.	41 (40)	25(24.27)	37(35.92)
I think equipments of teledentistry will be difficult for me to use them.	47 (45.6)	16(15.53)	40 (38.83)
In Rwanda, major challenges in teledentistry are illiterates, population below the poverty line and lack of infrastructure.	78 (76)	13(12.62)	12 (11.65)
I think lack of awareness about teledentistry benefits and applications by dental professionals will be a barrier to its use.	83 (80.6)	11(10.68)	9 (8.74)

4.4 FREQUENCY OF PRACTICES OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY.

Teledentistry practices being done by dental professionals are presented in Table 4.4. Majority 87(84.5%) are communicating with peer dental professionals through internet or mobile phone.

The results also revealed that the means of intercommunication highly used were email 69(67%) while only 7(6.8%) are using videoconference as a mean of intercommunication. Regarding reasons of intercommunication, majority of respondents were intercommunicating for patient information sharing 43(42%) and to discuss a patient case while a small number were intercommunicating for sharing digital photographs 8(7.8%) and digital x-ray image 13(12.6%) as presented in table 4.4.

Table 4.4: Practices of dental professionals towards teledentistry.

Practices of dental professionals	Yes N (%)	No N (%)
Interdisciplinary consultation or communication with peer dental professionals through internet or mobile phone	87(84.5 %)	15(14.5 %)
Category of people with whom intercommunication is done		
Consultation with patients	30 (29.1 %)	73(70.9%)
Consultation with students	52(50.5%)	51(49.5%)
Consultation with educators	29(28 %)	74(72%)
Consultation with specialists in the same field	32(31%)	71(69%)
Consultation with own peers	26(25%)	77(75%)
Consultation with insurance company	4(4%)	99(96%)
Means of intercommunication among dental professionals for health related purpose		
Usage of videoconference as a mean of intercommunication	7(6.8%)	96 (93.2%)
Usage of email as a mean of intercommunication	69(67%)	34(33%)
Phone call and sms	21(20.4%)	82(79.6%)
Facebook, Linkedin, whatsapp	13(12.6%)	90(87.4%)
Reasons for intercommunication		
Discussing a patients case as a reason of consultation	40(39%)	63(61%)
Patient information sharing as a reason of consultation	43(42%)	60(58%)
Getting opinion from an expert for a patient case as reason of consultation	26(25%)	77(74.8%)
Patient follow up as a reason of consultation	23(22.3%)	80(77.7%)
Course material clarification as a reason of consultation	37(36%)	66(64%)
Sharing digital photographs as a reason of consultation	8(7.8%)	95(92.2%)
Sharing digital x-ray images as a reason of consultation	13(12.6%)	90(87.4%)

4.5. MEAN SCORE OF KNOWLEDGE AND ATTITUDE WITH SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF DENTAL PROFESSIONALS.

To assess the overall knowledge and attitude with demographic data characteristics, calculation of the means and standard deviations to each category of socio-demographic characteristics was made. The calculation of mean knowledge or mean attitude was done by summing the scores of responses given. After all, One way ANOVA statistical analysis was performed and no association found between knowledge and attitude with socio-demographic data ($p>0.05$) as shown in table 4.5.

Table 4.5: Mean knowledge and attitude scores with socio-demographic characteristics and practice of dental professionals towards teledentistry.

Socio-demographic characteristics	**Knowledge**			**Attitude**		
	Mean ± SD	Freq.	P value	Mean ± SD	Freq.	P value
Age of Participants			**0.547**			**0.462**
20-30	8.7 ± 1.76	75		11.92 ± 3.05	75	
30-40	8.32 ± 1.58	22		11.36 ± 3.03	22	
>40	8.17 ± 2.22	6		10.5 ± 3.56	6	
Sex			**0.445**			**0.337**
Male	8.47 ± 2.01	57		11.45 ±3.36	57	
Female	8.73 ± 1.34	46		12.4 ± 2.66	46	
Level of education			**0.786**			**0.201**
Dental professionals without post-graduation	8.51 ± 1.75	98		11.80± 3.03	98	
Dental professionals without post-graduation	8.8 ± 1.78	5		10 ± 3.60	5	
Place of work			**0.712**			**0.794**
Private sector	8.41 ± 1.62	12		11.5± 3.31	12	
Government sector	8.61 ± 1.76	91		11.74 ± 3.05	91	
working experience			**0.813**			**0.571**
<5 years	8.65 ± 1.76	78		11.89 ± 3.03	78	
5-10 year	8.43 ± 1.71	16		11.06 ± 3.25	16	
>10 years	8.33 ± 1.80	9		11.33 ± 3.24	9	
Dairy internet access in general			**0.194**			**0.305**
Yes	7 ± 1.41	2		9.5 ± 3.53	2	
No	8.62 ± 1.74	104		11.76 ± 3.06	101	
Dairy internet accessibility for health related purpose in hours			**0.667**			**0.510**
<2	8.52 ± 1.86	43		11.97± 3.01	43	
>=2	8.66 ± 1.70	57		11.56 ± 3.19	57	

Statistical test applied: one way ANOVA.* indicates statistically significant difference at $p \leq 0.05$.

4.6 ASSOCIATION OF KNOWLEDGE AND ATTITUDE SCORES.

The proportion of knowledge and attitude scores have been calculated and

Chi square statistical analysis has been performed. The results revealed that statistically, there is an association between knowledge and attitude (P= 0.02) as shown in table 4.5.

Table 4.6: Association of knowledge and attitude scores:

Knowledge	**Attitude**			
	Agree **N (%)**	**Disagree** **N (%)**	**Total** **N (%)**	**Fisher's exact P value**
Agree	88(100.00)	13(86.67)	101(98.06)	**0.020***
Disagree	0(0.00)	2(13.33)	2(1.94)	
Total	**88(100.00)**	**15(100.00)**	**103(100.00)**	

Statistical test applied: Fisher's exact test.

*** indicates statistically significant difference at p ≤ 0.05.**

4.7 ASSOCIATION OF SOCIO-DEMOGRAPHIC DATA WITH PRACTICE OF TELEDENTISTRY.

One way ANOVA statistical analysis was performed to see the relationship between socio-demographic characteristics with practice. The results revealed that the only predictor of practice was internet access in general (P=0.017) as presented in Table 4.6.

Table 4.7: Association of socio-demographic data with practices of teledentistry.

Socio-demographic characteristics.	Practice		
	Yes n (%)	No n (%)	Fisher's exact P value
Age of Participants			**0.592**
20-30	63(70.79)	12(85.71)	
30-40	20(22.47)	2(14.29)	
>40	6(6.74)	0(0.00)	
Sex			
Male	49(55.06)	8(57.14)	**1.000**
Female	40(44.94)	6(42.86)	
Level of education			**1.000**
Dental professionals without post-graduation	84(94.38)	14(100.00)	
Dental professionals without post-graduation	5(5.62)	0(0.00)	
Place of work			**0.363**
Private sector	12(13.48)	0(0.00)	
Government sector	77(86.52)	14(100.00)	
working experience			**0.616**
<5 years	66(74.16)	12(85.71)	
5-10 year	14(15.73)	2(14.29)	
>10 years	9(10.11)	0(0.00)	
Dairy internet accessibility in hours			**0.017***
Yes	89(100.00)	12(85.71)	
No	0(0.00)	2(14.29)	
Dairy internet accessibility for health related purpose in hours			**0.229**
<2	35(40.23)	8(61.54)	
>=2	52(59.77)	5(38.46)	

Statistical test applied: Fisher's exact test.

*** indicates statistically significant difference at $p \leq 0.05$.**

4.8 ASSOCIATION BETWEEN PRACTICES OF DENTAL PROFESSIONALS WITH KNOWLEDGE AND ATTITUDE OF DENTAL PROFESSIONALS.

To assess the association of teledentistry practice of dental professionals with their knowledge and attitude, the questions asked about practice were combined into summary scores. One way ANOVA has been performed and the results revealed an association of teledentistry practice with knowledge and attitude statistically ($p<0.05$) as shown in the table 4.8.

Table 4.8: Correlation between teledentistry practices of dental professionals with their knowledge and attitude.

Practice	Knowledge				Attitude			
	Mean	SD	Freq.	P value	Mean	SD	Freq.	P value
Yes	8.142	2.824	89	**0.001***	11.966	2.866	89	**0.038***
No	8.662	1.522	14		10.142	3.919	14	
Total	8.592	1.745	103		11.718	3.072	103	

Statistical test applied: One way ANOVA

*** indicates statistically significant difference at $p \leq 0.05$.**

CHAPTER 5: DISCUSSION

5.0 INTRODUCTION:

In the present study we discussed the findings of knowledge, attitude and practices of dental professionals towards teledentistry based on literatures and other published researches done in relation to study objectives.

5.1 DEMOGRAPHIC DATA

Majority of participants 75(52%) fall in between 20 and 30 age group while only 6(5.8%) of participants were above 40 years old. Similar results have been found in a research done by (Nagarajappa et al., 2013) where a big number 50 (47.6%) of dental professionals were between 20-30 years old. The young age of majority of participants may be explained by the fact that majority of participants were students still in their mid career and the majority were undergraduate students.

5.2. KNOWLEDGE OF DENTAL PROFESSIONALS ABOUT THE BENEFITS AND APPLICATION OF TELEDENTISTRY.

The present study has revealed that teledentistry benefits and applications are known by many dental professionals in Kigali-Rwanda. Most of respondents agreed or strongly agreed with the statements regarding the benefits and application of teledentistry. A large number 92(89.3%) of dental professionals in the present study agreed that teledentistry can be used in every branch of dentistry. Our results are similarly reported elsewhere (Bhambal et al. 2010; Mihailovic et al. 2011). However, these results are a little different from those found in a study done in Udaipur in India in 2009 where only less than half (46.7%) of dentists agreed with the statement “teledentistry can be used in every branch of dentistry” (Nagarajappa et al., 2013). This difference might be due to the fact that in Rwanda, the information and communication technology has reached an advanced level in health sector (Ministry of Youth and ICT, 2012).

Teledentistry potentiality is also seen in dental education (Chen et al. 2003; Bhambal et al. 2010). In the present study, majority 88(85.4) of respondents agreed that teledentistry is used for education and training of primary healthcare dentists.

Also majority 95(92.2%) of participants agreed that teledentistry can be used as a good tool for education to undergraduate students, post-graduate students and continuing updates of dental practitioners. The similar results have been found in India where a big proportion (58%) of dentists agreed with the statement that teledentistry is good for dental education over internet and for training of dentists (Nagarajappa et al., 2013). Bhambal and colleagues also supported that undergraduate students and post graduate students can be well educated through teledentistry, continuing professional education is easily provided to dental professionals through teledentistry and that the number of dentals specialist trainees is increased through opportunities provided by teledentistry (Bhambal et al., 2010). Jain and colleagues also emphasized that teledentistry is a good tool to upgrade dental professionals' degree (Jain et al., 2013).

In Rwanda information technology have already started to be used in education even in primary schools where one laptop per child program has achieved a lot in the lives of Rwandan pupils (Ministry of Youth and ICT, 2012). Also e-learning programs are being used in some nursing school to train nurses (Frasier et al., 2008). However, in Rwanda there is no evidence showing the use of teledentistry in education.

In Rwanda there still a big number of dental professionals without postgraduate study (Seymour et al., 2013). The present study has also revealed a shortage of specialised dental professionals. Majority of respondents were dental professionals without post-graduation. Those are dental professionals holding advanced diploma in dentistry, Bachelors of dental therapy and few with a bachelor of dental surgery as revealed by the present study. Based on the literatures, teledentistry may contribute a lot to upgrade the degrees of dental professionals in Rwanda, there by resolving the problem of shortage of dental personnel.

Teledentistry may also contribute to education of dental students located in different branches of UR-CMHS like Huye and Nyamishaba branches without spending many resources like transports and other allowances of lecturers travelling to those campuses. If adopted, teledentistry could also help in the bridging program of dental professionals with advanced diploma to upgrade their degrees to bachelor' of dental therapy (Ao).

The same way dental professionals with bachelors of dental therapy or bachelor of dental surgery could upgrade their degree is different dental specialties through teledentistry.
Through teledentistry, dental professionals in remote areas are able to communicate with specialists or more skilled dental practitioners at distance (Glassman, Helgeson, & Kattlove, 2012). Majority 86(83.5%) of respondents in the present study, agreed with the statement "teledentistry can decrease the isolation of dental practitioners by providing peer contact specialist". (Jain et al., 2013) has supported those findings. They emphasized that peer contact specialist is one of teledentistry importance that breaks the isolation barrier among dental practitioners. (Nutalapati et al., 2011) also supported that through real time consultation or through store and forward teledentistry, dental professionals are able to share any information pertinent to their career thereby decreasing the isolation among those located in remote area.

In most of developing countries including Rwanda most specialist dental services are found in urban area and especially most dental specialists and more skilled dental professionals are located in cities (Berndt et al., 2008).

If adopted by dental professionals, teledentistry will decrease the isolation of dental professionals in remote area as emphasized by literatures (Sanjeev, & Shushant K, 2011). The results of the present study have also revealed that majority of respondents agreed with the statements "teledentistry can be useful in diagnosis and management of oral diseases 87(84.5%), teledentistry can be useful in early and easy consultation of oral-facial disorders with specialists 88(85.4%), teledentistry can enable dental practitioners to make sound decisions regarding management of oral diseases and referral to appropriate dental specialists 90(87.4%) and that teledentistry prevents doctors' mistakes and improves cost-effectiveness of dental treatment 77(75%)". Those results are supported by deterrents published literatures and researches. They support that speed, cost-effective, simplicity and maximum therapeutic gain are some of teledentistry benefits for consultation, diagnosis and management of oral diseases and oral-facial disorders (Nagarajappa et al., 2013); (Jain et al., 2013);(Rao et al., 2012);(Bhambal et al., 2010);(Sanjeev, & Shushant K, 2011);(Chhabra et al., 2011).

In addition, teledentistry prevents dental practitioners' mistakes and enable them to make sound decisions (Panat et al., 2012).

In Rwanda there is shortage of dental practitioners especially dental specialists of all kinds (Seymour et al., 2013). Oral diseases and oral -facial disorders are among dental problems that may impinge the lives of people (Jain et al., 2013). Due to shortage of qualified dental specialists to diagnose and treat these disorders earlier, Rwandan population with oral diseases may lose their lives due to lack or delay diagnosis and management of those oral problems (Seymour et al. 2013). The results of this study have shown that dental professional in Kigali-Rwanda are aware that teledentistry can help to overcome this problem by providing early and easy consultation of oral- facial disorders with specialists. If teledentistry could be adopted and used for consultation of oral- facial disorders with available specialists, the oral - facial disorders which impinge the lives of people in Rwanda could be reduced.

5.3 ATTITUDE OF DENTAL PROFESSIONAL TOWARDS THE BENEFITS AND APPLICATION OF TELEDENTISTRY.

In developing countries the number of general dentists and dental specialists per person is still low (Ozkan Ata, & Ozkan, 2009). Through applications provided by teledentistry, the existing dental professionals in those countries should be used effectively to be able to serve their population. In the present study the respondents agreed with the statements "teledentistry can save them time 80 (79.2%) and money 71 (69%). The results of the current study are similar to the results of a study than in Turkey in 2009 where 181 (83%) anticipated that teledentistry would save time and 157 (72%) anticipated that teledentistry would save money (Ozkan Ata, & Ozkan, 2009). Other different literatures have supported teledentistry as a mean to save money and to save time (Jain et al., 2013).

However the currents results are different from the results of a research done by Nagarajappa and colleagues in Udaipur, India where only 35 (33.3%) agree with the statement "teledentistry can save me time" and only 22 (21%) agree with the statement "teledentistry can reduce costs for the dental practices" (Nagarajappa et al., 2013).

Teledentistry is essential for monitoring of patients (tele-monitoring) (Ozkan Ata, & Ozkan, 2009). Majority of respondents 80 (77.7%) perceived teledentistry to be useful for monitoring of patients' conditions.

A study done in Turkey in 2009 has shown similar results where majority 178 (81%) of respondents were all positive that using teledentistry, they would be able to monitor patients' conditions (Ozkan Ata, & Ozkan, 2009). However different results have been found by (Nagarajappa et al., 2013) in a research done in India in 2013 where only 47(44.8) respondents were positive with the statement " using teledentistry, I will be able to monitor my patient's condition well".

Different applications of teledentistry for dental education have been emphasized by different literatures (Chhabra et al., 2011; Bhambal et al., 2010 ; Jain et al., 2013; Chen et al., 2003). In the present study, majority 94 (91.2%) of dental professionals thought that through videoconference (a medium of teledentistry) students can be educated and staff be trained effectively. A study done in Turkey has also revealed that majority 206 (94%) of respondents agreed that teledentistry is good for dental education (Ozkan Ata, & Ozkan, 2009).Teledentistry has been shown to be efficient to provide low cost real-time interactive between students and instructors. Different literatures emphasize the effectiveness videoconference for training dental practitioners, dental students, dental assistants and dental office staff (Eaton, Francis, Odell, Reynolds, & Mason, 2001; Chhabra et al., 2011). Through videoconference, universities can also collaborate to exchange and share experience among their staff which contribute to quality dental care services (Reynolds et al., 2008).

Majority of dental professionals practicing dentistry outside the city hold Bachelors of dental therapy or advanced diploma in dentistry (Seymour et al., 2013). This is an indicator that inequity of dental services is still available in Rwanda. The use of videoconference, a medium of teledentistry would be very beneficial to allow the population outside the city to access specialty dental services. Again dental professionals working in those areas would gain more skills and knowledge through Continuing Professional Development provided by teledentistry applications. Specialists or more skilled people can provide real-time teaching or presents clinical cases respectively to remaining dental professionals in the country.

Dental students nationwide could also benefit from teledentistry by sharing the available resources which may contribute to the standardization of their studies.

Teledentistry has been shown to have endless potential (Bhambal et al., 2010). Different literatures have emphasized the potentiality of teledentistry in different areas of dentistry (Bhambal et al., 2010; Nagarajappa et al., 2013). Majority 97 (94.2%) of respondents overall believe that teledentistry is potential and has to be integrated into their current practices. The same results have been revealed by a study done in Turkey in 2009 where 212 (97%) agreed or strongly agreed that teledentistry is potential and has to be integrated into their current practices (Ozkan Ata, & Ozkan, 2009). This is an indicator that dental professionals generally understand and would like to use teledentistry in their daily activities.

5.4 PERCEIVED CHALLENGES TO THE USE OF TELEDENTISTRY

Teledentistry involves the exchange of electronic data at distance (Sanjeev, & Shushant K, 2011). Privacy, ethical and legal issues are also concerns if teledentistry have to be implemented and practiced (Nagarajappa et al., 2013;Chang et al., 2003).

Confidentiality of medical information, general security of electronic information is significant issues in any medical area as well as in teledentistry practice (Sanjeev, & Shushant K, 2011; Chang et al. 2003). The results of the present study revealed that a large number 52 (50.5%) of respondents thought that teledentistry can violate the patient's privacy. About 41(40%) of respondents answered that they can't trust teledentistry equipment to work, while 50 (48.5%) were worried about data entry mistakes. The results of a study done in Turkey regarding the attitude of dental professionals towards teledentistry have also shown that (78%) of respondents raised their concerns as regards patient privacy, data entry mistakes (77%) and trust on equipments (72%) (Ozkan Ata, & Ozkan, 2009).

Current advances in technology allow maintaining the security and privacy of electronic data (Ponemon Institute 2012). Lack of data security is one of the barriers to acceptance to the use of new technology. The awareness on how the security is maintained for the users and on how legal and regulatory issues are observed, is very important if teledentistry has to be used (Sanjeev, & Shushant K, 2011). Based on these results, there is a need of assuring dental

professionals in Kigali- Rwanda on the current strong methods to maintain security and privacy of electronic medical data.

No statistical significant found between the association of knowledge and attitude with socio-demographic characteristics ($p>0.05$). Those results are surprisingly different from the results of a study done by Nagarajappa and colleague. Nagarajappa et al., 2013 in a study than in Udaipur, India found that the level of education and the working experience were statistically significant with knowledge and attitude. In their study, dental professionals with high level of education and with high working experience have revealed great knowledge and positive attitude. The findings of the current study on this matter may be due to advancement of ICT in health care where all categories of dental professionals are now aware of the benefits of ICT in healthcare delivery.

The results of the current study however, revealed a statistical significance between knowledge and attitude; these findings were supported by chien-yun and colleague. Chien-Yun et al. 2011 found that the knowledge of the learner affects his attitude and the attitude and knowledge may affect practice.

5.4 PRACTICES OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY.

Teledentistry has been defined as the use of telecommunication technology and internet in dental field (Sanjeev, & Shushant K, 2011). At its low level, practicing teledentistry has been said to be as simple as turning on the television or making a phone call (Sanjeev, & Shushant K, 2011).

In the present study, majority 87(84.5%) of respondents consult or communicate with other dental professionals through internet or mobile phone. Regarding category of people with whom they interact, 30(29.1%) intercommunicate with patients; 52(50.5%) with students; 29(28%) with educators; 32(31%) with specialists; 26 with own peer and only 4(4%) communicate with insurance companies. The results revealed that the means of intercommunication were email 69(67%); phone call and sms 21(20.4%); Facebook, linkedin and whatsapp 13(12.6%) while videoconference showed only 7 (6%).

Regarding reasons for intercommunication 43(42%) intercommunicate to share patient information, 40(39%) intercommunicate to discuss a patient case, 37(36%) intercommunicate for course materials clarification; 26(25%) intercommunicate to get opinion from an expert, 23(22.3%) intercommunicate for patient follow-up. Only a small number of dental professionals are sharing digital x-ray image 13(12.6%) or digital photographs 8(7.8%) as a reason of intercommunication.

Based on published literatures (Sanjeev, & Shushant K, 2011), dental professionals in Kigali-Rwanda are practicing teledentistry at low level. At its highest level teledentistry involved more sophisticated applications like real time interaction, i.e. in projects like PROVIDENT (Postgraduate Regional Online Videoconferencing in Dentistry) and DUET (Dental Undergraduate Education by Teleconferencing) teledentistry has shown positive impact in education and Continuing development of dental professionals (Reynolds et al., 2008).

These results are similar to the results of a study done by Ignatus. The objective was to determine what type of electronic consultation tool and methods used for dental consultation and patient-provider communication. The questionnaire has been sent to 120 dental practitioners in public and private sector. The results showed that majority (53%) used email for consultation. Videoconference use was at low level, only 10% used videoconference for consultation (Ignatius, 2013).

We found that there is a significant association between practice with knowledge, attitude and internet access. William and colleague found similar association. They have emphasized that knowledge and attitude can influence the adoption of technology in healthcare (William & Dickinson 2010). Peter has also supported that the practice of teledentistry goes together with the use of telecommunication and internet accessibility and that internet accessibility and usage is the source of different opportunities to human being when used in meaningful and positive way. He also said that, learning, gaining new experience and skills, acquiring new developing knowledge, are all benefits from internet access and usage (Peter, 2010). Teledentistry practice depends also on the availability of internet as stated in different literatures (Sanjeev, & Shushant K, 2011).

In Rwanda the internet availability has reached a high level compared to other low income countries in Africa continent (Ministry of Youth and ICT, 2012). The findings of the current study are an indicator that, if adopted, teledentistry can bring dental services provided in Rwanda to another step.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Based on the findings of the present study, the research questions have been answered. The results revealed that dental professionals are knowledgeable and have positive attitude towards teledentistry. Again, dental professionals overall believe that teledentistry is good and it has to be integrated into the current dental practice. However, the practice of teledentistry of dental professionals is still quite at low level comparing to other advanced applications of teledentistry done in other areas as shown in different literatures and researches. Also many of respondents raised concerns regarding perceived challenges to the use of teledentistry where a big number of dental professionals are worried about data entry mistakes can't trust teledentistry equipment and worried about the privacy of patients 'information. Therefore new policies and programs should be designed to assure the implementation of teledentistry and to allow its use at advanced level as shown in the literature. Again dental professionals should be reassured about the current method of keeping medical information security and privacy. To bring dental practice to another level in areas like dental education, dental research, community outreaches, and dental health care delivery and so on, there is a need to use the opportunities provided by teledentistry technology.

6. 2. RECOMMENDATIONS

6.2.1. Recommendation to MOH

To design the policy and program for using teledentistry opportunities in both education and care delivery. To avail infrastructure for teledentistry practice.

6.2.2. Recommendation to different dental clinics in public and private sector

To identify the areas of dentistry where teledentistry is needed and to communicate them to MOH or to other stakeholders.

6.2.3. Recommendation to Academia

Academic institution should integrate teledentistry module in their already existing teaching system to ensure that students are aware of teledentistry benefits and applications and how it is practiced earlier in dental career. This may help to engage students for innovation and critical thinking in the area of teledentistry. Also new insights in research of teledentistry might be allowed.

6.2.3. Recommendation to dental professionals

Dental professionals have to strive to put into practice their knowledge about teledentistry for the benefits of community they have to save.

Continuing professionals developments (CPDS) to train dental professionals on how to use teledentistry equipments have to be enforced.

6.2.4. Areas for future research

To the best of researcher knowledge, this is the first study done in Rwanda in teledentistry area. It has been conducted in Kigali, the big city of Rwanda. Therefore, the results can't be generalized nationwide. Further similar research is important which may include the rural area and the bigger sample size.

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APPENDICES

APPENDIX I: INFORMATION SHEET

My name is Julienne MURERÉREHE. I am conducting a research on "**ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICE OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY"** at the UR-CMHS (University of Rwanda, College of Medicine and Health Sciences) Kigali campus (former KHI) and dental clinics in Kigali city. This research is one of the requirements I have to fulfil in order to obtain the Masters 'degree in Health informatics in the above mentioned university. It is expected that the results from this study may be significant by providing the information which may be used by institutions or government to develop programs to raise awareness of applications and benefits of teledentistry among dental professionals aiming at implementation of teledentistry technology. This study may also inform planners and policy makers in Rwanda on the strategy to change the way oral health services and dental education are provided aiming at reduction of burden of oral diseases in Rwanda through teledentistry implementation

The questionnaire will be completed by all dental professionals who are practicing dentistry in different hospitals, health centers, academic institution and private dental clinic in Kigali and all dental students at UR-CMHS Nyarugenge campus.

Your answers will be treated with the confidentiality by avoiding the appearance of the name on the answer sheet. Your participation is on voluntary basis and you may withdraw your permission to participate at any stage without any negative consequences. I assure you that your answers will be used for scientific purposes only and the results of the survey may be published. The questionnaire will take about 20 minutes to be completed.

If you need more clarifications regarding this study, you may contact the researcher at the following contacts: Tel: +250788593017; Email: jmurererehe@khi.ac.rw

APPENDIX II: CONSENT FORM

After reading the information sheet regarding the study entitled < **ASSESSMENT OF KNOWLEDGE ,ATTITUDE AND PRACTICES OF DENTAL PROFESSONALS TOWARDS TELEDENTISTRY>** being conducted by Julienne MURERE REHE A student at UR-CMHS Nyarugenge campus (former KHI). I agree to answer the provided questions with awareness that the participation in the study is on voluntary basis. In addition, there is no appearance of the name of participants on the answer sheet.

If you consent to fill the provided questions, please sign in the place below.

Signature……

Researcher contact:
Julienne MURERE REHE
E-Mail: jmurererehe @khi.ac.rw
Tel: +250 788593017

Kigali, Rwanda

APPENDIX III: QUESTIONNAIRE TO DENTAL PROFESSIONALS

1. Demographic data of dental professional

Use the sign (✓) to choose the suitable option

1.1 How old are you?

- ☐ 20-25
- ☐ 26-30
- ☐ 30-35
- ☐ 36-40
- ☐ Above 40

1.2 What is your gender?

- ☐ Male
- ☐ Female

1.3 What is your level of education?

- ☐ A dental student (mention the level)……..
- ☐ Advanced diploma in dentistry
- ☐ Bachelors of dental therapy
- ☐ Dental hygienist
- ☐ Dental lab technician
- ☐ Dental assistant
- ☐ Bachelors of dental surgeon
- ☐ Specialist (mention the specialty)…….
- ☐ Others (mention)……

What is your place of work? (This question is not answered by students).

☐ Private clinic

☐ University hospital clinic

☐ Health center clinic

☐ District hospital clinic

☐ Academic institution

☐ Other (mention)……

1. What is your work experience (in yeas)?

☐ <5

☐ 5-10

☐ >10

Use the sign (✓) to choose the suitable option

2. Knowledge about the benefits and applications of teledentistry

QUESTIONS TO ASSESS KNOWLEDGE OF DENTAL PROFESSIONALS ABOUT TELEDENTISTRY					
Knowledge about applications and benefits of teledentistry	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1.Teledentistry is the practice of use of computers, internet and intraoral camera technologies to diagnosis and provide advice about treatment over a distance					
2. Teledentistry can be used in every branch of dentistry (oral medicine, paediatric dentistry, orthodontics, surgery, dental education and so on).					
3. Teledentistry is used for education and training of primary healthcare dentists.					
4. Teledentistry can decrease the isolation of dental practitioners by providing peer contact specialist.					
5. Teledentistry can be beneficial for monitoring patient oral health.					
6. Teledentistry can be useful in early and easy consultation of oral-facial disorders with specialists					
7. Teledentistry can enable dental practitioners to make sound decisions regarding management of oral diseases and referral to appropriate dental specialist.					
8. Teledentistry prevents doctors' mistakes and improves cost-effectiveness of dental treatment.					
9. Teledentistry can be used as a good tool for education to undergraduate students, post-graduate students and continuing updates for dental practitioners.					
10. Teledentistry has the potential to increase the number of dental specialist trainees and specialists in areas where population are dispersed.					

Use the sign (✓) to choose the suitable option

3. Attitude of dental professionals towards teledentistry

QUESTIONS TO ASSESS THE ATTITUDE OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY.					
Attitude of dental professionals towards the benefits of teledentistry	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Teledentistry can save me time					
2. Teledentistry can save me money.					
4. Using teledentistry, I will be able to monitor my patient's condition well.					
5. Teledentistry can provide me a good understanding of the patient`s oral health problem over the internet.					
6 .Teledentistry will be a standard way of oral health care delivery					
7. Teledentistry is a convenient form of oral health care delivery which makes dental examination easier.					
8. Teledentistry can be an addition to the regular care we provide.					
9. I think dental examination done through teledentistry is as accurate as face to face consultation					
10. I think teledentistry can reduce the costs of dental services.					
11. I think through videoconference (a medium of teledentistry) students can be educated and staff be trained effectively					
Perceived challenges to the use of teledentistry.	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Think teledentistry can violate the patient's privacy.					
2. I am worried about data entry mistakes.					
3. I can' t trust teledentistry equipment to work					
4. I think equipments of teledentistry will be difficult for me to use them.					
5. In Rwanda, major challenges in teledentistry are illiterates, population below the poverty line and lack of infrastructure.					
6. I think lack of awareness about teledentistry benefits and applications by dental professionals will be a barriers to its use					
Overall believes about teledentistry	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I generally believe teledentistry has a potential and has to be integrated into our current dental practice.					

Use the sign (✓) to choose the suitable option.

4. Practices of dental professionals towards teledentistry

4.1 Do you have internet access?

- ☐ Yes
- ☐ No

4.2 If yes, where do you have it?

- ☐ At work
- ☐ At home
- ☐ Others (Specify…….)

4.3 How often to do you access internet?

- ☐ Seldom (1-7 times per term)
- ☐ Quite often (2-7 times per month)
- ☐ Very often (2+ times per week)

4.4 Through which means do you access internet?

- ☐ Phone
- ☐ PC
- ☐ Others (Please mention)……

4.5 Which sites do you mostly visit?

- ☐ Google
- ☐ Professional website
- ☐ Social media website
- ☐ Others (please mention)

4.6 Do you use internet regularly for intercommunication with other health professionals?

- ☐ Yes
- ☐ No

4.7 How long do you use computer or internet for health related purpose?

- ☐ 0-2 hrs
- ☐ 2-4hrs
- ☐ 4-6hrs
- ☐ Above 6hrs

4.8 Dou you ever consult or communicate with other dental professionals through internet or mobile phone for health related purpose?

- ☐ Yes
- ☐ No

4.9 If yes, how often do you interact with them?

- ☐ Seldom (1-7 times per term)
- ☐ Quite often (2-7 times per month)
- ☐ Very often (2+ times per week)

4.10 If yes who do you consult with? (More than one answer is allowed)

- ☐ Patients
- ☐ Students
- ☐ Educators
- ☐ Specialists in my field
- ☐ With my peers
- ☐ With insurance companies
- ☐ Others (please mention)……

4.11 Through which mean do consult each other?

- ☐ Email
- ☐ Videoconference
- ☐ Other (please mention)…….

4.12 For which reason do you consult with others? (More than once answer is allowed)

- ☐ To discuss a patients case
- ☐ To share information regarding a patient case
- ☐ To get opinion from an expert for a patient case
- ☐ To contact a patient
- ☐ To contact a lecturer regarding clarification of course material
- ☐ To chare digital photographs
- ☐ To share digital x-ray image
- ☐ Others (Please mention)……

4. 13 If you don't consult or communicate with other dental professionals through internet for health related purpose, do you wish to do so in the future?

- ☐ Yes
- ☐ No

4. 14 if yes which mean do you wish to use more?

- ☐ Email
- ☐ Videoconference
- ☐ Both email and videoconference
- ☐ Other (please mention)

Thank you very much for your time!

APPENDIX IV: ETHICAL CLEARANCE CERTIFICATE AND DATA COLLECTION APPROVALS.

UNIVERSITY OF RWANDA — COLLEGE OF MEDICINE AND HEALTH SCIENCES

Directorate of Research Ethics and Consultancy

April 22nd, 2014

Ref: UR/RECC/ 131/2014

Dear

MURERE REHE Julienne

Master of Health Informatics Program

RE: ETHICAL CLEARANCE CERTIFICATE & APPROVAL FOR DATA COLLECTION

With reference to the application for Research and Ethical clearance; and approval for data collection for the study entitled **"Assessment of Knowledge, Attitude and Practices of Dental Professionals Towards Teledentistry"**

Following the review of your research proposal by Research, Ethics and Consultancy Committee in accordance with the authority granted to it; the reviewers recommended that your study be granted a Research and ethical certificate. It is on this note that the Directorate of Research, Ethics and Consultancy also grants approval for data collection. You will be required to submit the progress report and any major changes made in the proposal during the implementation stage. Also at the end of the study, the Directorate of Research, Ethics and Consultancy shall need to be given the final report of the study.

I wish you success in your study.

Mr. KANYONI Maurice

Chairperson of Research Ethics and Consultancy Committee

Cc:

- Principal, College of Medicine and Health Sciences
- Director of Postgraduate studies
- Director of Research, Ethics and Consultancy

UNIVERSITY OF RWANDA

College of Medicine and Health Sciences

OFFICE OF THE PRINCIPAL

Kigali, on ...23../.05./2014
N° ...731.../UR-CMHS/14

Miss MURERE REHE Julienne
UR-CMHS

Dear Julienne,

Re: Data Collection Authorization

We would like to inform you that permission has been granted with reference to your request for authorization letter dated 30th April, 2014. This is as per the requisites for your stated study titled, "Assessment of Knowledge, Attitude and Practices of Dental Professionals Towards Teledentistry" at the College of Medicine and Health Sciences, University of Rwanda.

As stipulated, you will be required to furnish documentation highlighting overall progress and changes including but not limited to any other deliverables as mandated by the Institutional Review Board (IRB). Thank You

Yours Sincerely,

Prof .Philip Cotton MD FRCGP
Principal, College of Medicine and Health Sciences, University of Rwanda

Cc:

- Director of Consultancy and Research, UR-CMHS

REPUBLIC OF RWANDA
RWANDA MILITARY HOSPITAL
Website: www.rwandamilitaryhospital.rw
P.O. Box: 3377 Kigali, Tel: (+250)252586420, Hotline: 4060
E-mail: info@rwandamilitaryhospital.rw

27/April/2015.

Dear MURERE REHE Julienne
UNIVERSITY OF RWANDA-CMHS

Dear Applicant, REF 013/010/2015,

REF: STUDY APPROVAL FOR THE STUDY TITLED: "*Assessment of Knowledge, Attitude and Practices of Dental Professionals Towards Teledentistry.*"

With respect to your application for ethical approval to conduct the above stated study at Rwanda Military Hospital, I am pleased to confirm that RMH Ethics Committee has approved your study. This approval lasts for a period of 12 months from the date of this notice, and after which, you will be required to seek another approval should the study not yet be completed.

You are welcome to seek other support or report any other study related matter to the Research office at Rwanda Military Hospital during the period of approval.

Sincerely,

Dr. Pacifique Mugenzi,
Co Chair: Rwanda Military Hospital Research Ethics Committee
E-mail: mpacific5@gmail.com

UNIVERSITY OF RWANDA

College of Medicine and Health Sciences
Tel: (250) 25257188; (255120145; 0788755364)
P.O. Box: 3286 Kigali – Rwanda
E-mail: fahs@khi.ac.rw

Kigali, on .29...../05/2014
N° PG128 ./UR-CMHS/14

To: The Director of Faith Clinic

Dear madam,

RE: REQUEST FOR PERMISSION TO COLLECT DATA

I am writing to request permission for MURERERERHE Julienne, an MSc Health Informatics student, to collect data from **dental professionals** of Faith Clinic for her research project being part of the fulfillment of criteria for completion of her studies. The Period of data collection will be one month starting effectively from 02/06/2014.

The title for her project is **"ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY".**

I will appreciate if she can be given the opportunity as requested

Yours sincerely,

Prof. NJUNWA Kato
Director of Postgraduate Studies,
UR-CMHS

C.C:

- **Academic Registrar, UR-CMHS**
- **Director of Research, UR-CMHS**
- **Coordinator of Health Informatics, UR-CMHS**

CENTRE HOSPITALIER UNIVERSITAIRE

UNIVERSITY TEACHING HOSPITAL

Quality Health Care
Training & Research

Ethics Committee / Comité d'éthique

June 06, 2014 **Ref.: EC/CHUK/094/14**

Review Approval Notice

Dear **Julienne Murererehe,**

Your research project: ***"Assessment of knowledge, attitude and practices of dental professionals towards teledentistry."***

During the meeting of the Ethics Committee of Kigali University Teaching Hospital (KUTH) that was held on 06/06/2014 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 KUTH Ethics Committee before publication.

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

Yours sincerely,

DR. STEPHEN RULISA
HEAD - DEPARTMENT OF CLINICAL RESEARCH
CHUK

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

<<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>

UNIVERSITY OF RWANDA

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CLINIQUE DENTAIRE ADA ASSOCIATION TEL : 0252596899 0788843901 ADA NYARUTARAMA

Kigali, on .29...../05/2014
N° 065.27./UR-CMHS/14

To: The Director of American Dental Association clinic (ADA)

Dear Sir,

RE: REQUEST FOR PERMISSION TO COLLECT DATA

I am writing to request permission for MURERE REHE Julienne, an MSc Health Informatics student, to collect data from **dental professionals** of ADA Clinic for her research project being part of the fulfillment of criteria for completion of her studies. The Period of data collection will be one month starting effectively from 02/06/2014.

The title for her project is **"ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES OF DENTAL PROFESSIONALS TOWARDS TELEDENTISTRY".**

I will appreciate if she can be given the opportunity as requested

Yours sincerely,

Prof. NJUNWA Kato
Director of Postgraduate Studies,
UR-CMHS

C.C:

- **Academic Registrar, UR-CMHS**
- **Director of Research, UR-CMHS**
- **Coordinator of Health Informatics, UR-CMHS**

REPUBLIC OF RWANDA

KIGALI CITY
NYARUGENGE DISTRICT
MUHIMA HOSPITAL
P.O BOX 2456 KIGALI
E-MAIL:hopitalmuhima@gmail

ETHICS COMMITTEE/ COMITE D'ETHIQUE

November, 4th 2014 Ref: MDH/EC/.06.2014

Review Approval Notice

Dear MURERE REHE Julienne,

Your research project: ***"Assessment of Knowledge, Attitude and Practices of Dental Professionals towards Teledentistry."***

During the meeting of the Ethics Committee of Muhima District Hospital that was held on 04/10/2014 to evaluate your protocol of the above mentioned research project, we are pleased to inform you that the Muhima Hospital Ethic Committee has approved your protocol.

You are required to present your research results to Muhima Hospital Ethics Committee before the publication.

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

Yours sincerely,

Dr SABUSHIMIKE Doriane
Chair Person, Ethics Committee,
Muhima District Hospital.